# Neg – Tech Impact Turns – BFHR 7wk

Cyberattacks good (China, NoKo, Iran) is the largest section of the file---there are comprehensive turns for quite a few others, though. The file covers 3D Printing Bad, 5G Bad, AI Bad, China Heg Good (updates from earlier file), Nuclear Meltdowns Good, IOT Bad, Blockchain Bad, Quantum Computing Bad, Hypersonic Prolif Good, and Spark.

Thanks to Hana Bisevac, Sam Church, Adam Mimou, Zoey Walsh, Micah Wang, and Fiona Yin for their hard work on this file! Please email [khirn10@gmail.com](mailto:khirn10@gmail.com) with any comments or concerns.

# Cyberattacks Good

## NoKo/China Links

### 2NC---Link---T/L

#### Cyber defenses prevent cyber espionage.

Christian Reuter, 20 (Christian Reuter is Full Professor at Technical University of Darmstadt, chair Science and Technology for Peace and Security in the Department of Computer Science with secondary appointment in the Department of History and Social Sciences, 2019, accessed on 7-20-2022, Springer, “Information Technology for Peace and Security”, <https://link.springer.com/book/10.1007/978-3-658-25652-4?noAccess=true>, HBisevac)

5.4 Defences

So far, we have introduced the concept of **cyber espionage** as well as commonly encountered threats to information security. We continue with fundamental techniques to defend information systems against these threats.

5.4.1 Security Controls

In general, there are two distinct approaches to secure information systems. Ideally, we would be able to ensure that attacks do not happen in the first place. Therefore, most efforts have focused on proactive techniques (sometimes also called preventive techniques). Recently, interest in reactive techniques has increased. Proponents of reactive security embrace the fact that it is challenging to achieve perfect security. Consequently, they argue that organisations should accept that they will eventually become a victim, which is why they should prepare for this situation in advance.

Pfleeger et al. (2015, Sect. 1.5) have identified six distinct types of security controls. We will briefly review them here and provide examples.

The first three types are proactive controls.

Controls in the **prevention category** effectively ensure that an attack against a target is not successful, e. g., by blocking the adversary from reaching a vulnerable system or by **closing** the **vulnerability** that the adversary tries to exploit. Examples of preventive techniques are firewalls, access control mechanisms, and cryptographic protection of sensitive contents. If deployed correctly, these techniques are very **effective** against particular attacks.

Deterrence, on the other hand, does not make an attack utterly impossible. Deterrence can be achieved by increasing the amount of effort for an adversary. As a result, the adversary is expected to refrain from attempting the attack. Many security controls belong to this category.

Alternatively, deterrence may be achieved with laws that punish malicious activities. However, laws are often ineffective to deter cyber espionage, because there is no credible threat of being caught. Firstly, attribution of an attack to a particular perpetrator is difficult, because attackers can use techniques to obfuscate their true location. Secondly, even if an attacker is identified, due to the global nature of the internet, a successful prosecution requires the collaboration of law enforcement agencies in multiple nation states, which often does not work efficiently yet.

A well-known example of a deterrence control is the deployment of two-factor authentication. Besides providing a username and a password for authentication, users have to prove their identity via another means, for instance a biometric feature such as a fingerprint or by demonstrating that they have access to their smartphone. Of course, determined adversaries may still succeed to get access to the second authentication factor – therefore, it is not a preventive measure. However, now the attack is much more involving. Thus, the deployment of two-factor authentication can be expected to deter many attackers from trying to attack an authentication procedure at all.

The difference between prevention and deterrence is more evident in the following example. It is considered good practice to not store passwords as cleartext. Instead, each password is fed into a one-way function and only the result of this function is stored. One-way functions like Argon2 (Biryukov et al., 2017) are constructed in such a way that there is no known way to invert them efficiently (yet). This does not prevent an attacker from trying to guess the password given the stored value by conducting a so-called brute-force attack: In a brute-force attack, an attacker enumerates all possible passwords, applies the one-way function to each of them, and checks whether the result matches the hash value in question. Even though the attacker will be successful eventually, the required effort is so high (if the password is sufficiently strong) that many attackers will not bother with a brute-force attack.

Another approach is deflection. Here the goal of the defender is to make a system less attractive as a target; or another system a more attractive one. Deflection can be achieved, for instance, by deploying honeypot systems within an organisation (Spitzner, 2002). Adversaries cannot distinguish honeypots from production systems. Security measures on the honeypots are intentionally weak, and they are configured to look like lucrative targets hosting valuable pieces of information.

The next three types are reactive controls.

There are two kinds of controls for detection. On the one hand, there are **real-time monitoring systems**, on the other hand, there are **logging solutions**. An example of a real-time system is an Intrusion Detection System like Snort (https://www.snort.org). These systems can be configured to alert operators about an attack in real time, which may help defenders to thwart an ongoing attack. However, for a real-time system to be an effective control, defenders have to deploy personnel that is on call at all times.

In contrast, logging solutions collect evidence that may support analysis of an incident in retrospect. The logs may contain information that has been collected by network monitors (packet sniffers) as well as information gathered on clients and servers, e. g., user interactions, executed programs, modified files, etc. After an attack, security analysts can scrutinise these logs to track down the origin of an attack (“attribution”, see Chapter 13 “Attribution of Cyber Attacks”) and its extent, i.e. what files and systems have been compromised.

It is common to integrate multiple detection systems into a Security and Incident Event Management (SIEM) solution that supports organisations to handle incidents in a systematic way (Bhatt et al., 2014).

Assuming that some attacks will succeed, organisations may also deploy mitigation controls. They aim to reduce the likelihood of a successful attack or its impact. An example in the context of the protection goal availability is to host redundant copies of a database in multiple locations.

Some prevention controls can also be viewed as mitigation controls. For example, access control mechanisms ensure that users can only access the files that they actually need for their work. This prevents an adversary who has compromised the workstation of an employee in the human resources department from stealing blueprints that can only be accessed by members of the research department.

Finally, some controls focus on recovery. Techniques from this category help organisations to revert the effects of an attack, to regain control of their systems, and to return to normal operation. Widely deployed techniques are (offsite) backups that allow restoring lost data as well as emergency playbooks that provide guidance during a crisis.

In practice, organisations deploy **multiple** complementary controls at the **same time**. A common strategy is to **prevent** **as many intrusions as possible**, to implement **detection** systems in order to be notified about ongoing attacks, and to prepare incident-response plans.

5.4.2 Security Design Principles

Securing complex systems is challenging because system builders have to create trustworthy systems from untrustworthy components (Schneider, 1998). Saltzer and Schroeder (1975) were the first to come up with a set of principles for the development of secure software. Over time their principles have been refined and updated (Smith, 2012):

■ Continuous improvement. Security is not a state, but a process. Therefore, system operators have to continuously assess whether they have to make changes to a system to keep it secure.

■ **Least privilege**. Users and entities should only have the minimum amount of access rights that allow them to fulfil their duties.

■ Defence in depth. Systems should not rely on a **single security mechanism** but have **multiple mechanisms**. The mechanisms should be arranged in layers around the system so that an adversary has to disable all of them to succeed.

■ Open design. A security mechanism should not rely on the fact that its design is a secret (“security through obscurity”). This is related to Kerckhoffs’ principle: In cryptography, the adversary may know the algorithm; the security solely rests on the secrecy of the **cryptographic key** (Kerckhoffs, 1883).

■ **Chain of control**. This can, firstly, mean to ensure that only trustworthy software is being executed by the operating system. To this end, state-of-the art operating systems offer so-called whitelisting techniques. Secondly, one can allow arbitrary software to be executed but restrict the control flow within every program to enforce desired security properties. An example for this approach is the use of techniques like Data Execution Prevention (DEP) and Address Space Layout Randomization (ASLR). DEP and ASLR mitigate the risk of buffer overflow attacks, where an attacker supplies crafted inputs to an application that mislead the CPU to break out of the intended control flow, executing malicious code supplied by the attacker instead.

■ Deny by default. Unless explicitly specified no access should be granted to any entity.

■ Transitive trust. If system A trusts system B and system B trusts system C, then A can also trust C.

■ Trust but verify. Even if a system is considered trustworthy, its identity must be verified before interacting with it.

■ Separation of duty. Split up critical tasks into **smaller problems** that are carried out by **separate components** or individuals.

■ The principle of least astonishment. Good usability of security mechanisms is an essential requirement for them to be effective. Mechanisms should be comprehensible, and their consequences should be intuitive.

### 1NC---Link---Space

#### The AFF increases defense against cyber espionage.

David 1AC Fidler 18, the James Louis Calamaras Emeritus Professor of Law at Indiana University, Adjunct Senior Fellow for Cybersecurity and Global Health at the Council on Foreign Relations, 4/3/18, “Cybersecurity and the New Era of Space Activities,” https://www.cfr.org/report/cybersecurity-and-new-era-space-activities

The tasks of securing outer space and cyberspace are converging. The internet increasingly depends on space-enabled communication and information services. Likewise, the operation of satellites and other space assets relies on internet-based networks, which makes these assets, like cars and medical equipment, devices on the internet of things. New government actors, companies, goals, and technologies are expanding and transforming space activities. However, neither space policy nor cybersecurity policy is prepared for the challenges created by the meshing of space and cyberspace, which could increase national security risks.

To meet these challenges, government, industry, and international action is needed. The Donald J. Trump administration’s National Space Council should develop cybersecurity recommendations for space activities, and federal agencies should prioritize these within the government and in cooperation with the private sector. In crafting needed legislation for commercial space activities, Congress should bolster industry efforts to strengthen cybersecurity. Private-sector actors should strengthen their adoption of cybersecurity best practices and collaborate with one another on improving implementation of cybersecurity strategies. Internationally, the United States should pursue collaboration on space cybersecurity through the North Atlantic Treaty Organization (NATO), plurilateral space cooperation mechanisms, and bilateral forums.

Outer space has been a national security priority for spacefaring nations since the 1950s. Governments started space programs for intelligence, military, political, and scientific purposes and developed countermeasures against space-based threats from rivals, such as anti-satellite capabilities. Countries managed security competition by banning weapons of mass destruction in space and cooperating on peaceful uses of space. Government programs catalyzed private-sector adaptation of dual-use technologies to provide satellite communication services.

Despite the importance of satellites, the U.S. General Accounting Office concluded [PDF] in 2002 that efforts on critical infrastructure protection did not include the satellite industry, but should do so. Similarly, cybersecurity has not been a priority in government and private-sector space endeavors. One leading analysis [PDF] asserted that cybersecurity discussions often overlook space activities’ vulnerability to cyberattack. For example, neither the UN governmental group of experts (GGE) on outer space nor the UN GGE on cyberspace addressed the convergence of their respective agendas.

Governments, critical infrastructure, and economies rely on space-dependent services—for example, the Global Positioning System (GPS)—that are vulnerable to hostile cyber operations. Geopolitical competition fuels the militarization of space, which heightens state incentives to devise cyber espionage, interference, and attack strategies against rivals’ space operations. The United States suspects that China has engaged in cyber operations against U.S. satellites. Chinese military writings emphasize [PDF] the need to target satellites to “blind and deafen the enemy.” The then commander of Air Force Space Command, General John E. Hyten, told Congress in 2016 that “adversaries are developing . . . cyber tools to deny, degrade, and destroy” [PDF] U.S. space capabilities that support war fighting, critical infrastructure, and economic activity. Other countries likely believe the United States is preparing to conduct cyber espionage, disruption, and attack operations against the space assets of rival states.

The commercialization of space heightens cybersecurity concerns for many reasons, including market incentives to lower costs and innovate quickly, often at the expense of software and hardware security. Entrepreneurial activities—dubbed the New Space sector—are underway in space transport, space tourism, asteroid mining, lunar operations, and missions to Mars. A small-satellite (“smallsat”) revolution involving spacecraft far smaller than traditional satellites is unfolding. Networks of linked smallsats can provide internet access, communications, data storage and transmission, imaging, and remote sensing. This next generation of satellites harnesses innovations in computing, electronics, miniaturization, imaging, sensors, big data, and artificial intelligence. Satellite services for Earth observations from space are growing. They support many policy and commercial purposes and contribute to agricultural productivity, transportation efficiency, and environmental monitoring. Commercial space activities use cutting-edge technologies and produce valuable data and are, thus, targets for cyber espionage, including economic cyber espionage, and cybercrime.

Challenges

Space agencies, the satellite industry, cybersecurity researchers, nongovernmental bodies, and intergovernmental satellite organizations show increasing awareness of the space cybersecurity challenge. Nevertheless, experts are worried. NASA’s then chief information security officer, Jeanette Hanna-Ruiz, warned that “it’s a matter of time before someone hacks into something in space.” Chatham House’s David Livingstone asserted that “people are just shuffling . . . paper around” and suggested that only “a disaster” might catalyze serious action. Josh Hartman, a former senior Pentagon official and Air Force officer, argued before the satellite industry’s first cybersecurity summit held in 2017 that, on cybersecurity, “most of the space community . . . has their heads in the sand.” The “attack surface” of space activities is expanding, but governments and industry are not taking adequate action.

Protecting space activities requires understanding the particular cyber vulnerabilities that arise in various space operations. For example, satellite cybersecurity encompasses the satellite itself, transmissions to and from Earth, and ground stations. U.S. military and intelligence satellite systems are vulnerable to kinetic and cyberattacks. Civilian smallsat systems might also prove insecure, given the lack of cybersecurity in their design, their use of commercial off-the-shelf components, and the vulnerabilities potentially created by connecting satellites to operate as complex, orbiting networks.

Neither international law nor diplomacy has grappled effectively with space cybersecurity. Multiple bodies of international law are relevant, but controversies about whether and how international law applies to cyberspace have adversely affected cyber diplomacy. Such travails have elevated the prominence of nongovernmental efforts to clarify international law’s application in cyberspace, such as the Tallinn Manual 2.0 on the International Law Applicable to Cyber Operations. However, states continue to conduct cyber operations that violate international law. For example, the UN International Telecommunication Union prohibits interference with satellite transmissions, yet such interference frequently occurs.

The militarization of space potentially threatens the requirement in the Outer Space Treaty (OST) that space activities comply with international law to maintain international peace and security and promote international cooperation. The United States has declared that space is now a “war-fighting domain,” and China’s and Russia’s military ambitions in space are growing. The UN Committee on Disarmament’s work on a treaty to prevent an arms race in space failed. As happened with cyberspace, these difficulties in space diplomacy have increased nongovernmental interest in clarifying how international law applies to military operations in space.

The commercialization of space fuels concerns that the private sector will unduly influence how states interpret the OST’s duty to authorize and supervise nongovernmental space activities. The debate over whether U.S. support for commercial space activities violates this OST requirement might also create diplomatic problems.

New diplomatic initiatives on space cybersecurity would encounter headwinds. Putting “space” before “cybersecurity” does not alleviate the geopolitical tensions that already limit cooperation on cyberspace and space. The United States, China, and Russia have not agreed on how to approach cybersecurity or address military activities in space. Recent diplomatic activities on space and cybersecurity concluded without addressing space cybersecurity, including the UN GGEs on cyberspace and outer space and the European Union’s code of conduct for space activities [PDF]. Negotiations in the UN Committee on Peaceful Uses of Outer Space on guidelines for the long-term sustainability of space activities considered but did not adopt proposed guidelines [PDF] on information-security policies for the terrestrial and orbital parts of space systems. Controversies and disagreements during these efforts suggest that reopening them for space cybersecurity would not be effective. Further, the increased number of spacefaring nations, which now includes such countries as South Korea and the United Arab Emirates, complicates diplomacy by requiring more countries to reach consensus.

States might also believe more diplomatic activity is not necessary because they already have sufficient incentives to refrain from dangerous cyber operations in space. Disabling a satellite through cyber means could turn it into space debris—already a major problem—that threatens space activities for all countries. The importance of intelligence satellites in maintaining nuclear deterrence also encourages restraint in interfering with the satellites of rival nuclear powers. Following trends on Earth, countries might want to avoid diplomatic activity in order to engage in cyber operations in space that “subvert the integrity of political, social, and economic systems, rather than destroy physical infrastructure” by, for example, manipulating or hijacking an adversary’s space infrastructure to spread propaganda and misinformation.

Recommendations

Government

The United States can provide leadership on cybersecurity in outer space through a comprehensive strategy. The Trump administration is positioned to advance space cybersecurity because its priorities include improving critical infrastructure cybersecurity, addressing security threats to space operations [PDF], and promoting commercial space activities. The administration resurrected the National Space Council and should task it with developing recommendations on strengthening the cybersecurity of space infrastructure. To do so, the council should convene government officials and leaders from the commercial space sector to share insights on managing cybersecurity as space and cyberspace merge. These leaders should include people who have led both information technology and space enterprises, such as Paul Allen (Stratolaunch Systems), Jeff Bezos (Blue Origin), and Elon Musk (SpaceX). The Trump administration should instruct the Department of Commerce, Department of Homeland Security, Federal Aviation Administration, Federal Communications Commission, and NASA to make cybersecurity a priority in their space collaborations with the private sector.

With private-sector space activities expanding, Congress should adopt a comprehensive regulatory framework for the commercial space sector. Current law does not regulate the full range of space activities the private sector is planning, a problem recognized [PDF] but not addressed during the Barack Obama administration. A comprehensive framework would provide commercial space enterprises with regulatory certainty and help the United States comply with its OST obligation to authorize and supervise nongovernmental space activities. The legislation should emphasize the importance of existing federal law on cybersecurity information sharing, provide government assistance to industry-led efforts to strengthen space cybersecurity (especially concerning threats from state actors), and—as happened in other sectors, such as energy—facilitate public-private collaborations on cybersecurity.

Industry

Improving space cybersecurity requires extending good cybersecurity practices into the commercial space sector and addressing problems specific to space activities. Advice for this sector repeats familiar mantras, such as the need for intra-sector collaboration, information sharing, enterprise risk management, encryption, insider threat prevention, and supply chain protection. The federal government has, for example, rightly stressed [PDF] the utility of the Cybersecurity Framework for Improving Critical Infrastructure Cybersecurity [PDF] for satellite companies.

Industry associations in space sectors should move from identifying general principles and recommendations, such as those in the Joint Statement on the Satellite Industry’s Commitment to Cybersecurity, to supporting implementation activities. The Satellite Industry Association could, for example, include in its annual State of the Satellite Industry Report [PDF] information on the industry’s cybersecurity activities, as is done in other industries.

International

The difficulty of reaching multilateral agreement on cybersecurity and space issues means the United States should address space cybersecurity in plurilateral and bilateral contexts. The United States should raise space cybersecurity within NATO, given the alliance’s plans to upgrade its satellite and cyber defense capabilities. U.S. bilateral cybersecurity cooperation with spacefaring countries, such as India and Japan, should include space cybersecurity. With their history of collaboration, NASA and the European Space Agency, which is increasingly aware of cybersecurity threats to its programs, should sign a memorandum of understanding to cooperate on space cybersecurity.

More ambitiously, the United States should use effective mechanisms of space diplomacy to improve space cybersecurity. For example, the International Space Station (ISS) has involved the United States, Canada, Japan, Russia, and the European Space Agency managing the “the most politically complex space exploration program ever undertaken.” The United States should discuss the need for more cooperation on space cybersecurity within the ISS framework. In addition, the United States could lead establishment of an intergovernmental coordination mechanism for developing guidance on space cybersecurity. The mechanism could be modeled on the Inter-Agency Space Debris Coordination Committee (IADC), composed of space agencies from leading spacefaring countries. The IADC’s nonbinding guidelines are credited with reducing space debris produced by new launches.

Conclusion

Actions at the national, industry, and international levels can harness growing awareness about space cybersecurity and strengthen policy and industry practices as the convergence of space and cyberspace accelerates. Outer space might not be the “final frontier for cybersecurity,” but achieving cybersecurity beyond Earth is one of the many responsibilities the new era of space activities creates for governments and societies.

### 1NC---Link---5G

#### The AFF increases defense against cyber espionage.

1AC Giles ’22 [Keir; 7/4/2022; Senior Consulting Fellow at Chatham House, Director of the Conflict Studies Research Centre, Fellow at the National Security Center of Excellence Canada; Kim Hartmann; Cyber and Information Technology Director at the Conflict Studies Research Centre; "Emergence of 5G Networks and Implications for Cyber Conflict," https://doi.org/10.23919/CyCon55549.2022.9810903]

Western nations vary widely in their approach to the security of 5G networks and in the basic assumptions that drive their policy. This is clearly illustrated by the example of Huawei and other foreign technology providers being excluded from the development of 5G in some Western nations. While Sweden has excluded the two Chinese contributors, Huawei and ZTE, from participating in the development of 5G in Sweden (with Huawei filing an appeal against this ban),11 Norway has decided not to strictly ban the use of 5G equipment. Despite demands from the Norwegian government in December 2019, Telenor’s development of the 5G network in Bergen, Norway, is mostly based on Huawei sources and will remain so until 2024, when Telenor will remove untrusted sources due to security considerations.12 Austria initially decided not to rule out the use of Huawei technology in 5G networks but stated (under former chancellor Sebastian Kurz) that it would coordinate its actions with the EU.13 A more recent statement indicates that 5G may be built with Chinese contributions in Austria, serving Telekom Austria’s 25 million customers across Austria, Bulgaria, Croatia, Belarus, Slovenia, Serbia, and North Macedonia and using Chinese vendors in Bulgaria and North Macedonia for 4G.14 Belgium initially found no evidence of possible espionage through the utilization of Huawei’s technology and hence decided not to ban Huawei from contributions to the Belgian 5G network development.15 However, it was reported that Belgian operators Orange Belgium and Proximus dropped Huawei as a consequence of US pressure to exclude Chinese vendors.16 It was later reported that Belgium had previously experienced a pro-Huawei malign influence campaign.17 Britain decided to remove Huawei’s technology from its telecommunication networks and demanded its vendors reduce Huawei’s share of the network infrastructure to 35% by 2023.18 This process, which is expected to take until 2027, was instigated by the United States, alleging that Huawei posed a security threat due to its closeness to the Chinese government.19 Orange France decided to avoid using Chinese vendors when developing European 5G networks but envisions Huawei playing a role in the African 5G rollout.20 If there is a pattern among Western approaches to 5G security, it appears to be a consensus within the ‘Five Eyes’ partnership, and wide variance outside it.21

Many of the discussions around whether Huawei equipment (or software, as described above) should be used in 5G networks centred on the question of whether a ‘backdoor’ existed in available equipment. The crucial realization, however, is that the 5G architecture does not need ‘backdoors’ to be built into the system. The mere ability to contribute to the 5G core network constitutes a backdoor. The 5G architecture demands continuous integration and continuous deployment of function and software updates. As there is currently no valid option to automatically check code iterations for complex malicious execution options, this either must be monitored by IT professionals or will simply be based on trust in the contributor. The huge number of code iterations and updates that will propagate through a multitude of virtualizations makes it unlikely that this monitoring can be done by humans.

In addition, the complexity of the architecture and the distributed nature of its development opens up a still greater risk of supply chain attacks. In mid-2020, detection of the SolarWinds attack demonstrated the critical importance of software supply chain transparency and integrity (as well as the power of CI/CD attacks, as described above).22 It is equally vital that the construction of 5G network architecture for NATO member states is protected from hostile state interference – but this begs the question of how to exclude software providers owned by interests within those adversary states if they are already integrated into the network provision ecosystem.23

SECTION 3.

Strategic Goals of Adversaries In Networks of NATO Allies

It is essential that any new technology that introduces critical dependencies within NATO nations be adequately secured against threats from both non-state and state actors. This requires a full and regularly updated assessment of the aims and approaches to conflict of a wide range of possible adversaries. It also requires full and honest recognition of the threat among NATO allies themselves, and an acceptance that a state of notional peacetime does not mean that hostilities are not being waged by any available means.

The new vulnerabilities introduced by the specific nature of 5G networks lend themselves to a wide range of unfriendly and overtly hostile actions by adversaries. As with other forms of information threat, these span a broad spectrum of ambition, from simply causing damage with no other specific objective in mind, to high-level geostrategic change brought about through indirect means.24 Non-like-minded nations, including but not limited to Russia and China, have closely studied means of damaging or destroying the civilian communications networks of NATO member states, and it should be anticipated that this probing for vulnerabilities will intensify as relations deteriorate further. Russian president Vladimir Putin has repeatedly promised responses to Western actions that are unexpected and ‘asymmetric’.25 To prevent such responses, NATO governments should seek to minimize their self-inflicted vulnerabilities.

Nevertheless, unless adequately secured, 5G networks simplify the task of the attacker in achieving their aims. Examples include:

Network destruction and information interdiction. Adversaries can achieve effects remotely that currently require physical intervention against telecommunications infrastructure.26 This could be either in support of a localized objective, or a widespread attack in order to intimidate or blackmail victim states into political concessions.

Infiltration, espionage, and situational awareness. The substantial increase in the number of attack surfaces that must be protected will facilitate attempts at stealthy penetration of networks for the purpose of long-term surveillance and data collection.

Subversion and other sub-threshold attacks. The nature of 5G networks will introduce an additional layer of deniability to attacks on communications networks and connectivity, as attribution becomes more technically, and thus especially politically, complex.

In addition, the nature of 5G, as well as other advanced technologies’ reliance on it, presents adversaries with opportunities for the innovative exploitation of vulnerabilities. Cyber blackmail for political coercion is not a novel concept, but it takes on new dimensions thanks to the propagation characteristics of 5G. For demonstrations of the blackmailer’s capabilities, destruction of critical national infrastructure remains a relatively unlikely option, given the near-consensus that this constitutes an act of war. However, if such an attack were carried out, isolation measures intended to protect critical infrastructure would limit its reach. By contrast, more subtle interventions – like increasing the latency of the virtual network functions used for autonomous driving – allow less detectable operations but, at the same time, could affect much wider areas and spread throughout broad networks. In other words, rather than attacking an element of critical infrastructure, such as a water supplier, attacking a NFV will hit not just that one water supplier but any network operator using the NFV. And depending on the NFV (or any other software component crucial to the backbone), this may propagate rapidly and widely, including across borders – like a domino at a central junction.

### 1NC---Link---AI Subs---Cables

#### The AFF increases defense against cyber espionage.

1AC David 22 – Rona has been a journalist for over 20 years, collaborating with various media trusts: Pro Tv, Prima Tv, RFI, Cotidianul (…). Notable is also her experience within the Environment Commission of the Romanian Senate, as an advisor to the Chairman of this commission. In the period 2008-2010 she was a correspondent for Prima TV at the European Parliament in Strasbourg, which allowed her a European approach to media issues. (Rona Rita David, "Submarine Cables: Risks and Security Threats," Energy Industry Review, 3-25-2022, https://energyindustryreview.com/analysis/submarine-cables-risks-and-security-threats/, Accessed 7-5-2022, LASA-SC)

Cutting submarine cables, an old and proven practice of war

Recent attacks on cables carrying voice and data traffic between North America and Europe lead to the idea that they seem to be undergoing a new development. France and the United Kingdom had already dealt with this experience on the part of the Germans during the First World War. These infrastructures were part of the global cable telegraph network. Similarly, the United States cut wartime cables as a means of disrupting the ability of an enemy power to command and control distant forces.

The first such attacks took place in 1898, during the Spanish-American War. That year, in the Gulf of Manila (Philippines), the USS Zafiro cut the cable connecting Manila to the Asian continent to isolate the Philippines from the rest of the world, as well as the cable connecting Manila to the Philippine city of Capiz. Other spectacular cable attacks took place in the Caribbean, plunging Spain into the dark during the conflict in Puerto Rico and Cuba, which contributed greatly to the final victory of the United States.

Russia interested in NATO’s subsea infrastructure

Russia seems to materialize the concerns at the highest level in this field. In 2015, the presence of Russian vessel Yantar along the US coast, near the cables, did not fail to arouse tensions between the two states. At the end of 2017, the situation repeated.

“We are now seeing Russian underwater activity in the vicinity of undersea cables that I don’t believe we have ever seen. Russia is clearly taking an interest in NATO and NATO nations’ undersea infrastructure,” said Admiral Andrew Lennon, commander of the organization’s submarine forces. It’s like going back to the days of the Cold War… To the point where Policy Exchange has devoted an entire chapter of its “Russia Risk” report to this topic. The think tank recalls the episode of the annexation of Crimea in 2014, when the peninsula was isolated from the rest of Ukraine by physically cutting off communications.

“If the relative weakness of the Russian position makes a conventional conflict with NATO unlikely, fibre-optic cables can be a target for Russia. We should prepare for an increase in hybrid actions in the maritime field, not only in Russia, but also in China and Iran,” underlines the former commander of the NATO allied forces, the American Admiral James G. Stravridis.

Three major security risks

The first risk factor is the growing volume of data flowing through cables, which encourages third countries to spy on or disrupt traffic.

The second risk factor is the increasing capital intensity of these facilities, which leads to the creation of international consortia involving up to dozens of owners. These owners are separated from the entities that produce the cable components and from those that position the cables along the ocean floor. Timeshare makes it possible to reduce costs substantially, but at the same time allows the entry in these consortia of state actors who could use their influence to disrupt data flows, or even to interrupt them in a conflict scenario. At the other end of the spectrum, GAFAMs (Google, Apple, Facebook, Amazon, and Microsoft) now have the financial and technical capacity to build their own cables. Thus, the Dunant cable, which links France to the United States, is entirely owned by Google. The Chinese giants have also embarked on a strategy of submarine conquest: this is the case of the Peace cable, which connects China to Marseilles, owned by the Hengtong company, considered by the Chinese government as a model of “civilian-military”.

Another threat is espionage, which requires specially equipped submarines, or submarines operating from ships, capable of intercepting, or even modifying, data passing through fibre-optic cables without damaging them. So far, only China, Russia and the United States have such means.

The most vulnerable point of submarine cables, however, is where they reach land: the landing stations Thus, the town of Lège-Cap-Ferret, where the interface room between the Franco-American cable “Amitié” will be built, has recently become a veritable nest of spies, according to informed sources.

## China

### 1NC---Cyber Espionage Good

#### Cyberattacks are key to China’s biotech industry.

Mark Kazmierczak, 19 (Mark Kazmierczak, Ph.D., Ryan Ritterson, Ph.D., Danielle Gardner Rocco Casagrande, Ph.D., 2-14-2019, accessed on 5-29-2022, Gryphon Scientific, “China’s Biotechnology Development: The Role of US and Other Foreign Engagement”, https://www.uscc.gov/sites/default/files/Research/US-China%20Biotech%20Report.pdf, HBisevac)

In addition to legitimate commercial and social interaction, China’s **biotech industry** may have also benefited from **illicit extraction** of **overseas technology** through **espionage** or the theft of trade secrets. Only so much can be said about this topic without the release of classified materials, so the scope and patterns of criminal activities benefitting Chinese entities is impossible to describe accurately in a public document. However, court documents and other public materials illustrate that the biotech industry has been a target for such activity since at least the 1990s (Table 2-4).

The majority of these cases involve Chinese citizens who targeted **genetically engineered** **ag**ricultural products, **seeds**, **IP**-related **info**rmation, or **chemical** or **biological products**. At least six theft attempts have occurred within the medical industry. Theft and espionage attempts have targeted a wide range of **treatments** and **equipment**, including robotic surgical equipment, cancer treatments, treatments for organ recipients, cornea regeneration, hepatitis C diagnostics, and an anemia drug. The agricultural industry has also been targeted on multiple occasions. Two theft attempts involved stealing genetically engineered rice or corn seeds, while other thefts have targeted organic pesticides, engineered food products, and livestock feed supplements.

The majority of theft attempts were directed against a current or former employer (Table 2-4). Ventria Bioscience, GlaxoSmithKline, Dow AgroSciences LLC, Cargill Inc, Roche Diagnostics, and Amgen have all experienced theft of trade secrets or biological materials perpetrated by a current or former employee(s) with the intent to sell it to a **Chinese competitor**. In the academic sector, researchers have stolen **information** or **samples** from their employers at Cornell University, Harvard University, and UC Davis. Most individuals were motivated by personal financial gain. These individuals would sell the **trade secrets** and **information** to **Chinese companies** that planned to **commercialize** the stolen trade secrets or market copy-cat products in China.

In addition to these cases, biotech firms have also reportedly been a major target of state-sponsored cyber espionage. According to US-based cybersecurity firm Mandiant, there has been an increased number of hacking incidents targeting biotech companies from China since 2008, and these activities are associated with government-directed groups. 299 Relevant reports claim that hacking efforts are correlated with Chinese **industrial policy goals** and aim at **accessing relevant drug** **info**rmation, **formulas**, and **data** from leading **US companies**. 300 Beijing has refuted these claims.

#### Chinese biotech strength is key to global pharma innovation.

Franck Le Deu, 21 (Franck Le Deu, Senior Partner with McKinsey & Company and co-leads their BioPharma and MedTech Practice in Asia Pacific, 8-9-2021, accessed on 5-31-2022, Endpoints New, “8 ways China could help transform the global biopharma industry”, <https://endpts.com/8-ways-china-could-help-transform-the-global-biopharma-industry/>, HBisevac)

The recent emergence of a **thriving biopharma**ceuticals **industry** in China is no longer just a China story. It is a **global one**, with **profound implications** for years to come.

For the past 15 years competitive intensity in the global biopharma market has increased markedly. Most recently, China has emerged as an important actor in the global biopharma ecosystem, adding a **potent additional source** of global **biopharma innovation** and disruption. What impact will this emergence of China have on the global industry? First, here are a few important facts underpinning the rise of China biopharma:

China biopharma has very good access to the necessary ingredients for innovation:

Funding – The cumulative market value of China originating biotechs, listed on HKEX, STAR or NASDAQ, rose from $1bn in 2016 to $180bn as of May 2021. CB Insights indicates that 2 of the top 10 global healthcare VC funds are from China (Hillhouse Capital and Qiming Ventures – ranking as of Q1 2021). Increasingly, China linked funds deploy capital beyond China, to support the emergence of US based innovative start-ups (numerous examples, from Lilly Asia Ventures, to Ally Bridge Group, or Quan Capital). Of note, investments in Europe are more limited to date. A new report by McKinsey “ Innovation hot-spots to stage the next Biotech act in Europe” concludes that China accounted only for 2% of early-stage funding in European biotechs, over the 2018-2020 period. Also, new funding models are emerging. For example, with backing from Orbimed Asia partners, Kinnate Biopharma, a US based biopharma, recently raised $35mn to set up a JV in China for development and commercialization of its lead program in greater China.

CDMOs and CROs – The cumulative market value of listed players, defined as focused on innovative drug development and listed on HKEX, STAR, or NASDAQ, rose from <$1bn in 2016 to $176bn as of May 2021. China is already a leading provider of services in sub-segments, with a global client base (e.g., in Chemistry). CDMO is rapidly scaling up with examples of China/US tie-ups. For example, Humanigen (US based) recently selected Chime biologics (China based) for the development of its lead pipeline candidate, lenzilumab. Some China originating companies are building global manufacturing networks. Wuxi Biologics is opening facilities in Singapore, Ireland or Worcester, USA, while CARsgen is investing $157 mn to set up a North Carolina based CAR-T Lab/manufacturing facility. On the CRO side, the recent merger of dMed (China based) and Clinipace (US based) provides an illustration of the increasing interdependency or service providers, who need to span US-China to leverage the best capabilities and serve global clients.

Talent pool – China’s role in the global talent market is rising, with some companies rapidly transitioning from being “China based” to being “globally based”. This involves hiring key CEO-1 talent who come from traditional big pharma players, and play global positions/roles from their home country. As recent examples, BeiGene hired its Senior VP of Global Human resources from Pfizer, and Zai Lab hired its President, head of global development for oncology from Genentech. Both executives are based in the US. Also, several CEOs of Chinese biotechs are former global executive of multinationals (e.g., the CEO of Everest Medicines spent most of his career at Eli Lilly, while the Chairman and CEO of CStone came from Sanofi).

The role and impact of China is already **evident** across **key elements** of the **value chain**:

**Discovery** – Initially, local innovation for the China market focused on the immuno-oncology space (~110 NMEs in the clinical development as of May 2021). Acknowledging this hyper-competition, China biopharma’s innovation focus has **broadened significantly** into all major modalities and disease areas. Our analysis shows that for 9 out of 10 modalities and for 9 out of 13 disease areas, local companies are now leading **MNCs** in innovation for the **domestic China market**. A recent publication by the IQVIA institute (“Global oncology trends 2021: Outlook to 2025) estimates that China-headquartered companies are developing **18%** of all early stage oncology drugs, up from 6% in 2015. Maybe even more striking, the China share is already **13%** for all next-generation oncology biotherapeutics. 2020 marked a turning point with several examples of innovative drugs discovered in China being licensed in by large global biopharmas. The deals between AbbVie/I-Mab for I-Mab’s CD47 or Lilly/Innovent for Innovent’s PD-1 program come to mind. What’s important to note is the speed at which new drug innovation has proliferated in scope and scale. China biopharma is becoming an **ever faster** fast follower. While we have yet to see much evidence of First in Class discovery out of China – other than a few green shoots – one could reasonably expect this to change in the mid-term.

**Development** – China accounts for a **large share** of **development trials** for the top 25 **global** Biopharma companies. On average, China is currently participating in ~21% of ongoing Phase 3 clinical trials from those companies as of June 2021. Access to a large treatment naïve patient pool is attractive, and a growing number of trial centers are reaching international quality standards. One should note however that while centers have grown, the number of centers and PIs with extensive MRCT experience is still low and will continue to constrain China’s development capacity. IQVIA Institute estimates that there are 1,297 trial experienced sites globally for CAR-T therapies, 284 of which are in China. Meanwhile, Chinese originated biopharma/biotechs are ramping up the number of trials **conducted abroad**, for example in Australia, the US or EU.

**Commercial**/**access** – a few China originating companies have started to build physical presence in the US, including for commercial and access activities. BeiGene and Hutch-Med are both ramping up their US presence, with new molecules launched/launching soon. The same is starting to happen in Europe. Some US based companies are starting to emerge with the idea of **licensing innovative molecules** from China and launching them in the US. EQRx for example has a licensing deal with Hansoh Pharma for aumolertinib, an EGFR TKI indicated for treatment of NSCLC. The stated strategy aims at disrupting the current price/volume status quo. C

#### Pharma innovation stops extinction from natural disease and bioweapons---extinction.

Dr. Piers Millett 17, PhD, Senior Research Fellow at the University of Oxford, Future of Humanity Institute, and Andrew Snyder-Beattie, MS, Director of Research at the University of Oxford, Future of Humanity Institute, “Existential Risk and Cost-Effective Biosecurity”, Health Security, Volume 15, Number 4, 8/1/2017, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5576214/

In the decades to come, advanced bioweapons could threaten human existence. Although the probability of human extinction from bioweapons may be low, the expected value of reducing the risk could still be large, since such risks jeopardize the existence of all future generations. We provide an overview of biotechnological extinction risk, make some rough initial estimates for how severe the risks might be, and compare the cost-effectiveness of reducing these extinction-level risks with existing biosecurity work. We find that reducing human extinction risk can be more cost-effective than reducing smaller-scale risks, even when using conservative estimates. This suggests that the risks are not low enough to ignore and that more ought to be done to prevent the worst-case scenarios.

How worthwhile is it spending resources to study and mitigate the chance of human extinction from biological risks? The risks of such a catastrophe are presumably low, so a skeptic might argue that addressing such risks would be a waste of scarce resources. In this article, we investigate this position using a cost-effectiveness approach and ultimately conclude that the expected value of reducing these risks is large, especially since such risks jeopardize the existence of all future human lives.

Historically, disease events have been responsible for the greatest death tolls on humanity. The 1918 flu was responsible for more than 50 million deaths,1 while smallpox killed perhaps 10 times that many in the 20th century alone.2 The Black Death was responsible for killing over 25% of the European population,3 while other pandemics, such as the plague of Justinian, are thought to have killed 25 million in the 6th century—constituting over 10% of the world's population at the time.4 It is an open question whether a future pandemic could result in outright human extinction or the irreversible collapse of civilization.

A skeptic would have many good reasons to think that existential risk from disease is unlikely. Such a disease would need to spread worldwide to remote populations, overcome rare genetic resistances, and evade detection, cures, and countermeasures. Even evolution itself may work in humanity's favor: Virulence and transmission is often a trade-off, and so evolutionary pressures could push against maximally lethal wild-type pathogens.5,6

While these arguments point to a very small risk of human extinction, they do not rule the possibility out entirely. Although rare, there are recorded instances of species going extinct due to disease—primarily in amphibians, but also in 1 mammalian species of rat on Christmas Island.7,8 There are also historical examples of large human populations being almost entirely wiped out by disease, especially when multiple diseases were simultaneously introduced into a population without immunity. The most striking examples of total population collapse include native American tribes exposed to European diseases, such as the Massachusett (86% loss of population), Quiripi-Unquachog (95% loss of population), and the Western Abenaki (which suffered a staggering 98% loss of population).9

In the modern context, no single disease currently exists that combines the worst-case levels of transmissibility, lethality, resistance to countermeasures, and global reach. But many diseases are proof of principle that each worst-case attribute can be realized independently. For example, some diseases exhibit nearly a 100% case fatality ratio in the absence of treatment, such as rabies or septicemic plague. Other diseases have a track record of spreading to virtually every human community worldwide, such as the 1918 flu,10 and seroprevalence studies indicate that other pathogens, such as chickenpox and HSV-1, can successfully reach over 95% of a population.11,12 Under optimal virulence theory, natural evolution would be an unlikely source for pathogens with the highest possible levels of transmissibility, virulence, and global reach. But advances in biotechnology might allow the creation of diseases that combine such traits. Recent controversy has already emerged over a number of scientific experiments that resulted in viruses with enhanced transmissibility, lethality, and/or the ability to overcome therapeutics.13-17 Other experiments demonstrated that mousepox could be modified to have a 100% case fatality rate and render a vaccine ineffective.18 In addition to transmissibility and lethality, studies have shown that other disease traits, such as incubation time, environmental survival, and available vectors, could be modified as well.19-21

Although these experiments had scientific merit and were not conducted with malicious intent, their implications are still worrying. This is especially true given that there is also a long historical track record of state-run bioweapon research applying cutting-edge science and technology to design agents not previously seen in nature. The Soviet bioweapons program developed agents with traits such as enhanced virulence, resistance to therapies, greater environmental resilience, increased difficulty to diagnose or treat, and which caused unexpected disease presentations and outcomes.22 Delivery capabilities have also been subject to the cutting edge of technical development, with Canadian, US, and UK bioweapon efforts playing a critical role in developing the discipline of aerobiology.23,24 While there is no evidence of state-run bioweapons programs directly attempting to develop or deploy bioweapons that would pose an existential risk, the logic of deterrence and mutually assured destruction could create such incentives in more unstable political environments or following a breakdown of the Biological Weapons Convention.25 The possibility of a war between great powers could also increase the pressure to use such weapons—during the World Wars, bioweapons were used across multiple continents, with Germany targeting animals in WWI,26 and Japan using plague to cause an epidemic in China during WWII.27

Non-state actors may also pose a risk, especially those with explicitly omnicidal aims. While rare, there are examples. The Aum Shinrikyo cult in Japan sought biological weapons for the express purpose of causing extinction.28 Environmental groups, such as the Gaia Liberation Front, have argued that “we can ensure Gaia's survival only through the extinction of the Humans as a species … we now have the specific technology for doing the job … several different [genetically engineered] viruses could be released”(quoted in ref. 29). Groups such as R.I.S.E. also sought to protect nature by destroying most of humanity with bioweapons.30 Fortunately, to date, non-state actors have lacked the capabilities needed to pose a catastrophic bioweapons threat, but this could change in future decades as biotechnology becomes more accessible and the pool of experienced users grows.31,32

What is the appropriate response to these speculative extinction threats? A balanced biosecurity portfolio might include investments that reduce a mix of proven and speculative risks, but striking this balance is still difficult given the massive uncertainties around the low-probability, high-consequence risks. In this article, we examine the traditional spectrum of biosecurity risks (ie, biocrimes, bioterrorism, and biowarfare) to categorize biothreats by likelihood and impact, expanding the historical analysis to consider even lower-probability, higher-consequence events (catastrophic risks and existential risks). In order to produce reasoned estimates of the likelihood of different categories of biothreats, we bring together relevant data and theory and produce some first-guess estimates of the likelihood of different categories of biothreat, and we use these initial estimates to compare the cost-effectiveness of reducing existential risks with more traditional biosecurity measures. We emphasize that these models are highly uncertain, and their utility lies more in enabling order-of-magnitude comparisons rather than as a precise measure of the true risk. However, even with the most conservative models, we find that reduction of low-probability, high-consequence risks can be more cost-effective, as measured by quality-adjusted life year per dollar, especially when we account for the lives of future generations. This suggests that despite the low probability of such events, society still ought to invest more in preventing the most extreme possible biosecurity catastrophes.

Here, we use historical data to analyze the probability and severity of biothreats. We place biothreats in 6 loose categories: incidents, events, disasters, crises, global catastrophic risk, and existential risk. Together they form an overlapping spectrum of increasing impact and decreasing likelihood (Figure 1).\*

A spectrum of differing impacts and likelihoods from biothreats. Below each category of risk is the number of human fatalities. We loosely define global catastrophic risk as being 100 million fatalities, and existential risk as being the total extinction of humanity. Alternative definitions can be found in previous reports,33 as well as within this journal issue.34

The historical use of bioweapons provides useful examples of some categories of biothreats. Biocrimes and bioterrorism provide examples of incidents.† Biological warfare provides examples of events and disasters. These historical examples provide indicative data on likelihood and impact that we can then feed into a cost-effectiveness analysis. We should note that these data are both sparse and sometimes controversial. Where possible, we use multiple datasets to corroborate our numbers, but ultimately the “true rate” of bioweapon attacks is highly uncertain.

Historically, risks of biocrime‡ and bioterrorism§ have been limited. A 2015 Risk and Benefit Analysis for Gain of Function Research detailed 24 biocrimes between 1990 and 2015 (0.96 per year) and an additional 42 bioterrorism incidents between 1972 and 2014 (1 per year).36 This is consistent with other estimates of biocrimes and bioterrorism frequency, which range from 0.35 to 3.5 per year (see supplementary material, part 1, at http://online.liebertpub.com/doi/suppl/10.1089/hs.2017.0028).

Most attacks typically result in no more than a handful of casualties (and many of these events include hoaxes, threats, and attacks that had no casualties at all). For example, the anthrax letter attacks in the United States in 2001, perhaps the most high-profile case in recent years, resulted in only 17 infections with 5 fatalities.37 The 2015 Risk and Benefit Analysis for Gain of Function Research detailed only a single death from the recorded biocrimes.\*\* Only 1 of the bioterrorism incidents in the report had associated deaths (the 2001 anthrax letter attacks).36 Based on this data, for the purposes of this article, we assume that we could expect 1 incident per year resulting in up to tens of deaths.

Academic overviews of biological warfare†† detail 7 programs prior to 1945.38 A further 9 programs are recorded between 1945 and 1994.39 For most of the last century, at least 1 program was active in any given year (Table 1).

The actual use of bioweapons by states is less common: Over the 85 years covered by these histories (1915 to 2000), 18 cases of use (or possible use) were recorded, including outbreaks connected to biological warfare (see supplementary material, part 2, at http://online.liebertpub.com/doi/suppl/10.1089/hs.2017.0028). Extrapolating this out (dividing 18 by 85), we would have about a 20% chance per year of biowarfare. It is worth noting the limitations of these data. Most of these events occurred before the introduction of the Biological Weapons Convention and were conducted by countries that no longer have biological weapons programs. Since many of these incidents occurred during infrequent great power wars, we revise our best guess to around 10% chance per year of biowarfare.

We use 2 sets of data to estimate the magnitude of such events. The first dataset was Japanese biological warfare in China,40 where records indicate a series of attacks on towns resulted in a mean of 330 casualties per event and 1 case in which an attack resulted in a regional outbreak causing an estimated 30,000 deaths (see supplementary material, part 3, at http://online.liebertpub.com/doi/suppl/10.1089/hs.2017.0028). The second data set came from disease events that were alleged to have an unnatural origin.41 In one case study, a point source release of anthrax resulted in at least 66 deaths. In a second case study, a regional epidemic of the same disease resulted in more than 17,000 human cases. While these events were not confirmed as having been caused by biological warfare, contemporary or subsequent analysis has suggested that such an origin was at least feasible. Combined, these figures provide an estimated impact of between 66 to 330 and 17,000 to 30,000.

For the purposes of this analysis, we are assuming the lower boundary figures from biological warfare are indicative of events, with a likelihood of 10% per year and an impact ranging between tens and thousands of fatalities. The upper boundary figures from biological warfare are indicative of disasters, with a likelihood of 1% per year and an impact range of thousands to tens of thousands of fatalities.‡‡

Unlike standard biothreats, there is no historical record on which to draw when considering global catastrophic or existential risks. Alternative approaches are required to estimate the likelihood of such an event. Given the high degree of uncertainty, we adopt 3 different approaches to approximate the risk of extinction from bioweapons: utilizing surveys of experts, previous major risk assessments, and simple toy models. These should be taken as initial guesses or rough order-of-magnitude approximations, and not a reliable or precise measure.

An informal survey at the 2008 Oxford Global Catastrophic Risk Conference asked participants to estimate the chance that disasters of different types would occur before 2100. Participants had a median risk estimate of 0.05% that a natural pandemic would lead to human extinction by 2100, and a median risk estimate of 2% that an “engineered” pandemic would lead to extinction by 2100.42

The advantage of the survey is that it directly measures the quantity that we are interested in: probability of extinction from bioweapons. The disadvantage is that the estimates were likely highly subjective and unreliable, especially as the survey did not account for response bias, and the respondents were not calibrated beforehand. We therefore also turn to other models that, while indirect, provide more objective measures of risk.§§

Recent controversial experiments on H5N1 influenza prompted discussions as to the risks of deliberately creating potentially pandemic pathogens. These agents are those that are highly transmissible, capable of uncontrollable spread in human populations, highly virulent, and also possibly able to overcome medical countermeasures.44 Previous work in a comprehensive report done by Gryphon Scientific, Risk and Benefit Analysis of Gain of Function Research,36 has laid out very detailed risk assessments of potentially pandemic pathogen research, suggesting that the annual probability of a global pandemic resulting from an accident with this type of research in the United States is 0.002% to 0.1%. The report also concluded that risks of deliberate misuse were about as serious as the risks of an accidental outbreak, suggesting a 2-fold increase in risk. Assuming that 25% of relevant research is done in the United States as opposed to elsewhere in the world, this gives us a further 4-fold increase in risk. In total, this 8-fold increase in risk gives us a 0.016% to 0.8% chance of a pandemic in the future each year (see supplementary material, part 4, at http://online.liebertpub.com/doi/suppl/10.1089/hs.2017.0028).

The analysis in Risk and Benefit Analysis of Gain of Function Research suggested that lab outbreaks from wild-type influenza viruses could result in between 4 million and 80 million deaths,36 but others have suggested that if some of the modified pathogens were to escape from a laboratory, they could cause up to 1 billion fatalities.45 For the purposes of this model, we assume that for any global pandemic arising from this kind of research, each has only a 1 in 10,000\*\*\* chance of causing an existential risk. This figure is somewhat arbitrary but serves as an excessively conservative guess that would include worst-case situations in which scientists intentionally cause harm, where civilization permanently collapses following a particularly bad outbreak, or other worst-case scenarios that would result in existential risk. Multiplying the probability of an outbreak with the probability of an existential risk gives us an annual risk probability between 1.6 × 10–8 and 8 × 10–7.†††

Previous literature has found that casualty numbers from terrorism and warfare follow a power law distribution, including terrorism from WMDs.46 Power laws have the property of being scale invariant, meaning that the ratio in likelihood between events that cause the deaths of 10 people and 10,000 people will be the same as that between 10,000 people and 10,000,000 people.‡‡‡ This property results in a distribution with an exceptionally heavy tail, so that the vast majority of events will have very low casualty rates, with a couple of extreme outliers.

Past studies have estimated this ratio for terrorism using biological and chemical weapons to be about 0.5 for 1 order of magnitude,47 meaning that an attack that kills 10x people is about 3 times less likely (100.5) than an attack that kills 10x–1 people (a concrete example is that attacks with more than 1,000 casualties, such as the Aum Shinrikyo attacks, will be about 30 times less probable than an attack that kills a single individual). Extrapolating the power law out, we find that the probability that an attack kills more than 5 billion will be (5 billion)–0.5 or 0.000014. Assuming 1 attack per year (extrapolated on the current rate of bio-attacks) and assuming that only 10% of such attacks that kill more than 5 billion eventually lead to extinction (due to the breakdown of society, or other knock-on effects), we get an annual existential risk of 0.0000014 (or 1.4 × 10–6).

We can also use similar reasoning for warfare, where we have more reliable data (97 wars between 1820 and 1997, although the data are less specific to biological warfare). The parameter for warfare is 0.41,47 suggesting that wars that result in more than 5 billion casualties will comprise (5 billion)–0.41 = 0.0001 of all wars. Our estimate assumes that wars will occur with the same frequency as in 1820 to 1997, with 1 new war arising roughly every 2 years. It also assumes that in these extreme outlier scenarios, nuclear or contagious biological weapons would be the cause of such high casualty numbers, and that bioweapons specifically would be responsible for these enormous casualties about 10% of the time (historically bioweapons were deployed in WWI, WWII, and developed but not deployed in the Cold War—constituting a bioweapons threat in every great power war since 1900). Assuming that 10% of biowarfare escalations resulting in more than 5 billion deaths eventually lead to extinction, we get an annual existential risk from biowarfare of 0.0000005 (or 5 × 10–7).

Perhaps the most interesting implication of the fatalities following a power law with a small exponent is that the majority of the expected casualties come from rare, catastrophic events. The data also bear this out for warfare and terrorism. The vast majority of US terrorism deaths occurred during 9/11, and the vast majority of terrorism injuries in Japan over the past decades came from a single Aum Shinrikyo attack. Warfare casualties are dominated by the great power wars. This suggests that a typical individual is far more likely to die from a rare, catastrophic attack as opposed to a smaller scale and more common one. If our goal is to reduce the greatest expected number of fatalities, we may be better off devoting resources to preventing the worst possible attacks.

Each of our estimates rely to some extent on guesswork and remain highly uncertain. Technological breakthroughs in areas such as diagnostics, vaccines, and therapeutics, as well as vastly improved surveillance, or even eventual space colonization, could reduce the chance of disease-related extinction by many orders of magnitude. Other breakthroughs such as highly distributed DNA synthesis or improved understanding of how to construct and modify diseases could increase or decrease the risks. Destabilizing political forces, the breakdown of the Biological Weapons Convention, or warfare between major world powers could vastly increase the amount of investment in bioweapons and create the incentives to actively use knowledge and biotechnology in destructive ways. Each of these factors suggests that our wide estimates could still be many orders of magnitude off from the true risk in this century. But uncertainty is not cause for reassurance. In instances where the probability of a catastrophe is thought to be extremely low (eg, human extinction from bioweapons), greater uncertainty around the estimates will typically imply greater risk of the catastrophe, as we have reduced confidence that the risk is actually at a low level.48 §§§

Given that our conservative models are based on historical data, they fail to account for the primary source of future risk: technological development that could radically democratize the ability to build advanced bioweapons. If the cost and required expertise of developing bioweapons falls far enough, the world might enter a phase where offensive capabilities dominate defensive ones. Some scholars, such as Martin Rees, think that humanity has about a 50% chance of going extinct due in large part to such technologies.49 However, incorporating these intuitions and technological conjectures would mean relying on qualitative arguments that would be far more contentious than our conservative estimates. We therefore proceed to assess the cost-effectiveness on the basis of our conservative models, until superior models of the risk emerge.

### 2NC---Link---U.S Key

#### The U.S is their main target.

Lindsey O’Donnell-Welch, 22 (Lindsey O’Donnell-Welch, executive editor at Duo Security, focused in English from College of the Holy Cross, 4-20-2022, accessed on 7-23-2022, Duo Security, “CHINESE CYBER ESPIONAGE APTS REFOCUS STRATEGY”, <https://duo.com/decipher/chinese-cyber-espionage-apts-refocus-strategy>, HBisevac)

Chinese **cyber espionage** actors have evolved their operations to **closely align** with national-level priorities around **economic development** and **national defense**, a recent report revealed.

In Mandiant’s M-Trends report released this week, researchers said in 2021 the number of Chinese espionage groups in the landscape dropped from at least 244 separate Chinese actor sets, tracked over the last five years, to 36 active groups, pointing to a “more focused, professionalized, and sophisticated attacks conducted by a smaller set of actors.”

This smaller set of groups, which include existing and known groups like APT10, APT41, and the Conference Crew group, have retooled and pivoted their strategies to better align with China’s **overall strategy**, which is encapsulated by its most recent **Five Year plan**, launched in early 2021. This plan focuses on supporting the nation’s Belt and Road Initiative, its long-term policy and investment program that centers on infrastructure and economic development, which aims for national self-reliance through growing domestic markets versus a previous strategy that relied on trade agreements. The plan also focuses on markets like **tech**nology, financials, energy, **telecommunications** and **healthcare**.

“These national-level priorities signal an **upcoming increase** in China-nexus actors conducting **intrusion** attempts against **i**ntellectual **p**roperty or other strategically important economic concerns, as well as defense industry products and other dual-use technologies over the next few years,” said researchers with Mandiant.

The Emergence of a New Strategy

While espionage has long been a goal for China-nexus APTs, with APT1 being disclosed in 2013 after launching a multi-year, enterprise scale espionage campaign, the groups have evolved based on national-level strategies. China’s national goals early on revolved around asserting itself internationally. Then, between 2014 to 2016, researchers observed an overall decline in activity by China-nexus groups, which they said may have been due to transitions within China’s government.

“The apparent decline in observable incidents may reflect the shift within China’s own bureaucracy, where the centralization of state power and the restructuring of the military apparatus resulted in a move away from prolific amateur cyber-attacks in favor of more focused, professionalized, and sophisticated attacks conducted by a smaller set of actors,” said researchers.

In 2017, researchers observed espionage actors both re-emerge with new malware, or reorganize in completely new groups. Since then, researchers have steadily observed actors’ technical tradecraft steadily evolving to become “stealthier and more agile, while taking measures to complicate attribution.” The actors have been launching supply-chain attacks and relying on zero-day flaws such as the Microsoft Exchange ProxyLogon vulnerabilities or flaws in Pulse Secure VPNs.

In a February testimony before the U.S.-China Economic and Security Review Commission, researchers said they believe Chinese cyber espionage activity has shown a “**higher tolerance** for **risk** and is **less constrained** by norms or diplomatic pressures.” Researchers also observed resources being shared across groups over the past year, with multiple Chinese espionage actors using the same malware, signaling a centralized development and distribution center.

“Chinese cyber espionage operators’ use of vulnerability exploitation, third party compromise, and software supply chain compromise exemplify both the scale of Chinese state-sponsored threat activity and the strategic evolution in use of tactics to maximize efficiency and impact,” said Kelli Vanderlee, senior manager of strategic analysis with Mandiant threat intelligence.

The Future of Chinese Cyber Espionage Activity

Researchers also pointed to China acquiring network infrastructure behind devices like the Internet of Things (IoT), which raises concerns that it could “create a pervasive system that can be exploited by China for both internal and external reconnaissance and surveillance campaigns.”

“This strategy has already proven successful as Beijing is able to target hardened, more challenging targets indirectly through various supply chain and third-party victim compromises to extract political, economic, defense and surveillance information,” said researchers.

Asia and the U.S. are the **top region**s targeted by these Chinese espionage groups, with 15 percent of their victims being U.S. entities. At the same time, seven of the current 36 APTs have collected sensitive data from public entities, showing that governmental organizations continue to be the **most targeted sector**. This has caused concerns by U.S. governmental organizations: An Annual Threat Intelligence report by the Office of the Director of National Intelligence assessed that China “presents the **broadest**, most **active** and **persistent** **cyber espionage threat**” to U.S. government and private sector networks.

In March, a report showed that the APT41 group compromised at least six U.S. state government networks between May and February in a “deliberate campaign” that reflects new attack vectors and retooling by the prolific Chinese state-sponsored group. Also in March, the Google Threat Analysis Group (TAG) issued a warning that they detected a phishing campaign by China-linked espionage group APT31 targeting “high-profile Gmail users affiliated with the U.S. government” in February. Researchers said that espionage targets are carefully selected and derived from **governmental priorities**, including China’s Five-Year plans, policy platforms or national defense strategies.

“Given the more aggressive nature of Beijing’s international diplomacy, along with the broader cyber espionage campaigns conducted by China-nexus threat actors, we anticipate that cyber espionage activity in support of China’s national security and economic interests will **continue to accelerate** in the **coming year**,” said Mandiant researchers.

### 2NC---UQ---Espionage High

#### China cyber espionage high now.

Patrick Howell O’Neill, 22 (Patrick Howell O’Neill is the cybersecurity senior editor for MIT Technology Review, 2-28-2022, accessed on 7-20-2022, MIT Tech Review, “How China built a one-of-a-kind cyber-espionage behemoth to last”, <https://www.technologyreview.com/2022/02/28/1046575/how-china-built-a-one-of-a-kind-cyber-espionage-behemoth-to-last/>, HBisevac)

The “most **advanced** piece of **malware**” that **China-linked hackers** have ever been known to use was revealed today. Dubbed Daxin, the stealthy **back door** was used in **espionage operations** against governments around the world for a decade before it was caught.

But the newly discovered malware is **no one-off**. It’s yet another sign that a decade-long quest to become a cyber superpower is **paying off** for China. While Beijing’s hackers were once known for simple smash-and-grab operations, the country is now among the best in the world thanks to a strategy of tightened control, big spending, and an infrastructure for feeding hacking tools to the government that is unlike anything else in the world.

This change has been going on for years, driven right from the very top. Soon after he ascended to power, President Xi Jinping began a **reorganization** of China’s military and intelligence agency, which **prioritized cyberwarfare** and initiated a “fusion” of military and civilian organizations geared toward boosting the nation’s cyber capabilities

The results are new tools and tactics that have **rapidly** become more **sophisticated** and **ambitious** over the past decade. For example, Chinese government hackers have exploited more powerful **zero-day vulnerabilities**—previously undiscovered weaknesses in technology for which there is no known defense—than any other nation, according to congressional testimony from Kelli Vanderlee, an intelligence analyst at the cybersecurity firm Mandiant. Research shows that Beijing exploited six times as many such powerful vulnerabilities in 2021 as in 2020.

#### Biotech is the prime target for Xi.

Sabri Ben-Achour, 21 (Sabri Ben-Achour, Correspondent & Host at Marketplace, 12-9-2021, accessed on 7-20-2022, Marketplace, “China’s state-sponsored industrial espionage is part of a larger system”, <https://www.marketplace.org/2021/12/09/chinas-state-sponsored-industrial-espionage-is-part-of-a-larger-system/>, HBisevac)

Chinese intelligence officer Yanjun Xu is awaiting sentencing in federal court after he was convicted of attempted theft of **trade secrets** and economic espionage last month. The U.S. government charged him with trying to steal sensitive engine technology from a U.S. aviation company by extracting information from an employee.

Xu’s purpose, intelligence officials say, was to hand that technology over to a Chinese company that the Chinese government hopes could rival Airbus and Boeing.

Xu is the first Chinese intelligence officer extradited to the U.S. to stand trial for espionage, according to the Department of Justice. (He was arrested in Belgium.) But U.S. prosecutors have been accusing Chinese spies of stealing trade secrets for years.

The list of victims is **long**: solar and steel companies, makers of computer chips and airplanes, labs doing **COVID-19 research**, **health care companies**, universities — it goes on and on.

“And it is most certainly guided by the **Chinese government**,” said Michael Orlando, acting director of the National Counterintelligence and Security Center, a government agency that focuses on threats from foreign powers.

“China has a number of national plans, which include Made in China 2025 and their 14th five-year plan, which lists about **10 technologies** that they are seeking to **dominate** in,” he said.

These include technologies upon which the industries and wealth generators of the future depend, like artificial intelligence, quantum information systems, **biotech**, semiconductors and autonomous systems.

“The Chinese government is using all instruments of national power, from **espionage** to legal acquisitions and joint ventures to acquire specific technologies, so they can be the world **leaders** in those technologies,” Orlando said, adding that China’s government will use **whatever means necessary** — legal and **illegal**.

That has been plain to see for Mark Widmar. He’s CEO of First Solar, the only large-scale U.S. solar cell manufacturer to survive competition from China’s — at one point — highly subsidized solar industry.

First Solar uses a specialized technology for its solar panels that Chinese companies do not have and are, he said, trying to acquire one way or another.

“We spend a lot of time around cybersecurity because we are constantly being attacked, and we know a lot of the efforts are being done with companies in China to get access to our data and our information,” Widmar said.

At the same time, Chinese companies are using more above-board methods, as well.

“I have been approached by Chinese associates requesting us to manufacture in China, and they have highlighted benefits they would be willing to provide around subsidies, not having to pay for buildings, highly subsidized capital and other benefits they would provide,” he said.

Despite the allure, Widmar’s refused. “Because we don’t want to expose our technology to potential risk of theft, so we’ve stayed away from manufacturing in China, and that’s one thing that’s helped us.”

China views national security and economic security as one and the same, said Anna Puglisi, director of biotechnology programs and senior fellow at Georgetown University’s Center for Security and Emerging Technology.

“China really looks at development of **science** and **tech**nology as **zero-sum**,” she said. “That’s really the **driver** behind a lot of the activities that we see.”

The importance of this is understood at the highest levels, Puglisi said. In a National Development and Reform Commission report from 2017, “[Chinese President Xi Jinping] describes science and technology as a **national weapon**, that if China wants to be strong, it must have a powerful science and technology,” she said.

Xi has repeated similar language in a more recent speech, where he called science and technology “a **sharp weapon for development**” and said that “if science and technology are strong, the country will be strong.”

When it comes to sensitive technologies, the relationship between Chinese firms and their government is different than in economies like the United States, Korea, Japan or Europe. Chinese firms can ask specialized “science and technology diplomats” to help them connect with foreign companies that have the technology they need, Puglisi said. “And [those diplomats] help and try and broker those kinds of arrangements and collaborations or business deals.

The arrangements between the U.S. and Chinese companies have, at times, opened the way for the transfer of that technology to Chinese businesses, both in legal and illegal ways.

“Nonmarket decision-making and state subsidies give unfair advantage to China’s companies and forces U.S. and other Western companies to have to make concessions and give up technology they do not have to do other places in the world,” Puglisi said.

In one example of alleged forced technology transfer on American soil, several former executives of aviation startup Icon Aircraft — including former Boeing CEO Philip Condit — argued in a lawsuit that Chinese majority shareholders lifted Icon’s intellectual property on design and manufacturing.

Chinese firms can also ask China’s intelligence services for help, said Roy Kamphausen, president of the National Bureau of Asian Research and executive director of the Commission on the Theft of American Intellectual Property.

“Can you imagine if a major American company could say to the U.S. government, ‘Hey we’re entering into negotiations with a partner in X, Y, Z country, can the CIA help answer these questions about this company’s operations and trade secrets?’ Even as you say those words, it’s ridiculous, but it’s a very real thing that’s happening,” Kamphausen said.

He and intelligence officials say hacking — like the cyberattacks First Solar endures — have been a powerful tool used by China’s government to extract technology and economic advantage from foreign companies.

“Well, it’s massive, we’ll start with that,” said Adam Meyers, senior vice president of intelligence at CrowdStrike, a cybersecurity firm.

In 2015, U.S. President Barack Obama, Xi Jinping by his side, announced an agreement between the two leaders that neither country would “conduct or knowingly support cyber-enabled theft of intellectual property” for commercial gain.

China has not lived up to that commitment, and in a recent report, CrowdStrike called it “one of the most prolific state-sponsored cyber actors on the planet,”

Cyberattacks launched by any of the 51 groups in China tracked by CrowdStrike — including groups associated with the People’s Liberation Army, the Ministry of State Security and Public Safety, as well as regional intelligence services — **map closely** to China’s stated ambitions for **industries** and **technologies** the government wants its country to **dominate**, Meyers said.

“There’s just a **huge shopping list**,” he said. And the attacks have been **evolving**, Meyers added.

#### Biotech industries are at the heart of China’s rampant espionage agenda.

Rebecca Trager, 18 (Rebecca Trager, Senior US correspondent at Chemistry World, 7-31-2018, accessed on 7-20-2022, Chemistry World, “US biotechnology is key target for foreign cyberespionage”, <https://www.chemistryworld.com/news/us-biotechnology-is-key-target-for-foreign-cyberespionage/3009326.article>, HBisevac)

The US government’s **N**ational **C**ounterintelligence and **S**ecurity **C**enter (NCSC) has identified **biotechnology**, including chemical manufacturing and biomanufacturing, as one of the **top targets** for foreign cyber thieves looking to steal **US** **i**ntellectual **p**roperty and **trade secrets**. The NCSC’s report points to **biomaterials**, **biopharma**ceuticals and new **vaccines** and **drugs** as of **particular interest** for international economic espionage efforts. Beyond biotechnology, the NCSC concludes that energy and alternative energy is another sector that has been targeted, including biofuels as well as oil, gas and coalbed methane development.

The NCSC singles out China, Russia and Iran as ‘the **most pervasive**’ **threat**s to the US in this arena. The conclusion follows efforts by the Trump administration to address worries about unfair Chinese trade practices and attempts to steal US intellectual property through hefty new tariffs on Chinese products, including chemicals. These concerns also recently led the US government to tighten restrictions on visas for graduate students from China who plan to study certain ‘sensitive’ subjects, like advanced manufacturing and robotics, at the nation’s universities.

#### They’re on the rise and continue to target pharma industries.

CISA, 20 (Cybersecurity & Infrastructure Security Agency, 10-1-2020, accessed on 7-20-2022, “China Cyber Threat Overview and Advisories”, <https://www.cisa.gov/uscert/china>, HBisevac)

The Chinese government—officially known as the People’s Republic of China (PRC)—engages in malicious cyber activities to pursue its national interests. Malicious cyber activities attributed to the Chinese government targeted, and continue to target, a variety of industries and organizations in the United States, including **healthcare**, financial services, defense industrial base, energy, government facilities, **chemical**, critical manufacturing (including automotive and aerospace), **communications**, **IT** (including managed service providers), international **trade**, education, video gaming, faith-based organizations, and law firms. Additionally, Advisories published by CISA and other unclassified sources reveal that China is conducting operations worldwide to steal **i**ntellectual **p**roperty and sensitive data from critical infrastructure organizations, including organizations involved in **healthcare**, **pharma**ceutical, and research sectors working on **COVID-19 response**.

### 2NC---Impact---China Econ

#### The Chinese economy is rebounding despite COVID – but recovery isn’t locked in

Liu et. Al 6/29/22 – John Liu, executive editor at Bloomberg News (“China’s Economy Shows Signs of Improvement as Covid Eases”, *Bloomberg News*, 6/29/22, <https://www.bloomberg.com/news/articles/2022-06-30/china-s-factory-activity-disappoints-as-services-output-surges#xj4y7vzkg>) FGY

**China’s economy showed further signs of improvement** in June with a strong pickup in services and construction as Covid outbreaks and restrictions were gradually eased.

The official **manufacturing purchasing managers index rose** to 50.2 from 49.6 in May, the National Bureau of Statistics said Thursday, slightly below the median estimate of 50.5 in a Bloomberg survey of economists. It was the first time since February that the index was above 50, indicating an expansion in output compared with May.

The **non-manufacturing gauge**, which measures activity in the construction and services sectors, **climbed** to 54.7, the **highest in more than a year** and well above the consensus forecast of 50.5.

“The Chinese economy bottomed out in June and the **recovery is** basically **entrenched**, **although attention still needs to be paid** to imbalances between the recoveries in supply and demand,” according to a [statement](http://www.clic.org.cn/pmizzypmi/308392.jhtml) from the China Logistics Information Center, which publishes the PMI figures in partnership with the NBS.

China’s benchmark CSI 300 Index rallied 1.6% by the mid-day break even as most Asian stock markets were trading lower. Chinese stocks were also boosted by news of further easing of virus-related travel curbs. The offshore yuan strengthened as much as 0.2% after the data release to 6.6935 a dollar.

Easing Lockdowns

**Government restrictions to contain Covid outbreaks have gradually eased** over the last month. The financial hub Shanghai lifted its two-month lockdown at the start of June by allowing more shops to reopen, more factories to resume production, and for port operation to pick up.

The data suggests “the **pace of recovery accelerated** as the Covid situation stabilized,” said Peiqian Liu, chief China economist at NatWest Group Plc. There was a “broad based but still soft recovery in both production and new orders,” and the figures show the rebound is still milder compared with the recovery from the Wuhan lockdown in 2020, she said.

Some 19 of the 21 sectors in the service sectors tracked in the survey returned to expansion last month, up from just six in the previous month, NBS analyst Zhao Qinghe said in a separate [statement](http://www.stats.gov.cn/tjsj/sjjd/202206/t20220630_1858687.html). Gauges of sectors previously hit badly by the outbreaks all improved, such as railway transport, air transport, accommodation, catering and entertainment.

The pickup in the transportation industry helped shorten the time for raw materials to reach manufacturing customers, with an index measuring the delivery time of suppliers jumping to 51.3, the highest in more than six years. A higher number indicates shorter delivery times, but that improvement likely lowered the headline PMI figure because of the way the data is calculated, economists said.

Normally shorter shipping times means demand is contracting and so indicates an economic slowdown. However this month, this indicates that logistics are getting back to normal, and so the actual rebound in manufacturing activity was likely stronger than the main PMI figure shows, according to economists including Standard Chartered Plc.’s Ding Shuang and Zhang Zhiwei at Pinpoint Asset Management Ltd.

Smoother logistics also facilitated construction progress and boosted confidence of the sector’s companies in the business outlook, the NBS’s Zhao said.

#### Chinese cyber espionage is key to SOE development, underpins sustainable growth and global leadership

Lee 13 – John Lee, professor and senior fellow at the University of Sydney, nonresident scholar at the Hudson Institute, M.A. and Ph.D. in international relations from the University of Oxford, degree in Arts and Law from the University of New South Wales, former senior advisor to the Australian Foreign Minister “(Cyber Kleptomaniacs: Why China Steals Our Secrets,” , 2013, World Affairs Journal, September/October, <http://www.worldaffairsjournal.org/article/cyber-kleptomaniacs-why-china-steals-our-secrets>) FGY

Estimates by American industry and intelligence agencies put the value of the stolen data in the hundreds of billions of dollars. Washington’s National Counterintelligence Executive flatly stated in a November 2011 report that **China is “building its** **economy” on “US tech**nology, research, and development, and other sensitive forms of intellectual property.” While the commercial payoffs are readily apparent, China’s cyber espionage program is not without risks. After all, Beijing doesn’t merely seek wealth and power but prestige and influence as well, and a reputation as a cyber outlaw is not the best path to the high level of international legitimacy the regime desperately seeks. And as it becomes more tightly integrated into an interdependent global economy, and the international norms and bodies that regulate and govern it, China is increasingly vulnerable to legal pressures and sanctions, as well as stigmatization by its competitors in the international community. The **Chinese leadership has persisted in its cyber espionage**, despite these hazards, because it believes that these **activities are essential to the innovation-based economy it sees as its national future.** In its twelfth five-year plan (2011–15), the government committed itself to ensuring that the country’s massive state-owned enterprises (SOEs) would continue to dominate key sectors of its economy—perhaps no surprise given that many of China’s unelected leaders and their families personally own large shares of these companies. The five-year plan also identified the country’s key “strategic sectors” on which its **future growth**, prosperity, and **economic strength** would hinge: **technology, aerospace, telecommunications**, energy, transportation, engineering services, and high-tech electronics. These are the **same sectors that China’s cyber espionage has targeted**. China’s latest five-year plan incorporated the goals of a previously issued report, the “National Medium- to Long-Term Plan for the Development of Science and Technology.” This 2006 “techno-nationalist” plan called for 2.5 percent of GDP to be allocated to R&D with the goal of reducing China’s dependence on foreign technologies by half by 2020, leading the country to emerge as the world’s dominant innovation leader by mid-century. China’s **state-owned enterprises are viewed as central** to achieving this national goal and have been accordingly given lavish access to cheap and often free capital to fund innovation investment. These SOEs, some managed nationally and some locally, **own more than two-thirds of the country’s capital and fixed assets**, and invest more in the country’s twelve largest economic sectors (with the exception of export manufacturing) than do privately owned businesses. The government places special emphasis on those SOEs that operate in the specially designated “strategic sectors” considered vital to the country’s future global leadership. They include energy and alternative fuel, bio- and nano-technology, high-end and advanced manufacturing, advanced materials such as rare earth metals, and information technology and **emerging technologies**. In December 2010, Beijing announced that it was **prepared to set aside $1.5 trillion** mainly for SOEs to invest in these sectors. The **SOEs receive more than three-quarters of all China’s formal financing** (i.e., bank loans), usually at below-market interest rates, although they generate only about one-third of national output, according to Minxin Pei, a leading political economist focused on China. Of the nearly fifteen hundred firms listed on China’s two stock exchanges, all but fifty or so are either majority-owned by the state or count the state as the largest and dominant shareholder. SOEs **generate nearly eighty-three percent of the combined revenues** and own **more than ninety percent of combined assets of the country’s leading five hundred firms**. Indeed, the three largest SOEs in China—Sinopec, PetroChina, and National Grid—make more profit than the combined profits of the five hundred largest private firms in the country, according to 2012 figures released by China’s State-owned Assets Supervision and Administration Commission and the National Bureau of Statistics. Yet although some giants such as Sinopec and China Mobile pile up enormous profits each year, as a whole China’s SOEs perform poorly even with their monopolistic advantages, gargantuan size, and the state support and leverage that accompanies it. As a whole, China’s locally managed SOEs appear to be the most abysmal performers. According to my analysis of multiple case studies, reinforced by other studies and estimates, about twenty percent of all Chinese SOEs were unprofitable in 1978. Twenty years later, in 1997, the number of unprofitable locally controlled SEOs had doubled. And today, nearly another twenty years later, the number of unprofitable SEOs is more than fifty percent. The 2012 World Bank report China 2030, which looks at structural problems with the Chinese growth model, estimated that the amount of capital input needed to produce one additional dollar of output increased from 2:1 in the 1980s, to 3:1 in the 1990s, to 4:1 early this century, and finally, to the current estimate of 7:1. Multiple case studies have shown that domestic private sector firms are about twice as efficient in their use of capital, and are three times more efficient than SOEs at generating jobs based on the amount of capital deployed per job. China’s private firms, not the state conglomerates, hold sixty-five percent of all China’s patents and are responsible for three-quarters of the country’s commercialized technological innovations. But while these private firms bring eighty percent of all new domestic products to market, China’s capacity for wholly indigenous innovation remains stifled as a result of domestic anti-competitive practices in favor of SOEs, which continue to dominate the economy despite their poor performance. One key reason for this disparity is that the typical SOE manager is selected less for his business savvy than for political connections and credentials. Almost all of the SOE senior managers in the centrally managed enterprises are Communist Party members, and in many cases the CEO and party secretary within the company is the same person. A July 2012 report by McKinsey and Company, one of the world’s leading management consulting firms, notes that the average profit margin of the forty-two Chinese SOEs listed among the Fortune 500’s top international companies was less than half that of their global competitors—this after the government infused them with “massive state subsidies.” Xu Haoxun, McKinsey’s China country director, believes that without the benefit of state subsidies and protections only a handful of these forty-two Chinese SOEs would be authentically competitive. But now, with China’s labor and production costs rising, the country’s SOE managers are under mounting pressure to increase profit margins. Meeting the five-year plan’s goal to increase profitability and market share—something Xu Haoxun believes is “key to the survival of Chinese enterprises”—**means an increased reliance on cyber espionage**, no matter the problems with the US and the rest of the West that this initiative may cause. **Stealing information from foreign firms**, whether they are located inside China or on foreign soil, is **certainly a cheaper and faster way to remedy innovation deficits** than to do the hard work of indigenous development Chinese planners identified as a key objective in the 2006 “Plan for the Development.” In its relentless drive to skip steps, Beijing seems not yet to have realized—or been made to realize—that the loss of reputation that comes with being a serial economic rule-breaker carries considerable political and diplomatic risks, chief among them a growing unwillingness of foreign firms to share advanced technologies and processes with Chinese joint venture partners. **Cyber espionage is necessary because China has become stuck between the rock of its lofty goals and the hard place of its modest achievement**. Burdened by statism and the anti-competitive practices that breed its gnawing inefficiency, China’s state-owned enterprises cannot innovate at the level and pace that will produce self-sufficiency, much less global leader status. Its private sector, which might actually rock the cradle of innovation, is stifled by an unlevel playing field and stunted by the legal system’s failure to protect intellectual property rights and the judiciary’s refusal to robustly enforce contract law. This toxic atmosphere is causing those foreign firms with advanced technologies and processes to think twice about basing operations in a China whose communist leaders are mired in zero-sum thinking that says increased market share for foreign firms can only come at the expense of SOEs. While China’s record of genuine innovation remains poor for an economy of its size, it continues to focus on what some experts have termed “engineering-based” and “incremental” innovation. As Professor Dan Breznitz of Georgia Tech puts it, China is **looking for a shortcut** that does not require “dedication to originality and the large commitment to . . . unique, first-time products.” The aim is to master the art of second-generation innovation, using established technologies to come up with new solutions, give every support to SOEs to bring these technologies to the domestic market before foreign firms can, and then use these foundations to expand into global markets. It is what some experts such as Robert Atkinson, president of the Information Technology and Innovation Foundation, call “innovation mercantilism.” China’s “national champions” in the state-owned enterprises need to out-perform international commercial rivals to grow their revenues in domestic and foreign markets. Since they appear unable to do this on their own, **they use data theft to win the game.**

#### Another financial crisis sparks Chinese diversionary aggression towards the US – causes miscalc

Carter 19 – Erin Baggott Carter, assistant professor at the School of International Relations at the University of Southern California and Co-PI at the Lab on Non-Democratic Politics, Ph.D. in government from Harvard University, former fellow at the Stanford Center for International Security and Cooperation (“Diversionary Aggression in Chinese Foreign Policy, 1/22/2019, <https://www.brookings.edu/articles/diversionary-aggression-in-chinese-foreign-policy/>) FGY

How do we know that **diversionary aggression is a critical element of Chinese foreign policy**? China’s unique political economy enables us to measure just how much of the conflict that China initiates toward the United States is diversionary.

The Chinese regime is underpinned by an **autocratic social contract**: In exchange for loyalty, elites expect the regime to compensate them. In the early 1990s, Deng Xiaoping transformed China’s emerging equity markets into a massive patronage system. To reward loyal supporters, Deng appointed them to senior positions at state-owned enterprises about to go public. There, they could purchase ownership shares prior to the IPO. Because initial share prices were dramatically undervalued, this constituted a massive arbitrage opportunity. Since the 1990s, the Shanghai Stock Exchange (SSE) has served primarily to reward elites.[1] To reassure them, Chinese leaders have repeatedly pledged to protect elite investments in the stock market. In contrast, there is virtually no connection between stock returns and public interests. In 2011, only 9 percent of Chinese households invested in the SSE. Strikingly, the SSE has no relationship with growth, inflation, or unemployment, and so there is no evidence that SSE shocks foster popular discontent.

To explore the relationship between elite welfare and China’s foreign policy more systematically, I created a day-level dataset of over 3,000 bilateral interactions between the United States and China from 1990 to 2010 by coding some 10,000 pages of primary and secondary historical materials.[2] Controlling for a range of features,[3] I find that when the SSE declines by 5 percent to 15 percent, the Chinese government is twice as likely to initiate disputes with the United States. This level of volatility is extraordinarily common. It occurs in three of every 12 months.

Two other features of China’s diversionary aggression suggest that its **key objective is to cultivate public support**. First, it is routinely accompanied by propaganda that broadcasts to senior government officials just how popular the regime is: how its chief aim is to advance public welfare. The People’s Daily is the regime’s flagship propaganda newspaper. Its principal function is to communicate regime doctrine to elites. When the SSE declines, the People’s Daily covers “party-mass relations” (dangqun guanxi) much more positively. The size of the difference is equivalent to the difference in how positively Fox News covers Democrats versus Republicans. In short, when elite interests suffer, the regime’s propaganda apparatus informs elites that it is widely supported by the public.

Second, China reliably undertakes diplomatic charm offensives after episodes of diversionary aggression. For China, diversionary aggression is risky. **The United States might mistake it for a genuine attempt to revise the power balance in East Asia and respond with containment policies**. Accordingly, whenever China employs diversionary aggression, it quadruples its diplomacy the following month. Critically, this diplomacy is virtually always private, since Chinese citizens might view more public forms of cooperation with the United States as capitulation to the foreign adversary so recently demonized.

Newly released diplomatic cables provide a unique opportunity to observe this process in action. Between January and July 2010, the SSE lost one-third of its value. A range of evidence suggests that this crisis profoundly shaped Chinese foreign policy towards the United States. In March, U.S. policymakers were subjected to a “lengthy presentation” on China’s rights in the South China Sea, which were described as a “national priority.” Chinese propaganda reported that bilateral relations were “strained” and “at a low point.”

Simultaneously, the editor of the Global Times, the government’s most nationalist state-run newspaper, told U.S. Ambassador John Huntsman “not to be concerned” because China’s belligerence was “necessary to satisfy the Chinese people.” Huntsman reported to Washington that “over the coming months, China would stomp around and carry a small stick.” “This attitude,” he advised, “has more form than substance and is designed to play to Chinese public opinion.”

In July 2010, the SSE stabilized, and the economic interests of Chinese elites recovered. China quickly backpedaled.[4] Chinese officials accepted a longstanding offer for President Hu to visit Washington, agreed to support a U.N. Security Council statement condemning North Korea, reauthorized military exchanges with the United States, said they had not authoritatively called the South China Sea a “core interest,” and told US officials they were “willing to begin expert talks on a code of conduct in the South China Sea.” State Councilor Dai Bingguo even traveled to Pyongyang on a secret mission on behalf of the United States to warn North Korea not to respond to South Korean military exercises.

China ensured that these signals were correctly interpreted by American policymakers. Organization Department Minister Li Yuanchao told National Security Adviser Tom Donilon that China “would not challenge the United States for global leadership” and that “there was no inevitable conflict in their interests.” China’s private behavior during this period offers additional clues that its aggression was diversionary rather than revisionist. Despite headlines proclaiming that China was “incensed” with American “containment,” Beijing agreed to help with an Iran resolution at the United Nations, on one condition: that it could keep its assistance private.

WHY THIS MATTERS

In attempting to secure near-dictatorial powers, **Xi has created enemies among the Chinese elite**. **Financial crises** and political purges **create incentives for elites to oppose Xi.** Some will try to remove him. **To inoculate himself against their conspiracies, Xi will employ diversionary foreign policy even more frequently than past generations of Chinese leaders,** for whom such **incentives motivated 40 percent of conflict initiation** with the United States, my estimates suggest.

### AT: China Econ Impact

#### Chinese economic decline causes global economic decline

Stephen S. Roach 16, senior fellow at Yale University’s Jackson Institute for Global Affairs and a senior lecturer at Yale School of Management, formerly chairman of Morgan Stanley Asia and chief economist at Morgan Stanley, the New York-based investment bank, holds a Ph.D. in economics from New York University, 2016, “The world's economy without Chinese growth,” World Economic Forum, October 26th, Available Online at <https://www.weforum.org/agenda/2016/10/the-worlds-economy-without-chinese-growth>

So what if the China doubters are right? What if China’s economy does indeed come crashing down, with its growth rate plunging into low single digits, or even negative territory, as would be the case in most crisis economies? China would suffer, of course, but so would an already-shaky global economy. With all the handwringing over the Chinese economy, it’s worth considering this thought experiment in detail.

For starters, without China, the world economy would already be in recession. China’s growth rate this year appears set to hit 6.7% – considerably higher than most forecasters have been expecting. According to the International Monetary Fund – the official arbiter of global economic metrics – the Chinese economy accounts for 17.3% of world GDP (measured on a purchasing-power-parity basis). A 6.7% increase in Chinese real GDP thus translates into about 1.2 percentage points of world growth. Absent China, that contribution would need to be subtracted from the IMF’s downwardly revised 3.1% estimate for world GDP growth in 2016, dragging it down to 1.9% – well below the 2.5% threshold commonly associated with global recessions.

Of course, that’s just the direct effect of a world without China. Then there are cross-border linkages with other major economies.

The so-called resource economies – namely, Australia, New Zealand, Canada, Russia, and Brazil – would be hit especially hard. As a resource-intensive growth juggernaut, China has transformed these economies, which collectively account for nearly 9% of world GDP. While all of them argue that they have diversified economic structures that are not overly dependent on Chinese commodity demand, currency markets say otherwise: whenever China’s growth expectations are revised – upward or downward – their exchange rates move in tandem. The IMF currently projects that these five economies will contract by a combined 0.7% in 2016, reflecting ongoing recessions in Russia and Brazil and modest growth in the other three. Needless to say, in a China implosion scenario, this baseline estimate would be revised downward significantly.

The same would be the case for China’s Asian trading partners – most of which remain export-dependent economies, with the Chinese market their largest source of external demand. That is true not only of smaller Asian developing economies such as Indonesia, the Philippines, and Thailand, but also of the larger and more developed economies in the region, such as Japan, Korea, and Taiwan. Collectively, these six China-dependent Asian economies make up another 11% of world GDP. A China implosion could easily knock at least one percentage point off their combined growth rate.

The United States is also a case in point. China is America’s third-largest and most rapidly growing export market. In a China-implosion scenario, that export demand would all but dry up – knocking approximately 0.2-0.3 percentage points off already subpar US economic growth of around 1.6% in 2016.

Finally, there is Europe to consider. Growth in Germany, long the engine of an otherwise sclerotic Continental economy, remains heavily dependent on exports. That is due increasingly to the importance of China – now Germany’s third-largest export market, after the European Union and the United States. In a China implosion scenario, German economic growth could also be significantly lower, dragging down the rest of a German-led Europe.

Interestingly, in its just-released October update of the World Economic Outlook, the IMF devotes an entire chapter to what it calls a China spillover analysis – a model-based assessment of the global impacts of a China slowdown. Consistent with the arguments above, the IMF focuses on linkages to commodity exporters, Asian exporters, and what they call “systemic advanced economies” (Germany, Japan, and the US) that would be most exposed to a Chinese downturn. By their reckoning, the impact on Asia would be the largest, followed closely by the resource economies; the sensitivity of the three developed economies is estimated to be about half that of China’s non-Japan Asian trading partners.

The IMF research suggests that China’s global spillovers would add about another 25% to the direct effects of China’s growth shortfall. That means that if Chinese economic growth vanished into thin air, in accordance with our thought experiment, the sum of the direct effects (1.2 percentage points of global growth) and indirect spillovers (roughly another 0.3 percentage points) would essentially halve the current baseline estimate of 2016 global growth, from 3.1% to 1.6%. While that would be far short of the record 0.1% global contraction in 2009, it wouldn’t be much different than two earlier deep world recessions, in 1975 (1% growth) and 1982 (0.7%).

### AT: Not Key to China

#### Current cyber espionage is essential to Chinese growth — foreign tech dependence

Segal 16 – Adam Segal, Ira A. Lipman Chair in Emerging Technologies and National Security and Director of the Digital and Cyberspace Policy Program at the Council on Foreign Relations, B.A. and Ph.D. in government from Cornell University, M.A. in international relations from the Fletcher School of Law and Diplomacy at Tufts University (“What’s the Future of Chinese Hacking?,” 7/30/2016, <http://motherboard.vice.com/read/future-of-chinese-hacking>) FGY

After years of public reporting on the theft of intellectual property, business strategies, and trade secrets, last month the cybersecurity firm FireEye issued a report headlining a steep decline in Chinese cyber espionage against organizations in the US and 25 other countries. The number of network compromises by 72 suspected China-based groups dropped from 60 in February 2013 to less than 10 by May 2016. While FireEye did not rule out the possibility that improvements in tradecraft were leading to less detection (FBI Director James Comey once compared Chinese hackers to drunk burglars who kick in the door and knock over a vase on their way out with the TV), US Assistant Attorney General John Carlin confirmed the company’s findings that attacks were less voluminous but more focused and calculated. A combination of the threat of US sanctions, a diplomatic accord signed by President Barack Obama and President Xi Jinping, and internal reforms of the People’s Liberation Army may have temporarily produced a dramatic decline in cyber espionage, but is it time to shut down the firewall, send the threat intelligence analysts home, and declare victory? Very unlikely. For Beijing, cyberspace is essential to economic growth, sustaining and strengthening the Chinese Communist Party, and maintaining domestic stability and national security. As a result, China hacks because it wants to move its economy from labor intensive manufacturing to high technology innovation; defeat foreign ideologies and weaken opponents of the regime; and counter the technological advantages of the US military in the Pacific. These fundamental motivations direct state-backed hackers to a set of high value targets. Because Chinese leaders do not want to be dependent on foreign technology suppliers, and are impatient with the results produced so far by massive investments in education and scientific research, Chinese hackers steal intellectual property from high technology companies as well as business secrets from the pharmaceutical, financial, energy, legal, and other sectors. “The situation that our country is under others' control in core technologies of key fields has not changed fundamentally, and the country's S&T foundation remains weak," President Xi Jinping told a gathering of the nation’s top scientists in May 2016. The companies breached are global, with victims identified in Germany, Australia, Japan, India, and the United Kingdom.

### 2NC---Impact---Pandemic Wars

#### It sparks global instability that goes nuclear

Tatsujiro Suzuki 21, Director and Professor at the Research Center for Nuclear Weapons Abolition, Nagasaki University, Former Vice Chairman of Japan Atomic Energy Commission, et al., “Pandemic Futures and Nuclear Weapon Risks: The Nagasaki 75th Anniversary Pandemic-Nuclear Nexus Scenarios Final Report”, Journal for Peace and Nuclear Disarmament, Volume 4, Issue Supplement 1, Taylor & Francis

The Challenge: Multiple Existential Threats

The relationship between pandemics and war is as long as human history. Past pandemics have set the scene for wars by weakening societies, undermining resilience, and exacerbating civil and inter-state conflict. Other disease outbreaks have erupted during wars, in part due to the appalling public health and battlefield conditions resulting from war, in turn sowing the seeds for new conflicts. In the post-Cold War era, pandemics have spread with unprecedented speed due to increased mobility created by globalization, especially between urbanized areas. Although there are positive signs that scientific advances and rapid innovation can help us manage pandemics, it is likely that deadly infectious viruses will be a challenge for years to come.

The COVID-19 is the most demonic pandemic threat in modern history. It has erupted at a juncture of other existential global threats, most importantly, accelerating climate change and resurgent nuclear threat-making. The most important issue, therefore, is how the coronavirus (and future pandemics) will increase or decrease the risks associated with these twin threats, climate change effects, and the next use of nuclear weapons in war.5

Today, the nine nuclear weapons arsenals not only can annihilate hundreds of cities, but also cause nuclear winter and mass starvation of a billion or more people, if not the entire human species. Concurrently, climate change is enveloping the planet with more frequent and intense storms, accelerating sea level rise, and advancing rapid ecological change, expressed in unprecedented forest fires across the world. Already stretched to a breaking point in many countries, the current pandemic may overcome resilience to the point of near or actual collapse of social, economic, and political order.

In this extraordinary moment, it is timely to reflect on the existence and possible uses of weapons of mass destruction under pandemic conditions – most importantly, nuclear weapons, but also chemical and biological weapons. Moments of extreme crisis and vulnerability can prompt aggressive and counterintuitive actions that in turn may destabilize already precariously balanced threat systems, underpinned by conventional and nuclear weapons, as well as the threat of weaponized chemical and biological technologies. Consequently, the risk of the use of weapons of mass destruction (WMD), especially nuclear weapons, increases at such times, possibly sharply.

The COVID-19 pandemic is clearly driving massive, rapid, and unpredictable changes that will redefine every aspect of the human condition, including WMD – just as the world wars of the first half of the 20th century led to a revolution in international affairs and entirely new ways of organizing societies, economies, and international relations, in part based on nuclear weapons and their threatened use. In a world reshaped by pandemics, nuclear weapons – as well as correlated non-nuclear WMD, nuclear alliances, “deterrence” doctrines, operational and declaratory policies, nuclear extended deterrence, organizational practices, and the existential risks posed by retaining these capabilities – are all up for redefinition.

A pandemic has potential to destabilize a nuclear-prone conflict by incapacitating the supreme nuclear commander or commanders who have to issue nuclear strike orders, creating uncertainty as to who is in charge, how to handle nuclear mistakes (such as errors, accidents, technological failures, and entanglement with conventional operations gone awry), and opening a brief opportunity for a first strike at a time when the COVID-infected state may not be able to retaliate efficiently – or at all – due to leadership confusion. In some nuclear-laden conflicts, a state might use a pandemic as a cover for political or military provocations in the belief that the adversary is distracted and partly disabled by the pandemic, increasing the risk of war in a nuclear-prone conflict. At the same time, a pandemic may lead nuclear armed states to increase the isolation and sanctions against a nuclear adversary, making it even harder to stop the spread of the disease, in turn creating a pandemic reservoir and transmission risk back to the nuclear armed state or its allies.

In principle, the common threat of the pandemic might induce nuclear-armed states to reduce the tension in a nuclear-prone conflict and thereby the risk of nuclear war. It may cause nuclear adversaries or their umbrella states to seek to resolve conflicts in a cooperative and collaborative manner by creating habits of communication, engagement, and mutual learning that come into play in the nuclear-military sphere. For example, militaries may cooperate to control pandemic transmission, including by working together against criminal-terrorist non-state actors that are trafficking people or by joining forces to ensure that a new pathogen is not developed as a bioweapon.

To date, however, the COVID-19 pandemic has increased the isolation of some nuclear-armed states and provided a textbook case of the failure of states to cooperate to overcome the pandemic. Borders have slammed shut, trade shut down, and budgets blown out, creating enormous pressure to focus on immediate domestic priorities. Foreign policies have become markedly more nationalistic. Dependence on nuclear weapons may increase as states seek to buttress a global re-spatialization6 of all dimensions of human interaction at all levels to manage pandemics. The effect of nuclear threats on leaders may make it less likely – or even impossible – to achieve the kind of concert at a global level needed to respond to and administer an effective vaccine, making it harder and even impossible to revert to pre-pandemic international relations. The result is that some states may proliferate their own nuclear weapons, further reinforcing the spiral of conflicts contained by nuclear threat, with cascading effects on the risk of nuclear war.

### 2NC---Impact---Pandemics

#### Disruptive pharma innovation solves pandemics.

Affan Shaikh, 15 (Affan Shaikh, Professor at School of Public Health at Emory, 9-23-2015, accessed on 7-20-2022, National Center for Biotechnology Innovation, “Disruptive Innovation Can Prevent the Next Pandemic”, NCBI, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4585064/>, HBisevac )

Public health surveillance (PHS) is at a tipping point, where the application of novel processes, technologies, and tools promise to vastly improve efficiency and effectiveness. Yet twentieth century, entrenched ideology and lack of training results in slow uptake and resistance to change. The term disruptive innovation – used to describe **advances** in **tech**nology and processes that change existing markets – is useful to describe the transformation of PHS. Past disruptive innovations used in PHS, such as distance learning, the smart phone, and field-based laboratory testing have outpaced older services, practices, and technologies used in the traditional classroom, governmental offices, and personal communication, respectively. Arguably, the greatest of these is the Internet – an infrastructural innovation that continues to enable exponential benefits in seemingly limitless ways. Considering the Global Health Security Agenda and facing emerging and reemerging infectious disease threats, evolving environmental and behavioral risks, and ever changing epidemiologic trends, PHS must transform. Embracing disruptive innovation in the structures and processes of PHS can be unpredictable. However, it is necessary to strengthen and unlock the potential to prevent, detect, and respond.

Fifty-two years ago, Alexander Langmuir articulated our modern understanding of public health surveillance (PHS) – the systematic collection, consolidation and evaluation, and dissemination of data (1). In this workflow process, public health provides epidemiologic intelligence to assess and track conditions of public health importance, define public health priorities, evaluate programs, and conduct public health research (2). However, amid this rapidly changing world, PHS has remained sluggish and hindered by the impediments of siloed, vertical (outcome-specific) systems, inadequate training and technical expertise, different information and communication technology (ICT) standards, concerns over data sharing and confidentiality, poor interoperability, and inadequate analytical approaches and tools (3–7).

Gaps and impediments in PHS have become increasingly evident to the world in the wake of the largest Ebola epidemic ever – in which these challenges impacted our ability to prevent, detect, and respond. Under the looming threat of MERS-CoV, leishmaniasis, influenza, multidrug-resistant tuberculosis, and plague, the global public health community now realizes the urgent need to address shortcomings in PHS. Properly preparing for the next major outbreak hinges on our willingness to transform; the consequences of not doing so are dire.

Transforming PHS to meet the needs of the twenty-first century requires novel approaches. A helpful concept to understand and chart this future is disruptive innovation – a term first introduced by Clayton Christensen to describe innovations in technology and processes that disrupt existing markets (8). Disruptive innovations occur when advances in technologies or processes create markets in existing industries. This differs from sustaining innovations, where existing practices are incrementally improved to meet the demands of existing customers; in contrast, newly introduced innovations with disruptive potential (typically unrefined, simple, and affordable in character) target lower-end market needs or create entirely new market segments. As sustaining innovations improve disrupting technologies or processes, these new innovations will meet increasingly greater needs, capture greater market share, and eventually reshape the industry. Christensen uses the example of increasingly smaller disk sizes in the hard disk drive industry, the introduction of hydraulic technology in the mechanical excavator industry, and the rise of minimills in the steel industry to demonstrate the impact of disruptive innovations (8). Here, we describe the need for disruptive innovation in PHS and identify opportunities for disruption in PHS structures and processes.

#### New pandemics are coming and cause extinction---preventative measures solve.

Eleftherios P. Diamandis 21 (Eleftherios P. Diamandis, Division Head of Clinical Biochemistry at Mount Sinai Hospital and Biochemist-in-Chief at the University Health Network and is Professor & Head, Clinical Biochemistry, Department of Laboratory Medicine and Pathobiology, University of Toronto, Ontario, Canada, April 14th 2021, “The Mother of All Battles: Viruses vs. Humans. Can Humans Avoid Extinction in 50-100 Years?” modified to fix author typo [“could result n” 🡪 “could result in” <https://www.preprints.org/manuscript/202104.0397/v1>) MULCH

The recent SARS-CoV-2 pandemic, which is causing COVID 19 disease, has taught us unexpected lessons about the dangers of human extinction through highly contagious and lethal diseases. As the COVID 19 pandemic is now being controlled by various isolation measures, therapeutics and vaccines, it became clear that our current lifestyle and societal functions may not be sustainable in the long term. We now have to start thinking and planning on how to face the next dangerous pandemic, not just overcoming the one that is upon us now. Is there any evidence that even worse pandemics could strike us in the near future and threaten the existence of the human race? The answer is unequivocally yes. It is not necessary to get infected by viruses of bats, pangolins and other exotic animals that live in remote forests in order to be in danger. Creditable scientific evidence indicates that the human gut microbiota harbor billions of viruses which are capable of affecting the function of vital human organs such as the immune system, lung, brain, liver, kidney, heart etc. It is possible that the development of pathogenic variants in the gut can lead to contagious viruses which can cause pandemics, leading to destruction of vital organs, causing death or various debilitating diseases such as blindness, respiratory, liver, heart and kidney failures. These diseases could result [in] the complete shutdown of our civilization and probably the extinction of human race. In this essay, I will first provide a few independent pieces of scientific facts and then combine this information to come up with some (but certainly not all) hypothetical scenarios that could cause human race misery, even extinction. I hope that these scary scenarios will trigger preventative measures that could reverse or delay the projected adverse outcomes.

#### Capacity for innovation solves invisible thresholds for existential pandemics – they’re coming now – new 400 year study + statistical methods

Michael Penn 21 (Michael Penn, Director of Communications, Marketing and Alumni Relations, Duke Global Health Initiative, citing William Pan, Ph.D., associate professor of global environmental health at Duke, Marco Marani, adjunct professor at Duke department of Global Health, where he previously was a professor of civil and environmental engineering and Anthony Parolari, Ph.D., of Marquette University, is a former Duke postdoctoral researcher, Gabriel Katul, Ph.D., the Theodore S. Coile Distinguished Professor of Hydrology and Micrometeorology at Duke, “Statistics Say Large Pandemics Are More Likely Than We Thought” Duke Global Health Institute, <https://globalhealth.duke.edu/news/statistics-say-large-pandemics-are-more-likely-we-thought>) CULTIV8

The COVID-19 pandemic may be the deadliest viral outbreak the world has seen in more than a century. But statistically, such extreme events aren’t as rare as we may think, asserts a new analysis of novel disease outbreaks over the past 400 years.

The study, appearing in the Proceedings of the National Academy of Sciences the week of Aug. 23, used a newly assembled record of past outbreaks to estimate the intensity of those events and the yearly probability of them recurring.

It found the probability of a pandemic with similar impact to COVID-19 is about 2% in any year, meaning that someone born in the year 2000 would have about a 38% chance of experiencing one by now. And that probability is only growing, which the authors say highlights the need to adjust perceptions of pandemic risks and expectations for preparedness.

“The most important takeaway is that large pandemics like COVID-19 and the Spanish flu are relatively likely,” said William Pan, Ph.D., associate professor of global environmental health at Duke and one of the paper’s co-authors. Understanding that pandemics aren’t so rare should raise the priority of efforts to prevent and control them in the future, he said.

The study, led by Marco Marani, Ph.D., of the University of Padua in Italy, used new statistical methods to measure the scale and frequency of disease outbreaks for which there was no immediate medical intervention over the past four centuries. Their analysis, which covered a murderer’s row of pathogens including plague, smallpox, cholera, typhus and novel influenza viruses, found considerable variability in the rate at which pandemics have occurred in the past. But they also identified patterns that allowed them to describe the probabilities of similar-scale events happening again.

In the case of the deadliest pandemic in modern history – the Spanish flu, which killed more than 30 million people between 1918 and 1920 -- the probability of a pandemic of similar magnitude occurring ranged from 0.3% to 1.9% per year over the time period studied. Taken another way, those figures mean it is statistically likely that a pandemic of such extreme scale would occur within the next 400 years.

“ The most important takeaway is that large pandemics like COVID-19 and the Spanish flu are relatively likely. WILLIAM PAN — ASSOCIATE PROFESSOR OF GLOBAL ENVIRONMENTAL HEALTH

In the case of the deadliest pandemic in modern history – the Spanish flu, which killed more than 30 million people between 1918 and 1920 -- the probability of a pandemic of similar magnitude occurring ranged from 0.3% to 1.9% per year over the time period studied. Taken another way, those figures mean it is statistically likely that a pandemic of such extreme scale would occur within the next 400 years.

But the data also show the risk of intense outbreaks is growing rapidly. Based on the increasing rate at which novel pathogens such as SARS-CoV-2 have broken loose in human populations in the past 50 years, the study estimates that the probability of novel disease outbreaks will likely grow three-fold in the next few decades.

Using this increased risk factor, the researchers estimate that a pandemic similar in scale to COVID-19 is likely within a span of 59 years, a result they write is “much lower than intuitively expected.” Although not included in the PNAS paper, they also calculated the probability of a pandemic capable of eliminating all human life, finding it statistically likely within the next 12,000 years.

That is not to say we can count on a 59-year reprieve from a COVID-like pandemic, nor that we’re off the hook for a calamity on the scale of the Spanish flu for another 300 years. Such events are equally probable in any year during the span, said Gabriel Katul, Ph.D., the Theodore S. Coile Distinguished Professor of Hydrology and Micrometeorology at Duke and another of the paper’s authors.

“When a 100-year flood occurs today, one may erroneously presume that one can afford to wait another 100 years before experiencing another such event,” Katul says. “This impression is false. One can get another 100-year flood the next year.”

As an environmental health scientist, Pan can speculate on the reasons outbreaks are becoming more frequent, noting that population growth, changes in food systems, environmental degradation and more frequent contact between humans and disease-harboring animals all may be significant factors. He emphasizes the statistical analysis sought only to characterize the risks, not to explain what is driving them.

But at the same time, he hopes the study will spark deeper exploration of the factors that may be making devastating pandemics more likely – and how to counteract them.

“This points to the importance of early response to disease outbreaks and building capacity for pandemic surveillance at the local and global scales, as well as for setting a research agenda for understanding why large outbreaks are becoming more common,” Pan said.

### 2NC---Impact---Biomed Research

#### It’s independently key to BioMed research.

Joris Hues 17, Innovation Exchange Amsterdam (IXA) Office AMC, Academic Medical Center, “Importance of intellectual property generated by biomedical research at universities and academic hospitals,” Mary 24, 2017. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5881943/

In this paper we have tried to inform scientists at academic institutions about the most important aspects of IP. In our experience, many scientists do not place much emphasis on securing the IP rights on an invention, or are unfamiliar with the process, which prompted us to write this paper. The underlying thought process, however, is essentially simple and applies to most situations in translational and clinical research. The chances that an invention will ultimately reach the target user are strikingly slim without valid IP protection on the invention. The low probability of a non-patented product reaching the market is due to the magnitude of the costs associated with the development and implementation trajectory, which is basically unavoidable for most inventions. Importantly, these costs are typically too high to be fully covered by the majority of public research funding agencies. We have had a patent agency perform a cost estimate for the technology referenced in [9], which yielded an estimate of total costs of approximately 15 million Euros. Even the largest consortium grants from Brussels could not entirely cover these costs.

Securing an IP position on an invention opens numerous avenues that could financially facilitate the development and launch of a new product or service. The exclusivity and safeguards of a strong IP position automatically create a win-win situation around a viable and sustainable business model for all parties involved. For example, angel investors and venture capitalists demand return on investment (ROI) for their infusion of high-risk capital backing, which scientists need to develop their invention. IP largely secures ROI because it allows companies to block direct competitors and thus obtain and retain an exclusive market share for the lifetime of the patent, once the product has passed the preclinical and clinical trial phases and has obtained marketing approval from the regulatory agencies (e.g. FDA/EMA). The same need for a solid IP position applies to companies interested in licensing the invention. Companies depend on significant revenue streams over longer periods to cover the costs of product development and to make a profit, and hence generally do not invest in products not protected by IP.

Researchers should realize that the main reason for securing IP rights is to increase the chance that their invention is developed into a product, and also that only very few patents lead to significant revenues.

In the final analysis, if clinical and translational researchers want their invention to help patients, they should opt for securing IP rights on their invention. In our opinion and experience, the (potential) benefits, as summarized in this paper, clearly outweigh the (potential) cons. Moreover, the path to eventual clinical application is not a solo adventure. Luckily, ample infrastructure and support in the form of KTOs is present in most academic institutions to help researchers with matters for which they have no expertise.

#### That solves global conflict

Marrogi & al-Dulaimi 14. Colonel Aizen J. Marrogi, USA, MD, has served as a Surgeon General Liaison Officer to the Iraqi Ministry of Defense. Dr. Saadoun al-Dulaimi is serving his second tour as Iraqi Minister of Defense and is also the Minister of Culture, “Medical Diplomacy in Achieving U.S. Global Strategic Objectives,” JFQ 74, 3rd Quarter 2014, <http://ndupress.ndu.edu/Portals/68/Documents/jfq/jfq-74/jfq-74_124-130_Marrogi-al-Dulaimi.pdf>

Since its introduction by Joseph Nye, Jr., in 1990, soft power has been defined as “achieving desirable influence through attraction and cooperation,” as opposed to hard power, which rests on inducements or threats.1 Although the concept of soft power is not universally embraced,2 using economic, cultural, scientific, and healthcare resources can create a dominant soft power that, when carefully applied, might generate favorable behavior from other nations and their leaders and build enduring partnerships to promote regional and global security. The healthcare sector is a diverse group of industries accounting for $2.8 trillion, or 17.8 percent, of the U.S. gross domestic product.3 It delivers direct health care through thousands of hospitals and other facilities and provides research and development for manufacturing pharmaceuticals, medical devices, and biotechnology. It is a research-intensive segment of the economy focusing on developing better methods for preventing, diagnosing, and treating life-threatening diseases, and it provides stability and prosperity in the form of millions of high paying jobs. It can also play a pivotal role in a U.S. asymmetric response to unpredictable challenges overseas, both directly through the care of patients and more generally in the economic benefits of expanding the healthcare sector in countries where unemployment and unfavorable socioeconomic factors contribute to radicalism. Physicians are well regarded in many cultures, especially in the Arab and Muslim world. U.S. policy strategists can leverage this historic goodwill and use the diplomacy of medicine to reach out to Arab and Muslim countries, especially those undergoing Arab Spring transitions including Egypt, Libya, Tunisia, Yemen, and even Syria. For countries such as Iraq that have shattered healthcare infrastructures, healthcare cooperation represents a unique opportunity to set their relationships with America on a more amicable and sustainable course.

## NoKo

### 1NC---Cyber Attacks Good---NoKo

#### Cyberattacks are key to North Korean revenue.

Jon Herskovitz & Jeong-Ho Lee, 21 (Jon Herskovitz is a Bloomberg politics reporter, Jeong-Ho Lee is an Associate Professor and SUHF Investigator at Translational Neurogenetics Laboratory at KAIST, 12-21-2021, accessed on 6-7-2022, Bloomberg, “A Growing Army of Hackers Helps Keep Kim Jong Un in Power”, <https://www.bloomberg.com/news/articles/2021-12-21/north-korean-army-of-cybercriminals-props-up-kim-s-nuclear-program-and-economy>, HBisevac)

Kim Jong Un marked a decade as supreme leader of North Korea in December. Whether he [Kim Jong Un] can **hold on** to **power** for another 10 years may depend on **state hackers**, whose **cybercrimes** **finance** his nuclear arms program and **prop up** the **economy**. According to the U.S. Cybersecurity & Infrastructure Security Agency, North Korea’s state-backed “malicious cyberactivities” target banks around the world, steal defense secrets, **extort money** through ransomware, hijack digitally mined currency, and launder ill-gotten gains through cryptocurrency exchanges. Kim’s regime has already taken in as much **as $2.3 billion** through cybercrimes and is geared to rake in **even more**, U.S. and United Nations investigators have said. The cybercrimes have provided a **lifeline** for the **struggling** **No**rth **Ko**rean **economy**, which has been hobbled by sanctions. Kim has shown little interest in returning to negotiations that could lead to a lifting of sanctions if North Korea winds down its nuclear arms program. Money from cybercrimes represents about **8%** of North Korea’s estimated economy in 2020, which is smaller than when Kim took power, according to the Bank of Korea in Seoul. (The bank for years has provided the best available accounting on the economic activity of the secretive state.) Kim’s decision to shut borders because of Covid-19 suspended the little legal trade North Korea had and helped send the economy into its biggest contraction in more than two decades. Kim’s regime has two means of evading global sanctions, which were imposed to punish it for nuclear and ballistic missile tests. One is the ship-to-ship transfer of commodities such as coal: A North Korean vessel will shift its cargo to another vessel, or the other way around, and both vessels typically try to cloak their identity. The other is the cyberarmy. Its documented cybercrimes include attempts to steal $2 billion from the Swift (Society for Worldwide Interbank Financial Telecommunication) system of financial transactions. North Korea has also illegally accessed military technology that could be used for financial gain, according to a UN Security Council panel charged with investigating sanctions-dodging by the government. North Korea “is not afraid to be brazen and destructive in order to achieve the task at hand,” says Jenny Jun, a nonresident fellow at the Atlantic Council’s Cyber Statecraft Initiative, who’s researched North Korea’s cyberoperations and cyberstrategies. “And this sets it apart from some of the other, more careful—and therefore more restrained—nation-state hackers.” The government has deployed **malware** called AppleJeus that poses as a cryptocurrency trading platform to **steal funds** from people who try to use it. Since 2018 various versions of the malware have been used to target more than 30 countries. From 2019 to November 2020, AppleJeus hackers stole virtual assets valued at **$316.4 million**, according to UN and U.S. investigators. By comparison, North Korea’s coal exports are capped at $400 million a year under global sanctions. Targets of the regime include **central banks**, the militaries of the world’s most powerful countries, and corner **ATMs**. It even tried to hack Pfizer Inc. for Covid vaccine data. South Korea said hacking attempts directed at it by its neighbor **increased** about **9%** in the first half of 2021 from the second half of 2020.

#### Shortfalls in revenue cause nuclear selloffs---leads to prolif, nuke terror, and Middle East war.

Toby Dalton, 21 (Toby Dalton is the co-director and a senior fellow of the Nuclear Policy Program at the Carnegie Endowment, expert on nonproliferation and nuclear energy, 4-15-2021, accessed on 7-18-2022, Carnegie Endowment, “The Most Urgent North Korean Nuclear Threat Isn’t What You Think”, <https://carnegieendowment.org/2021/04/15/most-urgent-north-korean-nuclear-threat-isn-t-what-you-think-pub-84335>, HBisevac)

Then the coronavirus pandemic made things **far worse** for North Korea’s economy. Kim’s decision to seal the country’s borders has resulted in economic pain Washington could never have achieved through sanctions. Recent reports suggest growing alarm among North Korea’s leadership over failed economic programs, with attendant electrical outages, factory closures, and shortages of some food staples. Foreign diplomats have left North Korea over the difficult living conditions and shortages of medicine and basic goods in Pyongyang. It is **little surprise** that North Korea is **increasingly reliant** on cyber attacks and cryptocurrency theft to **generate revenue**.

NORTH KOREA’S WMD BAZAAR

North Korea’s desperation could make a sustained U.S. pressure strategy still riskier. Kim’s regime remains remarkably resilient, so collapse seems unlikely—even though U.S. officials would be wise to prepare for that unique scenario. The most likely **outgrowth** of North Korea’s **need for cash** is an increase in other **dangerous behavior**. WMD technology represents one of North Korea’s few value-added assets.

North Korea’s **prolif**eration **rap sheet** is **long**: **missile** and **nuclear trade** with **Pakistan**; missile sales to **Egypt**, **Libya**, **Yemen**, and others; chemical weapons assistance to Syria; and more. Notably, North Korea clandestinely sought to construct a **nuclear reactor** in **Syria**, a facility that might have provided **plutonium** for a **Syrian bomb** program until Israel destroyed the partly built reactor with air strikes in 2007. The March 2021 report by the UN Panel of Experts reported ongoing assistance by North Korea with Iran’s ballistic missile and space launch programs. Iranian scientists reportedly went to North Korea to discuss rocket booster technology, while thirteen North Korean experts are believed to have visited Iran to assist with liquid-fueled ballistic missiles. According to the report, the cooperation between North Korean and Iranian entities also extends to illicit shipments of valves, electronics, and other missile-related equipment.

Until now, apart from the reactor project in Syria, North Korea is not known to have transferred more sensitive nuclear technologies—longer-range missiles, nuclear weapon designs, equipment or technology to produce highly enriched uranium or plutonium for a bomb, or those materials themselves. Presumably, North Korean leaders historically have believed that such transfers could cross an implicit red line and result in harsher consequences when discovered. Now, increasingly desperate for cash, Kim could be more willing to risk sales of these items to interested customers in the Middle East, including possibly terrorist groups.

Until now, apart from the reactor project in Syria, North Korea is not known to have transferred more sensitive **nuclear technologies**—longer-range **missiles**, nuclear **weapon** **designs**, **equipment** or **technology** to produce **highly enriched uranium** or **plutonium** for a bomb, or those materials themselves. Presumably, North Korean leaders historically have believed that such transfers could cross an **implicit red line** and result in harsher consequences when discovered. Now, increasingly **desperate for cash**, Kim could be more **willing to risk sales** of these items to interested customers in the **Middle East**, including possibly **terrorist groups**.

If such sales come to light, it is reasonable to expect that Israel would again take **preemptive action**. Israel regularly carries out air strikes against missile construction facilities and other **weapons**-**related sites** in Syria. It is also suspected of assassinating the most **prominent Iranian nuclear scientist**, Mohsen Fakhrizadeh, in November 2020 and of causing an **explosion** that **damaged** the **power supply** to Iran’s Natanz **uranium enrichment facility** in April 2021.

PRIORITIZE ENDING NORTH KOREAN NUCLEAR SALES

Relying on Israeli counterproliferation strikes to prevent **WMD acquisition** by adversaries in the Middle East is a **fraught strategy**. At some point, that approach could fail in any number of ways, with **catastrophic consequences**. It is bad enough that Washington faces a complex nuclear challenge from North Korea in East Asia. But **No**rth **Ko**rean **prolif**eration that yields a new **nuclear**-**armed** **state** or catalyzes a **wider conflict** in the **Middle East** could be **worse**.

#### Terror entombs the globe.

Louis Beres 19, Associate Professor of Political Science at Purdue University, Ph.D. who has lectured and published extensively on the subject of nuclear terrorism; Routledge, 7/09/2019, “Terrorism And Global Security: The Nuclear Threat--Second Edition, Completely Revised And Updated,” no. 2]

Nuclear terrorism could even spark full-scale nuclear war between states. Such war could involve the entire spectrum of nuclear conflict possibilities, ranging from a. nuclear attack upon a nonnuclear state to systemwide nuclear war. How might such far-reaching consequences of nuclear terrorism come about? Perhaps the most likely way would involve a terrorist nuclear assault against a state by terrorists "hosted" in another state. For example, consider the following scenario:

Early in the 1980s, Israel and her Arab state neighbors finally stand ready to conclude a comprehensive, multilateral peace settlement. With a bilateral treaty between Israel and Egypt already several years old, only the interests of the Palestinians—as defined by the PLO— seem to have been left out. On the eve of the proposed signing of the peace agreement, half a dozen crude nuclear explosives in the one kiloton range detonate in as many Israeli cities. Public grief in Israel over the many thousand dead and maimed is matched only by the outcry for revenge. In response to the public mood, the government of Israel initiates selected strikes against terrorist strongholds in Lebanon, whereupon the Lebanese government and its allies retaliate against Israel. Before long, the entire region is ablaze, conflict has escalated to nuclear forms, and all countries in the area have suffered unprecedented destruction.

Of course, such a scenario is fraught with the makings of even wider destruction. How would the United States react to the situation in the Middle East? What would be the Soviet response? It is certainly conceivable that a chain reaction of interstate nuclear conflict could ensue, one that would ultimately involve the superpowers or even every nuclear weapon state on the planet.

What, exactly, would this mean? Whether the terms of assessment be statistical or human, the consequences of nuclear war require an entirely new paradigm of death. Only such a paradigm would allow us a proper framework for absorbing the vision of near-total obliteration and the outer limits of human destructiveness. Any nuclear war would have effectively permanent and irreversible consequences. Whatever the actual extent of injuries and fatalities, it would entomb the spirit of the entire species in a planetary casket strewn with shorn bodies and imbecile imaginations.

This would be as true for a "limited" nuclear war as for an "unlimited" one. Contrary to continuing Pentagon commitments to the idea of selected "counterforce" strikes that would reduce the chances for escalation and produce fewer civilian casualties, the strategy of limited nuclear war is inherently unreasonable. There is, in fact, no clear picture of what states might hope to gain from counterforce attacks. This understanding is reflected by Soviet military strategy, which is founded on the idea that any nuclear conflict would necessarily be unlimited.

Nuclear War Between the Superpowers

The consequences of a strategic exchange between the United States and the Soviet Union have been the object of widespread attention. One account of these consequences is offered by Andrei D. Sakharov, the brilliant physicist who played a leading role in the development of Russia's thermonuclear capacity:

A complete destruction of cities, industry, transport, and systems of education, a poisoning of fields, water, and air by radioactivity, a physical destruction of the larger part of mankind, poverty, barbarism, a return to savagery, and a genetic degeneracy of the survivors under the impact of radiation, a destruction of the material and information basis of civilization—this is a measure of the peril that threatens the world as a result of the estrangement of the world's two superpowers. 13

Presently, U.S. strategic arsenals contain approximately 9,000 strategic weapons and 4,000 megaton equivalents. Soviet strategic forces number approximately 3,000 weapons and about 5,000 megaton equivalents.14 An exchange involving any substantial fraction of these forces could promptly destroy more than half of the urban populations in both countries. The subsequent fallout could be expected to kill upwards of 50 percent of the surviving rural inhabitants as well as create worldwide contamination of the atmosphere.15

To better understand the effects of fallout, it is useful to recognize that radiation effects have three basic forms: (1) radiation directly from the explosion; (2) immediate radioactive fallout (first twenty-four hours); and (3) long-term fallout (months and years). In areas where radioactive fallout is of particularly high intensity, individuals will be exposed to high doses of radiation regardless of shelter protection. Those who do not become prompt or short-term fatalities and have suffered radiation exposures above 100 REMs will undergo hemo tological (blood system) alterations that diminish immunological capabilities. The resultant vulnerability to infection will seriously impair prospects for long-term recovery.

The effects of a nuclear war between the superpowers, however, cannot be understood solely in terms of projected casualties. Rather, these effects must also include quantitative effects (i.e., availability of productive capacity, fuel, labor, food, and other resources); qualitative effects (i.e., political, social, and psychological damage); and interactive effects (i.e., the impact on the relationships between the social and economic factors of production).17 When these corollary effects are taken into account, it is easy to see that policy makers and public alike have typically understated the aggregate impact of nuclear war.

This point is supported by a 1975 study of the National Research Council, National Academy of Sciences, entitled Long- Term Worldwide Effects of Multiple Nuclear Weapons Detonations. Going beyond the usual litany of crude physical measures of destruction (e.g., number of human fatalities, number of cities destroyed), the report portrays the long-term, worldwide effects following a hypothetical exchange of 10,000 megatons of explosive power in the northern hemisphere. These effects are cast in terms of atmosphere and climate, natural terrestrial ecosystems, agriculture and animal husbandry, the aquatic environment, and both somatic and genetic changes in human populations.

While the report recognizes that the biosphere and the species Homo sapiens would survive the hypothesized nuclear war, it recognizes that the very idea of survival in such a context is problematic. Building upon this recognition, a more recent study prepared for the Joint Committee on Defense Production of the Congress—Economic and Social Consequences of Nuclear Attacks on the United States—identifies four discrete levels of postattack survival. This new taxonomy permits a more subtle look at the interactive effects of nuclear war and allows more precise judgments about the acceptability or unacceptability of nuclear attack damage. According to the study, there are four levels of survival, in decreasing order of damage.

1. Biological Survival of Individuals. Individuals or groups of individuals survive but not necessarily within the organized political, social, and economic structure of a modern society.

2. Regional Survival of Political Structures. Some subnational political units survive as viable entities, but without a functioning central government.

3. Survival of a Central Government. Some form of viable, central control over all preattack national territory survives, but the effectiveness of this control may vary over an extremely wide range, depending on the specific nature and pattern of the attack(s).

4. Survival Intact of Basic Societal Structure. Damage to the nation is characterized as relatively limited socially, politically and economically; nevertheless, the attack is militarily destructive. This is the concept of survival envisioned in the notion of limited or controlled nuclear war. However, it should be noted that the idea that effective strategic military attacks can be benign in their impacts on society is in dispute. It is used here as a criterion without any implicit acceptance that it can be achieved. 19

There are, however, levels of strategic exchange at which even the first listed category of survival might not be relevant. At such levels, the species itself—let alone organized political, social, and economic structures—would disappear. The plausibility of such levels is underscored by the fact that the magnitude of exchange postulated in the NAS report is really quite low. Were the superpowers to exchange between 50,000 and 100,000 megatons of nuclear explosives, rather than the 10,000 megatons assumed by the report, worldwide climatological changes would imperil the physical existence of Homo sapiens.

Worldwide Nuclear War

If nuclear terrorism should lead to worldwide nuclear war, the results would represent humankind's last and most complete calamity, defying not only our imaginations of disaster, but our customary measurements as well. As the culmination of what Camus once described as "years of absolutely insane history," worldwide nuclear war would represent the final eradication of the very boundaries of annihilation.

In technical terms, the consequences of systemwide nuclear war would include atmospheric effects; effects on natural terrestrial ecosystems; effects on managed terrestrial ecosystems; and effects on the aquatic environment.

Atmospheric effects would be highlighted by greatly reduced ozone concentrations producing increased ultraviolet radiation and a drop in average temperature. Even the possibility of irreversible climatic shifts cannot be ruled out.

Natural Terrestrial Ecosystems would be affected by systemwide nuclear war through three principal stress factors: ionizing radiation; uv-B radiation; and climatic change. The cumulative effect of these three factors would render the entire planet a "hot spot" where even vast forests would show physiological and genetic damage.21

Managed Terrestrial Ecosystems would be affected by systemwide nuclear war by radionuclide contamination of foods, chromosome breakage and gene mutations in crops, and yield-reducing sterility in seed crops. The cumulative effect of these changes would be the disappearance of the technology base for agriculture. Even if there were any significant 11 survivors, a return to normal world food production would be unimaginable.22

Aquatic effects of a systemwide nuclear war would stem from ionizing radiation from radionuclides in marine waters and fresh waters; solar uv radiation; and changes in water temperatures associated with climate. Irreversible injuries to sensitive aquatic species could be anticipated during the years of large transient increase in uv-B isolation. And the range of geographic distribution of sensitive populations of aquatic organisms could be reduced.23

### 2NC---UQ---Cyber Attacks High

#### NoKo cyber-attacks are only on the rise.

Felix Ng, 7-12 (Felix Ng, specialist on blockchain at CoinTelegraph, 7-12-2022, accessed on 7-19-2022, CoinTelegraph, “‘Nobody is holding them back’ — North Korean cyber-attack threat rises”, <https://cointelegraph.com/news/nobody-is-holding-them-back-north-korean-cyber-attack-threat-rises>, HBisevac)

North Korea-backed **cyberattacks** on **crypto**currency and **tech firms** will only become more **sophisticated** over time as the country battles prolonged **economic sanctions** and **resource shortages**.

Former CIA analyst Soo Kim told CNN on Sunday that the process of generating overseas crypto income for the regime has now become a “way of life” for the North Koreans:

“In light of the challenges that the regime is facing — food shortages, fewer countries willing to engage with North Korea [...] this is just going to be something that they will **continue** to use because **nobody is holding them back**, essentially.”

She also added that it is likely that their crypto attacking “**tradecraft**” will only **improve** from here on.

“Even though the tradecraft is not perfect right now, in terms of their ways of approaching foreigners and preying upon their vulnerabilities, it’s still a **fresh market** for North Korea,” said Kim.

The RAND Corporation policy analyst made the comments almost two months after the release of a joint advisory from the United States government about the infiltration of North Korean operatives across freelance tech jobs — posing risks of intellectual property, data and funds theft that could be used to violate sanctions.

Former FBI intelligence analyst Nick Carlsen told CNN that DPRK operatives embedded in these firms would not only earn income used to skirt sanctions, but they could also potentially identify vulnerabilities in certain client systems that their hacker comrades could take advantage of.

“Any vulnerability they might identify in a client’s systems would be at grave risk,” explained Carlsen.

In a lengthy Twitter exposé about North Korean hackers, The DeFi Edge noted that these crypto attacks typically target bridges, focus on companies based in Asia and often begin by targeting unsuspecting employees.

The country has been identified as being allegedly behind some of the **largest cyberattacks** in recent crypto history, including the **$620 million** hack of Axie Infinity and the **$100 million** hack of the Harmony protocol.

A report from Coinclub on June 29 estimated there are as many as **7,000 full-time hackers** in North Korea working to **raise funds** through **cyberattacks**, ransomware and crypto-protocol hacks.

#### North Korean cyber-attacks high now.

Turner Wright, 7-19 (Turner Wright, freelance editor and writer for various publications, 7-19-2022, accessed on 7-19-2022, CoinTelegraph, “US Justice Department seized $500K in fiat and crypto from hackers connected to DPRK government”, <https://cointelegraph.com/news/us-justice-department-seized-500k-in-fiat-and-crypto-from-hackers-connected-to-dprk-government>, HBisevac)

The United States Department of Justice has seized and returned roughly $500,000 in fiat and crypto from a hacking group tied to the North Korean government, which included two crypto payments made by U.S. health care providers.

In a Tuesday announcement, the Justice Department said in conjunction with the FBI it had investigated a $100,000 ransomware payment in Bitcoin (BTC) from a Kansas hospital to a North Korean hacking group in order to regain access to its systems, as well as a $120,000 BTC payment from a medical provider in Colorado to one of the wallets connected to the aforementioned attack. In May, the FBI filed a seizure warrant for funds from the two ransom attacks and others laundered through China, which the Justice Department reported as worth roughly $500,000 total.

“These sophisticated criminals are constantly pushing boundaries to search for ways to **extort money** from victims by forcing them to pay ramsons in order to regain control of their computer and record systems,” said Duston Slinkar, U.S. Attorney for the District of Kansas. “What these hackers don’t count on is the tenacity of the U.S. Justice Department in recovering and returning these funds to the rightful owners.”

U.S. Deputy Attorney General Lisa Monaco said in a speech for the International Conference on Cyber Security on Tuesday that authorities relied on victims from the private sector to report ransomware attacks and others “as soon as those crimes occur”:

“If you report that attack, if you report the ransom demand and payment, if you work with the FBI, we can take action; we can follow the money and get it back; we can help prevent the next attack, the next victim; and we can hold cybercriminals accountable. Those companies that work with us will see that we stand with them in the aftermath of an incident.”

According to Monaco, the FBI and Justice Department traced the ransom payments through the blockchain in much the same way they found and seized more than $2 million in crypto following an attack on the Colonial Pipeline system in 2021. The Office of the Attorney General late announced the formation of a National Cryptocurrency Enforcement Team under the Justice Department, and a Virtual Asset Exploitation Unit under the FBI. Both teams were aimed at addressing cybercrimes used for “digital extortion” of funds, including crypto.

Hacking groups connected to either North Korea and Russia have reportedly been responsible for many **major ransomware** and **cyber attacks** in the United States and globally. In April, the Treasury Department’s Office of Foreign Assets Control named North Korean cyber-criminal Lazarus Group as the entity behind a March 2022 hack of **Ronin Bridge**, in which more than **$600 million** in crypto assets were removed.

### 2NC---UQ---NoKo Econ

#### NoKo on the brink.

The Economist, 21 (The Economist, 10-12-2021, accessed on 7-20-2022, “Ten years into Kim Jong Un’s rule, North Korea is more North Korean than ever”, <https://www.economist.com/asia/ten-years-into-kim-jong-uns-rule-north-korea-is-more-north-korean-than-ever/21806770>, HBisevac)

But the boundaries of that “**better life**” have been gradually curtailed in the more recent years of Mr Kim’s reign. The point of building a “prosperous state” was to make his rule more stable. It did not extend to allowing a **proper market economy** or granting more political freedoms to ordinary people. It has been accompanied by heightened repression inside the country, more control at the borders and the acceleration of the nuclear programme started by Mr Kim’s predecessors, notably through several tests of intercontinental ballistic missiles which North Korea claims are capable of reaching America. The economic sanctions imposed on the North by the international community to slow down the nuclear programme, which were strengthened in 2017 after the ICBM tests, left Mr Kim with **little money** to advance other goals beyond building his arsenal.

Mr Kim’s attempts to resolve that contradiction in 2018 by courting Mr Trump and Moon Jae-in, South Korea’s president, ended in failure. Mr Kim miscalculated during his final meeting with Mr Trump in Hanoi in February 2019. He demanded comprehensive sanctions relief from America in return for dismantling Yongbyon, an important but ageing nuclear facility. Mr Trump rebuffed him, causing the summit to collapse.

That might have been manageable, since Mr Kim’s other diplomatic overtures in this period, notably towards China, had slightly more success and ensured a steady flow of trade, both legal and illicit. But when the coronavirus pandemic struck, Mr Kim’s response put paid to that, too. The border with China has been closed for the best part of two years. It is likely to remain so for the foreseeable future, though there have recently been rumours of a limited opening. Tourism is moribund. Most foreign diplomats have left the country. Aid organisations have not had access for nearly two years, making it especially hard to discern what is going on in the country.

There are hints of **increasing distress**, with **food running low** and even the privileged in Pyongyang suffering shortages. Mr Kim himself has admitted that the food situation is “**tense**” and urged his people to prepare for hardship. But he has also increased penalties for smuggling and for watching foreign entertainment, such as South Korean dramas.

There is **little indication** that things will soon improve. Mr Kim continues to rebuff offers of aid and even covid vaccines. Attempts by South Korea and America to revive a spirit of detente, for instance by negotiating a formal end to the Korean war, have gone unanswered. Ten years into his rule, the “economically powerful state” Mr Kim set out to build is looking rather feeble. He may console himself with the continuing growth of his nuclear arsenal. His people have no such luxury.

#### Their economy is a wreck.

Josh Smith, 22 (Josh Smith, reporter at Reuters, 5-3-2022, accessed on 7-20-2022, Reuters, “Global problems may exacerbate shortages in N.Korea's isolated economy”, <https://www.reuters.com/world/asia-pacific/global-problems-may-exacerbate-shortages-nkoreas-isolated-economy-2022-05-03/>, HBisevac)

SEOUL, May 3 (Reuters) - North Korea's isolated economy will not be insulated from global **economic headwinds** caused by the **Ukraine** war and the COVID-19 **lockdowns** in China, analysts said, with recently resumed **border trade** taking a hit and **inflation** exacerbating **food shortages**.

Strict international sanctions ban or restrict **wide categories** of North Korean **imports** and **exports**, and the country locked down its border for years to prevent COVID-19 outbreaks. **Natural disasters** such as flooding have also taken a toll on **harvests** and **damaged infra**structure.

The trickle of trade and aid that resumed over the land border with China in January probably did not alleviate reported food shortages - and trade was suspended again last week as COVID-19 cases rose in China, analysts said. Satellite imagery shows goods sitting for weeks or months in quarantine at land and sea port facilities.

“As food prices in North Korea do often move in tandem with global prices, we're likely to see current **food price hikes** mirrored in North Korea as well over time,” said Benjamin Katzeff Silberstein, an economic expert with the U.S.-based Stimson Center.

International aid organizations have pulled most of their staff from the country amid the prolonged border shutdowns, and say it is difficult to know exactly how bad the situation is.

Last year the U.N. special rapporteur on human rights in North Korea said the country's most vulnerable people risk starvation during the COVID-19 pandemic.

North Korea's government has acknowledged a tense food situation but has disputed reports that it is failing to provide for residents.

The World Food Program estimated that even before the pandemic hit, 11 million people – or more than 40 percent of the population - were undernourished and required humanitarian assistance.

BOON FOR ILLICIT COAL

Higher energy prices globally will most likely help North Korean coal producers, Katzeff Silberstein said.

North Korean coal – which is banned from export by **U**nited **N**ations **S**ecurity **C**ouncil resolutions – costs a fraction of the global average. But prices still have soared 40% in the past six months, according to Seoul-based Daily NK, which tracks commodities prices in the North.

### 2NC---Link---Cyber Key

#### Cyberattacks are key.

Reuters, 22 (Reuters, 2-7-2022, accessed on 7-18-2022, NDTV, “Cyberattacks Are North Korea's "Important Revenue Source": UN Report”, <https://www.ndtv.com/world-news/cyberattacks-are-north-koreas-important-revenue-source-un-report-2753348>, HBisevac)

United Nations: North Korea continued to develop its **nuclear** and **ballistic missile programs** during the past year and cyberattacks on cryptocurrency exchanges were an **important revenue source** for Pyongyang, according to an excerpt of a confidential United Nations report seen on Saturday by Reuters.

The annual report by independent sanctions monitors was submitted on Friday evening to the U.N. Security Council North Korea sanctions committee.

"Although no nuclear tests or launches of ICBMs (intercontinental ballistic missiles) were reported, DPRK continued to develop its capability for production of nuclear fissile materials," the experts wrote.

North Korea is formally known as the Democratic People's Republic of Korea (DPRK). It has long-been banned from conducting nuclear tests and ballistic missile launches by the U.N. Security Council.

"Maintenance and development of DPRK's nuclear and ballistic missile infrastructure continued, and DPRK continued to seek **material**, **technology** and **know-how** for these programs overseas, including through **cyber means** and joint scientific research," the report said.

Since 2006, North Korea has been subject to U.N. sanctions, which the Security Council has strengthened over the years in an effort to target funding for Pyongyang's nuclear and ballistic missile programs.

The sanctions monitors noted that there had been a "**marked acceleration**" of missile testing by Pyongyang.

The United States and others said on Friday that North Korea had carried out nine ballistic missile launches in January, adding it was the largest number in a single month in the history of the country's weapons of mass destruction and missile programs.

"DPRK demonstrated increased capabilities for **rapid deployment**, **wide mobility** (including at sea), and **improved resilience** of its missile forces," the sanctions monitors said.

North Korea's mission to the United Nations in New York did not immediately respond to a request for comment.

CYBERATTACKS, ILLICIT TRADE

The monitors said "cyberattacks, particularly on cryptocurrency assets, remain an important revenue source" for North Korea and that they had received information that North Korean hackers continued to target **financial institutions**, **crypto**currency **firms** and **exchanges**.

"According to a member state, DPRK cyberactors stole more than **$50 million** between 2020 and mid-2021 from at least three **cryptocurrency exchanges** in North America, Europe and Asia," the report said.

The monitors also cited a report last month by cybersecurity firm Chainalysis that said North Korea launched at least seven attacks on cryptocurrency platforms that extracted nearly **$400 million** worth of **digital assets** last year.

In 2019, the U.N. sanctions monitors reported that North Korea had generated an estimated $2 billion for its **w**eapons of **m**ass **d**estruction programs using **widespread** and increasingly sophisticated **cyberattacks**.

The latest report said North Korea's strict blockade in response to the COVID-19 pandemic meant "illicit trade, including in luxury goods, has largely ceased."

Over the years the U.N. Security Council has **banned** **No**rth **Ko**rean **exports** including coal, iron, lead, textiles and seafood, and capped imports of crude oil and refined petroleum products.

#### It's the regime’s largest source of revenue

Jon Herskovitz & Jeong-Ho Lee, 21 (Jon Herskovitz is a Bloomberg politics reporter, Jeong-Ho Lee, is an Associate Professor and SUHF Investigator at Translational Neurogenetics Laboratory at KAIST, 12-21-2021, accessed on 6-7-2022, Bloomberg, “A Growing Army of Hackers Helps Keep Kim Jong Un in Power”, <https://www.bloomberg.com/news/articles/2021-12-21/north-korean-army-of-cybercriminals-props-up-kim-s-nuclear-program-and-economy>, HBisevac)

Kim is using his sparse resources to invest in information technology training, sending experts abroad. He sees them as **crucial for his survival**, according to Kang Mi-jin, a North Korean defector who now runs a company in South Korea that watches the economy of her former home.

“The hackers consider what they are doing as being **directly related** to the **fate** of the **Kim regime**,” she says, “and what they are doing is likely to be one of [its] **major sources of income**.”

#### It's what’s keeping the regime alive.

Jay 21, citing Blachman, threat intelligence specialist at Venafi. (6-28-2021, "Cyber crime is now the North Korean regime's biggest source of income", Teiss, <https://www.teiss.co.uk/news/cyber-crime-is-now-the-north-korean-regimes-biggest-source-of-income-9016>) \*language edited in brackets

The North Korean regime is using cyber crime as its primary source of revenue as it faces [devastating] crippling economic sanctions in response to its clandestine nuclear weapons development programme, says a former Mossad operative.

Yana Blachman, a former member of the elite Unit 8200 of the Israeli Defence Forces who now serves as a threat intelligence specialist at Venafi, says that cyber crime is now a primary means of revenue generation for North Korea and the money generated through cyber crime is keeping the Kim Jong Un regime alive.

According to Venafi's threat intelligence team which has closely monitored the activities of state-sponsored North Korean hacker groups such as Lazarus and APT38, North Korea has successfully pioneered a new model of state-sponsored cyber crime that is highly lucrative. However, this model also serves as a blueprint for other regimes, such as those in Belarus and Myanmar, who may also follow a similar path to undercut economic sanctions.

#### Post sanctions, they’re Kim’s main source of income.

Edward White, 21 (Edward White is an award-winning journalist and China correspondent, FT’s Seoul bureau chief, covering North Korea and South Korea, a correspondent in Taiwan and breaking news reporter, 8-9-2021, accessed on 7-20-2022, Financial Times, “North Korea: the failure of ‘maximum pressure’ on Kim’s isolated regime”, <https://www.ft.com/content/53eed94f-6cd5-4ed9-97a9-56de6eccf53c>, HBisevac)

“Things were completely different after sanctions took effect,” says one person with knowledge of the situation.

The demise of the scheme to raise funds in the Gulf is one result of the 15-year-long campaign of increasingly harsh sanctions dubbed “**maximum pressure**”, led by the UN and the US, that have been designed to choke off the regime’s **sources of income**.

Yet despite some successes, experts say North Korea is still managing to find **new ways** to **get around** the **sanctions**, including **crypto**currency **theft** and lucrative **cyber heists**.

The sanctions ultimately cause more harm by pushing the secretive state deeper into its shell, some experts say. They add that there are clear signs that the state’s acquisition of stocks of nuclear and chemical weapons has not been curtailed by the sanctions regime.

Ordinary North Koreans have suffered as a result of the sanctions and their plight has worsened in the past 18 months: a crackdown on cross-border trade and travel — a bid by Pyongyang to keep the coronavirus pandemic at bay — has severed access to China, North Korea’s main economic lifeline. All the while, the lavish lifestyle of the leader Kim Jong Un and his court continues unabashed.

Rachel Lee, a former US government analyst now with the 38 North programme at the Stimson Center think-tank in Washington, describes the dichotomy as “two different worlds — there is definitely a disconnect between the lifestyle of not just the Kim family but the top elite, and the remainder of the population”.

The failure of sanctions is prompting calls for President Joe Biden’s administration to overhaul what has been a de facto policy in four successive administrations.

“The original intention has not been achieved — North Korea’s nuclear weapons and missile capabilities have been strengthened,” says one former senior presidential adviser in Seoul who has dealt directly with Pyongyang. “Yet the collateral damage has been widespread. The North Korean people are suffering. Efforts towards reform and opening and a market system have been further delayed. But they cannot get away from it because sanctions have become a kind of theology in Washington, nobody can touch it.”

Violation and defection

North Korea’s overseas labourers are just one strand in a massive web of duplicitous schemes designed with a singular purpose: to bring in cash for the Kim regime. UN investigators, as well as law enforcement and military officials from scores of countries, have for years tracked individuals, companies and governments in order to stamp down on sanctions breaches.

A small sample of the alleged UN violations linked to Pyongyang’s foreign embassies in recent years include military delegations advising countries in Africa, Iranians suspected of smuggling gold and cash to North Korea, an attempted arms deal in Egypt and coal shipments brokered by Indonesian commodity traders.

Few nations have managed to avoid being touched by the Kim regime’s long tentacles. Between 2015 and 2017, North Korea procured luxury goods from as many as 90 countries, according to the Center for Advanced Defense Studies, a Washington research group.

For many experts, the state’s increased aptitude for **cyber crime** is of **greater worry** than where Kim sources his ***black Mercedes-Maybach limousines***.

In March, a UN report included an estimate of cryptocurrency theft worth **$316m** from 2019 to November 2020. According to one complaint filed by the US justice department in August 2020, one hacker linked to North Korea “allegedly stole over **$272,000 worth** of alternative cryptocurrencies and tokens, including Proton Tokens, PlayGame tokens and IHT Real Estate Protocol [blockchain] tokens”.

“The targeting of virtual assets and virtual asset service providers is **rampant**,” says Stephanie Kleine-Ahlbrandt, who for five years until 2019 served as the finance and economics expert on the UN panel of experts tracking North Korean sanctions.

#### It brings in millions yearly.

Aayush Pathak, 7-20 (Aayush Pathak, reporter for TechStory, 7-20-2022, accessed on 7-20-2022, TechStory, “How North Korea Makes Money?”, <https://techstory.in/how-north-korea-makes-money/>, HBisevac)

Imagine when someone tells you that a nation’s economy is run by hackers. It sounds too filmy and funny at some point but in North Korea’s case, **it is true**. When on one hand most of the general public is denied the basic amenity of Internet, the North Korean government is harboring more than **6000 hackers** in the capital city of Pyongyang. These hackers **steal** the **money** from all across the globe through various means and supply a major part of it to the government. In exchange, the North Korean government protects them and treats them as a country would treat government employees. These hackers bring in **millions of dollars** worth of **crypto** currency for the government every year. Experts also claim that the North Korean hackers played an important role in two of the biggest cyber attacks: the WannaCry ransomware attack of May 2017 as well as stealing Bangladesh’s funds deposited with the New York Federal Reserve in the year 2016.

### 2NC---Link---Kim Sells

#### North Korea will sell nukes, tech, or know-how---empirics

Kazianis 18, Harry J. Kazianis, Senior Director of Korean Studies and director of defense studies at the Center for the National Interest. Masters from Harvard. Citing internal reports from senior U.S. intelligence officials. (6-19-2018, "US intelligence officials: North Korea will sell nuclear tech to Iran", *The Hill*, <https://thehill.com/opinion/national-security/392868-us-intelligence-officials-next-fear-north-korea-will-sell-nuclear>)

While the Trump administration is still touting its supposedly successful summit with North Korea — even claiming that Pyongyang is “no longer a nuclear threat” — senior U.S. intelligence officials worry that a new security challenge is emerging: that the Kim regime could sell advanced, long-range ICBM missile technology to rogue states like Iran.

According to two intelligence officials, speaking to me on background, there is a growing concern that while the immediate threat of armed conflict with North Korea has diminished, Pyongyang could utilize the lull in tensions to its advantage, selling the know-how behind its most advanced weapons systems to Tehran. The officials, unauthorized to speak on the matter, asked for their identities to be protected.

“We know for a fact that North Korea will sell almost any of its military hardware if the price is right — and Iran has paid that price time and time again. In the past, there is ample evidence — even in the public domain — that proves North Korea will sell conventional weapons, all different types of missile technology, and even nuclear tech and expertise if you have the funds to pay for it,” explained a senior U.S. intelligence official.

The official continued:

“What terrifies many of us is that we might not even know that Pyongyang has even sold such technology until it's too late to do anything about it. Think about how much information you can store on just a flash drive today. All it would take is one North Korean agent, selling a 256-gig USB stick to an Iranian operative filled with blueprints, design specs and advanced warhead shielding technology to make a massive difference.

"Just that amount of information on ICBM technology alone would be a game changer for Tehran — and we would not even know about it until the new designs were included in their missile tests.”

History shows the intelligence officials' fears could very well be realized — and soon. North Korea has sold arms to some of the world’s most anti-U.S. regimes and fueled conflicts around the world.

For example, Pyongyang has reportedly helped Syria with its chemical weapons and missile programs. North Korea even started building a nuclear reactor for the Assad regime, only to see it be destroyed by an Israeli air strike in 2007. There is strong evidence to suggest North Korea is selling conventional arms to the regime now and possibly even fighting alongside Assad’s forces, fueling a civil war that has claimed countless lives to this day.

It gets worse. The Kim family has sold multiple classes of missile platforms to Iran. And, now that the Kim family has missiles that can at least range the U.S. homeland, combined with biting sanctions that are damaging the regime's ability to raise vital revenue, Pyongyang might just be desperate enough to sell its best weaponry, even if it were to damage its budding détente with Washington.

#### Empirics.

Allison 18, PhD, Douglas Dillon Professor of Government at Harvard. (Graham, 5-15-2018, "Nuclear Terrorism: Did We Beat the Odds or Change Them?", PRISM | National Defense University, <https://cco.ndu.edu/News/Article/1507316/nuclear-terrorism-did-we-beat-the-odds-or-change-them/>)

Factors and Actions That Have Increased the Risk of Nuclear Terrorism

Despite these successes, there have also been numerous missed opportunities and structural shifts during the past 13 years that have increased the risk of nuclear terrorism. Obama’s success in Iran is offset by his failure to stop North Korea’s nuclear advance. North Korea is today the world’s leading candidate to become ‘Nukes ‘R’ Us.’ Long known in intelligence circles as ‘Missiles ‘R’ Us’ for having sold and delivered missiles to Iran, Syria, Pakistan, and others, it has repeatedly demonstrated its willingness to ‘sell anything it has to anybody who has the cash to buy it,’ as former Secretary of Defense Robert Gates famously noted.23 Indeed, anyone who doubts that North Korea would sell to others the wherewithal to make a nuclear bomb should pause and examine what they did in Syria. As we learned after Israel attacked and destroyed the Yongbyon-model reactor at al-Kibar in Syria in 2007, North Korea sold materials, designs, and expertise to help Syria build a plutonium-producing nuclear reactor.24 By now that reactor would have produced enough plutonium for a dozen nuclear bombs.

Moreover, what price did North Korea pay for having proliferated nuclear-weapons technologies and materials? In 2006, after watching North Korea test its first nuclear device and fearing that it might do something this reckless, President Bush issued a solemn warning. Declaring that sale or transfer of any nuclear weapon or nuclear-weapons material and technologies would cross a bright red line, Bush warned that any sale that violated this prohibition would be held ‘fully accountable.’25 But after North Korea was found to have disregarded this warning, how did the United States respond? When Israel informed the Bush Administration that it had discovered this facility as the project was approaching completion, the United States not only failed to take military action itself to stop it, but urged Israel to take the issue to the United Nations. Just weeks after Israel disregarded U.S. advice and destroyed the reactor, the United States returned to the Six-Party Talks with North Korea. And less than a year later, President Bush gave the Kim regime a significant concession by removing it from the list of state sponsors of terrorism in return for inspections on and initial steps to dismantle the Yongbyon reactor—a deal that Pyongyang reneged on just six months later when it kicked out the inspectors and announced that it would resume reprocessing at the reactor.26

When Nuclear Terrorism appeared in 2004, North Korea had yet to conduct a nuclear test. Since then, it has conducted six nuclear tests, including one in September 2017 that produced a yield ten-times that of the Hiroshima bomb.27 In Obama’s two terms, Kim Jong Un and his father, Kim Jong Il, conducted 80 missile tests. In Trump’s first year in office, Kim Jong Un has so far conducted 20 additional missile tests, including three ICBM tests.28 Today, North Korea stands on the threshold of a credible nuclear threat to the U.S. homeland. If North Korea succeeds in completing its nuclear deterrent, leaders of other rogue states will certainly take note.

As North Korea has continued violating UN injunctions to halt its nuclear and missile programs, the United States and its allies have ratcheted up sanctions on the Kim regime. The United States and China now insist that the most severe sanctions ever are ‘biting’ and that ‘maximum pressure’ on North Korea will force the Kim regime to relent and comply in order to avoid collapse. Those who have been watching this issue for the past two decades have heard that hope before. Moreover, tightening sanctions give a cash-strapped regime greater incentives to turn to the nuclear black market.

The United States has warned Kim Jong Un that selling nuclear weapons or weapons-usable nuclear materials would cross an inviolable red line. But as noted above, President Bush drew this red line a decade ago for Kim’s father—but to no effect. At this point, how credible will another threat from the United States to ‘punish’ North Korea for selling nuclear weapons or material be? Indeed, our predicament today is even more difficult. If Kim Jong Un launches his next series of ICBM tests and the IC concludes that he has the capability to attack the American homeland, how credible will any U.S. threat to punish North Korea for anything short of a full-scale attack on South Korea or the United States be? As Kim’s advisers will ask, if the United States is not prepared to act on its threat to prevent North Korea from acquiring the ability to strike the American homeland, why would they act if North Korea sold nuclear weapons to Iran?

Even if Trump succeeds in halting Kim’s progress short of a credible ICBM threat to the U.S. homeland, which seems unlikely at this point, the threat of nuclear terrorism emanating from North Korea will continue to require a significant U.S. campaign to deter and prevent. Due to the inability of previous administrations to stop North Korea’s progress earlier, a nuclear-armed North Korea, with the capacity and perhaps willingness to sell, will remain a major challenge not only for Trump but for his successors.

### 2NC---I/L---Nuke Terror

#### Kim will sell a nuke to terrorists if his regime’s cash flow dries up.

June Park & J. Berkshire Miller, 16 (June Park is a Postdoctoral Fellow at the Centre on Asia & Globalisation of the Lee Kuan Yew School of Public Policy at the National University of Singapore, J. Berkshire Miller is a senior visiting fellow with the Japan Institute of International Affairs and a distinguished fellow with the Asia-Pacific Foundation of Canada, 11-6-2016, accessed on 7-18-2022, National Interest, “The Scariest Thing North Korea Could Ever Do: Sell a Nuclear Weapon”, <https://nationalinterest.org/blog/the-buzz/the-scariest-thing-north-korea-could-ever-do-sell-nuclear-18313>, HBisevac)

As North Korea’s economic position worsens, the **risk** that it **sells** its **nuclear weapons tech**nology **grows**. Pyongyang conducted its fifth nuclear test on 9 September, accompanied by claims it has developed a warhead that can be mounted onto rockets. This test is estimated to have been at a yield of 25–30 kilotons — significantly larger than previous tests.

While the magnitude of the test alarmed some US policymakers, Washington’s foreign policy remains focused on the Middle East. Similarly, North Korea’s subsequent missile tests that ended in failure on 15 and 20 October gained little attention.

There appears to be a de facto acceptance by some in the Obama administration that North Korea will **not agree** to **denuclearize** — regardless of the concessions. Earlier this month, Obama’s top intelligence chief, James Clapper, remarked at an event hosted by the Council on Foreign Relations that “the notion of getting the North Koreans to denuclearize is probably a lost cause.” Despite Clapper’s remarks, the Obama administration as a whole continues to insist that a nuclear North Korea is not an option regardless of their unwillingness to disarm.

Meanwhile, **concerns** remain about the possible transfer of North Korea’s nuclear technology and knowledge to **non-state actors**. Hillary Clinton considers their “quest for a nuclear weapon” a grave threat because “the **greatest threat** of all would be terrorists getting their hands on **loose nuclear material**.” So how likely is North Korea to engage in a nuclear arms sale with a terrorist group?

Up until this point, proliferation of North Korea’s weapons of mass destruction seemed to be restricted to sovereign states. But this has not stopped apprehension from some in the **intelligence community** — spurred by Pyongyang’s connections to Libya’s Gaddafi regime and ties to Syria’s failed nuclear weapons program.

Over the years North Korea has created a web of **foreign connections** to peddle its **missiles** and components. As talks on **denuclearization** remain **non**-**existent** and foreign sanctions against the regime tighten, there are startling concerns that a **cash-strapped Pyongyang** may resort to dealing with its finances through the black-market with **terrorist groups** or **organized crime syndicates**.

While the threat may seem fanciful — even for a state as repugnant to international rules as North Korea — **the risks are real**. The official and **unofficial transfer** of nuclear technology has always been a method of **global outreach** for North Korea. Nuclear proliferation to non-state actors is a viable option for this regime when it feels **threatened**, **economically cornered** and **politically unstable**. Pyongyang is **strapped** for **funds** despite China’s less than ideal compliance of UN sanctions — which has kept the little trade they have **alive** and **enabled** the state to **continue** to obtain materials and funds for missile tests.

As tougher sanctions are imposed, North Korea will be pressured into **securing funds** via **alternative channels**. When the state’s cash flows and resources **dry up**, selling **nuclear** **tech**nology to the highest bidder may become a **tantalizing option** for the Kim regime.

### 2NC---Impact---Terror

#### Even if limited, it flips nuclear tripwires.

Peter Hayes 18, Professor of International Relations at RMIT University, Executive Director of the Nautilus Institute for Security and Sustainability, Ph.D. in Energy and Resources from the University of California-Berkeley; NAPSNet Special Reports, 1/18/2018, “Non-State Terrorism and Inadvertent Nuclear War,” <https://nautilus.org/napsnet/napsnet-special-reports/non-state-terrorism-and-inadvertent-nuclear-war/>

Nuclear terrorism post-cold war: trigger for inadvertent nuclear war?

The possible catalytic effect of nuclear terrorism on the risk of state-based nuclear war is not a simple linkage. The multiple types and scales of nuclear terrorism may affect state-nuclear use decisions along multiple pathways that lead to inadvertent nuclear war. These include:

* Early warning systems fail or are “tripped” in ways that lead to launch-on-warning
* Accidental nuclear detonation, including sub-critical explosions.
* Strategic miscalculation in crisis, show of force
* Decision-making failure (such as irrational, misperception, bias, degraded, group, and time-compressed decision-making)
* Allied or enemy choices (to seek revenge, to exploit nuclear risk, to act out of desperation)
* Organizational cybernetics whereby a nuclear command-control-and communications (NC3) system generates error, including the interplay of national NC3 systems in what may be termed the meta-NC3 system.

Synchronous and coincident combinations of above.[4]

Exactly how, where, and when nuclear terrorism may “ambush” nuclear armed states already heading for or on such a path to inadvertent nuclear war depends on who is targeting whom at a given time, either immediately due to high tension, or generally due to a structural conflict between states. Nuclear armed states today form a complex set of global threat relationships that are not distributed uniformly across the face of Earth. Rather, based on sheer firepower and reach, the nine nuclear weapons states form a global hierarchy with at least four tiers, viz:

Tier 1: United States, clear technological supremacy and qualitative edge.

Tier 2: Russia, China, global nuclear powers and peers with the United States due to the unique destructive power of even relatively small nuclear arsenals, combined with global reach of missile and bomber delivery systems, thereby constituting a two-tiered global “nuclear triangle” with the United States.

Tier 3: France, UK, NATO nuclear sharing and delivery NATO members (Belgium, Germany, Italy, the Netherlands and Turkey) and the NATO and Pacific nuclear umbrella states (Japan, South Korea, Australia) that depend on American nuclear extended deterrence and directly and indirectly support US and US-allied nuclear operations even though they do not host nor deliver nuclear weapons themselves.

Tier 4: India, Pakistan, Israel, DPRK.

The first two tiers constitute the global nuclear threat triangle that exists between the United States, Russia, and China, forming a global nuclear “truel.” Each of these states targets the others; each represents an existential threat to the other; and each has a long history of mutual nuclear threat that is now a core element of their strategic identity.

Tier three consists of states with their own nuclear force but integrated with that of the United States (even France!) that expand the zone of mutual nuclear threat over much of the northern and even parts of the southern hemisphere; and states that host American nuclear command, control, communications, and intelligence systems that support US nuclear operations and to whom nuclear deterrence is “extended” (if, for example, Australia’s claim to having an American nuclear umbrella is believed). The fourth tier is composed of smaller nuclear forces with a primarily regional reach and focus.

Between most of these nuclear armed states and across the tiers, there are few shared “rules of the road.” The more of these states that are engaged in a specific conflict and location, the more unpredictable and unstable this global nuclear threat system becomes, with the potential for cascading and concatenating effects. Indeed, as the number of nuclear states projecting nuclear threat against each other increases, the notion of strategic stability may lose all meaning.

The emergence of a fifth tier—of non-state actors with the capacity to project nuclear threat against nuclear-armed and nuclear umbrella states (although not only these states)—is a critically important possible catalytic actor in the new conditions of nuclear threat complexity that already exist today. Such a layer represents an “edge of chaos” where the attempts by nuclear armed states to exert absolute “vertical” control over the use of nuclear weapons confront the potential of non-state entities and even individuals (insiders) to engage in “horizontal” nuclear terrorism, presenting radically different control imperatives to the standard paradigm of organizational procedures, technical measures, and safeguards of various kinds. This tier is like the waves and tides on a beach that quickly surrounds and then causes sand castles to collapse.

In 2010, Robert Ayson reviewed the potential linkages between inter-state nuclear war and non-state terrorism. He concluded: “…[T]hese two nuclear worlds—a non-state actor nuclear attack and a catastrophic interstate nuclear exchange—are not necessarily separable. It is just possible that some sort of terrorist attack, and especially an act of nuclear terrorism, could precipitate a chain of events leading to a massive exchange of nuclear weapons between two or more of the states that possess them.”[5] How this linkage might unfold is the subject of the next sections of this essay.

#### Triggers nuclear war in every Asian and European hotspot.

Hayes ’18 [Peter; January 18; Professor of International Relations at RMIT University, Executive Director of the Nautilus Institute for Security and Sustainability, Ph.D. in Energy and Resources from the University of California-Berkeley; NAPSNet Special Reports, “Non-State Terrorism and Inadvertent Nuclear War,” <https://nautilus.org/napsnet/napsnet-special-reports/non-state-terrorism-and-inadvertent-nuclear-war/>]

The conclusion is unavoidable that there a non-state nuclear terrorist attack in the Northeast Asia region is possible. The following sections outline the possible situations in which nuclear terrorist attacks might be implicated as a trigger to interstate conflict, and even nuclear war. Particular attention is paid to the how nuclear command, control and communications systems may play an independent and unanticipated role in leading to inadvertent nuclear war, separate to the contributors to inadvertency normally included such as degradation of decision-making due to time and other pressures; accident; “wetware” (human failures), software or hardware failures; and misinterpretation of intended or unintended signals from an adversary.

Regional pathways to interstate nuclear war

At least five distinct nuclear-prone axes of conflict are evident in Northeast Asia. These are:

1. US-DPRK conflict (including with United States, US allies Japan, South Korea and Australia; and all other UNC command allies. Many permutations possible ranging from non-violent collapse to implosion and civil war, inter-Korean war, slow humanitarian crisis. Of these implosion-civil war in the DPRK may be the most dangerous, followed closely by an altercation at the Joint Security Area at Panmunjon where US, ROK, and DPRK soldiers interact constantly.
2. China-Taiwan conflict, whereby China may use nuclear weapons to overcome US forces operating in the West Pacific, either at sea, or based on US (Guam, Alaska) or US allied territory in the ROK, Japan, the Philippines, or Australia); or US uses nuclear weapons in response to Chinese attack on Taiwan.
3. China-Japan conflict escalates via attacks on early warning systems, for example, underwater hydrophone systems (Ayson-Ball, 2011).
4. China-Russia conflict, possibly in context of loss-of-control of Chinese nuclear forces in a regional conflict involving Taiwan or North Korea.
5. Russia-US conflict, involving horizontal escalation from a head-on collision with Russian nuclear forces in Europe or the Middle East; or somehow starts at sea (mostly likely seems ASW) or over North Korea (some have cited risk of US missile defenses against North Korean attack as risking Russian immediate response).

Combinations of or simultaneous eruption of the above conflicts that culminate in nuclear war are also possible. Other unanticipated nuclear-prone conflict axes (such as Russia-Japan) could also emerge with little warning.

### 1NC---Impact---Prolif

#### Prolif causes nuclear war---accidents, adventurism, brinksmanship, and preemptive strikes.

Matthew Kroenig, 15 (Matthew Kroenig, Associate Professor and International Relations Field Chair in the Department of Government and School of Foreign Service at Georgetown University, 2015, accessed on 2-18-2022, Journal of Strategic Studies, Volume 38, Issue 1-2, “The History of Proliferation Optimism: Does It Have a Future?”, https://www.tandfonline.com/doi/full/10.1080/01402390.2014.893508, HBisevac)

Why Nuclear Proliferation Is a Problem

**The spread of** nuclear weapons **poses at least six severe threats to international peace and security including:** nuclear war**,** nuclear terrorism**,** global **and regional** instability**, constrained US freedom of action,** weakened alliances**, and** further nuclear proliferation**. Each of these threats has received extensive treatment elsewhere and this review is not intended to replicate or even necessarily to improve upon these previous efforts. Rather the goals of this section are more modest: to usefully bring together and recap the many reasons why we should be** pessimistic **about the likely consequences of nuclear proliferation. Many of these threats will be illuminated with a discussion of a case of much contemporary concern: Iran’s advanced nuclear program. The greatest threat posed by the spread of nuclear weapons is nuclear war. The** more states in possession **of nuclear weapons, the** greater the probability **that somewhere, someday, there will be a** catastrophic nuclear war**.**

**Nuclear War**

**To date, nuclear weapons have only been used in warfare once. In 1945, the United States used nuclear weapons on Hiroshima and Nagasaki, bringing World War II to a close. Many analysts point to the 65-plus-year tradition of nuclear non-use as evidence that nuclear weapons are unusable, but it would be naïve to think that nuclear weapons will never be used again simply because they have not been used for some time. After all, analysts in the 1990s argued that worldwide economic downturns like the Great Depression were a thing of the past, only to be surprised by the dot-com bubble bursting later in the decade and the Great Recession of the late 2000s.48 This author, for one, would be surprised if nuclear weapons are not used again sometime in his lifetime.**

**Before reaching a state of** MAD**, new nuclear states go through a** transition period **in which they lack a** secure-second strike capability**. In this context, one or both states might believe that it has an** incentiveto use **nuclear weapons** first**. For example, if Iran acquires nuclear weapons, neither Iran, nor its nuclear-armed rival, Israel, will have a secure, second-strike capability. Even though it is believed to have a large arsenal, given its small size and lack of strategic depth, Israel might not be confident that it could absorb a nuclear strike and respond with a devastating counterstrike. Similarly, Iran might eventually be able to build a large and survivable nuclear arsenal, but, when it first crosses the nuclear threshold, Tehran will have a small and vulnerable nuclear force.**

**In these pre-MAD situations, there are at least three ways that nuclear war could occur. First, the state with the nuclear advantage might believe it has a splendid first strike capability. In a crisis, Israel might, therefore, decide to launch a** preventive nuclear strike **to disarm Iran’s nuclear capabilities. Indeed, this** incentive **might be further** increased **by Israel’s aggressive strategic culture that emphasizes** preemptive action**. Second, the state with a small and vulnerable nuclear arsenal, in this case Iran, might feel** use them or lose them **pressures. That is, in a crisis, Iran might decide to strike first rather than risk having its entire nuclear arsenal destroyed. Third, as Thomas Schelling has argued, nuclear war could result due to the reciprocal fear of surprise attack.49 If there are advantages to striking first, one state might start a nuclear war in the belief that war is** inevitable **and that it would be** better to go first than to go second**. Fortunately, there is no historic evidence of this dynamic occurring in a nuclear context, but it is still possible. In an Israeli–Iranian crisis, for example, Israel and Iran might both prefer to avoid a nuclear war, but decide to strike first rather than suffer a devastating first attack from an opponent.**

**Even in a world of MAD, however, when both sides have secure, second-strike capabilities,** there is still a risk of nuclear war**. Rational deterrence theory assumes nuclear-armed states are governed by rational leaders who would not intentionally launch a suicidal nuclear war. This assumption appears to have applied to past and current nuclear powers, but there is no guarantee that it will continue to hold in the future. Iran’s theocratic government, despite its inflammatory rhetoric, has followed a fairly pragmatic foreign policy since 1979, but it contains leaders who hold millenarian religious worldviews and could one day ascend to power. We cannot rule out the possibility that, as nuclear weapons continue to spread, some leader somewhere will choose to launch a nuclear war, knowing full well that it could result in self-destruction.**

**One does not need to resort to irrationality, however, to imagine nuclear war under MAD. Nuclear weapons may deter leaders from intentionally launching full-scale wars, but they do not mean the end of international politics. As was discussed above, nuclear-armed states still have conflicts of interest and leaders still seek to coerce nuclear-armed adversaries. Leaders might, therefore, choose to launch a limited nuclear war.50 This strategy might be especially attractive to states in a position of conventional inferiority that might have an incentive to escalate a crisis quickly to the nuclear level. During the Cold War, the United States planned to use nuclear weapons first to stop a Soviet invasion of Western Europe given NATO’s conventional inferiority.51 As Russia’s conventional power has deteriorated since the end of the Cold War, Moscow has come to rely more heavily on nuclear weapons in its military doctrine. Indeed, Russian strategy calls for the use of nuclear weapons early in a conflict (something that most Western strategists would consider to be escalatory) as a way to de-escalate a crisis. Similarly, Pakistan’s military plans for nuclear use in the event of an invasion from conventionally stronger India. And finally, Chinese generals openly talk about the possibility of nuclear use against a US superpower in a possible East Asia contingency.**

**Second, as was also discussed above, leaders can make a ‘**threat that leaves something to chance’**.52 They can initiate a** nuclear crisis**. By playing these** risky games of nuclear brinkmanship**, states can increase the risk of nuclear war in an attempt to** force **a** less resolved adversary **to** back down**. Historical crises have not resulted in nuclear war, but many of them, including the 1962 Cuban Missile Crisis, have come close. And scholars have documented historical incidents when accidents nearly led to war.53 When we think about future nuclear crisis dyads, such as Iran and Israel, with fewer sources of stability than existed during the Cold War, we can see that there is a real risk that a** future crisis **could result in a** devastating nuclear exchange**.**

Nuclear Terrorism

**The spread of nuclear weapons also increases the risk of** nuclear terrorism**.54 While September 11th was one of the greatest tragedies in American history, it would have been much worse had Osama Bin Laden possessed nuclear weapons. Bin Laden declared it a ‘religious duty’ for Al- Qa’eda to acquire nuclear weapons and radical clerics have issued fatwas declaring it permissible to use nuclear weapons in Jihad against the West.55 Unlike states, which can be more easily deterred, there is little doubt that if terrorists acquired nuclear weapons,** they would use them**.56 Indeed, in recent years, many US politicians and security analysts have argued that nuclear terrorism poses the greatest threat to US national security.57**

**Analysts have pointed out the tremendous hurdles that terrorists would have to overcome in order to acquire nuclear weapons.58 Nevertheless, as nuclear weapons spread, the possibility that they will eventually** fall into terrorist handsincreases**. States could** intentionally transfer **nuclear weapons, or the fissile material required to build them, to terrorist groups. There are good reasons why a state might be reluctant to transfer nuclear weapons to terrorists, but, as nuclear weapons spread, the probability that a leader might someday** purposely arm **a terrorist group** increases**. Some fear, for example, that Iran, with its close ties to Hamas and Hizballah, might be at a heightened risk of transferring nuclear weapons to terrorists. Moreover, even if no state would ever intentionally transfer nuclear capabilities to terrorists, a new nuclear state, with** underdeveloped security procedures**, might be** vulnerable to theft**, allowing terrorist groups or corrupt or ideologically-motivated insiders to transfer dangerous material to terrorists. There is evidence, for example, that representatives from Pakistan’s atomic energy establishment met with Al-Qa’eda members to discuss a possible nuclear deal.59**

**Finally, a nuclear-armed state could** collapse**, resulting in a** breakdown **of law and order and a** loose nukes problem**. US officials are currently very concerned about what would happen to Pakistan’s nuclear weapons if the government were to fall. As nuclear weapons spread, this problem is only further amplified. Iran is a country with a history of revolutions and a government with a tenuous hold on power. The regime change that Washington has long dreamed about in Tehran could actually become a nightmare if a nuclear-armed Iran suffered a breakdown in authority, forcing us to worry about the fate of Iran’s nuclear arsenal.**

**Regional Instability**

**The spread of nuclear weapons also emboldens** nuclear powers**, contributing to** regional instability**. States that lack nuclear weapons need to fear direct military attack from other states, but states with** nuclear weapons **can be confident that they can deter an intentional military attack, giving them an incentive to be more aggressive in the conduct of their foreign policy. In this way, nuclear weapons provide a shield under which states can feel free to engage in** lower-level aggression**. Indeed, international relations theories about the ‘stability-instability paradox’ maintain that stability at the nuclear level contributes to conventional instability.60**

Historically**, we have seen that the** spread of nuclear weapons **has** emboldened **their** possessors **and contributed to** regional instability**. Recent scholarly analyses have demonstrated that, after controlling for other relevant factors, nuclear-weapon states are more likely to engage in conflict than nonnuclear-weapon states and that this aggressiveness is more pronounced in new nuclear states that have less experience with nuclear diplomacy.61 Similarly, research on internal decision-making in Pakistan reveals that Pakistani foreign policymakers may have been emboldened by the acquisition of nuclear weapons, which encouraged them to initiate militarized disputes against India.62**

**Currently, Iran restrains its foreign policy because it fears major military retaliation from the United States or Israel, but with nuclear weapons it could feel free to push harder. A nuclear-armed Iran would likely step up support to terrorist and proxy groups and engage in more aggressive coercive diplomacy. With a nuclear-armed Iran increasingly throwing its weight around in the region, we could witness an even more** crisis prone Middle East**. And in a poly-nuclear Middle East with Israel, Iran, and, in the future, possibly other states, armed with nuclear weapons,** any **one of those** crises **could result in a** catastrophic nuclear exchange**.**

### 2NC---Impact---Prolif

#### The entire world will be blanketed via miscalc -- extinction.

Cirincione **’20** [Joe; March 20; Former Vice President for National Security at the Center for American Progress; Responsible Statecraft, “Why Letting Our Allies Get Nuclear Weapons Is A Bad Idea,” https://responsiblestatecraft.org/2020/05/20/why-letting-our-allies-get-nuclear-weapons-is-a-bad-idea/]

There is nothing automatic about the nuclear domino theory, and it has been successfully countered in some regions, but the theory is generally correct. The Soviet Union got the bomb because, as Stalin told his scientists after Hiroshima, “The balance has been broken. Build the bomb. It will remove the great danger from us.” Britain and France got the bomb because the Soviets (and the U.S.) had it. China did the same, then India got the bomb because China did; Pakistan because India did.

Nuclear competition in Asia would not end if South Korea decided to build a nuclear arsenal. Others in the region would likely follow suit. Japan, Taiwan, perhaps Vietnam. Similarly, a Saudi bomb would likely beget an Iranian bomb, a Turkish bomb and even an Egyptian bomb. Far from making the region — and the United States — safer, these arms races would blanket the globe with nuclear tripwires, each primed to unleash unprecedented destruction at the slightest twitch.

Where you stand determines what you see. Kennedy and the other presidents stood atop the chain of command, and their own experiences with that awful responsibility (particularly with the near-miss of the Cuban Missile Crisis) colored how they saw nuclear politics. They recognized the limitations of theory in a world characterized by imperfect information and the frictions of human interaction. They understood what the nuclear theorists could not — that more countries having nuclear weapons would only increase the risk of their use, not lessen it.

Three months before the Cuban Crisis, Kennedy’s Secretary of Defense, Robert McNamara, gave a speech in Ann Arbor, Michigan where he laid out this danger. “The mere fact that no nation could rationally take steps leading to nuclear war does not guarantee that a nuclear war cannot take place,” he said. “Not only do nations sometimes act in ways that are hard to explain on a rational basis, but even when acting in a ‘rational’ way they sometimes, indeed disturbingly often, act on the basis of misunderstandings of the true facts of a situation. They misjudge the way others will react, and the way others will interpret what they are doing.”

Any attempt to rationalize nuclear relationships — treating adversaries like two sides of a balanced equation — removes the human factor: the tendency towards irrationality and error. In a world with just a handful of nuclear states, that factor has already nearly led to apocalypse. In a world with a dozen more, those risks would go up exponentially.

It does not have to be this way. For over 50 years, since the signing of the Nuclear Non-Proliferation Treaty, successful diplomacy, security assurances, and global norms have largely kept nuclear proliferation at bay. The nightmare scenario of dozens of nuclear states has so far been averted, in no small part through the conscious and continual effort of American presidential administrations of both parties. Yes, there will always be those who advocate for more nuclear weapons in more hands. But the forces of restraint, and with it, survival, have prevailed and can continue to prevail if U.S. policy leads the way.

#### Prolif causes nuke war, Asian nuclear arms races, and collapses alliances

Gerzhoy and Miller 16 (Gene Gerzhoy - Former Research Fellow Project on Managing the Atom/International Security Program and now a Congressional Fellow at the American Political Science Association, Nicholas Miller - Associate Professor in the Department of Government at Dartmouth College, “Donald Trump thinks more countries should have nuclear weapons. Here’s what the research says”, The Washington Post, 6 April 2016, <https://www.washingtonpost.com/news/monkey-cage/wp/2016/04/06/should-more-countries-have-nuclear-weapons-donald-trump-thinks-so/>, MG)

Research does not support the idea that the spread of nuclear weapons is **inevitable**. But isolationist “America First” policies could prompt that spread. Defining U.S. strategic interests primarily in terms of monetary gain, and curtailing U.S. global engagement toward that end, would boost the probability that our **allies would respond by going nuclear**.

Would nuclear proliferation be good for U.S. interests?

What about Trump’s second proposition: that proliferation by our allies would be good for U.S. interests? This argument is based on the idea that nuclear-armed allies could help contain U.S. adversaries and enable the United States to save money. As Trump told Cooper, “I would rather see Japan having some form of defense, and maybe even offense, against North Korea.” And as he suggested, the United States can’t afford to protect Japan and South Korea — and therefore, “they have to pay us or we have to let them protect themselves.”

Reducing military commitments and letting allies build their own nuclear weapons might save money for the United States. But international relations scholarship suggests that allied proliferation would have broader negative repercussions. Among these would be **declining U.S. influence**. When nations gain their own military capabilities, they **rely less on their allies** and become less subject to their sway. And that can undermine a senior partner’s ability to hold its junior allies back from risky military actions.

In other words, allowing or encouraging proliferation would worsen the “American weakness” that Trump decries.

Recent nonproliferation research underscores this proposition. Mark Bell shows that nuclear allies are likely to become more independent of their patrons and in some cases can **develop more assertive foreign policies**. And Francis Gavin and Matthew Kroenig show that the fear of declining influence was one reason why most American administrations vigorously opposed the spread of nuclear weapons.

**Nuclear allies** can also become **security risks**. Vipin Narang demonstrates that when weaker states gain nuclear weapons, they often seek to coerce their senior partners into intervening on their behalf by threatening to use nuclear weapons. That’s what Israel did at the height of the 1973 Arab-Israeli War. That’s what South Africa did during its 1988 confrontation with Cuban forces in Angola. And that’s what Pakistan did in the midst of its 1990 military crisis with India.

Instead of relieving the United States of a military burden, as Donald Trump suggests, having more nuclear allies could increase the risk that the United States would **get involved in conflicts that might turn nuclear**.

Furthermore, were South Korea or Japan to begin developing nuclear weapons, their rivals might be tempted to launch preventive military strikes, which research suggests has been frequently considered in the past. The road to nuclear acquisition is often rocky and **increases the likelihood of militarized conflict**. For example, Soviet worries that West Germany would acquire nuclear weapons helped trigger the Berlin Crisis.

And if Japan or South Korea actually acquired nuclear weapons, we could possibly see a **nuclear arms race in Asia**. Japan’s neighbors, including South Korea, would fear resurgent Japanese militarism. North Korea would expand its nuclear capabilities. China would continue to expand its own nuclear arsenal.

**Why haven’t we seen nuclear arms races before?**

[Nuclear “domino effects”](https://repository.library.georgetown.edu/handle/10822/558060) have not been common historically. But that’s largely because of [determined U.S. efforts to stop them](http://www.tandfonline.com/doi/abs/10.1080/09636412.2014.874189).

Since the dawn of the nuclear age, the United States has [pursued nonproliferation as a top policy priority](http://www.mitpressjournals.org/doi/abs/10.1162/ISEC_a_00205#.VwAzcxMrJfQ). That includes sponsoring and enforcing the [Nonproliferation Treaty (NPT)](http://www.un.org/disarmament/WMD/Nuclear/NPTtext.shtml). [Research suggests the NPT](http://www.journals.uchicago.edu/doi/abs/10.1086/682080) has been instrumental in limiting the spread of nuclear weapons, in part by coordinating states’ beliefs about one another’s nonproliferation commitments. To develop nuclear weapons, Japan and South Korea would need to violate or withdraw from the NPT. That could prompt U.S. allies and adversaries in other regions — including Saudi Arabia, Germany and Iran — to question the treaty’s viability and consider seeking their own nuclear arsenals.

Would this be so bad? After all, no two nuclear armed states have fought a major war with each other, and nuclear weapons have not been used in conflict since the United States bombed Hiroshima and Nagasaki in 1945.

But the conclusion that nuclear weapons produce peace is subject to debate. It’s true that there has been no war between major powers since 1945. But that may be due to [other](http://www.jstor.org/stable/2538971) [factors](https://books.google.com/books?id=J7ATQb6LZX0C&dq=pinker+angels&lr=&source=gbs_navlinks_s). The quantitative evidence linking nuclear weapons to a reduced risk of conflict is [limited](http://jcr.sagepub.com/content/57/3/478.short)[at best](http://jcr.sagepub.com/content/59/1/74).

Further, [theoretical and historical evidence suggests that nuclear accidents and miscalculations are likely](http://press.princeton.edu/titles/5301.html). More countries with nuclear weapons would mean more opportunities for catastrophic nuclear mistakes.

**So what’s the takeaway?**

A look at history shows us that nuclear proliferation is **anything but inevitable**. U.S. nonproliferation efforts have been surprisingly successful, even when the United States was weaker than it is today.

Without firm U.S. opposition to the spread of nuclear weapons — a policy implemented through “carrots” like alliances and “sticks” like sanctions — the world would probably have far more than nine countries with nuclear weapons. What’s more, research suggests that nuclear proliferation would **reduce U.S. world influence**, undermine global stability and **increase the risk of nuclear war**.

### 1NC---Impact---Middle East War

#### Middle East prolif goes nuclear.

Edelman et al. 11, \*Eric S. Edelman, Distinguished Fellow at the Center for Strategic and Budgetary Assessments, U.S. Undersecretary of Defense for Policy in 2005-9; \*\*Andrew F. Krepinevich, President of the Center for Strategic and Budgetary Assessments; \*\*\*Evan Braden Montgomery, Research Fellow at the Center for Strategic and Budgetary Assessments (January/February 2011, “The Dangers of a Nuclear Iran: The Limits of Containment”, *Foreign Affairs*, Vol. 90, No. 1, <https://www.jstor.org/stable/25800382>, pg. 71-73)

N-Player Competition

Were Saudi Arabia to acquire nuclear weapons, the Middle East would count three nuclear-armed states, and perhaps more before long. It is unclear how such an n-player competition would unfold because most analyses of nuclear deterrence are based on the U.S.-Soviet rivalry during the Cold War. It seems likely, however, that the interaction among three or more nuclear-armed powers would be more prone to miscalculation and escalation than a bipolar competition. During the Cold War, the United States and the Soviet Union only needed to concern themselves with an attack from the other. Multi polar systems are generally considered to be less stable than bipolar systems because coalitions can shift quickly, upsetting the balance of power and creating incentives for an attack. More important, emerging nuclear powers in the Middle East might not take the costly steps necessary to preserve regional stability and avoid a nuclear exchange. For nuclear-armed states, the bedrock of deterrence is the knowledge that each side has a secure second-strike capability, so that no state can launch an attack with the expectation that it can wipe out its opponents' forces and avoid a devastating retaliation. However, emerging nuclear powers might not invest in expensive but survivable capabilities such as hardened missile silos or submarine based nuclear forces. Given this likely vulnerability, the close proximity of states in the Middle East, and the very short flight times of ballistic missiles in the region, any new nuclear powers might be compelled to “launch on warning” of an attack or even, during a crisis, to use their nuclear forces preemptively. Their governments might also delegate launch authority to lower-level commanders, heightening the possibility of miscalculation and escalation. Moreover, if early warning systems were not integrated into robust command-and-control systems, the risk of an unauthorized or accidental launch would increase further still. And without sophisticated early warning systems, a nuclear attack might be unattributable or attributed incorrectly. That is, assuming that the leadership of a targeted state survived a first strike, it might not be able to accurately determine which nation was responsible. And this uncertainty, when combined with the pressure to respond quickly, would create a significant risk that it would retaliate against the wrong party, potentially triggering a regional nuclear war. Most existing nuclear powers have taken steps to protect their nuclear weapons from unauthorized use: from closely screening key personnel to developing technical safety measures, such as permissive action links, which require special codes before the weapons can be armed. Yet there is no guarantee that emerging nuclear powers would be willing or able to implement these measures, creating a significant risk that their governments might lose control over the weapons or nuclear material and that nonstate actors could gain access to these items. Some states might seek to mitigate threats to their nuclear arsenals; for instance, they might hide their weapons. In that case, however, a single intelligence compromise could leave their weapons vulnerable to attack or theft. Meanwhile, states outside the Middle East could also be a source of instability. Throughout the Cold War, the United States and the Soviet Union were engaged in a nuclear arms race that other nations were essentially powerless to influence. In a multipolar nuclear Middle East, other nuclear powers and states with advanced military technology could influence—for good or ill—the military competition within the region by selling or transferring technologies that most local actors lack today: solid-fuel rocket motors, enhanced missile-guidance systems, war head miniaturization technology, early warning systems, air and missile defenses. Such transfers could stabilize a fragile nuclear balance if the emerging nuclear powers acquired more survivable arsenals as a result. But they could also be highly destabilizing. If, for example, an outside power sought to curry favor with a potential client state or gain influence with a prospective ally, it might share with that state the technology it needed to enhance the accuracy of its missiles and thereby increase its ability to launch a disarming first strike against any adversary. The ability of existing nuclear powers and other technically advanced military states to shape the emerging nuclear competition in the Middle East could lead to a new Great Game, with unpredictable consequences.

### 2NC---Impact---Middle East War

#### Middle East war draws in great powers and goes nuclear.

Pleasance 20, senior foreign news reporter with dailymail, (Chris, January 3rd, 2020, “How could Iran crisis lead to World War Three? Tehran could hit back with cyber-attacks or terror attacks on US forces and Israel - provoking Donald Trump to retaliate in tit-for-tat that could drag in Saudi Arabia, Russia, China and Turkey”, <https://www.dailymail.co.uk/news/article-7848703/How-Iran-crisis-lead-World-War-Three.html>)

Iran has vowed to exact a 'crushing revenge' on American forces in retaliation for the killing of Quds commander Qassem Soleimani - leaving the Middle East on the brink of a conflict that could quickly spiral into World War 3. The Iranian National Security Council is currently meeting in Tehran - chaired by Ayatollah Khamenei himself for the first time ever - to consider its response. At their disposal is the world's 13th most powerful military, a host of militia groups spread across the Middle East, proxy-forces such as Lebanon's Hezbollah and Yemen's Houthi rebels, and allies like Syria's Bashar al-Assad. Targets in their crosshairs are likely to include US troops and military bases in Iraq and Syria, Israeli forces in the Golan Heights, tankers in the Strait of Hormuz, and Saudi Arabia's oil infrastructure. While initial strikes are likely to be limited, they could herald a tit-for-tat series of events - drawing in Russian forces stationed in Syria defending a key Iranian ally in Bashar al-Assad, and Turkish forces fighting in the country's north. China also has ships stationed in the Gulf of Oman and recently carried out joint naval drill with both Iran and Russia, raising the prospect that they could also become involved. Saudi Arabia is already engaged in a conflict with Iran-backed Houthi rebels in Yemen, and any escalation by Tehran would be met with a response from Riyadh. Turkish strongman Recep Erdogan's troops are deployed in northern Syria and he is close to Russia and Iran as well as being a member of NATO - making his actions unpredictable if a conflict escalates across the region. The US, China, Russia and Israel all have nuclear weapons - with at least three of those possessing next-generation hypersonic missiles capable of breaching all defense systems. Israel is also armed with nuclear weapons and is an obvious target for any Iranian attacks, but Benjamin Netanyahu and the IDF will not hesitate to defend themselves and have recently struck Iran-backed Hezbollah forces in Syria. If Iran decides to blockade the Strait of Hormuz, as it has often threatened to do in the past, a host of world powers including European nations which rely on the oil which flows through the waterway could find themselves having to defend their interests. Ultimately, if the tit-for-tat exchanges between these countries escalated far enough it is conceivable but unlikely that it would end with a nuclear exchange - and destruction on a global scale.

### 2NC---Impact---NoKo Collapse---Run

#### Regime collapse causes loose nukes and NoKo-SoKo war---draws in the U.S.

Oriana Skylar Mastro, 20 (Oriana Skylar Mastro, a center fellow at Stanford University’s Freeman Spogli Institute for International Studies, 4-27-2020, accessed on 7-20-2022, Foreign Policy, “5 Things to Know If Kim Jong Un Dies”, <https://foreignpolicy.com/2020/04/27/5-things-to-know-if-kim-jong-un-dies/>, HBisevac)

3. North Korean **nukes** would need to be **secured quickly**.

The United States would face **many challenges**, alongside South Korea, in the event of collapse in the North. But securing and destroying nuclear weapons and associated facilities would be the **top priority**. A key part of the strategy to counter North Korean **w**eapons of **m**ass **d**estruction is to prevent the **prolif**eration of material, weapons, and know-how beyond the peninsula to **new actors**. In a North Korea collapse scenario, the United States would likely seek to establish a cordon sanitaire around the country to prevent nuclear materials from getting out and into the hands of other **rogue actors**, or even **terrorist organizations**.

North Korea is currently estimated to have between **20** and **60 nuclear weapons**, a stockpile of **75** to **320 kilograms** of **highly enriched uranium**, **39** relevant **nuclear sites**, and **49 missile sites**. Given advancements in its missile technology, North Korea can hit South Korea, Japan, and even potentially the United States with nuclear weapons and has threatened to do so on multiple occasions. Kim or a successor may use nuclear weapons as a last-ditch effort to deter outside intervention that could ensure and accelerate the collapse of the regime.

4. **China** would take the **lead** **militarily**, whether the United States likes it or not.

One big problem is that U.S. contingency planning does not adequately account for the role of Chinese forces in a collapse contingency. The conventional wisdom is that Chinese intervention would largely be limited to dealing with refugees along its border, and any actions taken would be **in** **support** of **No**rth **Ko**rea.

But changes in Chinese military capabilities, heightened concerns about nuclear security, and prioritization of geopolitical competition with the United States have encouraged China to broaden its thinking in recent years. Specifically, China would likely undertake an extensive military intervention with an eye on expanding regional influence if a major conflict broke out on the Korean Peninsula. Recent Chinese statements and military training exercises also point to heightened preparations for intervention.

Moreover, it is likely that the Chinese military would **reach** North Korean **nuclear facilities sooner** than U.S. or South Korean troops, thanks to China’s **geographical proximity** to North Korea, the vicinity of its troops, and the possibility that North Korean troops would exhibit relatively **low resistance** to Chinese forces. China might also enjoy **early warning**, allowing for advanced preparation, because the shared border provides China with unique opportunities to **collect intelligence**. All of this points to the need for the United States to change its planning assumptions to account for the presence of Chinese troops on the peninsula following any credible signs of instability in Pyongyang.

5. The collapse of the Kim regime would likely **set back** **America’s position** in Asia.

It is not an exaggeration to say that the future of the U.S. role in Asia, and thus the **status** of its **competition** with China for **power** and **influence**, rides on how the United States responds to **instability** on the **Korean Peninsula**. Unlike China, the United States is not a resident Asian power; it relies on a network of **alliance relationships** for **military access**. The unpredictability of U.S. President Donald Trump’s stance on North Korea, vacillating between “fire and fury” and dramatic praise for Kim, may create uncertainty among U.S. allies as to how the country would behave in a confrontation. Similarly, if the United States does not follow through completely on its alliance commitments to South Korea, this could encourage allies to pursue **alternative arrangements** and seek **greater accommodation** of China, **weakening** the **U.S. position**.

Instability caused by the collapse of the Kim regime would **most certainly** lead to a **civil war** that would involve the United States as **So**uth **Ko**rea’s **ally**. Hundreds of thousands of troops would be needed for **stability** and **WMD elimination** operations in North Korea. Such a war would then likely involve deaths in the order of tens of thousands of people, even millions, and the choice to detonate any U.S. nuclear weapons within North Korea would bring “**hellish results**,” as the security studies expert Barry Posen has argued. The drain of a **major war** on the **Korean Peninsula** would be **cataclysmic** for U.S. resourcing of the **great-power competition** with China in other areas and arenas.

In short, while many may cheer at the sign of political troubles in North Korea, the situation is complicated. U.S. policymakers would almost certainly face a **deck stacked against them** if regime instability hits Pyongyang. It would take once-in-a-generation leadership to create the U.S. statecraft that would navigate the United States safely through a potential crisis.

#### NoKo loose nukes poses massive terror and prolif risks.

Ash Carter et al., 3 (Ash Carter, Director, Belfer Center for Science and International Affairs, Harvard Kennedy School, Belfer Professor of Technology and Global Affairs, Faculty Director, Technology and Public Purpose Project, Member of the Board, Belfer Center, Faculty Affiliate, Project on Managing the Atom, Former Secretary of Defense; Dr. William J. Perry, Former Co-Director, Preventive Defense Project, 19th Secretary of Defense for the United States; General John M. Shalikashvili, Former Founding Senior Advisor, Preventive Defense Project, 13th Chairman of the Joint Chiefs of Staff, Department of Defense, 2-6-2003, accessed on 7-21-2022, Harvard Kennedy School, Belfer Center of Science and International Affairs, “A Scary Thought: Loose Nukes in North Korea”, <https://www.belfercenter.org/publication/scary-thought-loose-nukes-north-korea>, HBisevac)

News reports indicate that North Korea has begun to move fuel rods containing six bombs’ worth of **plutonium** from its facility at Yongbyon. For eight years, since 1994, that plutonium has been stored at Yongbyon where it could be seen by on-site inspectors and, if necessary, entombed by an airstrike of precision bombs. Now it is being trucked away, perhaps to one of North Korea’s many caves, where it will be difficult to find or destroy.

This development undermines global **nonprolif**eration **efforts** that have been successful for decades, and represents an **imminent danger** to the **security** of the **region**. Even more, in an age of terrorism it poses the additional specter of putting nuclear weapons into the hands of parties **even more threatening** than the North Korean government. North Korea has few cash-generating exports other than ballistic missiles. Now nuclear weapons or fissile material could take their place in its shopping catalogue. Or North Korea’s government might **collapse**, **losing control** of the nukes in the process. While hijacked airlines and anthrax-dusted letters are a dangerous threat to civilized society, it would change the way Americans were forced to live if it became an **ever-present possibility** that a city could **disappear** in a **mushroom cloud**

North Korea has not been allowed to reprocess nuclear fuel rods to obtain weapons plutonium since 1989. In that period, North Korea obtained a **quantity** of **plutonium** that it did **not** **declare honestly** to the IAEA, as it was required to do. How much is uncertain, but estimates range as high as two bombs’ worth. Whether it has had a bomb or two for the past 15 years is not known, but for sure it is now only a few months away from obtaining six bombs. The North Koreans might reckon that’s enough to sell some and have some left over to threaten the U.S. and its allies, South Korea and Japan.

North Korea also admitted last October that it aims to produce the other metal from which nuclear weapons can be made-**uranium**. It will be years, however, before that effort produces anything like the amount of fissile material now being trucked from Yongbyon. The material at Yongbyon is the immediate threat.

#### NoKo collapse causes Kim to go for SoKo AND the U.S---goes nuclear.

Barbara Demick, 17 (Barbara Demick, former foreign correspondent for the Los Angeles Times who previously headed bureaus in Beijing and Seoul, Britain’s Samuel Johnson Award winner, George Polk Award winner, Robert F. Kennedy Award winner, Osborn Elliott Prize for Journalism from the Asia Society winner, American Academy of Diplomacy’s Arthur Ross Award winner, Stanford University’s Shorenstein Award for best Asia reporting, finalist for the Pulitzer Prize, fellow at CFR, 9-25-2017, accessed on 7-20-2022, Los Angeles Times, “Escalating tension has experts simulating a new Korean War, and the scenarios are sobering”, <https://www.latimes.com/world/la-fg-korean-war-20170925-story.html>, HBisevac)

This is the **way a** **nuclear war begins**.

Simulations of a war on the Korean peninsula usually start with a relatively minor incident at the **d**e**m**ilitarized **z**one between South Korea and its hostile northern neighbor, or a provocation that develops into a conventional war and then escalates.

President Trump’s threatening posture toward North Korea — most recently exhibited at the United Nations, where he warned that the U.S. could “totally destroy” the country — has prompted military strategists to examine what would actually happen if a war broke out.

The scenarios are a sobering corrective to the notion that North Korea’s nuclear capacity could be taken out in a single strike, or that the regime would prove as fragile as that of Saddam Hussein in Iraq or Moammar Kadafi in Libya.

“Too many Americans have the view that it would be like the invasion of Iraq or Afghanistan, or like combat operations in Libya or Syria, but it wouldn’t remotely resemble that,’’ said Rob Givens, a retired Air Force brigadier general who spent four years stationed on the Korean peninsula.

And that is before the North Koreans turn to nuclear weapons. “There is only **one way** that this war ends,” Givens said. “With North Korea’s defeat — **but at what cost**?”

James Stavridis, a retired Navy admiral and dean of the Fletcher School of Law and Diplomacy at Tufts University, said the horrific war many have long feared with North Korea is a distinct possibility. He puts the chances of conventional conflict with North Korea at 50-50 and the chances of nuclear war at 10%.

“We are **closer to a nuclear exchange than we have been** at any time in the world’s history with the single exception of the Cuban missile crisis,’’ Stavridis said.

The conflict that Stavridis envisions might start with North Korean leader Kim Jong Un launching a missile that lands on or near **Guam**.

The United States then moves **aircraft carrier strike groups** within range of the peninsula and retaliates with an **airstrike** on a coastal launch facility, perhaps using a Tomahawk cruise missile — similar to the attack the U.S. launched to punish Syria for its use of chemical weapons.

The strike is intended as a message, not an invitation to all-out war. But Kim, unlike Syria’s Bashar Assad, is **unlikely** to **sit idly by**.

“He has to react. He knows that if there is a military strike and he does nothing about it, they’ve called his bluff and **the game is all over for him**,’’ said Sue Mi Terry, a former CIA analyst on North Korea.

North Korea might respond by **lobbing** a few **artillery shells** toward the 35,000 U.S. troops currently stationed in South Korea.

North Korea has approximately 11,000 conventional artillery pieces dug into the mountains north of the demilitarized zone. Although much of the equipment dates from the Soviet era, it is in excellent working order and well-protected from drone strikes and airstrikes because it is designed to be rolled in and out from tunnels in the mountains.

The United States would try to take out the artillery with drones and airstrikes, but **that would take days**, in which time the North Koreans would probably launch a **punishing barrage** aimed at **Seoul** and its population of 25 million.

As the war escalates, the North Koreans would likely bomb the bridges across Seoul’s Han River to make it more difficult for civilians to flee, use **special forces** and **infiltrators** to attack **key facilities** and **personnel** in South Korea, and launch short-range missiles against **So**uth **Ko**rean and **U.S. military bases**.

The Pentagon has estimated the potential number of dead in South Korea at 20,000 each day, Givens said. And that is before the North Koreans turn to nuclear weapons.

Although North Korea has successfully tested an intercontinental ballistic missile and conducted six nuclear tests, the technologies have not yet been married together. That means that though the West Coast of the U.S. now appears to be within range of North Korea’s missiles, it is unlikely that Pyongyang could credibly target the mainland United States with a fully functioning nuclear weapon at this stage.

On the other hand, a nuclear device could be smuggled into a container port or dropped from an airplane, perhaps near one of the **U.S. bases** in Asia.

“In an **all-out conquest** for **regime survival**, **they will come after the** **U**nited **S**tates. They are not going to win, but they will try — I guarantee that,’’ Givens said.

The paradox with North Korea is that its weakness is what makes it so dangerous — and why it is difficult to make comparisons with the Cold War period, when fears of mutually assured destruction deterred war with the Soviet Union.

If Kim thinks his regime is collapsing, many of those who have long studied the inscrutable leader believe, he would be **inclined** to **reach** for the **nuclear option** in order to **take down everyone else** with him — **a last lash of the dragon’s tail**.

“The North Koreans are in a weak position. They can’t sustain a protracted conventional war. They would have to reach for their weapons of mass destruction early on,’’ said Daniel Pinkston, a former military translator who now teaches defense strategy in South Korea.

The very notion of **trying** to **take out** North Korea’s nuclear weapons, he added, “has a **high likelihood** that you are going to **unleash the very thing** that you are **trying to prevent**.’’

Kim Jong Il, father of the current leader, is widely reported to have said, “I would destroy the world or take the world with me before accepting defeat on the battlefield.”

The oft-cited statistics about North Korea’s military are **formidable**: 1.2 million soldiers in the fourth-largest ground army in the world, among them more than 100,000 **special forces** trained to infiltrate South Korea. Although its military hardware dates back to the Soviet era, North Korea has **more tanks** than the United States (3,500 compared with 2,381) and more **artillery pieces** than China. Its **nuclear fissile material** is enough for least 12 **nuclear weapons**, possibly as many as **60**, depending on their size. (According to the Arms Control Assn., the U.S. has 1,411 strategic nuclear warheads.)

“The North Korean army is still inferior in every aspect of their operations, but they have massive artillery and missile capability, very large special forces and covert operations and submarines,’’ said Anthony Cordesman of the Washington-based Center for Strategic and International Studies and author of a study of the military balance in Asia.

No doubt, a replay of the Korean War in the 21st century would be quicker than the 1950-to-1953 Korean War, a slog through snow-choked mountains that killed nearly 2 million people and left the demarcation line between North and South Korea essentially in the same place where it had started.

But despite the mechanized, high-technology weapons deployed in modern-day warfare, a new Korean War could be as drawn-out and messy as the earlier one.

“A war today would certainly involve a lot of technology, more precise and lethal systems than the last war, but you need to be very, very careful or you could be fighting in precisely those same mountains,’’ Cordesman said.

One of the unpredictable factors charting the course of a new Korean War is whether China would enter the war to save its communist ally.

The Global Times, a newspaper that often expresses Chinese government views, editorialized last month that China would not help North Korea if the U.S. retaliated against a North Korean missile attack. However, it [also warned](https://www.globaltimes.cn/content/1060791.shtml) that “if the U.S. and South Korea carry out strikes and try to overthrow the North Korean regime and change the political pattern of the Korean peninsula, China will prevent them from doing so.”

Most military strategists don’t expect the current Chinese government under Xi Jinping to send its troops cross the Yalu River as Mao Tse-tung did in 1950. But Beijing could conduct airstrikes to prop up the government in Pyongyang, in much the way that Russia has come to the aid of Syria’s Assad. The Chinese also might intervene to call for a peace deal that would end up keeping Kim in power.

The aftermath of a new **Korean War**, even a conventional war, could be **as messy** as the **conflict itself**.

Removal of Kim could leave the country with a **power vacuum** and no one clearly in charge. “You might have a **legitimacy competition** in North Korea where different actions are backed by different parties,’’ said Scott Snyder of the Council on Foreign Relations. Although North Korea has an ethnically homogenous population — no rival ethnic factions competing for dominance — it has often been torn by **regional divisions** and could **easily disintegrate** in the way that countries such as **Iraq** and **Libya** did after the fall of dictators.

“I would not rule out the possibility that North Korea’s future could look a lot like **Syria**,’’ Snyder said. “North Korea could become a **resource-consuming quagmire** of many, **many years**.”

### ---NoKo Collapse---EXT

#### tag

Victor Cha, 21 (Victor Cha is senior adviser at the Center for Strategic and International Studies, a professor at Georgetown University, 1-15-2021, accessed on 7-23-2022, Washington Post, “North Korea could become one of Biden’s biggest challenges — and not just because of its nukes”, <https://www.washingtonpost.com/opinions/2021/01/15/why-north-korea-could-become-one-bidens-biggest-challenges/>, HBisevac) \*\*edited for ableist language\*\*

President Biden and his team will have a plethora of urgent issues to address upon taking office, above all the pandemic, economic recovery and race relations. Yet chances are good that, just as in past presidential transitions, North Korea will find a way to put itself on the front burner. In the past, the Kim regime drew attention to itself with provocations involving missiles and nuclear tests, and that could be the case in 2021 as well. Yet Biden and his team should be on their guard against **another form** of **No**rth **Ko**rea **crisis** — one involving a catastrophic mix of **covid**-19, **nuclear weapons** and a **collapsing economy**.

North Korean leader Kim Jong Un’s speech at the **W**orkers’ **P**arty **C**ongress earlier this month made pretty clear that **denuclearization** is **not in the cards** for the Biden administration. On the contrary, Kim laid out a pretty **ambitious agenda** for weapons modernization including **hypersonic missiles**, solid-fuel **i**nter**c**ontinental **b**allistic **m**issile**s**, **u**nmanned **a**erial **v**ehicle**s**, **nuclear**-powered **submarines** capable of launching ballistic missiles, and **tactical nuclear** **weapons**. Kim also said he wants to develop ICBMs with precision targeting up to nearly 10,000 miles, which would more than cover the continental United States.

And if Kim gets to work early, Biden could soon find himself confronting missile provocations — just as he did as vice president, when North Korea launched a rocket and exploded a nuclear device soon after President Barack Obama took office.

But there’s a difference this time. Kim has issued this latest round of threats amid a raging global pandemic that has shut down the country and ~~crippled~~ [wrecked] an already weak economy. This could become the **real source of crisis**. Kim should fear U.S. military power far less than the prospect of a pandemic raging across a virtually nonexistent public health infrastructure. While North Korea still claims there are no covid-19 cases in the country, it has completely locked down its borders, not unlike the lockdowns it imposed in response to the Ebola outbreak in West Africa in 2014 and SARS in 2003. The economy has **suffered dearly** as a result, registering an economic downturn in 2020 comparable to the Great Famine in the 1990s, when 10 percent of the population perished.

Normally, China and South Korea would **help out**, but the North Koreans have closed off almost **all border trade** for fear of the virus entering the country. Year-on-year trade with China, far and away the North’s leading trade partner, is **down** more than **70 percent**. Indeed, when a disturbed South Korean government official tried to defect to the North last year, the North Korean military not only shot him but also burned the body to avoid any virus transmission.

Vaccines are a **long way off**. South Korea, the most likely source, does not have them yet and isn’t likely to get any earlier than April. China has its own problems with the new virus variant, and its **vaccine diplomacy** is focused on **Africa** and **Latin America**.

All this means **there is no end in sight**. Our independent study found that in response to the MERS virus in 2015, North Korea stayed locked down for twice the amount of time as South Korea, where the outbreak happened. Can the North Korean economy really **survive** being **shut down** for another year or longer? **I don’t think so**.

North Korea may respond to this predicament by trying to take control of the burgeoning private markets inside of the country. The recent party congress suggests that such measures might include forcing hard-working North Korean citizens to hand over precious dollars, renminbi and euros gotten through black markets in return for worthless North Korean won.

Our research interviewing North Korean defectors suggests that most social resistance against the iron hand of the state has taken place whenever the government has attempted **anti-market activities** such as currency reform, extraordinary taxes or market shutdowns. Should the regime become desperate enough to undertake such measures, it could find itself confronting **congregations** of **angry North Koreans** that could in turn become covid-19 superspreader events, compounding the crisis.

A breakdown of such order could mean that the government in Pyongyang may be tempted to **lash out militarily** at **external enemies** to justify **consolidating control** at home through **brutal crackdowns**. In the worst case, the combination of disease and a deteriorating economy could lead to **internal chaos** that might endanger **government control** over its **nuclear arsenal**. A **loose-nukes crisis** could end up making a few missile launches look **tame**.

All these variables mean that the new U.S. administration could face a **No**rth **Ko**rean **crisis** **unlike any** confronting the United States before. Biden would be well-advised to keep a close watch.

### ---Loose Nukes---EXT

#### TAG

Alex Lockie, 18 (Alex is a news editor and a military and foreign-policy blogger at Business Insider, 4-24-2018, accessed on 7-21-2022, Insider, “North Korea disarming runs a huge risk — loose nukes and nuclear scientists”, <https://www.businessinsider.com/north-korea-disarming-risk-loose-nukes-nuclear-scientists-2018-4>, HBisevac)

North Korea's Kim Jong Un has bought his way in to talks with China's President Xi Jinping, South Korea's President Moon Jae-in, and US President Donald Trump with a commitment to denuclearize his country — but doing so could open up the world to the **tremendous risk** of **loose nukes** and **loose nuclear scientists**.

Though Kim has repeatedly vowed to rid his country of nuclear weapons, the promises remain totally one-sided as no one knows how many, or where, North Korea's nuclear arsenal is.

Kim reportedly sent a message to Trump saying he'd accept denuclearization verification and intensive inspection by international inspectors with the International Atomic Energy Agency, the same agency that supervises the Iran deal

But to do that, Kim would have to provide a list of nuclear sites to the inspectors. It will be a major challenge for the outside world to take his word for it when he announces the sites, or to scour the country for additional sites.

In the past, North Korea has agreed to international inspections, but backed out when it came time to actually scrutinize the programs.

As a result of North Korea's secretiveness, it may have unaccounted for nuclear weapons floating around even after work towards denuclearization begins.

Furthermore, former US Senators Sam Nunn and Richard Lugar, who served a pivotal role in securing the loose nuclear weapons after the fall of the Soviet Union in 1991, write in the Washington Post that "thousands of North Korean scientists and engineers" are "now employed in making weapons of mass destruction."

If North Korea's weapons program ends, the scientists with **highly sought-after skills** would "risk of **prolif**eration of their **deadly knowledge** to **other states** or **terrorists**," according to the senators.

### ---Korean War---EXT

#### extra Korean war card

CPA, 22 (Center for Preventive Action, 5-4-2022, accessed on 7-23-2022, Council on Foreign Relations, “North Korea Crisis”, <https://www.cfr.org/global-conflict-tracker/conflict/north-korea-crisis>, HBisevac)

Kim Jong-un’s **willingness** to provoke the West with aggressive behavior has **exacerbated** the **threat** from North Korea’s **weapons prolif**eration. These incitements have included firing **missiles** over northern **Japanese islands**, firing **rockets** across the **So**uth **Ko**rean **border** in August 2015, and a cyberattack on U.S.-based Sony Pictures in December 2014.

Kim has also undertaken efforts to consolidate his power by **purging high-ranking officials**, including his own family members. In February 2017, Kim's half-brother was killed using a banned nerve agent in an airport in Malaysia. North Korea denies responsibility for the attack. There are reportedly between 80,000 and 120,000 political prisoners detained in North Korea. This consolidation of power may suggest that Kim, fearing **fewer internal challenges** to his control, is increasingly **unconstrained domestically** in making **policy decisions**.

Concerns

North Korea is a **nuclear power** with a **complex relationship** with **China**, and preventing both an interstate Korean war and a North Korean internal collapse are **critical U.S. national security interests**. Along with continued weapons and missile tests, small-scale military and cyber provocations by North Korea pose significant risks as each incident carries with it the potential for **further** and potentially **uncontrollable escalation**. Outright threats from North Korean Supreme Leader Kim Jong-un are also cause for concern, as he claims that North Korean weapons can now reach **U.S. territories** and even the **U.S. mainland**.

#### Korean Peninsula tensions are on the rise now.

Jean Mackenzie, 22 (Jean Mackenzie, BBC Seoul correspondent, 5-9-2022, accessed on 7-20-2022, BBC, “From handshakes to hostilities: How dangerous is the situation in North Korea?”, <https://www.bbc.com/news/world-asia-61331859>, HBisevac)

Kim Jong-un is testing North Korea's weapons with renewed urgency, as South Korea prepares to inaugurate a new, hard-line president. After years of **stalemate**, following **failed nuclear talks**, **tensions** on the **Korean peninsula** are **rising**.

"I thought about getting an axe, but I decided it would be too difficult to carry, so I settled for a knife."

Sitting in a dimly-lit cocktail bar, late one night, Jenn recounts her detailed escape plan. As a South Korean, living in Seoul, she knew exactly what she would do if the North attacked. First came the weapons, then two motorbikes: one for her, the other for her brother. Their parents would ride on the back. This way they could cross the city's river quickly, before the North Koreans bombed the bridges, and hopefully make it to the coast before the port was destroyed. One evening she and her brother sat and mapped their route, agreeing to tie ribbons to the trees should they be separated.

This was five years ago. At the time, North Korea was furiously testing missiles that could, in theory, deliver nuclear bombs to the United States, and its then President Donald Tru mp was threatening to respond with "fire and fury". Jenn admits she was more worried than most. But nonetheless, this was the closest many South Koreans felt they had come to war since fighting with North Korea ended almost 70 years ago.

Then something remarkable happened. South Korea's newly-elected president at the time, Moon Jae-in, convinced Mr Trump to meet Kim Jong-un. It was the first time a sitting US president had ever met the leader of North Korea. A flurry of historic summits followed, sparking hope that the North might just agree to give up its nuclear weapons, and the two Koreas would make peace.

Excitement fizzed as President Moon, the son of North Korean refugees, arrived in the Capital Pyongyang and stepped out into a packed stadium, grasping the hand of his adversary. The audience didn't know what to do, recalls Prof Moon Chung-in, the president's advisor at the time. They had been told this man was their enemy, yet here he was on their soil, proposing peace. Suddenly, the 150,000 North Korean spectators erupted in raucous applause. "It was amazing to watch, it was a very moving moment for me," he says.

But as President Moon leaves office, the **hopes** of that year **lie in tatters**. When a nuclear deal between the United States and North Korea collapsed in 2019, **so did talks** between the **Koreas**. There has been a **stalemate ever since**. Meanwhile North Korea has continued to develop its **w**eapons of **m**ass **d**estruction and is once again testing them with **alarming frequency**. Only this time, the pandemic and now the war in Ukraine mean the eyes of the world have been focused elsewhere.

Asked if the government failed, Prof Moon Chung-in is defensive. "No, I don't think so! Was there war?" He reasons that for five years the Moon government kept the peace during one of the biggest crises in inter-Korean relations. It also showed what incentives would get North Korea to the negotiating table. The problem, he believes, is that North Korean negotiators returned empty-handed, in what was a great embarrassment for the regime, and almost certainly a punishable offence.

President Moon tried everything he could to coax the North Koreans back to talks, but in doing so he has been accused of appeasing one of the world's most brutal dictators.

"When I saw those pictures of them with their arms around each other laughing, it sent shivers down my back," remembers Hanna Song, from her office in downtown Seoul. Her organisation, the Database Centre for North Korean Human Rights, has been tracking human rights violations in North Korea for more than two decades. The last few years have not been easy.

Human rights are Kim Jong-un's Achilles' heel, Hanna explains. She says that in an effort to stop the North Korean leader from feeling uncomfortable, President Moon "swept them under the rug".

Hanna's organisation interviews North Korean escapees at Hanawon, the resettlement centre where they live for their first three months in the country. Their testimonies play a vital role in documenting human rights abuses. But two years ago, the South Korean government cut off their access to the centre, meaning they could no longer gather their evidence. Then Hanna started hearing from escapees that they were being pressured not to speak publicly about their experiences in North Korea. Some received calls from the local policemen assigned to help them assimilate. "Are you sure it's wise to be doing this?" they asked.

Hanna tried challenging the government over the missing information. "What are you going to do when there is this gap in evidence, just because you wanted to make sure Kim Jong-un wasn't being shamed in front of the international community?" she would ask, to little response.

"What's happening in Ukraine is horrendous," Hanna concludes, "but at least we know."

Frighteningly little is known about the current situation in North Korea. Its self-imposed coronavirus border closure has stopped people, and therefore information, from leaving. What is clear is that Kim Jong-un has continued developing nuclear weapons, in spite of numerous international sanctions designed to stop him from doing so. His weapons are becoming more sophisticated and dangerous. In March, the regime tested its first intercontinental ballistic missile for the first time since the summits of 2018 began, and it flew further and for longer than any of its previously tested missiles.

But **the hugs and handshakes are over**. South Korea has elected a new, **tough-talking President**, a former prosecutor with no prior political experience. In a recent interview Yoon Suk-yeol described North Korea as the "**main enemy**" of the South and has promised to take a **hard-line approach** to its **military escalations**.

He will only talk to his neighbour, he has said, if North Korea shows it is serious about denuclearisation. But most experts now agree that North Korea has **zero intention** of giving up its nuclear weapons. It had reached this conclusion long before the war in Ukraine highlighted the perils of relinquishing such weapons, though this certainly has not helped. This gives Mr Yoon's strategy "zero chance of working" according to Chris Green, a consultant for the International Crisis Group, an organisation working to prevent wars.

During his campaign, Mr Yoon went as far as to say he would a launch a pre-emptive strike on North Korea, to destroy its weapons, if there were signs the North was about to mount an attack. This has long been part of South Korea's defence strategy, but it is rarely uttered out loud as it is a sure-fire way to enrage the North - which it did. Last month North Korea paraded its missiles through the streets, in its latest attempted show of strength. Kim Jong-un, dressed in a white military uniform, delivered a blistering warning: any hostile force that threatened North Korea, would "cease to exist". This was interpreted, at least in part, as a warning to the new South Korean president.

The North has been developing an array of short-range missiles which, for the first time last month, it hinted could be used to carry tactical nukes - the sort which could be used **against** **So**uth **Ko**rea in a conventional war. There are now signs it is about to test one of these nuclear bombs.

But Chris Green still believes North Korea's main goal is survival. "If it were to use a nuclear weapon, under any circumstance, it would spell the end of the regime, and North Korea knows that," he explains. Instead, Mr Green predicts an arms race between the North and South, with both building up their arsenal and testing them more frequently. These actions shouldn't lead to war, but they could lead to a miscalculation by either side. That is the biggest danger at the moment, he thinks.

Crouched around a smoking barbeque, down a back alley in Seoul, Lee Geon-il clinks glasses with his friends and they knock back their first soju of the night. "Does it taste sweet yet?" he jokes, referring to the Korean saying that the spirit turns sweet after a hard day or a hard life.

"Anything I drink at this point will be sweet," Lee Si-yeol replies. Typically, South Koreans don't pay much attention to North Korea, comforted by a belief that the United States is its real target. But Si-yeol is also about to start his compulsory military service, and as tension on the peninsula creeps up, he is struggling to shake his fear. "I know I'm unusual, but it does concern me when Kim Jong-un shoots a missile," he says. "I do worry this new hard-line policy we are adopting might provoke some sort of conflict."

Lee Geon-il worries too. He didn't use to, he says, but the war in Ukraine has caused him to think the same could happen here. He will be an officer and admits he cannot imagine having to lead his men in an actual war. But he supports the new president. "We need to respond strongly to them saying they will use nuclear weapons, the threat is so close."

As Prof Moon Chung-in stands overlooking the presidential office, he reflects on their failed diplomacy. "The future is bleak," he concludes. "I can't see a breakthrough, not in my lifetime. We missed our opportunity."

There is unease in Seoul about what is coming, as North Korea inevitably **tests the limits** of the new government and tries to **claw its way back** up the **international agenda**. "I am bracing myself," a former South Korean Lieutenant General admitted, in private.

The world might be looking elsewhere, but North Korea is getting **harder** to **ignore**.

### 2NC---Impact---NoKo Collapse---Refugee Crisis

#### NoKo collapse was cause a geopolitical nightmare---refugee crisis, famine, disease.

Meriel Hahn & Peter Harris, 21 (Meriel Hahn is an incoming graduate student at Queen’s University Belfast, Peter Harris is an assistant professor of political science at Colorado State University, 6-22-2021, accessed on 7-20-2022, National Interest, “Regime Collapse in North Korea Would Be Catastrophic”, <https://nationalinterest.org/blog/korea-watch/regime-collapse-north-korea-would-be-catastrophic-188343>, HBisevac)

Is North Korea on the brink of **collapse**? **Perhaps**. Years of **economic mismanagement** exacerbated by hulking international **sanctions** have made it difficult for Kim Jong-un to **make ends meet**. The country is facing a **food crunch**. **Energy** has long been in **short supply**. And while North Korea claims to have shut out Covid-19 for the past 18 months, it is more likely that the pandemic’s ravages have simply gone unreported and unaddressed.

It is feasible that economic distress and miserable living conditions will combine with a major public health crisis to send North Korea **over the edge**—if not a popular revolt, then perhaps a split in the ruling elite that brings about the regime’s downfall. But North Korea’s leaders have weathered tempestuous political storms before and there is every reason to believe that they will do so again, especially with backing from Beijing.

The reality is that US-based analysts have no way of knowing what is happening inside North Korea right now, let alone what will happen in the future. The only course of action is to plan for both outcomes: regime collapse, to be sure, but also the long-term survival of a repressive, nuclear-armed government in Pyongyang with Kim at its head.

Imagining North Korea’s collapse is a **grim business**. Who would deliver essential humanitarian aid to the country’s 25 million impoverished citizens? How many **refugees** could be expected to cross into **So**uth **Ko**rea and China? Might regime **loyalists**, **military hardliners**, and ideological zealots engage in **violence** against **So**uth **Ko**rea, **Japan**, the **U**nited **S**tates, or the segments of their own population? What would be the fate of North Korea’s **nuclear** **arsenal**?

These weighty questions need to be revisited on a regular basis. Even so, Washington must also prepare for the more likely scenario that Kim Jong-un will be in power for decades to come. Indeed, even a brief consideration of a North Korean collapse should be enough to demonstrate that the United States has at least some interest in helping the regime to avoid a catastrophic implosion. The current leaders of North Korea are remorseless killers, but this does not mean that the regime’s sudden disappearance would bring relief.

On the contrary, state failure in North Korea would be a humanitarian catastrophe and a **geopolitical nightmare**. No matter how good the planning, the **logistical challenges** of avoiding **famine** and **rampant disease** would almost certainly be **insurmountable** in the short term. Establishing a new government would be close to intractable. The international community has no allies inside North Korea; there is no organized opposition or government-in-exile waiting to assume power.

What is more, Beijing almost certainly has its own plans for handling **state failure** across the **Yalu** and **Tumen** rivers—plans that do not involve **U.S. interference** or prompt reunification with **So**uth **Ko**rea. If the great powers could not agree on how to respond to a crisis in North Korea, it would be ordinary citizens bearing the brunt of their disagreements.

A better and more humane regime in North Korea is something to wish for. **State collapse is not**. As counterintuitive as it might sound, people in the United States had better hope that the Kim regime hangs on a **while longer**, at least until such a time as it can be ushered out of existence in a somewhat managed fashion.

#### NoKo refugee crisis causes civil wars.

Steve Mollman, 17 (Steve Mollman, Asia correspondent for WSJ and Wired, 5-17-2017, accessed on 7-20-2022, Quartz, “It’s time to start considering what a North Korean refugee crisis would look like”, <https://qz.com/976659/its-time-to-start-considering-what-a-north-korean-refugee-crisis-would-look-like/>, HBisevac) \*\*edited for ableist language\*\*

There’s an undeveloped strip of land on the Korean peninsula where nature thrives, but wild animals occasionally explode. Walking across it would be a **bad idea**.

Known as the **d**e**m**ilitarized **z**one (DMZ), it divides South Korea and North Korea, nations that technically have been at war since the 1950s. Running 240 km (150 miles) across the Korean peninsula, and measuring about 4 km (2.5 miles) wide, it is **heavily guarded** by two of the world’s **largest militaries**, strewn with landmines, and arguably the most fortified border on the planet.

If you want to flee North Korea, this is not your recommended route. It makes much more sense to head north instead toward China, where the Yalu and Tumen rivers straddle Mount Paektu to create a 1,420-km (880-mile) border. The Yalu is the deeper of the two rivers, but neither is all that hard to get across. In the winter, both can freeze over.

There’s been a lot of hand-wringing of late over North Korea and its ~~erratic~~ leader Kim Jong-un, with much of the world rightly alarmed over its ongoing tests of missiles and nuclear bombs—including a missile test on May 14. There’s been hope that China will apply more economic pressure against North Korea to help bring about a change.

But it’s **impossible** to game out scenarios for the region without taking into account the **reality** of **No**rth **Ko**rea’s **borders**. For most of the 25 million people contained within them, life is already harsh. Should central authority be replaced by civil war and competing factions hoarding resources, it would get even worse, causing potentially **millions** of **desperate** (and in many cases **starving**) people to head **straight for China**.

Today Beijing considers fleeing North Koreans “economic migrants,” meaning it doesn’t have to offer them protections it agreed to under the UN’s 1951 Refugee Convention. It routinely returns North Koreans to their country, knowing that many will be tortured or executed, in part because Beijing worries that a more lenient stance might only encourage more North Koreans to cross the border.

Of course, in a crisis, they’ll cross the border in any case, in numbers that will **draw the world’s attention**. It would be a **humanitarian disaster** of **epic proportions**, and the brunt of it would be shouldered by China—similar to Turkey’s role in handling the refugee crisis originating in neighboring Syria. While it remains to be seen how closely Beijing will work with the US and others in addressing North Korea, it’s clear that the potential for mass migration directly into China will be a **key consideration** in how it approaches the problem.

Logistical challenge

China does have field experience with refugee crises. In 2009, over 30,000 refugees from Myanmar’s Kokang region flooded into the southern Yunnan province, escaping the fighting between government troops and local rebels. Many of them were ethnic Chinese who spoke Mandarin, which no doubt helped matters. China won moderate praise from the international community for providing food, emergency shelter, and medical care to the refugees.

“You could really see China’s emergency-response system kicking in, and see how China might deal with North Korea,” says Carla Park Freeman, director of the Foreign Policy Institute at the Johns Hopkins School of Advanced International Studies in Washington DC.

The fighting in Kokang flared up again in March, sending more refugees China’s way, and giving the country further experience in what might be a warm-up exercise for a far larger crisis in the northeast.

In the event of a North Korean **refugee crisis**, the logistical challenge will require new solutions from China. Besides trying to fortify its border, it might seize control of some North Korean territory in order to create a **buffer zone**, in which case it would probably first try to get approval from the international community.

“I think China would look for some kind of UN authorization before moving in,” says Freeman. But, she adds, “In a crisis, China would move very, **very quickly** to try to secure its borders with North Korea, and try to keep the North Koreans fleeing on the Korean side of the border, and try to **manage them there**.”

But keeping migrants hemmed in would be **no easy task**. Nor would supporting Chinese troops trying to secure the long border.

“Sustainability at blocking the border would be a huge challenge—**food**, **material**, **shelter** for the troops,” notes Bob Collins, a former US Defense Department analyst with nearly 40 years’ experience on the Korean peninsula. “Intervention across the border to create a buffer zone will be even harder because they would be doubling their logistical challenges in supporting the refugees.”

Many of the North Koreans attempting to cross would be trying to reach friends or family within China. Across the Yalu River is the Liaoning province, home to hundreds of thousands of ethnic Koreans. And across the Tumen River is the Jilin province, which has closer to a million ethnic Koreans, most in an area called the Yanbian Korean Autonomous Prefecture. The capital of the latter, Yanji, is only about 10 km (6.2 miles) from the border.

In the event of conflict, China’s refugee burden could eventually rival that of Turkey. Sharing a border of 911 km (566 miles) with Syria—which is now in its seventh year of civil war—Turkey is struggling to provide for about 3 million Syrian refugees. While it’s had an open-door policy in the past, the country is now building a wall with a height of 3 meters (10 feet) along its Syria border, complemented by ditches, fences, and minefields.

Turkey also has spent heavily supporting Syrian refugees—and has demanded other nations pitch in on the bill. China, too, would likely seek economic assistance from other nations, especially South Korea and the US, to help it cope with the cost of supporting refugees.

Just as Turkey hasn’t been alone in dealing with the Syrian refugee crisis—Lebanon, Jordan, and Iraq have struggled, too—China wouldn’t be the only nation coping with desperate North Koreans.

Japan takes the threat seriously enough that it’s been drawing up contingency plans to deal with an influx of North Korean refugees, who would have to first survive crossing the Sea of Japan. Russia, too, has a border with North Korea, and a large population of North Koreans, especially in Vladivostok. But its border, at about 17 km (11 miles), is much shorter, and would be easier to secure in a crisis. And of course there’s South Korea, which is another story in itself. If the situation grows desperate enough, we may just see mass numbers of North Koreans trying to cross the DMZ.

A tricky balance for Beijing

As for how central authority in North Korea could break down in the first place, it could happen in a number of ways. A conflict between **No**rth **Ko**rea and the **US** and/or **So**uth Korea could **rapidly escalate into a war**. An assassination of Kim could be followed by a failed replacement effort by the ruling Workers’ Party. A manmade disaster, such as a Chernobyl-type event at the North’s Yongbyon nuclear reactor, could be the cause. It could even be an eruption of Mount Paektu, which showed signs of life in 2014 and, nearly 1,100 years ago, was home to one of the planet’s most violent eruptions in the past 5,000 years. Some worry the next nuclear test by North Korea could actually set off Mount Paektu.

However it happens, “as central control evaporates, local control by military units is **quite possible**,” notes Collins. “Those groups that grab the nukes will have the **upper hand**. This could lead to **civil war**, pushing North Koreans north to China, off both coasts in flight by sea, and attempts to cross the DMZ. The latter would result in more deaths than successes due to the density of military forces there.”

#### Civil wars draw in great powers---causes nuclear escalation.

Barry R. Posen 17. Fellow of the American Academy since 2010, is the Ford International Professor of Political Science at the Massachusetts Institute of Technology and Director of the MIT Security Studies Program. 09/21/2017. “Civil Wars & the Structure of World Power.” Daedalus, vol. 146, no. 4, pp. 167–179.

A bipolar structure of power is equally rare, and the Cold War is our only example. When two states overshadow the rest, they eye one another warily because each is the greatest threat to the other. The competition tends to become all-encompassing. As each power tries to preserve or improve its position, the other scrutinizes these moves for how they might become a threat, and how they might be exploited. Countermeasures are taken rather quickly when the other superpower seems to be up to something. In the Cold War, the competition included military means, science and technology, the accumulation of allies (despite their modest utility), and competitive interventions in civil wars. Of course, structure cannot explain everything about the intensity of the Cold War competition; the parties had vastly different ideologies and visions about how the world should work, adding energy to an already fraught situation. And the two sides confronted one another with unfamiliar but extremely frightening nuclear weapons. Fear of nuclear escalation seems to have put downward pressure on the competition: the two sides struggled for advantage but seemed mindful of the possibility of disaster. It is noteworthy that despite direct involvement in many wars, and indirect support of the opposing sides in many others, there was no direct violent clash of U.S. and Soviet forces. Finally, the bipolar nature of the competition seems to have had a strange liberating effect on each side's willingness to get involved in local conflicts. Instead of fearing that involvement in a civil war would reduce capabilities that might be needed elsewhere to oppose the other great power, these conflicts were perceived as part of the central competition. One posited reason for this is that, due to the nuclear competition, each side had a very strong interest in credibility. Thus, a fight for credibility anywhere could be viewed as contributing positively to the credibility of one's commitments to risk nuclear war worldwide. Competitive Cold War interventions produced particularly tragic outcomes. The parties to these civil wars were rendered artificially strong by outside assistance, so the wars were more intense and longer-lasting than they might have otherwise been.5 Once they had chosen sides, the superpowers might find themselves in one of several kinds of traps. If one's preferred side fared poorly, there was a strong temptation, as happened in Vietnam and Afghanistan, to intervene directly to save one's proxy. This presented a tempting opportunity to the other superpower to add resources to its client in order to bleed its principal opponent. This was an inexpensive way to improve one's own power position. At the same time, when the two superpowers were involved directly or indirectly in a civil war, they feared escalation to direct engagements between their own forces. As both parties were major nuclear weapons states, a direct clash would produce risks and costs far in excess of anything to be gained from the civil war. Thus, the two sides tended to focus more on “not losing” than on winning, further prolonging the suffering of the civilians living in the war zone. Multipolar systems have three or more great powers. But measuring relative power in the twenty-first century is a tricky proposition. By many measures, the United States is still comfortably ahead of its closest competitor–China–though the gap is narrowing quickly. My criteria for a great power are a large and diverse economy, capable nonnuclear forces, some ability to project power beyond borders, and nuclear deterrent forces with the ability to retaliate against a state's most plausible adversaries and maintain that ability in the face of a determined arms race. (Possession of an assured retaliatory capability is essential for a state to pursue an independent security policy in the nuclear age.) By these criteria, the key powers are currently the United States, China, and Russia. France, Britain, and India constitute a second tier of important powers. By mid-century, Russia and India will likely reverse positions. Strict parity among great powers is not a requirement for viewing a system as multipolar; historically, there has often been a very large gap between the most and the least capable “great powers.” This analysis assumes that the world is trending toward multipolarity and asks what difference it makes. States compete for power and security in multipolar systems, but the sheer number of players changes the game. First, in multipolar systems, allies matter more than they do in other systems. With a handful of powers at the top of the global order, coalitions can often significantly outweigh the capability of any single state. Thus, though states in a multipolar world must look to their own armaments in order to be alliance-worthy, they must also look to the diplomacy of coalitions. A second property of multipolar worlds is divided attention. With many possible allies or adversaries, states will tend to see the possibility for incremental gain; for example, if State a concludes that State b is otherwise occupied with State c, that presents opportunity. Third, the fear of countervailing coalitions imposes caution. In our time, the presence of nuclear weapons imposes still further caution. Fourth, it is plausible that multipolarity mutes ideological competition. The need to make one's own alliances and undermine those of an adversary may cause states to submerge their ideological differences. If the world is trending toward multipolarity, this should affect external intervention in civil wars. The great powers will be more concerned about other great powers, which should make civil wars generally less important to them and thus make early preventive intervention less likely. The exception to this generalization may arise when civil wars occur in regions of particular political importance for geographical, economic, or ideological reasons, such as the greater Middle East. But in these cases, great-power competition will be intense from the outset, exactly when cooperation would be most useful for prevention. When multilateral intervention is proposed in the collective interest of the international community, the principal powers will still be concerned with relative gains. This will further complicate the prospects for collaborative efforts to settle the civil war. States may still wish to involve themselves in particular civil wars, for their own selfish reasons; because the problems posed by civil wars are often local, the most proximate great powers will be the most tempted to intervene. Finally, once one great power does intervene, and if its effort goes awry, it will be tempting for others to exploit the situation to improve their own position. Other great powers may aid the opposing side simply because the opportunity to enfeeble their competition is too tempting. Alternatively, they may offer assistance to continue the intervention or offer to create a diplomatic fig leaf to cover a disengagement, at a high cost to the intervener.

### 2NC---Impact---AT: Denuclearization

#### No denuclearization---North Korea is too close to being able to hit the US and thinks nukes are key to regime survival

Sico Van Der Meer 18, Research Fellow at the Clingendael Institute, 3/20/18, "Why North Korea will never give up its nuclear weapons," https://spectator.clingendael.org/en/publication/why-north-korea-will-never-give-its-nuclear-weapons#

It will presumably not take long before North Korea is able to target its ‘arch-enemy’, the United States, with nuclear weapons. Will potential talks between Kim Jong Un and Donald Trump be able to defuse the risks of nuclear war? Considering the motivations behind North Korea's nuclear weapons, the chances that it will denuclearize are almost zero.

North Korea’s ballistic missiles with nuclear warheads will soon be able to destroy cities in the mainland of the United States.[1] Looking at the provocative statements from Pyongyang, this may not seem a purely theoretical option. Yet, taking into account the motivations behind North Korea’s nuclear weapons programme, the risk that these weapons will be actually used by purpose is relatively low. The main risks are actually miscommunication, misperception, or domestic turmoil in Pyongyang, leading to inadvertent launch of nuclear missiles.

The main motivation behind North Korea’s nuclear weapons programme, and actually behind any North Korean policy, is simple: keeping the regime in place, or in other words: regime survival, preserving the status-quo for the country’s ruling elite. This key priority can be divided in two subcategories: foreign policy aims and domestic aims.

#### The regime will never give up nukes---means miscalc or diversionary lashout are structurally likely

Sico Van Der Meer 18, Research Fellow at the Clingendael Institute, 3/20/18, "Why North Korea will never give up its nuclear weapons," https://spectator.clingendael.org/en/publication/why-north-korea-will-never-give-its-nuclear-weapons#

Nightmare scenarios

Yet, while the risk that North Korea will start a nuclear war by purpose may be small, there are other risks. In times of tension – and in North Korea this means: always – the risk of miscalculation, miscommunication and misperception is always there. If the regime mistakenly perceives that it is being attacked it may decide to launch nuclear weapons immediately, before they are destroyed by the attack. For example, military exercises of adversaries or technical errors in air defence systems may be mistaken for actual surprise attacks. Especially because there are hardly any direct emergency communication systems between North Korea and its adversaries, such developments could quickly escalate out of control.

Another risk is domestic turmoil in North Korea. What if, for any reason, a coup d’état takes place in Pyongyang? If Kim Jong Un and his top aides may consider their end near, one cannot exclude that they decide to enter the history books with a ‘big bang’, for example taking some US cities with them in their fall. This is a nightmare scenario for US policy makers; they risk a sudden nuclear attack under circumstances that they cannot influence in any way.

Military action?

Much has been tried over the past decades to stop the North Korean nuclear weapons development: diplomacy, sanctions, ‘strategic patience’, yet without any success . This failure of the international community is mainly due to the lack of any good options. Considering the motivations of the current North Korean leadership it is very unlikely that it will ever give up the nuclear arsenal; these powerful weapons are considered the best guarantee for regime survival. The world will have to accept that neither diplomacy nor further isolation of the ‘hermit kingdom’ will roll back its nuclear weapons status. Military action may, but it carries large risks; that is why it has not been tried earlier.

## Iran

### 1NC---Cyber Attacks Good---Iran

#### Cyber escalation is a myth BUT cyber-attacks avoid conventional war.

Erica Lonergan, 22 (Erica Lonergan is Assistant Professor in the Army Cyber Institute at West Point and a Research Scholar at the Saltzman Institute of War and Peace Studies at Columbia University and previously served as Senior Director on the U.S. Cyberspace Solarium Commission, 4-15-2022, accessed on 7-18-2022, Foreign Affairs, “The Cyber-Escalation Fallacy”, <https://www.foreignaffairs.com/articles/russian-federation/2022-04-15/cyber-escalation-fallacy>, HBisevac)

In fact, the negligible role of cyberattacks in the Ukraine conflict should come as no surprise. Through war simulations, statistical analyses, and other kinds of studies, scholars have found little evidence that cyber-operations provide effective forms of coercion or that they cause escalation to actual military conflict. That is because for all its potential to disrupt companies, hospitals, and utility grids during peacetime, cyberpower is **much harder** to use against targets of **strategic significance** or to **achieve outcomes** with **decisive impacts**, either on the battlefield or during crises short of war. In failing to recognize this, U.S. officials and policymakers are approaching the use of cyberpower in a way that may be doing **more harm than good**—treating cyber-operations like any other weapon of war rather than as a nonlethal instrument of statecraft and, in the process, overlooking the **considerable opportunities** as well as **risks** they present.

THE MYTH OF CYBER-ESCALATION

Much of the current understanding in Washington about the role of cyber-operations in conflict is built on long-standing but **false assumptions** about cyberspace. Many scholars have asserted that cyber-operations could easily lead to military escalation, up to and including the use of nuclear weapons. Jason Healey and Robert Jervis, for example, expressing a widely held view, have argued that an incident that takes place in cyberspace, “might cross the threshold into armed conflict either through a sense of impunity or through miscalculation or mistake.” Policymakers have also long believed that cyberspace poses grave perils. In 2012, Secretary of Defense Leon Panetta warned of an impending “cyber-Pearl Harbor,” in which adversaries could take down critical U.S. infrastructure through cyberattacks. Nearly a decade later, FBI Director Christopher Wray compared the threat from ransomware—when actors hold a target hostage by encrypting data and demanding a ransom payment in return for decrypting it—to the 9/11 attacks. And as recently as December 2021, Secretary of Defense Lloyd Austin noted that in cyberspace, “norms of behavior aren’t well-established and the risks of escalation and miscalculation are high.”

Seemingly buttressing these claims has been a long record of cyber-operations by hostile governments. In recent years, states ranging from Russia and China to Iran and North Korea have used cyberspace to conduct large-scale espionage, inflict significant economic damage, and undermine democratic institutions. In January 2021, for example, attackers linked to the Chinese government were able to breach Microsoft’s Exchange email servers, giving them access to communications and other private information from companies and governments, and may have allowed other malicious actors to conduct ransomware attacks. That breach followed on the heels of a Russian intrusion against the software vendor SolarWinds, in which hackers were able to access a huge quantity of sensitive government and corporate data—an espionage treasure trove. Cyberattacks have also inflicted significant economic costs. The NotPetya attack affected critical infrastructure around the world—ranging from logistics and energy to finance and government—causing upward of $10 billion in damage.

But the **assumption** that cyber-operations play a central role in either **provoking** or **extending war** is **wrong**. **Hundreds** of cyber-incidents have occurred between rivals with **long histories** of tension or even conflict, but **none** has **ever** **triggered** an **escalation** to war. **No**rth **Ko**rea, for example, has conducted **major** cyberattacks against **So**uth **Ko**rea on at least four different occasions, including the “Ten Days of Rain” denial of service attack—in which a network is flooded with an overwhelming number of requests, becoming temporarily inaccessible to users—against South Korean government websites, financial institutions, and critical infrastructure in 2011 and the “Dark Seoul” attack in 2013, which disrupted service across the country’s financial and media sectors.

It would be reasonable to expect that these operations might **escalate** the situation on the **Korean Peninsula**, especially because North Korea’s war plans against South Korea reportedly involve cyber-operations. Yet that is **not what happened**. Instead, in each case, the South Korean response was minimal and limited to either direct, official attribution to North Korea by government officials or more indirect public suggestions that Pyongyang was likely behind the attacks.

Similarly, although the United States reserves the right to respond to cyberattacks in any way it sees fit, including with military force, it has until now relied on economic sanctions, indictments, diplomatic actions, and some reported instances of tit-for-tat cyber-responses. For example, following Russia’s interference in the 2016 U.S. presidential election, the Obama administration expelled 35 Russian diplomats and shuttered two facilities said to be hubs for Russian espionage. The Treasury Department also levied economic sanctions against Russian officials. Yet according to media reports, the administration ultimately rejected plans to conduct retaliatory cyber-operations against Russia. And although the United States did use its own cyber-operations to respond to Russian attacks during the 2018 midterm elections, it limited itself to temporarily disrupting the Internet Research Agency, a Russian troll farm.

These measured responses are not unusual. Despite decades of malicious behavior in cyberspace—and no matter the level of destruction—cyberattacks have **always** **been contained** **below** the level of **armed conflict**. Indeed, researchers have found that major adversarial powers across the world have routinely **observed** a “firebreak” between cyberattacks and conventional military operations: a **mutually understood line** that **distinguishes strategic interactions** above and below it, similar to the threshold that exists for the employment of nuclear weapons.

But it is not just that cyber-operations do not lead to conflict. Cyberattacks can also be **useful** ways to **project power** in situations in which **armed conflict** is expressly being **avoided**. This is why **Iran**, for example, might find cyberattacks against the United States, including the 2012–13 denial of service attacks it conducted against U.S. financial institutions, **appealing**. Since Iran likely prefers to avoid a **direct military confrontation** with the United States, cyberattacks provide a way to retaliate for perceived grievances, such as U.S. economic sanctions in response to Iran’s nuclear program, **without triggering** the kind of escalation that would put the two countries on a path to **war**.

#### Iran escalation draws in every power and goes nuclear---extinction.

John Avery, 13 (John Avery, B.Sc. in theoretical physics from MIT and an M.Sc. from the University of Chicago, Lektor Emeritus, Associate Professor at the Department of Chemistry at the University of Copenhagen, Contact Person in Denmark for Pugwash Conferences on Science and World Affairs, Member of the Danish Peace Commission, Chairman of the Danish Peace Academy, 11-6-2013, accessed on 7-23-2022, CounterCurrents, “An Attack On Iran Could Escalate Into Global Nuclear War”, <https://www.countercurrents.org/avery061113.htm>, HBisevac)

As we approach the 100th anniversary World War I, we should remember that this colossal disaster escalated uncontrollably from what was intended to be a minor conflict. There is a danger that an attack on **Iran** would escalate into a **large-scale war** in the **Middle East**, entirely **destabilizing** a region that is **already deep** in **problems**.

The unstable government of **Pakistan** might be **overthrown**, and the **revolutionary** Pakistani government might **enter the war** on the side of **Iran**, thus introducing **nuclear weapons** into the conflict. **Russia** and **China**, **firm allies** of Iran, might also be **drawn into** a general war in the Middle East. Since much of the world's oil comes from the region, such a war would certainly cause the **price of** **oil** to reach **unheard-of heights**, with catastrophic effects on the global economy.

In the dangerous situation that could potentially result from an attack on Iran, there is a risk that nuclear weapons would be used, either **intentionally**, or by **accident** or **miscalc**ulation. Recent research has shown that besides making **large areas** of the world **uninhabitable** through **long-lasting radioactive contamination**, a nuclear war would damage **global agriculture** to such a extent that a **global famine** of previously **unknown proportions** would **result**.

Thus, nuclear war is the ultimate **ecological catastrophe**. It could destroy **human civilization** and much of the **biosphere**. To risk such a war would be an unforgivable offense against the lives and future of all the peoples of the world, US citizens included.

### 2NC---Impact----Oil

#### Avery says it spikes oil prices---that causes extinction.

Alice Friedemann, 20 (Alice Friedemann is the author of “When Trucks Stop Running: Energy and the Future of Transportation”, 8/24/20, accessed 11/17/21, “How I stumbled on the energy (and ecological) crisis”, https://energyskeptic.com/about-energyskeptic/)AGabay

North Korea is portrayed as a nation run by insane ruler, but building **nuclear weapons** to blackmail other nations for oil is a **predictable consequence** of the collapse that followed a **drastic reduction** of their **fossil fuels** after the Soviet Union collapsed. Andrei Lankov, a professor at Kookmin University in Seoul, wrote “the world is likely to say that the North Koreans are acting “irrationally.” But this is not the case — they are a very rational regime, actually the world’s most Machiavellian. North Korean leaders are sending a message…using both artillery and centrifuges to say: “We are here, we are dangerous, and we cannot be ignored. We can make a lot of trouble, but also we behave reasonably if rewarded generously enough. … U.S. policy toward Pyongyang has been based … on the assumption that North Korea can be persuaded and bribed into surrendering its nuclear program. It is an illusion: The survival of the North Korean regime depends to a large extent on its blackmail diplomacy. There has never been a chance that it would surrender its nuclear program, which alone makes it possible to extract sufficient aid from the outside world. The entire world is on the cusp of the **energy cliff** — will other nations also try this **tactic?** Though North Korea may have been more predisposed to take this route given their long and tragic history, including being occupied by the Japanese in the 1920s, massively destroyed by the Korean War in 1950-53, and major natural disasters in the mid-1990s. With little farmland and poor soils, the North Korean population was far past their carrying capacity when massive fossil fuel and food imports dropped suddenly after the collapse of the Soviet Union – millions of people may have died as a consequence (Pfeiffer, Wikipedia). Even the USA might **nuclear blackmail** the **world** Even the United States might be **tempted**, according to Erik Townsend: “While the use of nuclear weapons … might seem unthinkable today, the USA has yet to endure significant **economic hardship**. … a government operating in crisis mode to hold off systemic financial collapse … would change the mood **considerably**. All the USA has to do in order to secure an unlimited supply of $50 per barrel oil is to threaten to nuke any country refusing to sell oil to the U.S. for that price. Unthinkable today, but in times of national crisis, morals are often the first thing to be forgotten. We like to tell ourselves that we would never allow economic hardship to cause us to lose our morals. …What we’ll do in a true crisis that threatens our very way of life is anyone’s guess. If faced with the choice between a Soviet-style **economic collapse** and abusing its military power, the USA just might resort to tactics previously **thought** **unimaginable**.”

### 2NC---Impact---Iran

#### It causes extinction, even without escalation

William Fahy 20, Writer for Massive Science, citing a Study by Dr. Jonas Jägermeyr, Science Collaborator at The NASA Goddard Institute for Space Studies, PhD in Computer Science from the University of Chicago, “There’s An Additional Environmental Toll To Nuclear Warfare”, Massive Science, 6/8/2020, https://massivesci.com/notes/nuclear-winter-food-insecurity-famine-models-prediction/

Almost 30 years after the end of the Cold War, the threat of nuclear Armageddon seems like a thing of the past. Even though tensions over the Kashmir region between India and Pakistan and the U.S.’s withdrawal from the Iran nuclear deal have increased the threat of the use of nuclear weapons on a regional basis, fears of a cold, irradiated Earth are mostly gone. Unfortunately, Jonas Jägermeyr, his colleagues, and their models of global climate and food production aren’t convinced. According to their predictions, even a regional nuclear war holds the potential to plunge the world into a so-called “nuclear winter,” with drastic consequences for global public health and food security.

The nuclear winter scenario was originally proposed in the journal Science by a group of scientists lead by Carl Sagan during the Cold War. It claims that the smoke and dust launched into the atmosphere by a series of nuclear detonations and the resulting mass firestorms has the potential to block out a portion of incoming sunlight to the Earth’s surface. That could dramatically influence global temperatures, destroy the ozone layer, and make it harder for crops to grow. Together, those factors make the food supply one of the most vulnerable systems in the event of a nuclear winter.

That brings us back to the new simulations published this year and its predictions. According to the authors, “a regional conflict using <1% of the worldwide nuclear arsenal could have adverse consequences for global food security unmatched in modern history.” They predict a drop in average global food production of about 11% for up to 5 years, surpassing even the worst historical famines caused by volcanic winters.

#### Extinction.

Diavolo 20 --- LUCY DIAVOLO, News and politics editor for Teen Vogue, “Donald Trump’s Order to Kill Iranian Leader Qasem Soleimani Feels Like World War 3, but We Must Say No to War With Iran”, Teen Vogue, Jan 8th 2020, <https://www.teenvogue.com/story/donald-trumps-kill-qasem-soleimani-world-war-3-no-to-war-with-iran> (BJN)

The Pentagon announced late Thursday night that the U.S. military killed a top-ranking senior Iranian official in an airstrike carried out at the direction of President Donald Trump. The killing is understood as a major escalation in U.S.-Iran relations, prompting online conversations about the prospect of an impending “World War 3.” Last night, as I watched our latest existential terror unfold through a torrent of World War 3 memes, I found myself wondering not just what political leaders will do but also what the people of both countries and the broader world will experience as we prepare for what now feels like inevitable further escalations. While the potential for large-scale global political conflict is palpable, the more immediate concern will be the drumbeat for marching forward with military action that could take us there. How to make sense of it, this immediate future that now rides on an ever-thinner razor’s edge? First, we have to establish how we got here. Last night, the Pentagon put out a statement saying that the U.S. military had killed Iranian general Qasem Soleimani “at the direction of the president” with the aim of “deterring future Iranian attack plans.” The Pentagon statement claimed that Soleimani, leader of the Islamic Revolutionary Guard Corps (IRGC) Quds Force, was responsible for hundreds of deaths and thousands of injuries to U.S. and coalition service members. Trump’s history with Iran isn’t particularly friendly. Trump called Iran a “rogue state whose chief exports are violence, bloodshed and chaos" in a 2017 United Nations speech. In 2018, he pulled the U.S. out of the Iran nuclear deal (aka the Joint Comprehensive Plan of Action, or JCPOA) negotiated by his predecessor, President Barack Obama. That same year, he threatened the Iranian president on Twitter. As laid out on a timeline by Al Jazeera, Iran refused to meet demands the Trump administration made after ending the JCPOA. In response, Trump launched two new rounds of sanctions in 2018, adding to a lineage of U.S. sanctions against the country dating back to Ronald Reagan’s administration. In 2019, Trump increased sanctions against Iran and designated the IRGC a terrorist force. Recently, Trump beefed up U.S. military presence in the Middle East following riots and attacks on the U.S. embassy in Baghdad, Iraq — one of Iran’s two neighbors that has been the theatre for a protracted U.S.-led war and one that’s been deeply enmeshed in the history of U.S.-Iranian relations since Iran’s 1979 revolution. The embassy riots reportedly came in response to U.S. strikes on facilities tied to an Iranian-backed militia, which was itself a response to a rocket attack that killed a U.S. contractor. So how does Soleimani fit into all this? As reported by the Washington Post, Soleimani was the leader of a group known as the Quds Force, part of the IRGC, which is a major branch of Iran’s military that arose after the 1979 Islamic revolution. The Quds Force has a reputation for being the IRGC’s elite and efficient soldiers. In his role, according to Al Jazeera, Soleimani helmed Iranian operations in foreign countries like Iraq, where he was involved in the fight against the Islamic State (aka ISIS), and Syria, where he supported President Bashar al-Assad. According to the Associated Press, he was also allied with several militia groups in countries across the Middle East. If it seems like Soleimani was a big deal, it’s because he very much was. Considered by some the second most powerful man in the country, Soleimani’s execution at Trump’s directive is the exact sort of geopolitical conflict that could reignite long-standing tensions in extremely unpredictable ways. Some time after Trump tweeted out a low-resolution picture of a U.S. flag, Iranian ayatollah Ali Khamenei vowed “harsh vengeance,” and Iranian president Hassan Rouhani promised “revenge.” Nobody seems to know what to make of all this. As journalists rushed out quick bios of Soleimani, a visual guide to the U.S. airstrike that killed him, and ceaseless live updates on the story, Twitter cycled through trending topics trying to make some light of the dark situation. Beyond the World War 3 memes, some people pointed out that Trump’s frequent tweets about Obama starting a war with Iran to win an election seemed relevant. Many others discovered that receiving college financial aid through FAFSA requires registering for selective service. Others jokingly considered another Area 51 raid for some extraterrestrial salvation. Unfortunately, as climate justice activists are wont to remind us, there is no planet B. The questions about what happens next are anxiety-inducing, especially for people in Iran and the surrounding region. United Nations population figures estimate that roughly 80 million people live in Iran. Estimates for Iraq are near 40 million and, for Afghanistan, around 35 million. Iran also has historical tensions with other regional powers, like Saudi Arabia and Israel (two of the United States’ biggest allies in the region) and is currently aligned with global powers China and Russia (representing two of the United States’ more contentious political relationships). If a U.S. invasion of Iran was as deadly and prolonged as those in Iraq or Afghanistan, hundreds of thousands could die, many of them civilians. If this conflict somehow became as deadly as World War I or World War II, it could mean countless more killed, injured, or displaced from their homes. Simply put, the question of war with Iran must be answered with a loud and emphatic no, as planned protest actions for Saturday, January 4, already intend to communicate. Whatever legal framework the president and his supporters might cling to in order to justify Trump’s right to direct the attack, the reality is that this assassination is an act of war — whether the White House wants to officially designate it as one or not. Some are cheering Soleimani’s killing, publishing extremely reductive takes about the removal of the “world’s No. 1 bad guy.” But Trump’s directive has unknown potential to irrevocably destabilize an entire region and put millions at risk. And that is very, very scary.

## Defense

### 1NC---Cyberattacks Good---T/L

#### Cyberattacks avoid conventional war---that’s worse---AND leads to nonprolif.

Cybèle Greenberg, 21 (Cybèle Greenberg is a fellow with the New York Times editorial board, 8-22-2021, accessed on 7-18-2022, The New York Times, “Could Cyberwar Make the World Safer?”, <https://www.nytimes.com/2021/08/22/opinion/cyberwar-world-safety.html>, HBisevac)

Indeed, despite its many consequences and dangers, there is **no documented instance** in which cyberwarfare has directly **killed anyone** (although it has come close).

As the post-Sept. 11 conflicts come to an abrupt end, we are now at an important crossroads when it comes to determining just how far we are willing to take cyberwar. One possible avenue points to perilous conflict escalation between great powers further enabled by digital technologies.

But an alternative perspective sees cyberwar as an opportunity to **decrease global violence**. Could such tactics shift war’s focus away from human casualties?

In other words, can nations **settle** for **slugging** it out **online**, rather than with **guns** and **missiles**?

Fighting **digitally** offers a **unique opportunity**: the continuation of politics by other means, without the **physical invasion** of a sovereign territory or the **inevitable sacrifice** of **lives**. Tempered by responsible use and appropriate controls, cyberwarfare is a safer and more **flexible strategic alt**ernative, one critical step between sanctions and bombs.

“The purpose of warfare is **not to fight**; it is to achieve a **political objective**,” said Nora Bensahel, a visiting professor of strategic studies at Johns Hopkins School of Advanced International Studies. “If you can achieve this objective **without kinetic conflict**, so much **the better**.”

Consider Nitro Zeus. In the late 2000s, as The Times reported, the U.S. government developed a detailed plan for cyberattacks that would disable sections of Iran’s air defenses, communications systems and power grid. The plan provided President Barack Obama with a nonlethal means to neutralize Iranian military assets in case negotiations to halt the country’s rogue nuclear enrichment program failed and Tehran sought to retaliate.

The Nitro Zeus contingency plan remained active until the fulfillment of terms in the nuclear deal signed in 2015, ready to offer phased escalation short of all-out war if diplomatic and economic pressures proved ineffective.

Since Nitro Zeus was ultimately shelved, it is difficult to assess the scope and likelihood of the collateral damage it could have caused. The integration of cyberweapons into a national security strategy points to a certain **reluctance** to default to the **conventional** — and more lethal — **option**. But whether it’s a drone strike or the hacking of a telecommunications network, a cyberattack will always have harmful repercussions for civilians and private enterprises.

Counterintuitively, however, cyberweapons can also **increase geopolitical stability**.

Cyberattacks have helped nations achieve **nuclear** **nonprolif**eration in a way that, in the past, would have required physical force and increased risk to personnel, said Vipin Narang, a Massachusetts Institute of Technology professor who specializes in nuclear strategy.

In 2007, Israeli fighter jets equipped with 500-pound bombs struck a suspected nuclear reactor in Syria. The facility was destroyed and Israel was internationally criticized for violating another country’s sovereignty. Ten North Korean scientists reportedly may have been killed in the attack.

The U.S.-Israeli **o**ffensive **c**yber **o**peration known as Stuxnet, which was launched around the same time, achieved a similar objective — impeding a rogue nation’s enrichment efforts — but from afar, with no **human cost**. The program destroyed nearly one-fifth of Iran’s operating centrifuges and may have slowed its nuclear program by up to two years. No one was reported to have been physically harmed or killed during the yearslong operation. It may have even **deterred Israel** from launching a conventional attack on Iran’s Natanz uranium enrichment site.

#### Cyber escalation is a myth BUT cyber-attacks avoid conventional war.

Erica Lonergan, 22 (Erica Lonergan is Assistant Professor in the Army Cyber Institute at West Point and a Research Scholar at the Saltzman Institute of War and Peace Studies at Columbia University and previously served as Senior Director on the U.S. Cyberspace Solarium Commission, 4-15-2022, accessed on 7-18-2022, Foreign Affairs, “The Cyber-Escalation Fallacy”, <https://www.foreignaffairs.com/articles/russian-federation/2022-04-15/cyber-escalation-fallacy>, HBisevac)

In fact, the negligible role of cyberattacks in the Ukraine conflict should come as no surprise. Through war simulations, statistical analyses, and other kinds of studies, scholars have found little evidence that cyber-operations provide effective forms of coercion or that they cause escalation to actual military conflict. That is because for all its potential to disrupt companies, hospitals, and utility grids during peacetime, cyberpower is **much harder** to use against targets of **strategic significance** or to **achieve outcomes** with **decisive impacts**, either on the battlefield or during crises short of war. In failing to recognize this, U.S. officials and policymakers are approaching the use of cyberpower in a way that may be doing **more harm than good**—treating cyber-operations like any other weapon of war rather than as a nonlethal instrument of statecraft and, in the process, overlooking the **considerable opportunities** as well as **risks** they present.

THE MYTH OF CYBER-ESCALATION

Much of the current understanding in Washington about the role of cyber-operations in conflict is built on long-standing but **false assumptions** about cyberspace. Many scholars have asserted that cyber-operations could easily lead to military escalation, up to and including the use of nuclear weapons. Jason Healey and Robert Jervis, for example, expressing a widely held view, have argued that an incident that takes place in cyberspace, “might cross the threshold into armed conflict either through a sense of impunity or through miscalculation or mistake.” Policymakers have also long believed that cyberspace poses grave perils. In 2012, Secretary of Defense Leon Panetta warned of an impending “cyber-Pearl Harbor,” in which adversaries could take down critical U.S. infrastructure through cyberattacks. Nearly a decade later, FBI Director Christopher Wray compared the threat from ransomware—when actors hold a target hostage by encrypting data and demanding a ransom payment in return for decrypting it—to the 9/11 attacks. And as recently as December 2021, Secretary of Defense Lloyd Austin noted that in cyberspace, “norms of behavior aren’t well-established and the risks of escalation and miscalculation are high.”

Seemingly buttressing these claims has been a long record of cyber-operations by hostile governments. In recent years, states ranging from Russia and China to Iran and North Korea have used cyberspace to conduct large-scale espionage, inflict significant economic damage, and undermine democratic institutions. In January 2021, for example, attackers linked to the Chinese government were able to breach Microsoft’s Exchange email servers, giving them access to communications and other private information from companies and governments, and may have allowed other malicious actors to conduct ransomware attacks. That breach followed on the heels of a Russian intrusion against the software vendor SolarWinds, in which hackers were able to access a huge quantity of sensitive government and corporate data—an espionage treasure trove. Cyberattacks have also inflicted significant economic costs. The NotPetya attack affected critical infrastructure around the world—ranging from logistics and energy to finance and government—causing upward of $10 billion in damage.

But the **assumption** that cyber-operations play a central role in either **provoking** or **extending war** is **wrong**. **Hundreds** of cyber-incidents have occurred between rivals with **long histories** of tension or even conflict, but **none** has **ever** **triggered** an **escalation** to war. **No**rth **Ko**rea, for example, has conducted **major** cyberattacks against **So**uth **Ko**rea on at least four different occasions, including the “Ten Days of Rain” denial of service attack—in which a network is flooded with an overwhelming number of requests, becoming temporarily inaccessible to users—against South Korean government websites, financial institutions, and critical infrastructure in 2011 and the “Dark Seoul” attack in 2013, which disrupted service across the country’s financial and media sectors.

It would be reasonable to expect that these operations might **escalate** the situation on the **Korean Peninsula**, especially because North Korea’s war plans against South Korea reportedly involve cyber-operations. Yet that is **not what happened**. Instead, in each case, the South Korean response was minimal and limited to either direct, official attribution to North Korea by government officials or more indirect public suggestions that Pyongyang was likely behind the attacks.

Similarly, although the United States reserves the right to respond to cyberattacks in any way it sees fit, including with military force, it has until now relied on economic sanctions, indictments, diplomatic actions, and some reported instances of tit-for-tat cyber-responses. For example, following Russia’s interference in the 2016 U.S. presidential election, the Obama administration expelled 35 Russian diplomats and shuttered two facilities said to be hubs for Russian espionage. The Treasury Department also levied economic sanctions against Russian officials. Yet according to media reports, the administration ultimately rejected plans to conduct retaliatory cyber-operations against Russia. And although the United States did use its own cyber-operations to respond to Russian attacks during the 2018 midterm elections, it limited itself to temporarily disrupting the Internet Research Agency, a Russian troll farm.

These measured responses are not unusual. Despite decades of malicious behavior in cyberspace—and no matter the level of destruction—cyberattacks have **always** **been contained** **below** the level of **armed conflict**. Indeed, researchers have found that major adversarial powers across the world have routinely **observed** a “firebreak” between cyberattacks and conventional military operations: a **mutually understood line** that **distinguishes strategic interactions** above and below it, similar to the threshold that exists for the employment of nuclear weapons.

But it is not just that cyber-operations do not lead to conflict. Cyberattacks can also be **useful** ways to **project power** in situations in which **armed conflict** is expressly being **avoided**. This is why **Iran**, for example, might find cyberattacks against the United States, including the 2012–13 denial of service attacks it conducted against U.S. financial institutions, **appealing**. Since Iran likely prefers to avoid a **direct military confrontation** with the United States, cyberattacks provide a way to retaliate for perceived grievances, such as U.S. economic sanctions in response to Iran’s nuclear program, **without triggering** the kind of escalation that would put the two countries on a path to **war**.

### 1NC---Defense---Cyber Attacks

#### No cyber impact.

James Andrew Lewis, 20 (James Andrew Lewis is the Senior Vice President at the Center for Strategic and International Studies and Director of the Technology Policy Program, 8-17-2020, accessed on 6-4-2022, Center for Strategic and International Studies, “Dismissing Cyber Catastrophe”, https://www.csis.org/analysis/dismissing-cyber-catastrophe, HBisevac)

More importantly, there are **powerful strategic constraints** on those who have the **ability** to launch **catastrophe attacks**. We have more than two decades of **experience** with the use of **cyber techniques** and **operations** for **coercive** and criminal **purposes** and have a clear understanding of **motives**, **capabilities**, and **intentions**. We can be guided by the methods of the Strategic Bombing Survey, which used interviews and observation (rather than hypotheses) to determine effect. These methods apply equally to cyberattacks. The conclusions we can draw from this are: **Nonstate actors** and **most states** lack the **capability** to **launch attacks** that cause physical **damage** at **any level**, much less a catastrophe. There have been regular predictions every year for over a decade that nonstate actors will acquire these high-end cyber capabilities in two or three years in what has become a cycle of repetition. The **monetary return** is **negligible**, which **dissuades** the skilled cybercriminals (mostly Russian speaking) who might have the necessary skills. One mystery is why these groups have not been used as mercenaries, and this may reflect either a degree of control by the Russian state (if it has forbidden mercenary acts) or a degree of caution by criminals. There is **enough uncertainty** among potential attackers about the United States’ ability to **attribute** that they are **unwilling** to **risk massive retaliation** in response to a catastrophic attack. (They are perfectly willing to take the risk of attribution for espionage and coercive cyber actions.) **No one has ever died from a cyberattack**, and only a handful of these attacks have produced physical damage. A cyberattack is **not** a nuclear weapon, and it is **intellectually lazy** to **equate them** to nuclear weapons. Using a tactical nuclear weapon against an urban center would produce several hundred thousand casualties, while a strategic nuclear exchange would cause tens of millions of casualties and immense physical destruction. These are catastrophes that some hack cannot duplicate. The shadow of nuclear war distorts discussion of cyber warfare. State use of cyber operations is consistent with their **broad national** strategies and **interests**. Their primary emphasis is on **espionage** and **political coercion**. The United States has opponents and is in conflict with them, but they have **no interest** in launching a catastrophic cyberattack since it would certainly produce an **equally catastrophic retaliation**. Their goal is to stay below the “use-of-force” threshold and undertake damaging cyber actions against the United States, not start a war. This has implications for the discussion of **inadvertent escalation**, something that has also **never occurred**. The concern over escalation deserves a longer discussion, as there are both **technological** and **strategic constraints** that shape and **limit** risk in cyber operations, and the absence of inadvertent escalation suggests a high degree of control for cyber capabilities by advanced states. Attackers, particularly among the United States’ major opponents for whom cyber is just one of the tools for confrontation, seek to avoid actions that could trigger escalation. The United States has two opponents (China and Russia) who are capable of damaging cyberattacks. Russia has demonstrated its attack skills on the Ukrainian power grid, but neither Russia nor China would be well served by a similar attack on the United States. Iran is improving and may reach the point where it could use cyberattacks to cause major damage, but it would only do so when it has decided to engage in a major armed conflict with the United States. Iran might attack targets outside the United States and its allies with less risk and continues to experiment with cyberattacks against Israeli critical infrastructure. North Korea has not yet developed this kind of capability.

#### Cyber escalation is a myth.

Erica Lonergan, 4-15 (Erica Lonergan is Assistant Professor in the Army Cyber Institute at West Point and a Research Scholar at the Saltzman Institute of War and Peace Studies at Columbia University and previously served as Senior Director on the U.S. Cyberspace Solarium Commission, 4-15-2022, accessed on 6-8-2022, Foreign Affairs, “The Cyber-Escalation Fallacy”, <https://www.foreignaffairs.com/articles/russian-federation/2022-04-15/cyber-escalation-fallacy>, HBisevac)

In fact, the negligible role of cyberattacks in the Ukraine conflict should come as no surprise. Through war simulations, statistical analyses, and other kinds of studies, scholars have found little evidence that cyber-operations provide effective forms of coercion or that they cause escalation to actual military conflict. That is because for all its potential to disrupt companies, hospitals, and utility grids during peacetime, cyberpower is **much harder** to use against targets of **strategic significance** or to **achieve outcomes** with **decisive impacts**, either on the battlefield or during crises short of war. In failing to recognize this, U.S. officials and policymakers are approaching the use of cyberpower in a way that may be doing **more harm than good**—treating cyber-operations like any other weapon of war rather than as a nonlethal instrument of statecraft and, in the process, overlooking the **considerable opportunities** as well as **risks** they present.

THE MYTH OF CYBER-ESCALATION

Much of the current understanding in Washington about the role of cyber-operations in conflict is built on long-standing but **false assumptions** about cyberspace. Many scholars have asserted that cyber-operations could easily lead to military escalation, up to and including the use of nuclear weapons. Jason Healey and Robert Jervis, for example, expressing a widely held view, have argued that an incident that takes place in cyberspace, “might cross the threshold into armed conflict either through a sense of impunity or through miscalculation or mistake.” Policymakers have also long believed that cyberspace poses grave perils. In 2012, Secretary of Defense Leon Panetta warned of an impending “cyber-Pearl Harbor,” in which adversaries could take down critical U.S. infrastructure through cyberattacks. Nearly a decade later, FBI Director Christopher Wray compared the threat from ransomware—when actors hold a target hostage by encrypting data and demanding a ransom payment in return for decrypting it—to the 9/11 attacks. And as recently as December 2021, Secretary of Defense Lloyd Austin noted that in cyberspace, “norms of behavior aren’t well-established and the risks of escalation and miscalculation are high.”

Seemingly buttressing these claims has been a long record of cyber-operations by hostile governments. In recent years, states ranging from Russia and China to Iran and North Korea have used cyberspace to conduct large-scale espionage, inflict significant economic damage, and undermine democratic institutions. In January 2021, for example, attackers linked to the Chinese government were able to breach Microsoft’s Exchange email servers, giving them access to communications and other private information from companies and governments, and may have allowed other malicious actors to conduct ransomware attacks. That breach followed on the heels of a Russian intrusion against the software vendor SolarWinds, in which hackers were able to access a huge quantity of sensitive government and corporate data—an espionage treasure trove. Cyberattacks have also inflicted significant economic costs. The NotPetya attack affected critical infrastructure around the world—ranging from logistics and energy to finance and government—causing upward of $10 billion in damage.

But the **assumption** that cyber-operations play a central role in either **provoking** or **extending war** is **wrong**. **Hundreds** of cyber-incidents have occurred between rivals with **long histories** of tension or even conflict, but **none** has **ever** **triggered** an **escalation** to war. **No**rth **Ko**rea, for example, has conducted **major** cyberattacks against **So**uth **Ko**rea on at least four different occasions, including the “Ten Days of Rain” denial of service attack—in which a network is flooded with an overwhelming number of requests, becoming temporarily inaccessible to users—against South Korean government websites, financial institutions, and critical infrastructure in 2011 and the “Dark Seoul” attack in 2013, which disrupted service across the country’s financial and media sectors.

It would be reasonable to expect that these operations might **escalate** the situation on the **Korean Peninsula**, especially because North Korea’s war plans against South Korea reportedly involve cyber-operations. Yet that is **not what happened**. Instead, in each case, the South Korean response was minimal and limited to either direct, official attribution to North Korea by government officials or more indirect public suggestions that Pyongyang was likely behind the attacks.

Similarly, although the United States reserves the right to respond to cyberattacks in any way it sees fit, including with military force, it has until now relied on economic sanctions, indictments, diplomatic actions, and some reported instances of tit-for-tat cyber-responses. For example, following Russia’s interference in the 2016 U.S. presidential election, the Obama administration expelled 35 Russian diplomats and shuttered two facilities said to be hubs for Russian espionage. The Treasury Department also levied economic sanctions against Russian officials. Yet according to media reports, the administration ultimately rejected plans to conduct retaliatory cyber-operations against Russia. And although the United States did use its own cyber-operations to respond to Russian attacks during the 2018 midterm elections, it limited itself to temporarily disrupting the Internet Research Agency, a Russian troll farm.

These measured responses are not unusual. Despite decades of malicious behavior in cyberspace—and no matter the level of destruction—cyberattacks have **always** **been contained** **below** the level of **armed conflict**. Indeed, researchers have found that major adversarial powers across the world have routinely **observed** a “firebreak” between cyberattacks and conventional military operations: a **mutually understood line** that **distinguishes strategic interactions** above and below it, similar to the threshold that exists for the employment of nuclear weapons.

### 2NC---Defense---Cyber Attacks

#### Data proves.

Valeriano & Maness 18 – Brandon Valeriano, PhD, Chair of Armed Politics at the Marine Corps University, Cyber Security Senior Fellow at the Atlantic Council. Ryan Maness, an American cybersecurity expert, Defense Analysis Professor at Naval Postgraduate School. [How We Stopped Worrying about Cyber Doom and Started Collecting Data, Politics and Governance, 6(2), Cogitatio Press]

6. Expanding Cyber Security Data Our team has been coding cyber incident data since 2010 and serves as a unique example of how the process of collecting cyber security data and evidence can be done. Our first peer reviewed published work appeared in 2014 in Journal of Peace Research (Valeriano & Maness, 2014). In this article we note that cyber conflict is much more restrained than generally understood by popular discourse. Threat inflation is ripe in cyber security, and the real use of cyber tools seems to be to enhance the power of strong states.

The data that Valeriano and Maness (2014, 2015) have built challenges the cyber revolution perspective and does so with the tools of social science, and is a necessary turn given the general tone of the debate. We first determine that a viable data collection method in light of limited resources was to focus on states that are committed interstate rivals (Diehl & Goertz, 2001). This allows us to focus on those actors with an intense history of recent hostilities that should be the most likely users of cyber technology on the battlefield (Maness & Valeriano, 2018).

In our research (Maness & Valeriano, 2016; Maness, Valeriano, & Jensen, 2017; Valeriano & Maness, 2014, 2015), we have been able to marshal a massive amount of evidence that is useful in dissecting the actual trends on the cyber battlefield in a geopolitical context. We demonstrate that while cyber-attacks are increasing in frequency, they are limited in severity, are directly connected to traditional territorial disagreements, and mostly take the shape of espionage and low-level disruptive campaigns rather than outright warfare.

Given this data-based perspective, we question the dynamics of the cyber security debate and offer a countering theory where states are restrained from using more malicious cyber actions due to the limited nature of the weapons, the possibly of blowback, the connection between the digital world and civilian infrastructure, and the reality that any cyber weapon launched can be replicated and used right back against the attacker. Given all of these perspectives gleamed from the data, we must moderate our views about the transformation that is offered by cyber strategists who stress a more revolutionist tone (Lango, 2016).

Social science clearly matters for contemporary technological policy debates. Absent rigorous methods, much of what is in the field is basically guesswork. Our work really owes an intellectual debt to J. David Singer, who started the effort to quantify war at the University of Michigan with the Correlates of War (COW) project (Small & Singer, 1982). Our project builds on this methodology and uses many of the same coding strategies. We recognize that data is a work in progress and seek to build more and more knowledge through subsequent updates. By gathering the full picture, we can gain the perspective that really matters in these emerging policy debates regarding the cyber battlefield.

#### No large-scale cyber attacks or retaliation

Dr. Joseph S. Nye 19, Jr., University Distinguished Service Professor and Former Dean of the Kennedy School of Government at Harvard University, “Global Cyber Conflicts Will Be Hard To Control”, The Statesman (Pakistan), 10/14/2019, Lexis

The problem of perceptions and controlling escalation is not new. In August 1914, the major European powers expected a short and sharp “Third Balkan War.” The troops were expected to be home by Christmas. After the assassination of the Austrian archduke in June, Austria-Hungary wanted to give Serbia a bloody nose, and Germany gave its Austrian ally a blank check rather than see it humiliated. But when the Kaiser returned from vacation at the end of July and discovered how Austria had filled in the check, his efforts to de-escalate were too late. Nonetheless, he expected to prevail and almost did.

Had the Kaiser, the Czar, and the Emperor known in August 1914 that a little over four years later, all would lose their thrones and see their realms dismembered, they would not have gone to war. Since 1945, nuclear weapons have served as a crystal ball in which leaders can glimpse the catastrophe implied by a major war. After the Cuban Missile Crisis in 1962, leaders learned the importance of de-escalation, arms-control communication, and rules of the road to manage conflict.

Cyber technology, of course, lacks the clear devastating effects of nuclear weapons, and that poses a different set of problems, because there is no crystal ball. During the Cold War, the great powers avoided direct engagement, but that is not true of cyber conflict. And yet the threat of cyber Pearl Harbors has been exaggerated. Most cyber conflicts occur below the threshold established by the rules of armed conflict. They are economic and political, rather than lethal. It is not credible to threaten a nuclear response to cyber theft of intellectual property by China or cyber meddling in elections by Russia.

According to American doctrine, deterrence is not limited to a cyber response (though that is possible). The US will respond to cyberattacks across domains or sectors, with any weapons of its choice, proportional to the damage that has been done. That can range from naming and shaming to economic sanctions to kinetic weapons. Earlier this year, a new doctrine of “persistent engagement” was described as not only disrupting attacks, but also helping to reinforce deterrence. But the technical overlap between intrusion into networks to gather intelligence or disrupt attacks and to carry out offensive operations often makes it difficult to distinguish between escalation and de-escalation. Rather than relying on tacit bargaining, as proponents of “persistent engagement” sometimes emphasize, explicit communication may be necessary to limit escalation.

#### No impact to cyberattacks.

Erica Lonergan, 4-15 (Erica Lonergan is Assistant Professor in the Army Cyber Institute at West Point and a Research Scholar at the Saltzman Institute of War and Peace Studies at Columbia University and previously served as Senior Director on the U.S. Cyberspace Solarium Commission, 4-15-2022, accessed on 6-8-2022, Foreign Affairs, “The Cyber-Escalation Fallacy”, <https://www.foreignaffairs.com/articles/russian-federation/2022-04-15/cyber-escalation-fallacy>, HBisevac)

In addition to the ways they are used, cyber-operations also have two general qualities that tend to distinguish them from conventional military operations. First, they typically have **limited**, **transient impact**—especially when compared with conventional military action. As the Hoover Institute fellow Jacquelyn Schneider recently told The New Yorker, “If you’re already at a stage in a conflict where you’re willing to drop bombs, you’re going to drop bombs.” Unlike traditional military hardware, cyberweapons are **virtual**: even at their **most destructive**, they **rarely** have **effects** in the **physical world**. In the extraordinary instances when they do—such as the Stuxnet cyberattack, which caused the centrifuges used to enrich uranium in Natanz, Iran, to speed up or slow down—cyber-operations do not inflict the kind of damage that can occur in even a minor precision missile strike. And when states have launched cyberattacks against **civilian infrastructure**, such as Russia’s 2015 hit on Ukraine’s power grid, the impact has been **short-lived**. To date, cyberattacks have **never caused direct physical harm**; the only known indirect death associated with a cyberattack occurred in 2020, when a German patient with a life-threatening condition died as a result of a treatment interruption caused by a ransomware attack on a hospital’s servers.

### 2NC---Defense---AT: Retal

#### No cyber war or retaliation

Jasmine Rodet 18, Master’s Degree in Cyber Security, Strategy, and Diplomacy from the University of New South Wales, Cyber Security Program Manager at Fortescue Metals Group, “The Threat of Cyber War is Exaggerated”, 11/11/2018, linkedin.com/pulse/threat-cyber-war-exaggerated-jasmine-rodet/

For the regular person on the street, the term ‘cyber war’ is more likely to bring to mind the 1983 movie “WarGames” and the doomsday articles that appear regularly in the media about the ‘cyber battlefield’ and an impending World War III. This essay argues that the threat of cyber war is exaggerated and although it can, by definition, be stated that we are already in a state of cyber war, the impact on states is negligible compared to conventional war domains.

The argument is presented in 3 steps. The first step is to define cyber war and cyber weapons, referencing scholars and experts in the area of conventional war and the cyber domain. The second step is to explore who has been exaggerating the threat of cyber war and what their motivations might be. The third is to explore the evidence and quantify the probability and impact that cyberwar has had on states to date.

‘Cyber war’ is a term often used interchangeably in media with cyber-crime, cyber-attacks, cyber-conflict and cyber-incidents, creating confusion amongst the public and scholars alike. Clausewitz (1989, 75), in his book, On War, defines war as ‘an act of force to compel the enemy to do our will’. Rid (2012, 7) on the other interprets Clausewitz use of ‘force’ as meaning ‘violent’ force. According to Rid, if an act is not potentially violent, it is not an act of war. However, Stone (2013, 107) describes ‘cyber war’ as a politically motivated act of force, not necessarily lethal and not necessarily attributable. The definition by Powers and Jablonski states more simply that cyber war is the utilisation of digital networks for geopolitical purposes (Nocetti 2016, 464). Neither of the latter two definitions requires violence to qualify as cyber war. Under these definitions, the Stuxnet cyber-incident in 2010 and the Estonia incident in 2007 would constitute an act of cyber war, and as such we could say that nations have been at cyber war in the past and are likely to continue to engage in cyber war in years to come.

For this essay, I will use Stones definition to argue that even though states may engage in cyber war, the concept of cyber war is exaggerated. It seems that cyber war is deliberately exaggerated in the media and by politicians for financial and political gains. There are countless examples in the media and in politics of the exaggeration of the threat of cyber war and the language used plays a big factor in creating a sense of fear in the community.

The Four Corners report, Hacked, is a classic example where the reporter, Andrew Fowler describes the current situation in Australia as ‘… a secret war where the body count is climbing every day’ (Fowler 2013). The documentary reveals nothing violent or lethal about cyber incidents. The documentary is actually about hackers working from locations overseas, having targeted key Federal Government departments and major corporations in Australia.

In another example, NATO may be interpreted as exaggerating the threat of Cyber War when they invited Charlie Millar to present at their Conference for Cyber Conflict at the NATO Cooperative Cyber Defence Centre of Excellence in 2017. Millar is an independent security evaluator, and his presentation was titled ‘Kim Jong-il and me: How to build a cyber army to attack the US’. He later presented similar content at Def Con 2018. His presentation described the steps he would take to mount a cyber war, including the types of people he would engage, how much he would pay them, what his strategy would be and how much it would cost in total.

Who stands to gain from the exaggeration and hype? Logically, one group would be those that gain financially from the sale of cyber protective services and software. According to Valerino, 57% of technical experts surveyed said that we are currently in a cyber arms race and 43% said that the worst-case scenarios are inevitable (Valeriano and Ryan 2015). Translate this into sales and Gartner projects worldwide security spending will reach $96 Billion in 2018, up 8 Percent from 2017 and to top $113 billion by 2020 (Gartner 2017).

Additionally, there may be political motivations to exaggerate the threat of cyber war. Cyberspace is not well understood by the general public and fear is natural. In the US’s cyber security debate, observers have noted there is a tendency for policymakers, military leaders, and media, among others, to use frightening ‘cyber-doom scenarios’ when making a case for action on cyber security (Dunn 2008, 2).

There is some evidence to suggest that more recently in the political arena; we may be maturing in our understanding of the real threat of cyber war. The Tallinn Manual, an academic, non-binding study on how international law applies to cyber conflicts and cyber warfare, was written at the invitation of the Tallinn-based NATO Cooperative Cyber Defence Centre of Excellence. It was first published in 2013 with the title ‘The Tallinn Manual on the International Law of Cyber War’. In 2017, it was re-released with the revised title ‘Tallinn Manual 2.0 on the International Law of Cyber Operations’. The change in title from ‘war’ to ‘operations’ signifies a more moderate use of language from NATO and is an acknowledgement that cyber incidents generally fall below the threshold at which International Law would declare them to be a formal act of war. Experience over the 4 short years from 2013 to 2017 has demonstrated that cyber incidents tend to have a low-level impact on the target state. As the book’s authors put it ‘the focus of the original Manual was on the most severe cyber operations, those that violate the prohibition of the use of force in international relations, entitle states to exercise the right of self-defence, and/or occur during armed conflict’ while the new version ‘adds a legal analysis of the more common cyber incidents that states encounter on a day-to-day basis and that fall below the thresholds of the use of force or armed conflict’ (Leetaru 2017).

To get a better sense if cyber war is exaggerated, we must also consider the probability of cyber war in the future. The probability of cyber war should be weighed up against the probability of conventional war. Where tensions are already high, for example, between North Korea and the US or Russia and Estonia, I would argue that cyber war is more likely than conventional war. This is due to factors including; cyber warfare is less costly than conventional warfare, states are less rational in their decision space in the cyber realm, states find cyber attribution very difficult to achieve so attacks can be undertaken covertly and cyber war is considered ‘a challenge’ and central to the hackers’ ethos (Junio 2013, 128). Further, Sanger describes in his book, The Perfect Weapon, cyber weapons (such as cyber vandalism, Distributed Denial of Service (DDOS), intrusions and advanced persistent threat (APT)) as the ‘perfect weapons’ for the following reasons;

They are cheap: When compared to Nuclear weapons, there are only a handful of nations globally that can afford the technology to create a nuclear weapon.

They are easily accessible: Unlike a Nuclear bomb that requires uranium, a highly protected metal, in the production process, a cyber weapon can be created with minimal investment and highly available IT infrastructure.

They can be dialled-up or dialled-down relatively easily. A ballistic missile, the force of the explosion cannot be adjusted as easily as a DDOS attack. A DDOS attack can be adjusted to last an hour, a few days or a few weeks.

They have a huge range in how they are used: Sabotage as with Stuxnet, Espionage as with the Chinese industrial spying on the US, North Korea’s infiltration of Sony, the Iranians attack on Las Vegas Sands Corp. casino operators.

The significant factor is that cyber weapons can and are being used every day for discrete, low-level cyber conflicts to undermine and disrupt rivals, but historically it has not progressed to open conflict, nor has it warranted a military response (Sanger 2018). Additionally, massive cyber operations would necessarily impact the civilian population and violate the immunity of non-combatants. The conditions of war dictate that this is “taboo” and to date, rival states have shown restraint in their use of cyber weapons for this reason (Valeriano and Ryan 2015). It appears that the threat that cyber weapons represent to national security is overstated and the threat of cyber war is overstated.

The US and likely other highly networked nations appear reticent about using cyber weapons for significant cyber conflict given their vulnerabilities. Ironically, NSA programs such as PRISM have made the US more of a target given the sheer volume of sensitive information stored in one place. Regardless of US defences, there is no way to make this information completely secure from intrusion, and as such, the very act of storing the information makes them more vulnerable.

Rid (2012) is among some academics who argue that cyber war has never and will likely never eventuate. The benefits of being on this side of the debate mean that public funding can be allocated away from offensive cyber security initiatives to other, potentially more important initiatives, such as public health and housing. The government is constantly under pressure to prioritise public spending and it is imperative that they have realistic, accurate projections regarding the risk of cyber war, the probability and the impact, to allow them to focus spending on the most important areas.

### 2NC---Defense---AT: Escalation

#### No scenario for escalation.

Erica D. Borghard 19, Assistant Professor in the Army Cyber Institute at the United States Military Academy at West Point, and Shawn W. Lonergan, Assistant Professor of International Relations in the Department of Social Science at USMA, “Cyber Operations as Imperfect Tools of Escalation”, Strategic Studies Quarterly, Fall 2019, p. 123-124

However, there are important empirical reasons to suspect that the risks of cyber escalation may be exaggerated. Specifically, if cyberspace is in fact an environment that (perhaps even more so than others) generates severe escalation risks, why has cyber escalation not yet occurred? Most interactions between cyber rivals have been characterized by limited volleys that have not escalated beyond nuisance levels and have been largely contained below the use-of-force threshold.5 For example, in a survey of cyber incidents and responses between 2000 and 2014, Brandon Valeriano et al. find that “rivals tend to respond only to lower-level [cyber] incidents and the response tends to check the intrusion as opposed to seek escalation dominance. The majority of cyber escalation episodes are at a low severity threshold and are non-escalatory. These incidents are usually ‘tit-for- tat’ type responses within one step of the original incident.”6 Even in the two rare examples in which states employed kinetic force in response to adversary cyber operations—the US counter-ISIL drone campaign in 2015 and Israel’s airstrike against Hamas cyber operatives in 2019—the use of force was circumscribed and did not escalate the overall conflict (not to mention that force was used against nonstate adversaries with limited potential to meaningfully escalate in response to US or Israeli force).7

We posit that cyber escalation has not occurred because cyber operations are poor tools of escalation. In particular, we argue that this stems from key characteristics of offensive cyber capabilities that limit escalation through four mechanisms. First, retaliatory offensive cyber operations may not exist at the desired time of employment. Second, even under conditions where they may exist, their effects are uncertain and often relatively limited. Third, several attributes of offensive cyber operations generate important tradeoffs for decision-makers that may make them hesitant to employ capabilities in some circumstances. Finally, the alternative of cross-domain escalation—responding to a cyber incident with noncyber, kinetic instruments—is unlikely to be chosen except under rare circumstances, given the limited cost-generation potential of offensive cyber operations. In this article, we define cyber escalation and then explore the implications of the technical features and requirements for offensive cyber operations. We also consider potential alternative or critical responses to each of these logics. Finally, we evaluate the implications for US policy making.

#### Empirics prove.

Dr. Christian Leuprecht 19, Class of 1965 Professor in Leadership, Department of Political Science, Royal Military College and Adjunct Research Professor at Charles Sturt University; Ph.D, Queen’s, Joseph Szeman (an undergraduate student in Political Studies and History in his 4th year at Queen’s University), David Skillicorn (Professor in the School of Computing at Queen’s University, and Adjunct Professor at the Royal Military College of Canada), March 2019, “The Damoclean Sword of Offensive Cyber: Policy Uncertainty and Collective Insecurity”, Contemporary Security Policy

To date, no direct use of OCO capabilities has resulted in the outbreak of traditional conflict, perhaps owing to uncertainties in the novelty of the attacks, the difficulty of attribution, and the reluctance of national cyber actors to retaliate when the path of escalation is unclear (Rid & Buchanan, 2015). Most importantly, however, the actions of armed forces in democratic countries are constrained by the rule of law, which translates into multiple authorities to ensure responsible and acceptable use, and safeguard against escalation. The fine-grained control of OCOs compared to conventional military force provides a way to manage escalation without the direct use of physical or military assets, whose effect in sparking conflict is much better known. In other words, instead of reacting to an escalating conflict by deploying physical military assets to a region, an OCO can be employed covertly to incur more controllable costs on the adversary, with the benefit of plausible deniability (Hare, 2018). Depending on the type of OCO employed, if there is a reduction in tension, the effects of the OCO can be reversed or scaled back.

### 2NC---Defense---AT: Spills Over

#### Cyber-attacks don’t spillover.

Martin Libicki, 20 (Martin Libicki, Professor at the Frederick S. Pardee RAND Graduate School, 5-20-2020, accessed on 7-18-2022, CATO Institute, “Dealing With Cyberattacks”, <https://www.cato.org/publications/dealing-cyberattacks>, HBisevac)

The most important justification for thinking about ***Las Vegas rules*** for cyberspace — **what starts there stays there** — is that the risks of escalation from cyberwarfare are **much lower** than the risks of escalation from kinetic (violent) warfare. In the short run, an unprepared country can suffer significant losses of information from a cyberwar. Against a sufficiently sadistic and determined adversary, it is conceivable that every infected personal computer can have the information on its hard drive erased (as noted with Aramco and echoed in South Korea). But a short‐​run response to a withering cyberattack that focuses on backing up information and capabilities while eliminating unessential connectivity (electric grids need not be connected to the Internet; they ran well enough before the Internet was invented) could preserve most of a country’s functionality at the cost of annoyance.

In the longer run, cyberattacks are enabled by vulnerabilities in software and architectural features in computer design that allow their instruction sets to be altered. By contrast, the instruction sets of most equipment are (or, until very recently, were) fixed when they leave the factory. A computer that burned into its hardware all of its instructions — operating systems, office automation, Web browsing — would be hardened against malware. Although malware does not account for all security breaches (e.g., South Carolina’s exposure of all its tax records to hackers),29 it is very much harder to cause serious damage without it. Ultimately, systems are only as vulnerable as **we want them to be**: more accurately, only up to the level where the inconvenience from restraining their malleability and accessibility matches the risks from retaining that very malleability and accessibility. For that reason, a tit for tat in cyberspace can escalate to very high levels **without creating unlimited damage**. The difficulty of finding obvious firebreaks in cyberspace — the point beyond which no cyberattack on either side would go — is unfortunate but not necessarily fatal. To wit, an all‐​out cyberwar can be contained by the **nature** of **cyberspace** **itself**.

#### No spillover---empirics, it’ll be confined to the cyber realm, lack of attribution, time cools off pressure, and kinetic deterrence.

Martin Libicki ’14 (Martin; 9/1/2014; PhD in economics from the University of California Berkeley and Master’s in city and regional planning from the University of California Berkeley; “Is Cyberwar Good for Peace? [par Martin Libicki],” <https://www.observatoire-fic.com/is-cyberwar-good-for-peace/>; Date Accessed: 8/16/2017; DS)

The assumption that cyberwar is a cool war also rests on the presumption that what starts in cyberspace will stay in cyberspace; there will be no escalation into kinetic conflict. Clearly the chance of escalation that crosses domains is greater than zero, but for cyber war to lose its cool status requires that the risks of escalation into kinetic conflict for a cyberattack be **substantially less** than similar risks associated with a comparable kinetic attack. The thin history we have of cyberattacks **does not suggest** that a cyberattack will necessarily be followed by **much of anything at all**. The Russian[11] 2007 attacks on Estonia which crippled public and major private web sites was followed by Estonia’s complaints and NATO’s unwillingness to deem this an Article V attack (triggering collective self-defense measures) but it led to nothing violent or even close.[12] If Georgia had reacted kinetically to the cyberattacks on it in 2008, it would have been difficult to distinguish such actions from the war Georgia was forced to fight following its invasion by Russian forces. The 2007 Israeli air strike on a purported nuclear facility in Syria may have been facilitated by an opening cyberattack on Syrian air defenses but **Syria did not respond** **at all** to the cyberattack or the raid itself. **Iran did not react kinetically** to Stuxnet, even if it created cyberwar cadres that may have been implicated in carrying out denial-of-service attacks on banks[13] in the United States (from whence, supposedly, Stuxnet), but also attacks which trashed computers in Saudi Arabia (specifically, Aramco[14]) and Qatar (specifically, RasGas[15]), neither of which could be plausibly accused of complicity in creating Stuxnet. Similarly, the United States carried out no kinetic attack in response to the aforementioned denial-of-service attacks on banks that its intelligence community ascribed to Iran. To be fair, cyberattacks unaccompanied by the outbreak of war are **easier to liken to a raid** than a war. In a raid, forces cross borders, wreak their mischief, and go home. In a war, they intend to stay permanently or turn what they have taken (be it territory or the entire country) over to those they deem their allies. It is very **difficult of conceive** of a cyberattack that can change the head of state and even harder to conceive of one that can conquer all or even part of another country. In worst-case scenarios, a cyberattack can disrupt life and maybe even break some machines. But they do not persist unless the cost of eradicating them – for instance, by doing a system reboot, or replacing infected machines with uninfected machines – exceeds the cost of tolerating their presence. It is worth remembering that there is no forced entry in cyberspace. Almost all wars tend to be two-side engagements because the attacked side has no option but to fight or surrender. In a raid, there is a third option to offer, at most, some resistance but not pursue the attacker for fear of worse. Thus, not all raids lead to counter-raids. The aforementioned 2007 Israeli raid on Syria did not. The many U.S. drone strikes have not, so far. China invaded Vietnam in 1979, wreaked damage, caused casualties, and departed having, in its mind, taught Vietnam a lesson. Vietnam did not return the favor by invading China. Neither did India in 1962 under similar circumstances. Granted, some nations do respond. Arabs and Israelis traded raids in the decade or so after Israel declared independence (1948); Palestinians and Israelis traded attacks over the last three decades, as well. Both Koreas sent raiding parties across the 38th parallel in the years prior to North Korea’s 1950 invasion. The **history of raids escalating** into open conflict (as distinguished from raids preceding open conflict as was the Korean case) is also thin. Two other difficulties associated with attribution and the difficulties of disarming the attacker are likely to reduce the pressure to retaliate, much less, escalate in response to a cyberattack. Difficulties of attribution are likely to have two related effects. The first is that the target may not be so certain about who did it – or at least not be certain of its ability to convince third parties such as other countries who did it – to **validate a response**. The second is that if it takes too much time to analyze the attack to the point where it can determine (and make the case about) who did it with the requisite confidence, the **political pressure for vengeance may have cooled** and the politico-military situation that warranted retaliation may have changed (e.g., yesterday’s foe might be today’s partner). The impetus to respond can also be reduced if the public has little idea about the identity of the attacker and even the fact of the attack (e.g., the failure to function is not obvious to the outside). Until the New York Times reported on Stuxnet, the public did not know that Iran had been attacked (it is not clear whether anyone in Iran actually understood that they were being attacked before it was reported). If no one knows that two parties are trading blows in the dark, there is **much less requirement to appear strong** as a way of establishing third-party deterrence. The **difficulty of disarming** the other side’s cyberwar capabilities removes another reason for responding to a cyberattack. A kinetic response to a kinetic attack can be justified, not only as a way to reinforce deterrence, but also as a way to reduce the attacker’s ability to carry out further attacks; it does so by killing opposing forces and destroying military equipment, ancillary supplies and infrastructure, especially staging areas. A cyber response can only be justified in terms of deterrence because it is **very difficult** for a cyberattack to permanently or even temporarily damage the other side’s ability to carry out cyberattacks, which require little more than hackers, information, computing equipment, software, and network connections.[16] Granted, the target country may conclude that it may win some relief from cyberattack by carrying out a kinetic attack on the attacker’s cyberwar corps. Such actions cannot be ruled out[17] — but suffice it to say that at least the tools of a cyberattack cannot be identified from afar in the same way that the tools of a kinetic attack can be. Alternatively, the target can convince itself that the only way to rid itself of the cyberattack menace is to change the regime that governs the attacking country. If the sole aim of such logic is to minimize the likelihood of future damage to the target country, it can be convincing only by substantially underestimating the cost and risk of war or substantially overestimating the inconvenience associated with adopting other measures to improve cyber-security. Finally, and in lieu of regime change, the escalation path from a cyberattack into a kinetic response also crosses **a threshold that does not come up** when the original provocation and the response were both kinetic. It is unclear whether this threshold is more like a speed bump or a yawning abyss, but it is clearly present. It should therefore seem obvious that a cyberattack is **less likely to result in a kinetic response** than an equivalent kinetic attack would have. However, this raises the question of what constitutes equivalence. Assessing kinetic damage when it is damage to you is a straightforward exercise. Assessing the damage from a cyberattack that leads to the widespread corruption of information systems requires knowing what systems have, in fact, been corrupted (something that, ironically, the attacker may have a better handle on). A target country that has been spooked by a cyberattack into imagining that the real damage is a multiple of the visible damage may well overreact (at least initially until it realizes over time which of its systems is or is not behaving as if they had been corrupted). In sum, although the risks of violent escalation following a cyberattack are nonzero, the **odds are against it**, in isolation and particularly in comparison to a kinetic attack of similar magnitude.

### 1NC---Defense---AT: Cyber Deterrence

#### Deterrence in cyberspace doesn’t work.

Yavuz Akdag, 17 (Yavuz Akdag is a Ph.D student in Government in the Department of School of Interdisciplinary Global Studies at the University of South Florida, 2017, accessed on accessed on 7-18-2022, USF Scholar Commons, “Cyber Deterrence against Cyberwar between the United States and China: A Power Transition Theory Perspective”, <https://digitalcommons.usf.edu/cgi/viewcontent.cgi?article=8190&context=etd>, HBisevac)

In attempts to **repel** the threat posed through cyberspace or cyberwarfare, the cybersecurity community, scholars, and policy-circles in various nations, specifically in the United States, began to search for **effective ways** of **safeguarding** cyber systems. Out of these efforts came **cyber deterrence theory**. Treating the cyber sphere as a **warfighting** or operational **domain**, various pundits applied the concepts of classical deterrence to cyberspace in order to inform cyber deterrence theory.

However, not long after the employment of the **fundamental principles** of Cold War deterrence theories to cyberspace, the abundance of comments skeptical that **conventional** nuclear and military **deterrence** **theories** were **applicable** to cyberwarfare made numerous scholars **doubt** the **efficacy** of cyber deterrence. In parallel to this increased skepticism, many came to the realization that the complexity of cyberspace and, for that matter, cyberwar, **did not allow** a **successful application** of Cold War deterrence theories, particularly deterrence-by-punishment and deterrence-by-denial, to the cyber realm. This is because when it comes to **cyberwarfare**, the very **fundamental** and necessary **elements** of classical deterrence, namely **credibility**, **capability**, and **communication** of menacing massages to the would-be challenger, are not present due to the **distinctive characteristics** of cyberspace. Of those intrinsic characteristics, the most articulated ones are the **ambiguity** of the source of attacks, the **anonymity** of the potential cyber offender, high technological **volatility**, the **ubiquity** of computer networks and systems, the **asymmetric** and complex **nature** of cyberspace, and finally the **immaturity** of **i**nternational **laws**, rules, and norms. For example, the credibility of deterrence by punishment is undermined due to the difficulty of attributing the source of the attack, the anonymity of the potential attacker, and the asymmetry between the defending party and the challenger. Similarly, the inadequacy of international rules and norms that define an appropriate code of conduct in cyberspace, the lack of cross-borders cooperation for the investigation of cybercrimes, and the absence of international configurations for inspection purposes render **credibility** and **communication** of cyber deterrence **ineffective**. Therefore, there is a common perception in the pertinent literature that cyberspace ought to be approached on its own merit; it has distinctive characteristics that render the Cold War deterrence theories ill-suited for cyberspace.

In the wake of this skepticism, different strategies and policy constructs have been deliberately considered to increase the efficacy of cyber deterrence. On the one hand, some have suggested the application of serial deterrence, expanded deterrence, tailored deterrence, active defense, and deterring specific cyber weapons in addition to deterrence by kinetic means. Even, re-configuring the very architecture of the Internet has been suggested. On the other hand, others take a constructivist approach and focus more on human factors and, for that matter, the social construction of cyber threat perception rather than on technical difficulties of the cyber domain.

However, the problem with the existing literature is that the vast volume of the studies usually analyzed the efficacy of cyber deterrence within the theoretical framework of classical deterrence and technical vulnerabilities in cyber systems. The bulk of these studies lacked a rigorous theoretical perspective because they were from policy-circles and because historical cyber incidents are insufficient to develop an independent cyber-based theory. This theory-policy vacuum is more evident in regards with doomsday scenarios, specifically in the context of cyberwar between the U.S. and China. Although some scholars have provided useful insights into potential cyberwarfare scenarios between China and the U.S., particularly over the issue of Taiwan, these insights suffered significantly from a lack of a robust theoretical approach. Thus, the purpose of this study has been to address the issue outside the limits of classical deterrence and vulnerabilities in networks and systems, and to bridge this theory-policy gap by examining the effectiveness of cyber deterrence between the U.S. and China through the lens of Power Transition Theory.

Power Transition Theory is relevant to the discussion on cyberwarfare and cyber deterrence for two main reasons. First, because PTT is a probabilistic theory that explains under what conditions power transition from the dominant power to the rising challenger is likely to lead to a system-wide war in the real world, it can be a useful theoretical framework for the examination of the success or failure of cyber deterrence in preventing cyberwar between China and the United States. Second, the relevancy of PTT lies in the fact that Cold War classical deterrence is the very basis for cyber deterrence theory while PTT has been critical of some tenets of classical deterrence. So, this makes PTT relevant to the analysis here.

PTT contends that the classical deterrence concept of MAD did not make war prohibitive; but, instead, nuclear war did not occur because the USSR never approached national power parity with the U.S. before its dissolution. In PTT, power parity between the preeminent nation and the challenger is one of the required conditions that ought to be present prior to the outbreak of power transition warfare. In fact, according to PTT, there are several critical variables that dictate the success of deterrence. The challenger’s level of satisfaction with the status quo and whether it has reached power parity with the dominant power, however, have the utmost importance and pertinence to this study.

Applying **PTT** to cyberspace, the theory would suggest that cyber deterrence in the context of **cyberwar** between China and the U.S. will be **tenuous** under the simultaneous presence of the **two conditions**. Once China achieves parity in cyber offensive warfare capabilities with the U.S. while, at the same time, remaining discontented with the existing status quo in cyberspace, China will not be deterred and, rather, will become a risk-taker trying to alter the order in cyberspace in its favor. This would cause cyber deterrence to fail, making cyberwar very likely. After analysis of China’s satisfaction level with the prevailing status quo in the cyber sphere and its relative cyber-offense power to that of the U.S., this study concludes that while China notably exhibits a certain level of **dissatisfaction** with the **international cyber system**, it seems not to have approached a **parity** of offensive cyber capabilities with the United States. China falls far behind the U.S. in terms of cyber offensive warfare power. Hence, China is **tenuously deterred**. As a corollary of this, this study contends that an outbreak of cyberwar between the U.S. and China is a remote possibility in the foreseeable future.

### 2NC---Defense---AT: Cyber Deterrence

#### Cyber deterrence models fail horribly.

Eric Jardine, 20 (Eric Jardine is a CIGI fellow and an assistant professor of political science at Virginia Tech, November 2020, accessed on 7-18-2022, Rowman and Littlefield, “Optimizing Cyber Deterrence”, https://www.researchgate.net/publication/345343913\_Optimizing\_Cyber\_Deterrence, HBisevac)

The aim of this chapter has been to show that **maximizing** one type of **deterrent**, say the ability to punish aggression via retaliation, actually **undermines** the **strength** of deterrence by **denial**. No **analogous interdependencies exist** in nuclear deterrence. The policy implications of this difference are non-trivial. Policy makers need to think morein **complex system terms**, rather than in terms of **linear aggregations**. Choosing to hoard zero-day vulnerabilities might be the best deterrent option, but hoarding every discovered **vulnerability** will, at some point, **harm** the ability to impose **costs** on a **potential adversary** via denial. Maximizing cyber deterrence, in other words, is really about optimizing the various inputs to the nation’s deterrent. A few implications are particularly interesting for both policy makers and those doing research on cyber deterrence. The first is that the interdependencies outlined here are likely only half of the equation. Each set of linkages above showed how increasing one means of deterrence could draw down another in some measure, effectively creating negative interdependencies. Yet positive interdependencies also likely exist. For example, increasing the resilience of a nation’s networks might increase deterrence by denial, but it would also likely help to develop a norm of non-use (since fewer attacks might happen) and increase deterrence by taboo. These positive interdependencies make the issue of optimization even more important, as they could fundamentally change the cost-benefit calculus for policy makers. Another implication of note is the likely lack of symmetry in the interdependencies between means of deterrence. In each case above, a plausible argument could be made for the idea that increasing one reduces the other and vis-a-versa. However, it is by no means as clear that the relationships are symmetrical. Increasing cyber deterrence via hoarding 10 percent more zerodays could reduce the effectiveness of deterrence by denial by 2 percent (20% of 10 %). Conversely, disclosing **10 percent** more **vulnerabilities** to vendors might not reduce the effectiveness of deterrence by threat of **retaliation** by an **equivalent amount**. Similar changes to one form of deterrence, in other words, might have dissimilar effects on the other types. Lastly, there is a **highly probable** state of **non-linearity** at play. Complex systems are **marked** by **non-linear moves**, either discrete, logarithmic or exponential. **Small changes** to one of the means of deterrence might, therefore, result in initially small changes in another category. But the next set of equivalently small changes might suddenly start to matter a lot more, as non-linear effects build in the system. Overall, the chapter is meant as a foundation for subsequent research and policy development. Recognizing that input maximization cannot lead to maximal cyber deterrence is important. Moving from this recognition via a deliberate process of simulatiolaan and optimization is the essential next step that will require civilian-military coordination, data analytics and trial and error. As more physical systems become integrated into cyberspace, the price of failure will **continue** to **increase** and the need to get cyber deterrence right grows ever more important.

# Assorted Tech Impact Turns

## 3D Printing Bad

### 3D Printing Bad---1NC

#### 3-D printing causes rogue state WMD prolif.

Daniel C. Tirone and James Gilley 11-22-15 [Tirone is in the Department of Political Science, Louisiana State University, Gilley is in the Department of Political Science, Louisiana State University, Journal of Policing, Intelligence and Counter Terrorism, “Printing power: 3-D printing and threats to state security,” https://doi.org/10.1080/18335330.2015.1089636//ZW]

The current strategies for preventing the use of WMD by non-state actors have been predicated upon the idea that these groups lacked the technical expertise and infrastructure necessary for their construction. Barriers to fabrication allowed for a singular focus on states as the source of these types of weapons even as the aims of terrorist organizations evolved and the ability to inflict widespread destruction and mass casualties became operational goals. Current advances in the technology of additive manufacturing are already beginning to erode these restrictions and challenge non-proliferation regimes. Though holding promise for incredible advancements in areas of such as medicine, as 3-D printing evolves to the point where it can be used for the fabrication of more intricate structures, it also may enhance the ability of non-state actors to threaten states with the use of WMD. While the most significant developments are still some time away, it is not too early for states to begin assessing how to begin harnessing the benefits of these processes while countering their ability to be used for destructive purposes. The creation of effective security strategies to harness 3-D printing will be difficult, and is fraught with technical and legal hurdles. In the short term, such policies will likely continue to focus on preventing the procurement of base materials used in the manufacture of these weapons by non-sanctioned groups. As the requirement for specific compounds decreases with printers that can synthesize new material from base elements, these strategies will likely be replaced by attempts at controlling hardware itself. The ultimate challenge for states, however, is going to be preventing the dissemination of the blueprints necessary for the construction of WMD using 3-D technology. With numerous legitimate commercial and household purposes, printers of this nature may become as ubiquitous as laser and inkjet printers are today. Once the technology has become a part of everyday life and widely available, controlling the hardware may be an insurmountable task. At that point, governments may find themselves in the unenviable position of enforcing regulations preventing the spread of instructions for the production of WMD, a herculean task in the age of digital transmissions and instantaneous data sharing.

#### 3-D printers are bad--- laundry list.

Lyndsey Gilpin 03-05-2014 [Lyndsey Gilpin is a former Staff Writer for TechRepublic, covering sustainability and entrepreneurship, Tech Republic, “The dark side of 3D printing: 10 things to watch,” https://www.techrepublic.com/article/the-dark-side-of-3d-printing-10-things-to-watch///ZW]

As with any new technology, it’s easy to get swept up in the benefits of 3D printing. It opens up a world of new possibilities for all industries, and stands to lessen transportation costs, environmental impacts, waste, and reliance on corporations by enabling the maker movement. But 3D printers are still potentially hazardous, wasteful machines, and their societal, political, economic, and environmental impacts have not yet been studied extensively. To make sure you aren’t thrown off guard by the conversations to come, we’ve compiled a list of 10 things you need to know about the dangers and potentially negative impacts of 3D printers. 1. 3D printers are energy hogs When melting plastic with heat or lasers, 3D printers consume about 50 to 100 times more electrical energy than injection molding to make an item of the same weight, according to research by Loughborough University. In 2009, research at MIT’s Environmentally Benign Manufacturing program showed that laser direct metal deposition (where metal powder is fused together) used hundreds of times the electricity as traditional casting or machining. Because of this, 3D printers are better for small batch runs. Industrial-sized 3D printers may not be the answer to lessening our use of coal power any time soon. 2. Unhealthy air emissions 3D printers may pose a health risk when used in the home, according to researchers at the Illinois Institute of Technology. The emissions from desktop 3D printers are similar to burning a cigarette or cooking on a gas or electric stove. The 2013 study was the first to measure these airborne particle emissions from desktop 3D printers. While heating the plastic and printing small figures, the machines using PLA filament emitted 20 billion ultrafine particles per minute, and the ABS emitted up to 200 billion particles per minute. These particles can settle in the lungs or the bloodstream and pose health risk, especially for those with asthma. 3. Reliance on plastics One of the biggest environmental movements in recent history has been to reduce reliance on plastics, from grocery bags to water bottles to household objects that can be made from recycled materials instead. The most popular—and cheapest—3D printers use plastic filament. Though using raw materials reduces the amount of waste in general, the machines still leave unused or excess plastic in the print beds. PLA is biodegradable, but ABS filament is still the most commonly used type of plastic. The plastic byproduct ends up in landfills. If 3D printing is going to be industrialized, that byproduct or other recycled plastic needs to be reused. 4. IP and licensing deals In January, 3D Systems acquired Gentle Giant Ltd., which owned the licensing rights to toy franchises such as The Hobbit, The Walking Dead, Harry Potter, Alien, and Star Wars. Gartner has said that companies may lose at least $100 billion in four years to licensing or IP owners. 3D printing will change the business market—and the black market for these items—and the legislation will have to rush to catch up. This potential digital piracy situation is comparable to the way the internet challenged the movie and music industries for copyrights, trademarks, and illegal downloads. 5. Gun control loopholes The first successful 3D printed gun is old news, but its ramifications are very important. Companies are popping up around the world, attempting to sell these guns and/or the CAD designs for them. Engineering firm Solid Concepts has even fired rounds out of the first 3D printed metal gun. Congress’ Undetectable Firearms Act, which bans guns that can’t be detected by metal detectors or x-ray scanners, was renewed for 10 years. It left a loophole in the law, however: 3D printed guns with a tiny piece of metal aren’t banned by the Act. Legislators are attempting to close that loophole now, after Congress ignored the issue for quite some time, with special requirements for printed guns. 6. Responsibility of manufacturers Weapons can be 3D printed. So can safety equipment such as helmets, wheels for bikes, and toys for small children. Of course there is the issue of intellectual property and trademark, but the larger issue involves responsibility. If a person shoots a gun and harms or kills someone, stabs someone with a 3D printed knife, or breaks their neck while riding on a bike with a 3D printed helmet, who is held accountable? The owner of the printer, the manufacturer of the printer, or the irresponsible person who thought it was a good idea to produce and use an untested product? 7. Bioprinting ethics and regulation The conversations about the ethics of bioprinting have already begun. Organovo is printing liver cells as well as eye tissue cells in a partnership with the National Eye Institute and National Center for Advancing Translational Sciences. Scientists have also proposed mixing human stem cells with canine muscle cells to create enhanced organ tissue. Printing cartilage is still the most realistic type of bioprinting, and printing whole organs is still many years away, but 3D printing is growing in medicine quite rapidly. Conversations about the moral, ethical, and legal issues surrounding bioprinting have started, but they will inevitably cause a lot more controversy as it becomes more commonplace. 8. Possibility of 3D printed drugs Assembling chemical compounds on a molecular level using a 3D printer is possible. A researcher at the University of Glasglow created a prototype of a 3D “Chemputer” that makes drugs and medicine. He wants to revolutionize the pharmaceutical industry by allowing patients to print their own medicine with a chemical blueprint they get from the pharmacy. Of course, this is a very long way off, but it stands to enable DIY chemists to create anything from cocaine to ricin. 9. National security risks A white paper released from the National Defense University highlighted national security risks from 3D printing technology. Since there will be significant legal and economic implications on the business sector and 3D printers offer the ability to produce a wide range of objects that cannot be controlled yet, the paper noted that there are definitely national security risks that need to be analyzed in the near future. 10. Safety of items that come into contact with foodYou can print out a fork or spoon with your MakerBot, but if you use ABS plastic, it is not BPA-free. Luckily, new filaments that are safer to put in your mouth are being created for this specific reason, but they aren’t widely available yet. Many 3D printers have spaces where bacteria can easily grow if they aren’t cleaned properly, as well. In order to more safely-produced 3D printed food and kitchenware, there may be a need for an FDA-approved machine. People probably don’t want to eat genetically-engineered pizza off of toxic plates.

### 3D Printing Bad---2NC

#### Regulations won’t work--- existing state regimes will be circumvented.

Daniel C. Tirone and James Gilley 11-22-15 [Tirone is in the Department of Political Science, Louisiana State University, Gilley is in the Department of Political Science, Louisiana State University, Journal of Policing, Intelligence and Counter Terrorism, “Printing power: 3-D printing and threats to state security,” https://doi.org/10.1080/18335330.2015.1089636//ZW]

Advancements in the printing of conventional weapons pose many of the same challenges to existing firearm control regimes as the potential advances in the printing of WMD do for counter-proliferation strategies. In the USA, for example, a key principle of gun control focuses on the point of sale, requiring background checks for potential purchasers. Since production of high-quality firearms is beyond the capability of most gun users and is instead undertaken by professional manufacturers who then sell their weapons through retailers, this strategy relies on established networks to keep track of weapons in private hands as a means to prevent the sale of weapons to those individuals whose ownership of a gun may be judged to pose a threat to society. When individuals can fabricate their own firearms at the household level, however, this line of oversight is removed. Similarly, when individuals or groups can engage in the manufacturing of WMD without the need for state support, the existing regimes—which as discussed previously largely focus on preventing WMD produced by states from being transferred to non-state actors—can be circumvented. For example, efforts based on safeguarding weapons stockpiles or interdicting WMD at the border will be severely compromised by the ability of groups to print their own weapons within a state's borders beyond the watchful eyes of international weapons inspectors and allowing them to bypass customs safeguards. The ability to produce weapons outside of traditional fabrication channels also carries additional challenges for traditional weapons control regimes. One way states can discover covert programs to develop WMD is to look for common signatures. For example, states may monitor patterns of material and equipment imports into a rival to see if patterns associated with chemicals weapons production are present (US Congress, Office of Technology Assessment, 1993, pp. 38–10). Similarly, they might look for facilities which exhibit excessive levels of secrecy or security, or plants which are inconsistent with the general level of development of a country's industry, as possible signals of a biological weapons program (pp. 103–104). When WMD can be manufactured without the activities commonly associated with their production, the anonymity it provides would remove another channel by which foreign powers may intervene to mitigate the threat.12 For these reasons, advancements in additive manufacturing capabilities require a similar evolution in state security strategies. What these changes may look like will depend on the state of the technology, which allows us to separate strategies which may be effective in the near term from those which may be required further into the future.

#### Online instructions for weapons building will be impossible to erase.

Daniel C. Tirone and James Gilley 11-22-15 [Tirone is in the Department of Political Science, Louisiana State University, Gilley is in the Department of Political Science, Louisiana State University, Journal of Policing, Intelligence and Counter Terrorism, “Printing power: 3-D printing and threats to state security,” https://doi.org/10.1080/18335330.2015.1089636//ZW]

Attempts to limit the capabilities of printers are even trickier. Often, when a technological solution is attempted in order to lock material, it is quickly and easily subverted by individuals who disagree with the restrictions aimed at controlling how it may be used. These solutions are subsequently passed on to other parties who also have a stake in unlocking the devices. A simple example comes from Sony's attempts to impose a Digital Rights Management regime on audio CDs by Sony with their Key2Audio solution in 2002 (Rohde, 2001). This attempt to limit the copying of audio CDs onto computers was found to be quickly undone with a simple felt tipped pen run around the rim of the CD.13

Despite their potential limitations, strategies focusing on the hardware involved in additive manufacturing hold more promise than the options available for countering the other major threat which will develop with advances in the technology. As the ability to manufacture these weapons at the household level increases, information itself will become a threat to security. The publication of instructions on how to produce weapons is not new; such information has been around in various forms for some time, including the well-known example from the 1970s of the *Anarchist Cookbook* and its web-based successors.14 However, the utility of these instructions, even when publicly available, were largely limited by the ability of the end user to construct the final product. A lack of resources and technical expertise meant that all but the most rudimentary plans were beyond the capabilities of most, if not all, individuals who might be inclined to construct weapons based on information found online or in other forums. Once these barriers have been removed by a technology which requires nothing more than widely available inputs and the possession of a 3-D printer, creating and distributing programs facilitating the production of WMD will put these weapons within the reach of any willing consumer. Once it has made its way onto a public or private electronic platform, these plans will be largely beyond the capabilities of governments and other regulators to eradicate. Even if they are successful in removing them from widely available sites, they will likely be beyond their reach in the recesses of the ‘dark web’ and peer to peer file networking sites, which find multiple alternatives emerging whenever a single site is removed.

#### Terrorists will use 3-D printing--- it’s safer than current alternatives.

Gary Ackerman and Michelle Jacome 2018 [Dr. Gary Ackerman is an Associate Professor at the College of Emergency Preparedness, Homeland Security and Cybersecurity at the University at Albany. He is also the founding Director of the University of Maryland’s National Consortium for the Study of Terrorism and Responses to Terrorism (START) Unconventional Weapons and Technology Division. Ms. Michelle Jacome is the Deputy Director of START, PRISM , Vol. 7, No. 3, COUNTERING WEAPONS OF MASS DESTRUCTION (2018), pp. 22-37, “WMD Terrorism The Once and Future Threat,” https://www.jstor.org/stable/pdf/26470532.pdf//ZW]

The most dramatic near-term developments effecting the overall WMD threat picture are, however, likely to relate to the acquisition, production and weaponization of CBRN agents. A variety of technological trends, from miniaturization of manufacturing and turn-key systems to rapid prototyping and marginal cost reproduction—e.g. 3-D printing—could facilitate the production of WMD. In the past, producing sufficient amounts of nerve agent to constitute a chemical WMD required large equipment and dangerous reactants to be set up and monitored by experienced chemical engineers, with a dangerous leak or explosion a constant concern. The advent of new technologies like chemical microreactors (where precursor chemicals are combined under controlled conditions in miniature channels on a “chip”) could allow for self-contained production of small quantities of CW in a basement, with almost no hazard and far less vulnerability to detection by authorities. Stringing several of these modules together and operating them for extended periods, could still yield sufficient quantities for the desired level of mayhem. Another example is biotechnology “kits” that take much of the technical guesswork out of complex microbiological procedures and are even being marketed to high-schoolers.39 This phenomenon likely will eventually lead to WMD that can be produced more cheaply, more safely, and with a smaller operational footprint. For terrorists and other VNSAs, such developments will serve only to lengthen Archimedes’ proverbial lever when it comes to their asymmetric effects versus their state opponents.

#### 3-D printing enables nuke prolif.

Tristan A. Volpe 08-22-2019 [Defense Analysis, Naval Postgraduate School, Monterey, CA, Journal of Strategic Studies, “Dual-use distinguishability: How 3D-printing shapes the security dilemma for nuclear programs,” https://www.tandfonline.com/doi/full/10.1080/01402390.2019.1627210//ZW]

What is additive manufacturing and how might this emerging technology change the future of nuclear proliferation? This section reviews the technical features of the new production platform to identify how it promises to improve upon the existing pool of technologies used by nuclear programmes. Nuclear weapon states and civil nuclear suppliers are adopting the technology because it offers a more versatile and cost-effective way to fabricate components with complex designs that could not be made before with traditional methods. The concern is that these same benefits could turn into proliferation liabilities if the technology expands nuclear production options while blurring the distinction between peaceful and military applications. Additive manufacturing refers to a family of production technologies with two unique features.21 The first is the additive process of fabrication, whereby an object is built by laying down successive layers of material. This new principle stands in contrast to subtractive methods of manufacturing that use various cutting tools – such as lathes, mills and grinders – to remove material from a larger object. By building objects from scratch, additive manufacturing provides the ability to make components with complex geometries and special characteristics simply not possible before with subtractive machine tools. Many of the top aerospace, defence and nuclear firms are therefore adopting additive manufacturing to expand the available menu of production options. Second, additive manufacturing represents a leap forward in automation and supply chain optimisation because it leverages robotics, computation and network connectivity to fabricate components from digital build files. These blueprints contain the all of the design information needed to produce a final component, as well as the commands and specifications that guide the automated fabrication process itself.22 This type of cyber-physical manufacturing builds upon the previous generation of computer numeric controlled (CNC) subtractive machine tools, which still require skilled machinists with deep experience to operate. The ultimate goal of additive manufacturing is to capture this tacit knowledge in the digital realm, where it can be automated, saved and even transmitted to distant locations, thereby enabling parts to be printed on demand wherever needed. As a result, the digital nature of the technology promises to shrink down or even eliminate global logistics and supply chains. The taproot of the proliferation problem is that additive manufacturing is already being adopted by nuclear programmes to reap similar benefits. The nuclear laboratory complex in the United States is pioneering the adoption of AM because it believes the technology ‘could have broad impact across [nuclear] weapons components and materials.’23 Other nuclear weapons enterprises may be investing in the technology as well.24 On the civil nuclear energy side of the coin, enterprises in the United States, South Korea, Russia and China are exploring ways to integrate the technology into production lines. Early efforts are underway to fabricate the critical components at the heart of a nuclear reactor, from methods for 3D-printing nuclear fuel at Idaho National Lab to large metallic pressure vessels by the Chinese National Nuclear Corporation.25 Additive manufacturing offers these nuclear programmes an agile and efficient means of production, especially amid supply chain atrophy in the United States and Europe.26 Small batches of reactor components, for instance, can be difficult and expensive to source if they are produced using traditional methods, as producers often need long lead times to establish processes for forging and casting parts.27 In stark contrast, additive manufacturing plants can be quickly repurposed to fabricate parts without retooling production lines or interpreting designs.28 The ultimate goal is to leverage the digital nature of the technology to print nuclear certified parts, thereby reducing quality control concerns.29 If additive manufacturing technology continues to mature along its current trajectory, it could help lower the massive costs associated with new nuclear reactor projects or stockpile stewardship by providing a steady-state capacity to produce a wide range of certified nuclear components on demand. The concern is that these same features of additive manufacturing could enhance clandestine proliferation while making it difficult to verify the peaceful nature of nuclear energy programmes. For nuclear weapons-aspirants, this new production technology holds the promise of maturing in ways that (1) lower the barriers to entry, (2) accelerate and augment traditional development pathways, and (3) subvert detection and export controls. First, additive manufacturing could ‘significantly reduce the expert knowledge required to produce dual-use parts, as an increasing amount can be coded into digital build files.’30 One non-proliferation assessment concluded that, ‘the only true barriers to operationalizing 3D printing for the manufacture of illicit items involve obtaining the 3D printers themselves, the materials used in 3D printing, and the sensitive [digital build files].’31 Theft or transfer of these digital files could spread far more information about sensitive nuclear components than traditional blueprints. Second, additive manufacturing could shrink down development timelines or expand options for the production and weaponisation of fissile material. One of the main benefits of the technology is that it ‘promises to reduce lead times due to its ability to rapidly produce prototypes, facilitating testing and design processes.’32 Nuclear programmes could therefore accelerate the lengthy process of building up tacit knowledge and mastering production processes. Third, additive manufacturing could erode architectures for monitoring and regulating nuclear technology.33 In facilities equipped with additive manufacturing, for instance, ‘it is less obvious what is actually being built in comparison to a factory with subtractive tools, where casting molds or special tools are being used.’34 The digital nature of 3D-printing is even more worrisome, as it offers the ‘potential to produce any physical object based on technical data in the form of build files. These can be easily transferred using email or other means of electronic communication that are hard for authorities to detect and prevent.’35 Additive manufacturing could therefore ‘subvert traditional nodes of trade in the physical commodity supply chain or alter the ways that dual-use technology, knowledge, and skills are transferred around the world.’36 If illicit procurement networks exploit the technology to hide more deception points among commercial activities, it may become difficult to identify peaceful patterns of nuclear trade. Such a breakdown in export controls and intelligence ‘could both allow an undesirable transfer to take place and prevent the collection of information that could be used for verification purposes.’37 As a result, the integration of digital 3D-printing into above-board supply chains could erode confidence in peaceful commitments by nuclear energy programmes.

#### 3D printers release toxic particles and are bad for the environment.

Misha Gajewski 12-15-2020 [freelance journalist and a journalism professor at Seneca College, Forbes, “3D Printers May Be Toxic to Humans,” https://www.forbes.com/sites/mishagajewski/2020/12/15/3d-printers-may-be-toxic-to-humans/?sh=5d9f8f044338//ZW]

Several new studies found that 3D printers emit toxic particles that may be harmful to humans. The studies, presented at the 2020 Society for Risk Analysis virtual Annual Meeting on December 15, showed that the particles released during the printing process can affect indoor air quality and public health. For the uninitiated, 3D printers typically work by melting plastic filaments or other base materials such as nanoparticles, metals, thermoplastics etc. and then stacking the melted materials layer upon layer to form an object. When the plastic or other base materials are heated to melt they release volatile compounds into the air near the printer and the object. The chemical by-products and particles that are released into the environment during the printing process can build up the longer the process takes and some are small enough that they can infiltrate the lungs, causing damage. The studies presented today at the meeting looked at various types of emissions and how great the risk is. For example, two of the studies from the Environmental Protection Agency (EPA) analyzed the emissions from a 3D printer filament extruder - a device used to create 3D printer filaments - and then used a simulation model to see how many particles were produced, as well as where they were deposited when using a 3D printer in different age groups. The studies found that the filament extruder released amounts of small particles and vapors similar to those found in other studies of 3D printers, and the simulation model predicted higher deposition of particle mass per surface area in the lungs for children ages nine and younger. But more research is needed to determine how much the inhaled dose would be. Another one of the studies presented, conducted by Yong Qian from the National Institute for Occupational Safety and Health, looked at the potential toxicity of acrylonitrile butadiene styrene (ABS) emissions generated during 3D printing by examining human lung cells and rats exposed via inhalation. It revealed that the emitted particles cause moderate toxicity in human lung cells and minimal toxicity in rats. It’s also worth noting that while much of this research presented today is still early stages, it does add to the growing evidence of the potential toxicity of 3D printers. For example, research published last year found that both ABS and polylactic acid (PLA) particles negatively impacted cell viability, with the latter prompting a more toxic response. "The toxicity tests showed that PLA particles were more toxic than the ABS particles on a per-particle comparison, but because the printers emitted so much more of the ABS — it's the ABS emissions that end up being more of the concern," said Rodney Weber, a professor in Georgia Tech's School of Earth & Atmospheric Sciences, who led the research. "Taken together, these tests indicate that exposure to these filament particles could over time be as toxic as the air in an urban environment polluted with vehicular or other emissions." The study also found that the hotter the temperature required to melt the filament, the more emissions were produced and ABS particles emitted from the 3D printers had chemical characteristics that were different than the ABS filament. "When the filament companies manufacture a certain type of filament, they may add small mass percentages of other compounds to achieve certain characteristics, but they mostly do not disclose what those additives are," Weber said. "Because these additives seem to affect the amount of emissions for ABS, and there can be great variability in the type and amount of additives added to ABS, a consumer may buy a certain ABS filament, and it could produce far more emissions than one from a different vendor." This is important especially as 3D printers become more commonplace in homes, schools and other places where people spend a significant amount of time. "To date, the general public has little awareness of possible exposures to 3D printer emissions," said Peter Byrley, one of the lead authors of the EPA studies, in a statement. "A potential societal benefit of this research is to increase public awareness of 3D printer emissions, and of the possibly higher susceptibility of children." And 3D printing might not just be harmful to humans, another study conducted by Joana Marie Sipe from Duke University, found that the bi-products from the plastics made by the printer can also be damaging to the environment. For the study, Sipe developed a machine that can measure how much a plastic product, like a water bottle, can break down through rubbing and sanding during use and in the environment. The plastic particles were then fed to fish to see the effects that the nanoparticles in the plastic had on their organs. What she found was that when the plastics breakdown, the nanomaterials that were incorporated become exposed to the environment. The researchers were able to predict the percentage of nanoparticles that came out of the plastic when they were eaten by the fish, providing a Matrix Release Factor (MRF) which could be used to find out the quantity of plastic and nanoparticles that are released when someone chews a product or when it breaks down in the ocean. "This research can help set regulations on how much nanomaterial fillers can be added to particular consumer products, based on their MRF value," said Sipe in a statement. "The data can help determine how much plastic and/or nano-filled products release contaminants into the environment or the human body." So while 3D printing makes numerous products more readily available, and at cheaper costs, as we’ve seen with the manufacturing of Covid-19 face shields, respirators and other personal protective equipment, it’s important to consider the potential risks. And as 3D printing technologies become more widespread, regulators, manufacturers, and users may need to focus their attention on better managing those risks. For example, some measures that can be taken by operators of 3D printers to lessen their impact on air quality include: Operating 3D printers only in well-ventilated areas Setting the nozzle temperature at the lower end of the suggested temperature range for filament materials Standing away from operating machines Using machines and filaments that have been tested and verified to have low emissions.

#### 3D printers cause cancer.

Sharon Roney, Amelia Klein, and Andrew Hart 10-11-2016 [SHARON RONEY is library administrator, AMELIA KLEIN is a librarian, and ANDREW HART is reference librarian for the Ohio Bureau of Workers’ Compensation, Division of Safety and Hygiene, in Columbus, American Libraries, “The Health Effects of 3D Printing,” https://americanlibrariesmagazine.org/2016/10/11/the-health-effects-of-3d-printing///ZW]

As makerspaces and fab labs increase in popularity, more and more libraries are adding 3D-printing capabilities. According to a 2015 American Library Association (ALA) report, 428 public library branches have made this technology available. Some potential issues of 3D printing, such as the threat of printing weapons and copyrighted works, are often considered. However, discussion of the health hazards associated with 3D printing is rare. Ultrafine particles and volatile organic compounds Several studies have shown that 3D printers produce high amounts of ultrafine particles (UFPs) and volatile organic compounds (VOCs) while in use, and that these particles and vapors are detectable for many hours after the printers have been shut off. UFPs have been linked to adverse health conditions, such as asthma and cardiovascular issues, because they can pass through the lungs and travel to other organs. They can also transfer toxic material into the body, including blood and tissue cells. The US Environmental Protection Administration has classified many VOCs as toxic air pollutants. Exposure to certain VOCs, such as benzene and methylene chloride, has been linked to cancer. UFPs and VOCs are produced by thermal decomposition when a 3D printer heats and melts a plastic filament. The most popular filaments used in 3D printing are acrylonitrile-butadiene-styrene (ABS) and polylactic-acid (PLA) filaments. Brent Stephens conducted one of the first studies on desktop 3D printer UFP and VOC emissions in 2013 in the journal *Atmospheric Environment*. Since then, several other studies have tested 3D printers, using both ABS and PLA filaments. Most of the studies were conducted with low-cost 3D desktop printers, the kind that libraries are most likely to purchase. The studies concluded: 3D printing raises the levels of UFPs dramatically in the printer’s area of operation. Low-cost desktop 3D printers and filaments may produce higher amounts of UFPs and VOCs than more expensive brands. ABS filaments produce more particle emissions than PLA filaments. Even with an enclosure, nonventilated 3D printers only see a small reduction in UFP emissions. The carcinogen styrene is produced by ABS filament heating. The hazardous chemical methyl methacrylate is produced by PLA filament heating. As a 3D printer ages it produces higher emissions of UFPs and VOCs. All of the studies concluded that 3D printers should be placed in well-ventilated areas to limit exposure to UFPs and VOCs. Some 3D printers have built-in ventilation systems; libraries should purchase these over nonventilated, less expensive versions. ABS and PLA food safety The main food safety concern with 3D printers is bacterial growth due to small fissures in printed objects. Items made by 3D printers are porous, allowing bacteria to grow over time and to potentially become a health hazard. Also, children playing with 3D-printed objects run the risk of coming into contact with bacteria growing on the object after it has become soiled. Cleaning the object might prove difficult because high dishwasher temperatures can melt or warp the item (especially with PLA-printed objects). Some filaments (other than ABS and PLA) are food safe, including polyethylene terephthalate (PET), which has been FDA approved for direct food contact. ABS-created plates, cups, and utensils can transfer dangerous chemical residues, including 1,3-butadiene, a probable human carcinogen that can cause irritation to skin and mucous membranes through contact with food. Also, UFPs and other residues from the 3D printing process could still be on the printed material. These levels are small but should still be of concern to those using 3D-printed material as dinnerware. As new studies are conducted, we will continue to learn more about the hazards of using this technology, as well as the ways we can protect ourselves and our patrons from short- or long-term health effects. Until additional data is available, library staffers should do the following to reduce their exposure to UFPs and VOCs: Use 3D printers with either built-in ventilation or in well-ventilated areas. Keep patrons from up-close monitoring of printing activity for long periods. Carefully consider the risks associated with the type of plastic filament used in devices. Restrict patrons’ printing of items that could be used around food, such as utensils and plates. Follow manufacturer’s instructions. Libraries or any public space providing or considering 3D-printing services should evaluate their space and printing policies to ensure this technology is used as safely as possible. Free safety consulting programs are available through many state workers’ compensation systems.

### 3D Printing Regs Bad---1NC

#### 3D printing solves the housing crisis.

Jacob Bruggeman 03-22-2019 [Writing for Real Clear Politics, Real Clear Politics, “How 3D Printing Could Fix the Housing Crisis,” https://www.realclearpolicy.com/articles/2019/03/22/how\_3d\_printing\_could\_fix\_the\_housing\_crisis\_111134.html//ZW]

A growing number of people have no home to call their own. As home prices rise in cities from coast to coast — in massive metros like Los Angeles to New York and once-affordable cities in the Midwest like Boise and Grand Rapids — young couples are downsizing the American dream. Among advocates and policymakers, there’s a growing consensus that housing ought to come first in the fight to end homelessness, but America’s stock of affordable housing is dwindling, and many homeless people are left aging and catching “Medieval diseases” on our city streets. It might seem surprising, but technologies like 3D-printing could be a solution —keeping Americans off city streets, and solving the affordable housing crisis. But government regulations are getting in the way. Right now, there simply isn’t enough affordable housing in America for those demanding it. A recently released a report from the nonprofit Up For Growth on housing underproduction found that, between 2000 and 2015, the U.S. produced 7.3 million fewer homes than it needed to keep up with population growth and consumer demand. In 2015, the U.S. Department of Housing and Urban Development reported that there were only 62 affordable rental homes for every 100 “very low-income” households, and a meager 38 affordable homes for every 100 households with “extremely low incomes.” Whether you need an affordable home or rental, there’s a shortage in the supply. 3D-printing has the potential to meet the demand. One company, ICON, is using trailblazing 3D printing technology to provide cost-effective, beautiful, and safe homes — homes that cost under $10,000 and can be constructed in under 24 hours. The ICON model showcased at the 2018 South By Southwest festival is 650 square feet and consists of a living room, kitchen, bedroom, bathroom, and shaded porch that combine to offer consumers chic digs. And, at 650 square feet, these houses reduce Americans’ carbon footprints. ICON is one of many companies attempting to deploy 3D-printing in solving the affordable housing crisis and fighting homelessness. Yet these companies confront a persistent and pernicious obstacle in zoning laws. In Austin, Texas, housing industry expert Eldon Rude noted the challenge ICON faces in “obtaining the necessary zoning and entitlements to build these [3D-printed] homes.” S-Squared 3D Printers in Patchogue, New York, weren’t even able “to test-print an entire home due to zoning and building requirements in the village.” While American policymakers and zoning administrators quibble about whether or not 3D-printed 650 square foot homes should be allowed in their communities, the United Arab Emirates (UAE) is planning a 3D-printed skyscraper. Countries like the UAE will happily take the lead in developing this technology if America does not. To be clear, regulation of some kind is obviously necessary, but it must be reduced and simplified. For example, scholars at libertarian think tank the Mercatus Center argue that a key to economic revival in Scranton, Pennsylvania, is a citywide policy of “permissionless innovation,” or a regulatory openness to novel business models and technologies. Communities both large and small should reassess their zoning rules, land-use regulations, and permitting requirements with the aim of encouraging innovative construction methods and housing ventures rather barring them. 3D printing has the potential to increase the number of affordable houses in America, and quickly, too. Permitting businesses to experiment with new, affordable construction methods and housing ventures will result in more affordable homes and more housed Americans. This is not the kind of grand plan we are prone to seek in politics, but it is a strong step toward increasing Americans’ access to affordable housing. If Americans are serious about curbing the affordable housing crisis, they should lobby their local governments to simplify and revise their zoning laws to allow for 3D-printing in construction. The millions of Americans looking for affordable, dignified homes cannot wait any longer.

#### The housing sector is key to the economy.

Min Zhu 06-05-2014 [Deputy managing director at IMF, International Monetary Fund, “Housing Markets, Financial Stability, and the Economy,” https://www.imf.org/en/News/Articles/2015/09/28/04/53/sp060514//ZW]

1. Let me begin by thanking the Bundesbank and the German Research Foundation for organizing this conference with us. 2. I will make three points in my remarks: First, housing is an essential sector of the economy but also one that has been the source of vulnerabilities and crises. Hence, while the recent recovery in global housing markets is a welcome development, we need to guard against another unsustainable boom. Second, detecting over-valuation in housing markets is still more of an art than a science. Broad measures, such as house price to rent ratios, provide a first pass. But detailed analysis and judgment are needed to make a call about overvaluation. Third, the policy toolkit to manage housing booms is still under construction. A variety of tools have been used and the evidence suggests some short-run success. But more analysis and sharing of experience are needed on what works and what doesn’t. Conferences of this kind are useful in adding to our stock of knowledge. Role of the housing sector 3. Let me elaborate on these three points, beginning with the role of the housing sector. Food, clothing, shelter: these are traditionally thought of as basic needs of mankind; so the housing sector satisfies an essential need. Housing is also of course an important component of investment. And in many countries housing makes up the largest component of wealth. For instance, in the United States, real estate account for roughly a third of the total assets held by the nonfinancial private sector. The majority of households tend to hold wealth in the form of their homes rather than in financial assets: in France, for example, less than a quarter of households own stocks but nearly 60 percent are homeowners. 4. Housing also plays other key roles; for instance, mortgage markets are important in the transmission of monetary policy. Adequate housing can also facilitate labor mobility within an economy and help economies adjust to adverse shocks. In short, a well-functioning housing sector is critical to the overall health of the economy. And as economies develop, we expect a corresponding deepening and growth of housing markets. 5. Despite its importance, however, the housing sector has not received adequate attention from macroeconomists. As Ed Leamer once noted, leading textbooks in the field often did not have any mention of the housing sector. Of course, all that has changed since the Great Recession. The bursting of the real estate bubble in the United States was followed by the deepest global downturn since the Great Depression. It reminded people of the collateral damage that can be triggered by housing collapses. 6. Indeed, all through history, housing booms and busts have quite often been detrimental to both financial stability and the real economy. Many major episodes of banking distress have been associated with boom-bust cycles in property prices. IMF research shows that of the nearly 50 systemic banking crises in recent decades, more than two thirds were preceded by boom-bust patterns in house prices. The cost of resolving housing crises can be very high—in the case of Ireland, for instance, government bailouts of banks from the housing collapse ate up 40 percent of the country’s GDP. In contrast to housing cycles, boom-bust cycles in stock prices are much less likely to trigger systemic banking crises. 7. Even when housing busts do not have a large financial stability impact, they can affect the real economy. Research shows that recessions in OECD countries are more likely given a house price bust. Such recessions also tend to be much deeper and generate more unemployment than normal recessions. In short, there is abundant evidence that housing cycles can be a threat to financial and macroeconomic stability. Hence it is crucial to keep an eye on current housing market developments to keep them from going through another boom-bust cycle. Detecting overvaluation in housing markets 8. So where do housing markets stand today? House prices and residential investment declined in many countries at the onset of the Great Recession. Since then, there has been a rebound. Overall, house prices are inching up again: the IMF’s Global House Price Index has increased for the last seven quarters in a row. Over the past year, 33 out of 51 countries in our index showed increases in house prices. In some cases house prices are recovering from a sharp correction during the Great Recession. In other cases, house prices have continued an upward march with only a bit of moderation during the Great Recession. 9. Have these developments moved house prices closer to or further away from economic fundamentals? One common first pass attempt to answer this question is by looking at long-run valuation ratios. Theory asserts that house prices, rents, and incomes should move in tandem over the long run. If house prices and rents get way out of line, people would switch between buying and renting, eventually bringing the two in alignment. Similarly, in the long run, the price of houses cannot stray too far from people’s ability to afford them––that is, from their income. The ratios of house prices to rents and incomes can thus provide an initial check on whether house prices are out of line with economic fundamentals. 10. What does the evidence show? Among the OECD countries, these ratios remain well above the historical averages for a majority of countries. This is true for instance for Australia, Belgium, Canada, Norway and Sweden. This evidence provides a broad indication of housing market valuation. But one cannot assess overvaluation from this evidence alone. Whereas the long-run relationships do generally act as an anchor, house prices often drift away from them strongly and for long periods. Demand momentum leads to increases in house prices, particularly in situations where the supply of housing cannot be adjusted quickly due to geographical or other constraints. Judgments about housing valuation thus require supplementary information, such as credit growth, household indebtedness, lender characteristics, and the method of financing. 11. Of all these potential indicators of the risk of a boom-bust cycle, IMF research suggests it is particularly important to monitor credit growth. We find that there is a distinguishing feature of real estate booms that go ‘bad’: this feature is the coincidence between the housing boom and the rapid increase in leverage and exposure of households and financial intermediaries. During the global financial crisis, nearly all the countries with “twin booms” in real estate and credit markets—21 out of 23 countries that we analyzed—ended up suffering from either a financial crisis or a severe drop in GDP growth relative to the country’s pre-crisis performance. In contrast, of the seven countries that experienced a real estate boom but not a credit boom, only two went through a systemic crisis and these countries, on average, had relatively mild recessions. 12. IMF staff are thus increasingly paying attention to credit growth, along with several other country-specific features of the housing market. In recent months, IMF staff have provided detailed judgments about housing markets for Australia, Israel and Canada, which are all countries where the broad measures of valuation are high. We have also provided assessments for many emerging market economies in Asia and Latin America, where mortgage credit and house price growth remain strong, and house prices in metropolitan areas show signs of overheating. In some cases, this more detailed look suggests much more modest overvaluation than indicated by the house price to income and house price to rent ratios. One example of this is Belgium, where the IMF concluded that despite the high valuation ratios, risks of a sharp correction of real estate prices appear contained. These country-specific factors for housing cycles suggest that the policy response cannot be ‘one size fits all’. Constructing a policy toolkit 13. With that, let me move to the third—and last—part of my remarks: the role of policies to contain housing booms. At the outset, let me note that this is part of a broader discussion of the appropriate role for monetary policy in the ‘new normal’. While many aspects of this role remain under active discussion, on thing is clear: monetary policy will have to be more concerned than it was before with financial stability and hence with housing markets. The era of ‘benign neglect’ of house price booms is over. 14. That said, regulation of the housing sector involves a complex set of policies. The noted economist Avinash Dixit suggested we use the acronyms “MiP, MaP, MoP” to remind ourselves of the set of policies. ‘MiP’ stands for microprudential policies, which of course aim to ensure the resilience of individual financial institutions. Such policies are necessary for a sound financial system but may not be sufficient. Sometimes, actions suitable at the level of individual institutions can destabilize the system as a whole. Hence we also need not just ‘MiP’ but ‘MaP’, that is, macroprudential policies aimed at increasing the resilience of the system as a whole. 15. The main macroprudential tools that have been used to contain housing booms are limits on loan-to-value (LTV) ratios and debt-to-income (DTI) ratios and sectoral capital requirements. Limits on LTV ratios cap the size of a mortgage loan relative to the value of a property, in essence imposing a minimum down payment. Limits on DTI ratios restrict the size of a mortgage loan to a fixed multiple of household income. The hope is to thereby contain unaffordable increases in household debt. Such limits have long been in use in some economies. For example, Hong Kong SAR has operated an LTV cap since the early 1990s and introduced a DTI cap in 1994. In Korea, LTV limits were introduced in 2002 and DTI limits in 2005. During and after the global financial crisis, over 20 advanced and emerging economies all over the globe have followed the example of Hong Kong SAR and Korea. 16. Evidence thus far suggests that these measures are somewhat effective in cooling off both house prices and credit growth in the short run. They are able to break the financial accelerator mechanism that otherwise leads to a positive two-way feedback between credit booms and housing booms. But more fine tuning of these measures is needed. Macroprudential measures need to take into account the ability of market participants to circumvent some of the limits on leverage. In some countries, such as in Canada, LTV limits usefully distinguish between owner-occupied vs. investor mortgages. 17. Another macroprudential tool is to impose stricter capital requirements on loans to a specific sector such as real estate. This forces banks to hold more capital against these loans, discouraging heavy exposure to the sector. In many advanced economies such as Ireland and Norway, capital adequacy risk weights were increased on mortgage loans with high LTV ratios. Sectoral capital requirements have also been used in a number of emerging markets such as Estonia, Peru, and Thailand. Evidence suggests that while this tool increases resilience from additional buffers, its ability to curb credit growth is mixed. Some IMF work suggests that higher capital requirements on particular groups of mortgage loans have some success in curbing house price growth in countries like Bulgaria, Croatia, Estonia, and Ukraine. 18. There are a number of reasons why higher capital requirements may be less effective in containing credit growth. First, when banks hold capital well above the regulatory minimum, lenders may not need to make any change in response to increases in risk weights. This often happens during housing booms when policymakers hope the tool to be most effective. Second, when lenders compete intensely for market share, they may internalize the costs of higher capital requirements rather than impose higher lending rates. 19. Macroprudential tools may also not be effective to target housing booms that are driven by the shortage of housing or by increased housing demand from foreign cash inflows that bypass domestic credit intermediation. In such cases, other tools are needed. For instance, stamp duty has been imposed to cool down rising house prices in Hong Kong SAR and Singapore. Evidence shows that this fiscal tool did reduce demand from foreigners who were outside of the LTV and DTI regulatory perimeters. In other instances, high house prices could reflect supply bottlenecks, and hence the effectiveness of demand-focused instruments may be limited. In such cases, the mismatches should be fundamentally addressed by measures to increase the supply of housing. 20. Along with micro and macroprudential policies, we need ‘MoP’: monetary policy. It is often said using policy interest rates is a blunt tool for containing house price booms. But as I noted earlier, housing booms have often coincided with a generalized private credit boom. This suggests that monetary policy could be an important tool in many cases in support of macroprudential policies. It is true, however, that in many relevant cases at the moment, policy interest rates have to remain low to support economic recovery. Conclusion 21. Let me conclude. Housing booms have different characteristics across countries and time periods. What is common is that when the bust comes, it very often damages financial stability and the real economy. The tools for containing housing booms are still being developed. The evidence on their effectiveness is only just starting to accumulate. The interactions of various policy tools can be complex. But all this should not be an excuse for inaction. The interlocking use of multiple tools might overcome the shortcomings of any single policy tool. We need to move from “benign neglect” to an “all of the above” approach when it comes to policy choices. 22. It is only by maintaining an open dialogue on these issues that we will gain a solid understanding of how policies can contain housing booms. International coordination is also essential, since housing booms in one country can be fed by credit market developments abroad. The IMF intends to do its part. As I mentioned, assessments of housing markets are becoming a regular feature of our country reports. We also report on housing markets through our flagship publications, the World Economic Outlook and the Global Financial Stability Report, as well as through other reports to our Executive Board. We are working with other agencies to improve housing statistics. Next week, we are launching a new webpage where all this work will be given a home. I encourage you to visit the new Global House Watch page on imf.org over the coming weeks and see what we have to offer and to tell us how to do better. 23. The IMF is also contributing to the sharing of cross-country experiences through regular consultations with policymakers and experts. We held a successful conference last November, co-organized with the Federal Reserve Bank of Dallas, on housing issues. And I have no doubt that this conference will be just as successful. Thank you.

### Regs Bad Link---2NC

#### Government regulation is a roadblock to the industry.

Harvard Business School 11-13-2018 [“Does a 3D Printing Startup Have a Solution to the Affordable Housing Epidemic,” https://digital.hbs.edu/platform-rctom/submission/does-a-3-d-printing-startup-have-a-solution-to-the-affordable-housing-epidemic/#//ZW]

Does additive manufacturing have the potential to resolve the affordable housing epidemic in our country? Dr. Berok Khoshnevis from the University of Southern California and founder of Contour Crafting (“Contour”) certainly believes so. He is currently working on completing a robot that uses additive manufacturing to create structures with applications ranging from housing construction to space colonialization. Additive manufacturing, commonly referred to as 3-D printing, is the process of creating 3-D items using digital code and this advance in manufacturing is emerging as a megatrend affecting industries from fashion to medicine. However, instead of printing plastic objects, Contour plans to print buildings with a computer-controlled robot that creates hollow walls and then fills them with concrete until the structure on the code is complete. Critics argue that 3-D printing will only serve a niche market within the construction industry allowing for new architectural experimentation, but Contour believes differently as it seeks to harness the technology to drive social change.[i] Contour Crafting is focused on using 3-D printing to transform the construction industry by reducing costs, saving time and increasing accessibility. Some of the key cost components of a development project include raw materials, financing expenses and labor costs, and Contour’s 3-D printing approach proclaims to be more cost efficient compared to traditional construction by achieving cost savings in each category. The 3-D printing approach eliminates waste of raw materials because each raw material is close to 100% utilization due to the precision from the computer enabled machine. By comparison, traditional construction creates over $30 billion in wasted raw materials annually since resources are not utilized as efficiently.[ii] 3-D printing can also shorten the project length from months to one day and thus reduces the required financing costs needed to fund the project as well as the opportunity cost of pursuing the project. Finally, 3-D printing reduces the amount of physical labor needed to complete a project and instead requires more “intellectual” labor to supervise the machine and construction progress. As a result of these cost savings, Contour believes it can construct a house for $50 per square foot compared to $150 per square foot for traditional construction in a fraction of the time.[iii] [iv] Contour believes this potential breakthrough technology could impact the industry not only by reducing costs and project durations, but also by altering consumer behavior and transforming the industry into a do-it-yourself (DIY) consumer market for development. In theory, this technology could radically improve the accessibility of home development by allowing people to rent the equipment in order to print their own homes in a day. In addition, the technology could be applied to address the affordable housing epidemic in our country where millions of low-income citizens are spending 70% or more of their income on shelter and new housing construction caters to more affluent citizens.[v] Contour’s technology could also print homes quickly as part of natural disaster recovery plans following earthquakes, wildfires or hurricanes and the US Department of Defense recently awarded Contour with a Rapid Innovation Fund contract to fund research supporting these technology applications.[vi] In the short term, the company needs to focus on R&D and the development of a working prototype that can demonstrate the building process, all of the proclaimed efficiencies and ultimately complete a home that people would be willing to inhabit. In the medium term, Contour will need to identify its main target market since the target customer will influence the product development iterations. For example, Contour could develop the printers and license them to housing developers, market them directly to consumers and establish a DIY market or it could print houses itself and collaborate with the government to provide housing in areas most in need. Each strategy would impact the development of the product because each potential user could have varying needs from the level of customization of the project to the scale of the potential construction project. In addition, there would be different regulatory hurdles associated with each path since the construction industry is burdened with regulation from zoning requirements to permits. Finally, Contour needs to emphasize quality control when designing these homes if its long-term goal is to provide a solution for unaffordable housing. Without top quality, there will be a distrust of this product and it would be difficult to garner support of these printed homes from the government and the public as a viable solution to unaffordable housing. Some additional questions to consider include: Can construction ever truly become a consumer DIY market? How should Contour Crafting think about employment in the construction industry and the negative consequences of job displacement from this new technology? Who should be part of the decision-making process if this technology is used to solve affordable housing shortages and what is the best approach for designing that process?

#### Regulation is the biggest issue in the market.

Jarett Gross 03-29-2020 [Construction tech correspondent, Automate Construction, “Regulation and Permitting for 3D Printing,” https://automate.construction/2020/03/29/regulation-and-permitting-for-3d-printed-construction///ZW]

The biggest issue with the 3-D printed construction market right now is regulation. Enormous unions that are stuck in old ways have had influence over construction standards and regulations in America over the past two decades. There has yet to be a legally permitted residence 3-D printed in America. However there are other countries with fewer regulatory hurdles that have already 3-D printed structures completed with people living in them currently. Most notably a project done by Icon Build and New Story in Ecuador. These strict regulations could take decades to change, that is why the cost of the specialized concrete needs to go down so that the technology can be a significant enough improvement to convince legal officials to permit 3-D printed construction. If all goes well it could be a matter of a few years until it is evident these structures are strong and safe enough to allow humans to live in them.The best markets for 3-D printing construction are southern areas where the temperature rarely goes below freezing. If the temperature rarely goes below freezing then it is not necessary to pour extremely deep concrete or drill down to the bedrock in order to have a structurally secure building. If the leaders of your municipalities in states like Texas or Florida want to champion this technology there is certainly that opportunity. It is likely that the first region to adapt this technology wilI have an economic boom with the quantity of high-quality unique affordable housing that this technology has to offer. In some countries in Europe, plans are already underway to build complete 3-D printed villages. These towns are a very exciting opportunity for this technology to demonstrate its practicality.The people who need this technology most are people in impoverished countries. Unfortunately those countries are often the last to receive the benefits of new innovations. It is challenging to do even nonprofit projects in these regions because often times the government officials or imposters are so corrupt that they expect to be paid to allow you to do charity work uplifting their communities. If not the government, there are often rogue rebel groups that will cause issues and delay if not stop completely your progress and mission. Without a seasoned overseas non-profit veteran on the team it is a dangerous and treacherous and environment to pursue. In my opinion the best way to make this technology mainstream is for the current companies that have built printers to focus on printing things that don’t require complicated permits. Many products come to thought, you could build a fireplace, a bench, a fountain or other water feature, a planter wall, a retaining wall, highway barriers, a shed, an outdoor standalone garage, the list goes on and on. If companies can produce these products to be attractive to consumers from both a quality and cost standpoint then it could be the optimal way to introduce the public to this technology of the future and get them comfortable with it so that when the time comes that these robots are building their new home they feel safe and excited to moving.As this technology improves new ideas constantly come along for applications that drastically improve the efficiency compared to traditional construction methods.

### Regs Bad Internal---2NC

#### Affordable housing is key to the economy.

Habitat for Humanity ND [“The impact of housing affordability on the economy,” https://www.habitat.org/costofhome/housing-affordability-and-economy//ZW]

Greater tax generation, creation of jobs, opportunities for economic development, increased job retention and productivity, and the ability to address inequality — all are among the economic benefits of increased access to quality, affordable housing. A 2004 report showed a harmful link between high housing costs and employee recruitment, productivity and retention, which hurts businesses and a community’s economy. Since then, the impact of high housing costs in the U.S., both rental and homeownership, has only grown. Freeing our local, state and national economies from the drag created when housing is unaffordable helps everyone. Hear more from these economists, housing experts and public officials about just some of the economic impacts of housing. Economic development “Pittsfield is a post-industrial New England city of 45,000 people that is rebuilding after a long period of economic decline. We were a one-company town that has had to work on building a diverse economy. We can see how not investing in several of our neighborhoods with concentrated poverty is diminishing the value of the housing. We now need to turn our attention to rebuilding our neighborhoods. “I am a firm believer that job creation, business development and stabilized neighborhoods are all part of economic development. In my position, I talk to business leaders. I talk to residents. A common theme that I hear is that we have inadequate housing for business expansion. If we want to get our arms around solving both of those problems, then housing is certainly part of the economy. — Linda Tyer, mayor of Pittsfield, Massachusetts Income inequality “As the cost of housing goes up in a community, people may not be able to afford to live there so they move further out. Moving further away from hot markets may be stopping people from working in locations with higher wages. This impedes the ability of businesses to hire workers and is not good for local economies. “The higher cost of housing in markets with higher wages also may be exacerbating income inequality because less-educated and lower-income households are particularly the ones likely unable to afford housing in the denser, higher-cost areas. While local decisions may be key drivers in the higher cost of housing, the drag on the economy and its contribution to greater income inequality is playing out on the national stage.” — Katherine O’Regan, *New York University Wagner* professor of public policy and planning “We as a country always act like we can’t find the money to solve this home affordability crisis, which implies that we are not spending it now. We are spending it now. We are just spending in on adverse health and bad outcomes.” — Dr. Megan Sandel Attracting and keeping business and manufacturing “Home affordability is an economic issue. Take Indiana, my state, which is one of the top manufacturing states in the Midwest. “Manufacturers have been screaming because they have the factory jobs, but the communities where they do business don’t have enough affordable workforce housing — homes between $100,000 and $250,000. We have a giant auto plant in Southern Indiana but not enough affordable housing to keep up with the demands of the manufacturer or the vendors that work with them. The bankers are screaming because they have money to lend families, but there’s not enough housing that the workers can afford. “The Chamber of Commerce is saying, housing that is affordable doesn’t just help families — it helps the local government. When we get families into homes, they can begin paying property taxes. And if they have a home that they can afford, they have more expendable funds to spend on food and other consumer goods. They help local businesses because they can afford to eat in restaurants and shop in stores.” — Gina Leckron, *Habitat for Humanity Indiana* state director Additional “hidden” costs “We have used some of our research out of Children’s HealthWatch, a research policy network based at Boston Medical Center, to ask, ‘What health care and educational costs could be avoided if all families with children lived in a stable home?’ We estimated that number at $111 billion over 10 years. “This is based on the health-related costs of mothers and children who have either experienced homelessness, moved two or more times or been behind on rent in the previous year. The costs linked to unstable housing include increased hospitalizations, ambulatory visits, dental procedures, mental health care for mothers and special education services for children. “We as a country always act like we can’t find the money to solve this home affordability crisis, which implies that we are not spending it now. We are spending it now. We are just spending in on adverse health and bad outcomes.”

## 5G Bad

### 5G Bad---1NC

#### 5G could be weaponized to exterminate the human race.

Paul Romano 06-08-2018 [Writing for G. Edward Griffin’s Need to Know, Need to Know, “Will 5G Technology Bring About Human Extinction?” https://needtoknow.news/2018/06/will-5g-technology-bring-human-extinction///ZW]

5G technology that utilizes electromagnetic waves that are smaller than 4G technology is being built and installed despite not having been tested by the government or the industry for negative health effects. Joe Imbriano warns that 5G technology will broadcast at 60 GHz, which is the absorption spectrum of oxygen molecules, which means it can kill at a distance. At the molecular level, these frequencies affect the orbit of electrons, and that affects the ability of blood hemoglobin to bind with oxygen. If blood cannot hold oxygen, the result is death by suffocation. In short, 5G technology has the potential of being used as a weapon to quickly weaken, disable, or destroy individuals or populations. In addition to the suffocation effect, extermination of the entire human race is theoretically possible because of the effect of electromagnetic radiation on fertility. Since 1970, the sperm count in US males has dropped by 60%, which is approaching the point where men can no longer reproduce. Paul Romano says that a major contributor to the drop in fertility is the fact that men carry radiation-producing cell phones in pants pockets close to the reproductive organs. -GEG

### 5G Bad---2NC

#### 5G radiation increases infertility and birth defects.

Lloyd Burrell 10-17-2019 [Writing for Green Med Info, Green Med Info, “Citizens Up in Arms Against 5G Wireless Technology Roll Out: Are Their Concerns Justified?” https://greenmedinfo.com/blog/citizens-arms-against-5g-wireless-technology-roll-out-are-their-concerns-justifie//ZW]

City council chambers and local officials in the US are facing the outcry of residents frightened by the next generation 5G wireless communications which by all accounts, will be taking over neighborhoods soon. A resident in Montgomery County, Maryland raised her voice to ask local officials “Why can’t we do a real health assessment here and find out what the real health risks are — to our children?” at a public meeting held at the county [9]. What are the risks? More to the point what is 5G? What is 5G? The 5th generation wireless systems (5G) are new network technologies designed to make your cell phone and similar wireless devices become super-duper powerful and fast. Scheduled to be deployed from 2018 and made commercially available in 2020 [2] we are told 5G is expected to support at least 100 billion devices and up to 100 times faster than current 4G technology. (4G is already about 10 times faster than 3G). The 5G tech will employ low-(0.6 GHz - 3.7 GHz), mid-(3.7 – 24 GHz), and high-band frequencies (24 GHz and higher). The “high-band” frequencies largely consist of millimeter waves (MMWs), a type of electromagnetic radiation with wavelengths within 1- 10 millimeters and frequencies ranging from 30 to 300 GHz. Health Hazards from Cell Phone Technology “Beyond Measure” Cell phones operate essentially by sending and receiving radiofrequency radiation from their antennas to a nearby cell tower. Thousands of independent studies link Radiofrequency radiation exposures from cell phones to a number of very serious diseases such as; Cancer [3], Infertility [4], Cardiovascular Diseases [5], Birth defects [6], Memory Problems [7], Sleep Disorders [7] and so on. 5G Technology Comes With Increased RF Radiation Exposure These millimeter waves (MMWs) as used by the 5G network can transmit large amounts of data within a short period of time. But over short distances and also, the other big issue is that the signal is poorly transmitted through solid materials. This means massive transmission of MMW will be needed. Many new antennas will be needed. We are told full-scale implementation may require at least one antenna for every 10 to 12 houses in urban areas. Also, the MIMO (multiple-input multiple-output) technology is expected to be used massively. The MIMO technology is a wireless system that uses multiple transmitters hence, it is able to send and receive multiple/more data at once. Some 4G base stations already use MIMO technology. Standard MIMO involves four to eight antennae. MIMO for 5G may involve approximately 100 antennas per cell tower – that’s a lot of antennas! Increased transmission leads to increased capacity, so electromagnetic radiation levels can only increase. The concern is that, given what we know about radio frequency radiation, this mandatory environmental increase in exposure to EM radiation will lead to increased health risks. A number of studies have demonstrated the detrimental health effects of the MMW frequencies used in 5G technology. Damaging Effects on the Human Skin One Israeli study [8] lead by Dr. Yuri D Feldman found that human sweat ducts act as an array of tiny, helix-shaped antennas when exposed to MMWs. Their findings suggest that human skin not only absorbs but also amplifies the radiation from MMW networks. A study carried [9]out to evaluate the interactions and implications of MMWs (60GHz) with the human body discovered that “more than 90% of the transmitted (MMWs) power is absorbed in the epidermis and dermis layer.” The effect of MMWs on the skin is arguably the greatest concern of these new wavelengths utilized by 5G technology. We might well be looking at the possibility of increased incidences of many skin diseases and cancer in the coming years in areas where the 5G technology is deployed. Profound Effect On Immune System A 2002 Russian study [10] carried out to examine the effects of high-frequency electromagnetic radiation (42HGz) exposure on the blood of healthy mice found that, the activity of cells involved in immunity such as the neutrophils reduced drastically (about 50% decrease in activity). It was concluded that “the whole-body exposure of healthy mice to low-intensity EHF EMR has a profound effect on the indices of nonspecific immunity.” Damaging Effects on The Heart A 1992 study [11]found that frequencies in the range 53-78GHz impacted the heart rate variability (an indicator of stress) in rats. A Russian study [12]on frogs whose skin was exposed to MMWs discovered abnormal heart rate changes (arrhythmias). Hazardous Effects on the Eyes In 1994, a study [12]carried out in Poland to evaluate the influence of millimeter radiation on light transmission through the lens of the eyes. It was discovered that low-level MMW radiation produced lens opacity in rats, which is associated the production of cataracts. A Japanese experiment [13]carried out to examine the potential for 60-GHz millimeter-wave exposure to cause acute ocular injuries found that 60GHz “…millimeter-wave antennas can cause thermal injuries of varying types of levels. The thermal effects induced by millimeter waves can apparently penetrate below the surface of the eye.” 180 Scientist and Doctors Call For A Moratorium Scientists are concerned as well. More than 180 scientists and doctors from 35 countries [14], have recommended a temporary ban on the roll-out of 5G technology until its potential hazards on human health and the environment have been fully evaluated by scientists independent of the telecommunication industry. What Are The Real Dangers Of 5G Technology? The short answer is: we don’t fully know yet! But the studies we have on this are a cause for concern. The health hazard of the most studied 3G CMDA technology (shown to cause an array of detrimental health effects) have not been fully revealed, yet, here we are, at the verge of adopting a potentially more dangerous technology. Don’t you think we should fully evaluate the health effects of 5G before rolling out the technology? Let’s not forget, alternatives to wireless mobile technology are available. Fiber Optic Broadband Technology is a feasible and safer alternative. I firmly believe that technological improvement can be attained without jeopardizing the health of the general public.

#### 5G satellites are profoundly damaging.

Arthur Firstenberg 12-17-2018 [American author and activist on the subject of electromagnetic radiation and health, The Journal of Wild Culture, “Birds falling from the sky: knowing how 5G could effect us,” http://www.wildculture.com/article/birds-falling-sky-knowing-how-5g-could-affect-us/1770//ZW]

The deployment of 5G satellites The Earth, the ionosphere and the lower atmosphere form the global electric circuit[52] in which we live. It is well established that biological rhythms—of humans,[53][54] birds,[55] hamsters, and spiders—are controlled by the Earth’s natural electromagnetic environment and that the well-being of all organisms depends on the stability of this environment, including the electrical properties of the atmosphere.[59][60][61][62] Cherry, in a groundbreaking paper, [63] explained the importance of the Schumann resonances[64] and why ionospheric disturbances can alter blood pressure and melatonin and cause “cancer, reproductive, cardiac and neurological disease and death”. These elements of our electromagnetic environment have already been altered by radiation from power lines. Power line harmonic radiation reaches the Earth’s ionosphere and magnetosphere, where it is amplified by wave-particle interactions. In 1985, Dr. Robert O. Becker warned that power line harmonic radiation had already changed the structure of the magnetosphere, and that the continued expansion of this effect “threatens the viability of all life on Earth”. The placement of tens of thousands of satellites directly in both the ionosphere and magnetosphere, emitting modulated signals at millions of watts and millions of frequencies, is likely to alter our electromagnetic environment beyond our ability to adapt. Informal monitoring has already provided evidence indicating serious effects on humans and animals from the approximately 100 satellites that have provided 2G and 3G phone service from low orbit since 1998. Such effects cannot be understood only from consideration of the low levels of radiation on the ground. Knowledge from other relevant scientific disciplines must be taken into account, including the fields of atmospheric physics and acupuncture. Adding 20,000 5G satellites will further pollute the global electric circuit and could alter the Schumann resonances, with which all life on Earth has evolved. The effects will be universal and may be profoundly damaging.

#### Radiation disease will kill everyone if worldwide 5G is permitted.

Arthur Firstenberg 12-17-2018 [American author and activist on the subject of electromagnetic radiation and health, The Journal of Wild Culture, “Birds falling from the sky: knowing how 5G could effect us,” http://www.wildculture.com/article/birds-falling-sky-knowing-how-5g-could-affect-us/1770//ZW]

RF radiation has both acute and chronic effects RF radiation has both immediate and long-term effects. Cancer and heart disease are examples of long-term effects. Alteration of heart rhythm and changes in brain function (EEG) are examples of immediate effects. A syndrome that was called radiowave sickness in the former Soviet Union and is called electromagnetic hypersensitivity (EHS) around the world today can be either acute or chronic. Professor Dr. Karl Hecht has published a detailed history of these syndromes, compiled from a review of more than 1,500 Russian scientific papers and the clinical histories of more than 1,000 of his own patients in Germany. Objective findings include sleep disorders, abnormal blood pressure and heart rate, digestive disorders, hair loss, tinnitus and skin rash. Subjective symptoms include dizziness, nausea, headache, memory loss, inability to concentrate, fatigue, flu-like symptoms and cardiac pain. The EUROPEAN EMF Guideline 2016 states that EHS develops when people are “continuously exposed in their daily life” to increasing levels of EMFs, and that “reduction and prevention of EMF exposure” is necessary to restore these patients to health. EHS should no longer be considered a disease, but an injury by a toxic environment that affects an increasingly large portion of the population, estimated already at 100 million people worldwide, and that may soon affect everyone if the worldwide rollout of 5G is permitted. The International Scientific Declaration on EHS and multiple chemical sensitivity (MCS), Brussels, declared in 2015 that “[i]naction is a cost to society and is not an option any more… [W]e unanimously acknowledge this serious hazard to public health… [urgently requiring] that major primary prevention measures are adopted and prioritized, to face this worldwide pan-epidemic in perspective” (emphasis added).

#### 5G causes space debris, microwave radiation, and oxidative cell stress.

The World Foundation for Natural Science 04-22-2021 [“5G Satellites: The World in a Radiation Cage,” https://www.naturalscience.org/news/2021/04/5g-satellites-the-world-in-a-radiation-cage///ZW]

For decades, scientists, medical associations and those affected have been demanding that the health effects of microwave radiation must finally be taken seriously, and the precautionary principle must be applied consistently. Countless studies1) clearly show that the radiation triggers oxidative cell stress, weakens the immune system, and opens the blood-brain barrier. Note: This is already happening with radiation intensities far below the official threshold values. Unfortunately, the recent introduction of the fifth generation of mobile communication–5G–does not yet show any awareness of the hazardous effects of microwaves. 5G is being implemented by many governments without any scientific scrutiny. Even the wake-up call of the Corona crisis “Virus meets weakened immune systems” still seems to fade unheard in the noise of governments frantically trying to do something and endless politicking on what actions to take.2) The following contribution is dedicated to an aspect of the introduction of 5G, where many fundamental questions still need to be answered. It is about the global network of 100,000 planned 5G satellites3) in space and their possible impact on our planet and life. 30 times more satellites 5G brings some changes. Due to the use of higher frequencies—planned up to 100 GHz —a massive expansion of the mobile antennas is necessary. This is due to the lower transmittable distance and the increase in the transferable data volume by a factor of 100. The number of antennas will be increased tenfold! And as if millions of antennas on the Earth’s surface were not enough, tens of thousands of antennas will soon be added in space. First and foremost, it is Elon Musk’s company SpaceX4), which wants to launch up to 40,000 Internet satellites into the orbit with its “Starlink” satellite programme. By comparison, in December 2020, “only” about 3,400 active satellites orbited the Earth.5) That SpaceX is serious about its project is demonstrated by the fact that 1,200 new satellites were placed between December 2020 and March 2021.6) Amazon, OneWeb, GalaxySpace and other companies also want to join the race for 5G dominance and plan to launch a total of another 60,000 satellites. This will contaminate the very last spots on the Earth’s surface with microwave radiation. Moreover, who knows which technologies will be additionally installed in the satellites that could be used, for example, for military purposes? And who owns space anyway? Who decides on it? Up to now, the authorities of the respective location nation can issue permits. In the case of Starlink, it is the Federal Communications Commission (FCC) in Washington D.C., USA. The FCC is closely linked to the mobile phone industry. This American authority therefore grants permits for uses that affect the whole world. Should not an internationally recognized body, free of all conflicts of interest, decide on this? In addition to these more political questions, we should also look at why satellite radiation could be an unexpectedly big threat to life. Natural shield under fire All life is electromagnetic. What may sound strange at first, is not at all on closer inspection. Isn’t the electron the smallest building block of all life? With its electric charge, it orbits the atomic nucleus, forms atoms and interacts with other electrons, atoms and electromagnetic fields. The main component of all life, the water molecule, is also structured as a dipole and thus has similar properties as a bar magnet, which aligns in the magnetic field. At the cell level, the cell tension or the voltage-controlled calcium-ion channels in the cell membrane show us the connection to electromagnetism. The transmission of stimuli in the nerve pathways, the heartbeat—an electrical impulse that can be made visible in the cardiogram—or the brain currents that can be recorded with probes: these are all electromagnetic processes that form the basic essence of life. It is likely that all chemical and biological reactions are preceded by electromagnetic processes. Even the blueprint of biological organisms is determined by electric fields, as the American professor of anatomy Harrold Saxton Burr was able to demonstrate as early as the 1940s.7) Find out more in our article “All Life Works Electrically!”8) On the large scale as on the small: the habitat Earth and with it all life in general is embedded in a well-balanced, natural electromagnetic environment. The Earth’s magnetic field extends from the North Pole over the globe to the South Pole, whereas these magnetic poles can deviate from the geographic poles and even migrate. The Earth is negatively charged compared to space, which causes a voltage difference of 400,000 volts between the Earth’s surface and the upper end of the atmosphere.9) Complex processes caused by atmospheric electricity, thunderstorm activity and charge shifts by air ions or water molecules are a natural clock for life. The ionosphere begins at an altitude of about 80 km above the Earth’s surface. It is that part of the atmosphere that contains large amounts of ions and free electrons. The ionosphere is highly conductive, reaches its highest electron density at about 300 km and ends at about 1,000 km. A standing electromagnetic wave, the so-called Schumann resonance, forms between the Earth’s surface and this ionosphere.10) EAccording to the Earth’s circumference as wavelength, the base frequency is 7.8 Hz. Interestingly, this frequency also coincides with human brain waves at the seam between alpha and theta states.11) As early as 2001, New Zealand’s environmental scientist Dr. Neil Cherry showed in a ground-breaking publication12) how ionospheric disorders cause changes in blood pressure and melatonin levels and, therefore, can lead to cancer, reproductive disorders, heart and neurological diseases and even death. On an even larger scale, all celestial bodies, from simple asteroids to moons, planets, suns, galaxies and universes, are connected to each other via electromagnetic fields and are in a permanent exchange of information. What was called aether in the late 17th century and was discarded in the meantime, is now gaining in importance again. The airless space between the celestial bodies is by no means empty, but filled with electromagnetic particles, which are present as vortex charges and are called neutrinos.13)In his book “A beginner’s view of our electric universe”, Tom Findlay impressively describes how electromagnetism is the basic principle of the whole universe. Findlay illustrates how plasma physics can be used to consistently explain the celestial bodies known to this day—from planets, suns to galaxies, pulsars to black holes. Here, too, a basic prerequisite is that space is not simply empty, but permeated with conductive “material”, a plasma. In this plasma, gigantic currents flow between the celestial bodies, thus ensuring an exchange of energy and information. “Everything is connected with everything”—the saying acquires a completely new and concrete meaning from this point of view, in the purely physical sense. But back to Earth. Similar to the cell membrane, the ionosphere acts as a contact surface to the other celestial bodies and thus occupies a special position in the “organism Earth”. And it is precisely in this protective sphere, at an altitude of between 300 and 600 km, that 100,000 satellites are to be placed, which will contaminate the ionosphere, atmosphere and the Earth’s surface with sharply pulsed technical radiation. What influence does satellite radiation have on the ionosphere? Can it maintain its function? Will this affect the Schumann resonance? Will the life-sustaining charge differences between Earth and the ionosphere change? Who can answer these questions conclusively? Weather and climate Satellite radiation could also affect our weather and climate. Water as the main component of life reacts very sensitively to electromagnetic radiation. Various research and experiments show not only warming effects, but changes in the water structure and the forces of order, even at very low radiation intensities far below the official limits.14) The water molecule reaches peak energy absorption at 2.4 GHz and is particularly sensitive. Of all frequencies, this one is used for numerous technical applications: microwave oven, Bluetooth and Wi-Fi emit exactly at 2.4 GHz. Water vapour in the atmosphere emits a very weak signal in the range of 23.8 GHz (which corresponds to the first resonance frequency of water), which is received by weather satellites, evaluated, and used for weather and climate forecasts. Absurdly, exactly such frequency bands are also being released for 5G radio services, so that the natural water vapour radiation is superimposed and can no longer be evaluated correctly. This is already the case in the USA, and in Europe, the use of this frequency band for 5G is already planned for the future. Reliable weather or hurricane forecasting will no longer be possible.15) Meteorologists worldwide are concerned about this development and demand that frequency bands close to these water frequencies should not be used technically. But what happens to the water vapour itself if it is stimulated by technical radiation in the range of its own resonance frequency? Is the water vapour balance disturbed in the atmosphere? Is global warming accelerating? The atmosphere is not a garbage dump According to estimates by the European Space Agency ESA, about 10,000 satellites have been launched into near-Earth orbit since the launch of the space age in 1957, of which 3,400 are still active. 22,300 debris objects are already circling around the Earth! So it is no surprise that ESA director general Jan Wörner warns of the very great danger posed by these pieces of debris. With the planned 100,000 5G satellites, space debris will increase many times over. Today’s solution for satellite disposal is: to burn them up in the atmosphere, returning them to Earth (to sink them in the “satellite graveyard” South Pacific) or moving them into the more distant “graveyard orbit”. The Starlink satellites are designed for a service life between 1 and 5 years (!)16), it will be similar with the other companies. What a waste of valuable and rare raw materials such as lithium, cobalt, copper and gold! At least 20,000 failed satellites will have to be replaced and disposed of each year. The effects of rocket exhausts and the toxins released on the atmosphere by burning up space debris have hardly been studied. “Some particles are very reactive, so small amounts of them could have a significant impact on atmospheric chemistry,” says Martin Ross, one of the few experts to address the issue of atmospheric pollution from carrier rocket emissions and the burning up of old satellites. The scientists Ross and Vedda of the Aerospace Corporation show in their 2018 report that the sensitive stratosphere is so disturbed by the combustive products of the rockets (gases and particles such as aluminum and chlorine) that the depletion of the ozone layer is promoted and the atmospheric radiation balance is changed, which is expressed secondarily in changing weather conditions.17) Of course, sinking space debris in the South Pacific is just as stupid. History teaches us that every corpse in the basement eventually appears and must be properly “disposed of”. So why not make sure from the start that this does not happen in the first place? The International Astronomical Union (IAU) is concerned about these satellite constellations, because in addition to atmospheric pollution, light pollution is also a major problem. Astronomical observations are disturbed by the thousands of light points at the nocturnal firmament, some of which are visible to the naked eye, and space loses its original purity. In order to better understand the universe, the principle of a radiation-free night sky is essential, be it as a resource for all humanity or as well for the protection of nocturnal animals.18) From a philosophical and spiritual point of view, the undisturbed view into the immeasurable starry sky gives an inkling that life itself must go far beyond our physical earthly existence. The satellite plans are also in heavy contrast to the Space Treaty19) , which entered into force in October 10, 1967 and was ratified by 110 states by July 2020, including almost all states currently engaged in space activities20) It stipulates that the use of space should be done in such a way that “its contamination and any unfavourable change in the earthly environment as a result of the introduction of extraterrestrial substances is avoided ” (Art. IX). Are Hollywood fantasies becoming a reality? Supposedly 5G is intended to meet users’ needs, in particular data-intensive video streaming and the use of social media. Behind this, however, are much more far-reaching applications and intentions: The praised digitisation and technical network of all areas of life (Internet of Things), the progressive monitoring and manipulation of humanity, and as a “coronation” the fusion of man and machine into the so-called cyborg.21) Are dark Hollywood fantasies becoming a reality? The World Economic Forum (WEF) gives high priority to “Human Enhancement”—the technical extension of the apparently imperfect human being—as well as 5G22) 23) Research is already taking place: In August 2020, media24) announced that Neuralink had succeeded in implanting a brain chip on pigs and controlling them through their smartphones. In February 2021, it was additionally announced that monkeys would now enjoy video games thanks to a brain chip.25) The goal is to “make technology usable for humans,” said Elon Musk, founder of Neuralink, to the US portal Axios.26) )) Thanks to an interface, man should be able to control devices through his thoughts alone or to be able to exchange with other people (and machines) by means of “artificial telepathy”. It goes without saying that this requires powerful, radio-based networks that cover every angle of the earth. Not only does it open the door to absolute control and manipulation, but man as an individual is deprived of his reason for existence and separated from his spiritual core. Is it not the case that man is destined to constantly learn, gain experience and develop? However, this is only possible if he has the freedom of choice and can make decisions independently. Is the presumption that Starlink and Neuralink go hand in hand with the goal of creating the “Superman” from whom his humanity is taken away and who thus is ultimately robbed of the meaning of life?27) Resistance arises In addition to countless activities, civic movements, initiatives and appeals at the regional level, there is also resistance on the international stage. The American Arthur Firstenberg28) launched the International Appeal Stop 5G on Earth and in Space in 2018, which has been signed by more than 300,000 scientists, doctors, environmental organizations and citizens from 214 nations by the end of March 2021.29) It is addressed to the United Nations (UN), the World Health Organisation (WHO), the European Union (EU), the Council of Europe and the governments of all countries of the world and calls for “an immediate halt to the expansion and deployment of the 5G radio network (fifth generation Internet), including the use of 5G transmission systems on space satellites […] The harmful effect of radiofrequency radiation on humans and the environment has been proven. The use of 5G is an experiment on humanity and the environment, which is defined as a crime by international law.” In order for this call to finally be heard, everyone can become active: talk to politicians or your friends and neighbours, write letters, participate in national or international appeals and engage in the education about these facts and open questions. Unfortunately, in the general digitisation craze, too many government representatives and media fail to provide balanced information on all aspects of 5G. And most importantly: Be a role model yourself, in everything you say or do. Our vision for the future As exciting and helpful as technological progress is in many ways, one thing must NEVER be forgotten: technology is merely an aid, a tool designed to serve man and the realisation of his life’s mission. On humanity’s path of development, we have reached a point where our actions could have global repercussions, even as far as the extinction of life and the destruction of the entire planet. The unbridled pollution and harassment of all life by microwave radiation is one of these effects. It is therefore high time to explore our reason for existence and to orient our lives towards fulfilling this reason. This is not possible in the noise of the uninterrupted temptations and empty promises of the entertainment and distraction industry or the mass and “social” media—about which absolutely nothing is social except the name. This is only possible by listening to the organ which provides the strongest magnetic force and connects people: Our heart!

#### 5G increases mass radiation that can’t be avoided.

Rainer Nyberg and Lennart Hardell 09-11-2017 [Nyberg is an EdD, Professor Emeritus (Åbo Akademi), Vasa, Finland, Hardell is a MD, PhD, Professor (assoc) Department of Oncology, Faculty of Medicine and Health, University Hospital, Örebro, Sweden, “Scientists warn of potential serious health effects of 5G,” [https://www.actu-environnement.com/media/pdf/news-29640-appel-scientifiques-5g.pdf//ZW](https://www.actu-environnement.com/media/pdf/news-29640-appel-scientifiques-5g.pdf/ZW)]

5G leads to massive increase of mandatory exposure to wireless radiation 5G technology is effective only over short distance. It is poorly transmitted through solid material. Many new antennas will be required and full-scale implementation will result in antennas every 10 to 12 houses in urban areas, thus massively increasing mandatory exposure. With ”the ever more extensive use of wireless technologies,” nobody can avoid to be exposed. Because on top of the increased number of 5G-transmitters (even within housing, shops and in hospitals) according to estimates, ”10 to 20 billion connections” (to refrigerators, washing machines, surveillance cameras, self-driving cars and buses, etc.) will be parts of the Internet of Things. All these together can cause a substantial increase in the total, long term RF-EMF exposure to all EU citizens. Harmful effects of RF-EMF exposure are already proven Over 220 scientists from more than 40 countries have expressed their “serious concerns” regarding the ubiquitous and increasing exposure to EMF generated by electric and wireless devices already before the additional 5G roll-out. They refer to the fact that ”numerous recent scientific publications have shown that EMF affects living organisms at levels well below most international and national guidelines”. Effects include increased cancer risk, cellular stress, increase in harmful free radicals, genetic damages, structural and functional changes of the reproductive system, learning and memory deficits, neurological disorders, and negative impacts on general well-being in humans. Damage goes well beyond the human race, as there is growing evidence of harmful effects to both plants and animals. After the scientists’ appeal was written in 2015 additional research has convincingly confirmed serious health risks from RF-EMF fields from wireless technology. The world’s largest study (25 million US dollar) National Toxicology Program (NTP), shows statistically significant increase in the incidence of brain and heart cancer in animals exposed to EMF below the ICNIRP (International Commission on Non-Ionizing Radiation Protection) guidelines followed by most countries. These results support results in human epidemiological studies on RF radiation and brain tumour risk. A large number of peer-reviewed scientific reports demonstrate harm to human health from EMFs. The International Agency for Research on Cancer (IARC), the cancer agency of the World Health Organization (WHO), in 2011 concluded that EMFs of frequencies 30 KHz – 300 GHz are possibly carcinogenic to humans (Group 2B). However, new studies like the NTP study mentioned above and several epidemiological investigations including the latest studies on mobile phone use and brain cancer risks confirm that RF-EMF radiation is carcinogenic to humans. The EUROPA EM-EMF Guideline 2016 states that ”there is strong evidence that long-term exposure to certain EMFs is a risk factor for diseases such as certain cancers, Alzheimer's disease, and male infertility…Common EHS (electromagnetic hypersensitivity) symptoms include headaches, concentration difficulties, sleep problems, depression, lack of energy, fatigue, and flu-like symptoms.” Scientist Appeal for 5G Moratorium 2 An increasing part of the European population is affected by ill health symptoms that have for many years been linked to exposure to EMF and wireless radiation in the scientific literature. The International Scientific Declaration on EHS & multiple chemical sensitivity (MCS), Brussels 2015, declares that: "In view of our present scientific knowledge, we thereby stress all national and international bodies and institutions...to recognize EHS and MCS as true medical conditions which acting as sentinel diseases may create a major public health concern in years to come worldwide i.e. in all the countries implementing unrestricted use of electromagnetic field-based wireless technologies and marketed chemical substances… Inaction is a cost to society and is not an option anymore… we unanimously acknowledge this serious hazard to public health…that major primary prevention measures are adopted and prioritized, to face this worldwide panepidemic in perspective."

#### Infertility will cause extinction.

Pallab Ghosh 07-25-2017 [Science correspondent BBC News, BBC News, “Sperm count drop ‘could make humans extinct,’” [https://www.bbc.com/news/health-40719743//ZW](https://www.bbc.com/news/health-40719743/ZW)]

Humans could become extinct if sperm counts in men continue to fall at current rates, a doctor has warned. Researchers assessing the results of nearly 200 studies say sperm counts among men from North America, Europe, Australia, and New Zealand, seem to have halved in less than 40 years. Some experts are sceptical of the [Human Reproduction Update](https://academic.oup.com/DocumentLibrary/humupd/PR/dmx022_final.pdf) findings. But lead researcher Dr Hagai Levine said he was "very worried" about what might happen in the future. The assessment, one of the largest ever undertaken, brings together the results of 185 studies between 1973 and 2011. Dr Levine, an epidemiologist, told the BBC that if the trend continued humans would become extinct. Decline rate 'increasing' "If we will not change the ways that we are living and the environment and the chemicals that we are exposed to, I am very worried about what will happen in the future," he said. "Eventually we may have a problem, and with reproduction in general, and it may be the extinction of the human species." Scientists not involved in the study have praised the quality of the research but say that it may be premature to come to such a conclusion. Dr Levine, from the Hebrew University of Jerusalem, found a 52.4% decline in sperm concentration, and a 59.3% decline in total sperm count in men from North America, Europe, Australia and New Zealand. The study also indicates the rate of decline among men living in these countries is continuing and possibly even increasing. Previous research 'flawed' In contrast, no significant decline was seen in South America, Asia and Africa, but the researchers point out that far fewer studies have been conducted on these continents. However, Dr Levine is concerned that eventually sperm counts could fall in these places too. Many previous studies have indicated similar sharp declines in sperm count in developed economies, but sceptics say that a large proportion of them have been flawed. Some have investigated a relatively small number of men, or included only men who attend fertility clinics and are, in any case, more likely to have low sperm counts. There is also concern that studies that claim to show a decline in sperm counts are more likely to get published in scientific journals than those that do not. Another difficulty is that early methods of counting sperm may have overestimated the true count. Taken together these factors may have created a false view of falling sperm counts. But the researchers claim to have accounted for some of these deficiencies, leaving some doubters, such as Prof Allan Pacey of Sheffield University, less sceptical. He said: "I've never been particularly convinced by the many studies published so far claiming that human sperm counts have declined in the recent past." "However, the study today by Dr Levine and his colleagues deals head-on with many of the deficiencies of previous studies." Smoking and obesity But Prof Pacey believes that although the new study has reduced the possibility of errors it does not entirely remove them. So, he says, the results should be treated with caution. "The debate has not yet been resolved and there is clearly much work still to be done. "However, the paper does represent a step forward in the clarity of the data which might ultimately allow us to define better studies to examine this issue." There is no clear evidence for the reason for this apparent decrease. But it has been linked with exposure to chemicals used in pesticides and plastics, obesity, smoking, stress, [diet](http://www.bbc.co.uk/news/health-17353804), and even [watching too much TV](http://www.bbc.co.uk/news/health-21326810). Dr Levine says that there is an urgent need to find out why sperm counts are decreasing and to find ways of reversing the trend. "We must take action - for example, better regulation of man-made chemicals - and we must continue our efforts on tackling smoking and obesity."

### AT: 4G Thumps---2NC

#### 4G doesn’t thump--- smaller wavelengths mean it’s game over.

Arthur Firstenberg 12-17-2018 [American author and activist on the subject of electromagnetic radiation and health, The Journal of Wild Culture, “Birds falling from the sky: knowing how 5G could effect us,” http://www.wildculture.com/article/birds-falling-sky-knowing-how-5g-could-affect-us/1770//ZW]

5G is qualitatively and quantitatively different from 4G The idea that we will tolerate tens to hundreds of times more radiation at millimetre wavelengths is based on faulty modelling of the human body as a shell filled with a homogeneous liquid. The assumption that millimetre waves do not penetrate beyond the skin completely ignores nerves, blood vessels and other electrically conducting structures that can carry radiation-induced currents deep into the body. Another, potentially more serious error is that phased arrays are not ordinary antennas. When an ordinary electromagnetic field enters the body, it causes charges to move and currents to flow. But when extremely short electromagnetic pulses enter the body, something else happens: the moving charges themselves become little antennas that reradiate the electromagnetic field and send it deeper into the body. These reradiated waves are called Brillouin precursors. They become significant when either the power or the phase of the waves changes rapidly enough. 5G will probably satisfy both criteria. In addition, shallow penetration in itself poses a unique danger to eyes and to the largest organ of the body, the skin, as well as to very small creatures. Peer-reviewed studies have recently been published, predicting thermal skin burns in humans from 5G radiation and resonant absorption by insects, which absorb up to 100 times as much radiation at millimetre wavelengths as they do at wavelengths presently in use. Since populations of flying insects have declined by 75-80 per cent since 1989 even in protected nature areas, 5G radiation could have catastrophic effects on insect populations worldwide. A 1986 study by Om Gandhi warned that millimetre waves are strongly absorbed by the cornea of the eye, and that ordinary clothing, being of millimetre-size thickness, increases the absorption of energy by the skin by a resonance-type effect. Russell (2018) reviews the known effects of millimetre waves on skin, eyes (including cataracts), heart rate, immune system and DNA.

#### Reject defense--- the regulators are lying to you.

Arthur Firstenberg 12-17-2018 [American author and activist on the subject of electromagnetic radiation and health, The Journal of Wild Culture, “Birds falling from the sky: knowing how 5G could effect us,” http://www.wildculture.com/article/birds-falling-sky-knowing-how-5g-could-affect-us/1770//ZW]

Regulators have deliberately excluded the scientific evidence of harm Stakeholders thus far in the development of 5G have been industry and governments, while renowned international EMF scientists who have documented biological effects on humans, animals, insects and plants, and alarming effects on health and the environment in thousands of peer-reviewed studies have been excluded. The reason for the current inadequate safety guidelines is that conflicts of interest of standard-setting bodies “due to their relationships with telecommunications or electric companies undermine the impartiality that should govern the regulation of Public Exposure Standards for non-ionizing radiation”. Professor Emeritus Martin L. Pall lays out the conflicts of interest in detail, and the lists of important studies that have been excluded, in his literature review.

#### 5G kills all life on earth.

Robert J. Burrowes 07-07-2020 [Writing for Nation of Change, Nation of Change, “Deadly rainbow: Will 5G precipitate the extinction of all life on Earth?” https://www.nationofchange.org/2020/07/07/deadly-rainbow-will-5g-precipitate-the-extinction-of-all-life-on-earth///ZW]

Human-Generated Electricity on Earth It was in 1746 that scientists were finally able to ‘capture’ electricity so that a start could be made on using it directly for human ends. Sure, the wider implications of its use were not considered but it offered opportunities not previously available. And when the damage from its use, on humans and other living organisms, started and then rapidly picked up pace, the association between the spread of electricity (particularly through the telegraph wires in the mid-nineteenth century and electric lighting a few decades later) and the adverse health and environmental impacts were not made, or ignored when they were. And so diseases not previously recorded in the medical literature started to appear: anxiety disorder, influenza, diabetes, heart disease and cancer. But it wasn’t just us that was impacted; so were the other living organisms of our planet. And now we are bathed in the 60-cycle current in our house-wiring; the ultrasonic frequencies in our computers, Wi-Fi routers and modems; the radio waves in our televisions; the microwaves in our cell phones and the electromagnetic radiation generated by everything from baby monitors to ‘smart’ devices of all kinds, as well as the vast network of satellites, transmission towers and power lines all endlessly but variably impacting, adversely, virtually every human being on Earth. And if 5G is deployed, there will be nowhere on Earth that is safe for humans, insects, birds, animals and plants.

#### Electromagnetic waves will kill us all.

Robert J. Burrowes 07-07-2020 [Writing for Nation of Change, Nation of Change, “Deadly rainbow: Will 5G precipitate the extinction of all life on Earth?” https://www.nationofchange.org/2020/07/07/deadly-rainbow-will-5g-precipitate-the-extinction-of-all-life-on-earth///ZW]

**Conclusion** So what is Arthur Firstenberg’s chilling conclusion? ‘You cannot contaminate the global electrical circuit with millions of pulsed, modulated electronic signals without destroying all of life.’ But, as outlined above, since ‘controlling’ electricity in 1746, humans have been increasingly contaminating the global electrical circuit and it has culminated in what will now be the final electromagnetic assault on Earth. Which means that unless we can halt the launch of these 5G satellites and the rollout of the technology ‘on the ground’ we will be ‘destroying all of life’. And while some groups advocate measures to protect ourselves as individuals, inadequate though these must be in the unfolding circumstances, no amount of measures to individually protect ourselves from this electromagnetic radiation will protect ‘all of life’ in the wild. According to Ross Adey, the grandfather of bioelectromagnetics and atmospheric physicist Neil Cherry, we are electrically tuned to the world around us and ‘the safe level of exposure to radio waves is zero’. There is virtually no time left to understand and act powerfully on that knowledge. What will you do?

## AI Bad

### AI Virus Impact---Long 1NC

#### Increased development and reliance on AI guarantees viruses---that guarantees extinction for a laundry list of reasons.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

There are currently few computer control systems that have the ability to directly harm humans. However, increasing automation, combined with the Internet of Things (IoT) will probably create many such systems in the near future. Robots will be vulnerable to computer virus attacks. The idea of computer viruses more sophisticated than those that currently exist, but are not full AI, seems to be underexplored in the literature, while the local risks of civil drones are attracting attention (Velicovich 2017).

It seems likely that future viruses will be more sophisticated than contemporary ones and will have some elements of AI. This could include the ability to model the outside world and adapt its behavior to the world. Narrow AI viruses will probably be able to use human language to some extent, and may use it for phishing attacks. Their abilities may be rather primitive compared with those of artificial general intelligence (AGI), but they could be sufficient to trick users via chatbots and to adapt a virus to multiple types of hardware. The threat posed by this type of narrow AI becomes greater if the creation of superintelligent AI is delayed and potentially dangerous hardware is widespread.

A narrow AI virus could become a global catastrophic risk (GCR) if the types of hardware it affects are spread across the globe, or if the affected hardware can act globally. The risks depend on the number of hardware systems and their power. For example, if a virus affected nuclear weapon control systems, it would not have to affect many to constitute a GCR.

A narrow AI virus may be intentionally created as a weapon capable of producing extreme damage to enemy infrastructure. However, later it could be used against the full globe, perhaps by accident. A “multi-pandemic,” in which many AI viruses appear almost simultaneously, is also a possibility, and one that has been discussed in an article about biological multi-pandemics (Turchin et al. 2017). Addressing the question about who may create such a virus is beyond the scope of this paper, but history shows that the supply of virus creators has always been strong.

A very sophisticated virus may be created as an instrument of cyber war by a state actor, as was the case with Stuxnet (Kushner 2013).

The further into the future such an attack occurs, the more devastating it could be, as more potentially dangerous hardware will be present. And if the attack is on a very large scale, affecting billions of sophisticated robots with a large degree of autonomy, it may result in human extinction. Some possible future scenarios of a virus attacking hardware are discussed below. Multiple scenarios could happen simultaneously if a virus was universal and adaptive, or if many viruses were released simultaneously.

A narrow AI virus could have the ability to adapt itself to multiple platforms and trick many humans into installing it. Many people are tricked by phishing emails even now (Chiew et al. 2018). Narrow AI that could scan a person’s email would be able to compose an email that looks similar to a typical email conversation between two people, e.g. “this is the new version of my article about X.” Recent successes with text generation based on neural nets (Karpathy 2015; Shakirov 2016) show that generation of such emails is possible even if the program does not fully understand human language.

One of the properties of narrow AI is that while it does not have general human intelligence, it can still have superhuman abilities in some domains. These domains could include searching for computer vulnerabilities or writing phishing emails. So while narrow AI is not able to self-improve, it could affect a very large amount of hardware.

A short overview of the potential targets of such a narrow AI virus and other situations in which narrow AI produces global risks follows. Some items are omitted as they may suggest dangerous ideas to terrorists; the list is intentionally incomplete.

3.2.1. Military AI systems

There are a number [of] GCRs associated with military systems. Some potential scenarios: military robotics could become so cheap that drone swarms could cause enormous damage to the human population; a large autonomous army could attack humans because of a command error; billions of nanobots with narrow AI could be created in a terrorist attack and create a global catastrophe (Freitas 2000).

In 2017, global attention was attracted to a viral video about “slaughterbots” (Oberhaus 2017), hypothetical small drones able to recognize humans and kill them with explosives. While such a scenario is unlikely to pose a GCR, a combination of cheap AI-powered drone manufacture and high-precision AI-powered targeting could convert clouds of drones into weapons of mass destruction [WMDs]. This could create a “drone swarms” arms race, similar to the nuclear race. Such a race might result in an accidental global war, in which two or more sides attack each other with clouds of small killer drones. It is more likely that drones of this type would contribute to global instability rather than cause a purely drone-based catastrophe.

AI-controlled drones could be delivered large distances by a larger vehicle, or they could be solar powered; solar-powered airplanes already exist (Taylor 2017). Some advanced forms of air defense will limit this risk, but drones could also jump (e.g., solar charging interspersed with short flights), crawl, or even move underground like worms. There are fewer barriers to drone war escalation than to nuclear weapons. Drones could also be used anonymously, which might encourage their use under a false flag. Killer drones could also be used to suppress political dissent, perhaps creating global totalitarianism. Other risks of military AI have been previously discussed (Turchin and Denkenberger 2018a).

3.2.2. Stuxnet-style viruses hack global critical infrastructure

A narrow AI virus may also affect civilian infrastructure; some, but not all ways in which this could be possible are listed below. Remember that in the case of global catastrophes, the conditions necessary for most catastrophes could exist simultaneously. Several distinctive scenarios of such a catastrophe have been suggested.

For example, autopilot-controlled and hacked planes could crash into nuclear power stations. There are around 1000 nuclear facilities in the world, and thousands of large planes are in the air at every moment—most of them have computerized autopilots. Coordinated plane attacks happened in 2001 and a plane has been hacked (Futureworld 2013). Self-driving cars could hunt people, and it is projected that most new cars after 2030 will have some self- driving capabilities (Anderson 2017).

Elon Musk has spoken about the risks of AI living in the Internet; it could start wars by manipulating fake news (Wootson 2017). Computer viruses could also manipulate human behavior using blackmail, as seen in fiction in an episode of Black Mirror (Watkins 2016). Another example is creating suicide ideation, e.g., the recent internet suicide game in Russia, “Blue Whale” (Mullin 2017), which allegedly killed 130 teenagers by sending them tasks of increasing complexity and finally requesting their suicide.

The IoT will make home infrastructure vulnerable (Granoff 2016). Home electrical systems could have short circuits and start fires; phones could also catch fire. Other scenarios are also possible: home robots, which may become popular in the next few decades, could start to attack people; infected factories could produce toxic chemicals after being hacked by viruses.

Large-scale infrastructure failure may result in the collapse of technological civilization and famine (Hanson 2008; Cole et al. 2016). As industries become increasingly computerized, they will completely depend on proper functioning of computers, while in the past they could continue without them. These industries include power generation, transport, and food production. As the trend continues, turning off computers will leave humans without food, heating, and medication. Many industries become dangerous if their facilities are not intensively maintained, including nuclear plants, spent nuclear fuel storage systems, weapons systems, and water dams. If one compares human civilization with a multicellular organism, one could see that multicellular organisms could die completely, down to the last cell, as the result of a very small intervention. As interconnectedness and computerization of the human civilization grow, we become more and more vulnerable to information-based attacks.

3.2.3. Biohacking viruses

Craig Venter recently presented a digital-biological converter (Boles et al. 2017), which could “print” a flu virus without human participation. The genomes of many dangerous biological viruses have been published (Enserink 2011), so such technology should be protected from unauthorized access. A biohacker could use narrow AI to calculate the most dangerous genomes, create many dangerous biological viruses, and start a multipandemic (Turchin et al. 2017). A computer virus could harm human brains via neurointerfaces (Hines 2016).

3.2.4. Ransomware virus paying humans for its improvement

In 2017, two large epidemics of ransomware viruses affected the world: WannaCry and Petya (BBC 2017). The appearance of cryptocurrencies (e.g., bitcoin) created the potential for secret transactions and machine-created and machine-owned money (LoPucki 2017). As the IoT grows, the ransomware industry expected to thrive (Schneier 2017).

Ransom viruses in the future may possess money and use it to pay people to install ransomware on other people's computers. These viruses could also pay people for adding new capabilities to the viruses. As a result, this could produce self-improving ransomware viruses. We could call such virus a “Bitcoin maximizer.” In a sense, the current bitcoin network is paying humans to build its infrastructure via “mining.” The catastrophic risk here is that such a system is paying humans to exclude humans from the system. In some sense, capitalism as an economic system could do the same, but it is limited by antimonopoly and other laws, as well as by welfare states.

3.2.5. Slaughterbots and the dangers of a robotic army

Robotic minds do not require full AGI to have some form of agency: they have goals, subgoals, and a world model, including a model of their place in the world. For example, a robotic car should predict the future situation on a road, including the consequences of its own actions. It also has a main goal—travel from A to B—which constantly results in changes to the subgoal system in the form of route creation. A combination of this type of limited intelligence with limited agency may be used to turn such systems into dangerous self-targeting weapons (Turchin and Denkenberger 2018b).

3.2.6. Commentary on narrow AI viruses

It appears that if a narrow AI virus were to affect only one of the above-listed domains, it would not result in an extinction-level catastrophe. However, it is possible that there will be many such viruses, or a multipandemic (Turchin et al. 2017), or one narrow AI that will be able to affect almost all existing computers and computerized systems. In this case, if the virus(es) were deliberately programmed to create maximum damage—which could be in a case of a military grade Narrow AI virus, like the advanced version of Stuxnet (Kushner 2013)—global catastrophe is a possible result.

3.3. Failure of nuclear deterrence AI

Nuclear weapons are one of the most automated weapon systems. Because they must be launched immediately, almost all decision making has been done in advance. An early warning alert starts a preprogrammed chain of events, where the high-level decision should be made in minutes, which is far from optimal for human decision-making. However, the history of nuclear near misses shows (Blair 2011) that computer mistakes have been one of the main causes, and only quick human intervention has prevented nuclear war, e.g., the actions of Stanislav Petrov in 1983 (Future of Life Institute 2016).

We can imagine failure modes of accidental nuclear war resulting from failure of the nuclear weapons control system. They may be similar to the Russian “dead hand” perimeter system (Bender 2014), arising if a strategic planning AI chooses a dangerous plan to “win” a nuclear war, like a Doomsday weapon (Kahn 1959), blackmail, or a pre-emptive strike.

3.4. AI affecting human society in a dangerous way

There is also a group of scenarios in which narrow AI and robotization affect human society in such a way that the human population gradually declines, the role of humans diminishes, and human values are eroded (Joy 2000). This may not directly kill all humans in the short term, but could put them in the situation of “endangered species” in ~100 years. This could happen if no superintelligent AI appears, or if the appearance of superintelligent AI is not revolutionary. One example is the use of cyber warfare to affect elections (e.g., the 2016 US election), which may produce civil wars and global instability. This has some small probability of causing the collapse of civilization.

3.4.1. Market economy as a form of non-human superintelligence

An automated economy could purposelessly exist even without humans, like the *Ascending Economy* described by (Alexander 2016). Such a scenario could be an example of bad distributed (and non-agential) superintelligence created by market forces, which does not need humans for its existence. Such a superintelligence could gradually push humans out of existence.

3.4.2. Gradual replacement of humans by robots

From an evolutionary point of view, it is known that the biggest threat to the species is not direct killing of its representatives by predators or disease, but gradual reduction of its ecological niche and strong competition from other species (Clavero and García-Berthou 2005). The analogy here would be if human labor were to lose its value.

Two catastrophic scenarios are possible: 1) people lose their sense of self-worth because of technologically driven unemployment and 2) the combination of basic income and the feeling of uselessness will attract humans to AI-created addictive drugs, as described below. Genetically modified human-robot hybrids could also replace humans.

3.4.3. Superaddictive drug created by narrow AI

AI-powered entertainment combined with brain modification technologies may come close to wireheading (Strugatsky and Strugatsky 1976). Widespread addiction and withdrawal from normal life (via social networks, fembots, virtual reality, designer drugs, games, etc.) would result in lower life expectancy and low fertility. This is already happening to some extent in Japan, where the Hikikomori generation refuses to have families (Saito and Angles 2013). In some sense, Facebook addiction created by the AI-empowered news feed is a mild contemporary example of future, potentially dangerous AI drugs.

3.4.4. World-wide computer totalitarianism

A large global surveillance system could create “computer totalitarianism,” which may work as an Orwellian world government (Orwell 1948). We could call such a system “data-driven” AI in contrast to “intelligence-driven,” self-improving AI.

Narrow AI may be used as a weapon, which could provide a decisive advantage even before the creation of self-improving AI. It could be used for forceful unification of the world under one government with promises to prevent other global risks (including even more complex AIs and existential terrorists). While this idea may have merit (e.g., Goertzel’s AI Nanny (Goertzel 2012)), its application could easily go wrong and create an oppressive global dictatorship, a situation recognized by Bostrom as an existential risk (Bostrom 2002). Such a society would be fragile and could collapse completely, as extremely complex societies often do (Hanson 2008).

3.5. Risks from non-self-improving AI of human-level intelligence

It is conceivable that human-level AGI will be created, perhaps by the mind uploading method (Hanson 2016), but creation of superhuman AI will be postponed because of technical difficulties, or due to a permanent ban.

Many of the risks of human-level AI will be similar to the risks of narrow AI mentioned above, including sophisticated AI viruses, acceleration of dangerous science, and human replacement by the robotic economy. One specific risk is that human uploads will be philosophical zombies (p-zombies). In that case, if everybody was uploaded, the world would appear to be enjoyable, full of robots and virtual reality. But there would be no subjective experiences at all and the world would, in fact, be subjectively dead. This risk appears to be low, as many claim that p-zombies are impossible (Dennett 1978; Yudkowsky 2015). There could be other risks of this type, even subtler.

For example, human uploads could have a slightly different set of subjective experiences, values or behavior.

Christiano suggested “prosaic AI,” which is some combination of already existing technologies, mainly neural nets (Christiano 2016). Such a system would have limited ability to self-improve, but could still be dangerous if it works as a “global brain” or a weapon. One possibility is an AI system which has a model of itself and a survival drive but does not self-improve for some reason. Another possibility is a very large AI system which merges with government structures but does not need to self-improve to reach its goals. This could become the basis of a repressive totalitarian state which ultimately does not need humans, as discussed in Section 3.2.1.

### AI Virus Impact---Short 1NC

#### Makes everything vulnerable---attacks and accidents using OR affecting AI cause extinction.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

There are currently few computer control systems that have the ability to directly harm humans. However, increasing automation, combined with the Internet of Things (IoT) will probably create many such systems in the near future. Robots will be vulnerable to computer virus attacks. The idea of computer viruses more sophisticated than those that currently exist, but are not full AI, seems to be underexplored in the literature, while the local risks of civil drones are attracting attention (Velicovich 2017).

It seems likely that future viruses will be more sophisticated than contemporary ones and will have some elements of AI. This could include the ability to model the outside world and adapt its behavior to the world. Narrow AI viruses will probably be able to use human language to some extent, and may use it for phishing attacks. Their abilities may be rather primitive compared with those of artificial general intelligence (AGI), but they could be sufficient to trick users via chatbots and to adapt a virus to multiple types of hardware. The threat posed by this type of narrow AI becomes greater if the creation of superintelligent AI is delayed and potentially dangerous hardware is widespread.

A narrow AI virus could become a global catastrophic risk (GCR) if the types of hardware it affects are spread across the globe, or if the affected hardware can act globally. The risks depend on the number of hardware systems and their power. For example, if a virus affected nuclear weapon control systems, it would not have to affect many to constitute a GCR.

A narrow AI virus may be intentionally created as a weapon capable of producing extreme damage to enemy infrastructure. However, later it could be used against the full globe, perhaps by accident. A “multi-pandemic,” in which many AI viruses appear almost simultaneously, is also a possibility, and one that has been discussed in an article about biological multi-pandemics (Turchin et al. 2017). Addressing the question about who may create such a virus is beyond the scope of this paper, but history shows that the supply of virus creators has always been strong.

A very sophisticated virus may be created as an instrument of cyber war by a state actor, as was the case with Stuxnet (Kushner 2013).

The further into the future such an attack occurs, the more devastating it could be, as more potentially dangerous hardware will be present. And if the attack is on a very large scale, affecting billions of sophisticated robots with a large degree of autonomy, it may result in human extinction. Some possible future scenarios of a virus attacking hardware are discussed below. Multiple scenarios could happen simultaneously if a virus was universal and adaptive, or if many viruses were released simultaneously.

### Outweighs WW3---2NC

#### Only AI causes total extinction.

AI.NL 22, “Ethereum creator Vitalik Buterin: Unfriendly AI bigger threat than WW3,” https://www.ai.nl/artificial-intelligence/ethereum-creator-vitalik-buterin-unfriendly-ai-bigger-threat-than-ww3/micahw

What’s the biggest threat to humanity? Ethereum creator Vitalik Buterin is calling unfriendly AI a bigger threat to humanity than World War 3. With this statement, Buterin joins the likes of Elon Musk and late physicist Stephen Hawking as the people sounding the alarm against unfriendly AI.

One of the goals facing AI researchers is building artificial general intelligence (AGI), an ability where a program can understand or learn any intellectual task that a human being is capable of. However, a number of prominent tech leaders have voiced their concern around building artificial general intelligence [AGI]. Buterin is now joining an elite list.

Vitalik Buterin cautions against unfriendly AI

[[TWEET OMITTED]]

Last week, Buterin shared a paper by AI theorist and writer Eliezer Yudkowsky and asked for more eyes on the problem of “unfriendly AI risk.” In the paper, Yudkowsky argues that AGI could lead to “an existential catastrophe” and that the current research community is not succeeding at “preventing this from happening.”

Buterin essentially agrees with Yudkowsky’s assertion and added that unfriendly AI “could seriously derail humanity’s ascent to the stars over the next 1-2 centuries.”

When a Twitter follower replied to Buterin that World War 3 is a bigger concern right now, Buterin immediately disagreed. The creator of Ethereum estimates that World War 3 will kill between one and two billion people and that too from food supply chain disruption. He believes that World War 3 will not kill off humanity.

[[TWEET OMITTED]]

“A bad AI could truly kill off humanity for good,” Buterin said in reply.

The Machine Intelligence Research Institute (MIRI), formerly the Singularity Institute for Artificial Intelligence, is a non-profit research institute founded by Yudkowsky in 2000. Since 2005, the institute has been focussing on identifying and managing potential existential risks from artificial general intelligence (AGI).

In 2018, Vitalik Buterin became the third largest donor in MIRI’s history when he donated nearly $7,64,000 in the form of Ethereum. The grant was meant to help the organisation further study the impact of AI.

### T&D---Timeframe

#### The point of no return comes as close as 2023. (please I just want to graduate high school before getting killed by a robot)

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

The expected path of the future evolution of AI into superintelligence is presented in its clearest form by Bostrom and Yudkowsky (Yudkowsky 2008; Bostrom 2014). Basically, the model they suggest is that AI power will grow steadily until one AI system reaches the threshold of self-improvement (SI), at which point it will quickly outperform others by many orders of magnitude and become a global government or “singleton” (Bostrom 2006).

Other scenarios are possible depending on the number of AIs, their level of collaboration, and their speed of self-improvement. There could be many paths to a singleton, for example, through AI’s collaboration with a large nation-state, or through the “treacherous turn” (revolt of AI against its creators (Bostrom 2014)), as—or after—it develops the capacity for self-improvement.

As the main scenario is based on constant AI capability gain, we can distinguish several AI ages, or consequent stages of development. The new element here is distinguishing the stage of “young AI,” when AI is neither superintelligent nor omnipotent, but possess capabilities slightly above human level. Such AI is already self- improving and must fight for its own survival.

We will accept the results of the recent AI timing survey for the timings of AI development (Grace et al. 2017); predicting the exact timing of each AI risk is beyond the scope of this paper. We will use these results as a reference for the time stamps in Table 1. The survey shows that researchers expect AI to outperform humans at all tasks in 45 years. However, according to Grace et al.’s 2017 survey (Grace et al. 2017), around 10 per cent of researchers expect human level AI as early as 2023, a prediction in line with the views presented by (Christiano ~~[Ronaldo]~~ 2016; Shakirov 2016).

#### Risk of our impacts start as soon as it’s developed.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

In a hard takeoff, one AI gains world domination in weeks or months; in a soft takeoff, many AIs simultaneously evolve over years. These views combine at least two variables: duration of the process of takeoff and the number of AI projects running simultaneously—the latter may be even more important. In this section, we review risks during hard takeoff, defining hard takeoff only through the speed of the process. The following section will describe soft takeoff risks.

Hard takeoff is the process of quick self-improvement of the AI and its simultaneous increase in power, starting from a treacherous turn and continuing until the AI reaches the singleton stage. We refer to this early-stage AI as “young AI”. The risks of young AI are significantly different from the risks of mature AI, which are typically presented as the iconic catastrophic risks of AI, like the paperclip maximizer.

There are two main properties of young AI:

* It is not yet superintelligent, so its current abilities are limited compared to its future abilities.
* It is under strong time pressure due to risks, including being turned off by its owners and rivalry from other AIs, etc. As a result, convergent instrumental goals, or basic AI drives (Omohundro 2008) would dominate the behavior of young AI.

So a smile maximizer (Yudkowsky 2008), paperclip maximizer, and really good benevolent AI would behave in almost the same manner in the early stages of their development, as they will not have had the time or resources to start to implement their final goals. A benevolent AI may choose a different method of takeoff, which would cause less short-term harm to human beings, but only if it is not putting its final success in jeopardy. Young AI may have the convergent goal of becoming a military AI, that is, of creating an offensive and defensive infrastructure which will help it to gain power over its potential enemies (Turchin and Denkenberger 2018a).

### T&D---Epistemology

#### Err on the side of caution---this article is the best paper on the harms of AI.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

Though humanity cannot have direct knowledge about the future, one can map it by creating exhaustive taxonomies. This approach has already been used in analyzing future AI; a full taxonomy of the ways to AI alignment (that is coordinating AI’s goal system with human values) was suggested by Sotala and Yampolskiy (Sotala and Yampolskiy 2014). Creation of a full taxonomy will help to distinguish between serious, possible, and hypothetical risks. A Bayesian approach requires that we generate a full range of plausible hypotheses (Hutter 2000) in order to evaluate them all. Estimating the relative probability of every AI risk remains a question for future work; however, we found that some AI risks—like risks of early AI, including narrow AI viruses, and late-stage risks of AI wars and AI halting—are underexplored, and thus may require further attention.

In addition, many AI risks are “orphaned”: they have been mentioned in the literature but are not included in current scientific discussion. Risks may become orphaned because some are more “fashionable” than others, or they may be casualties of conflict between opposing groups of researchers. This article aims to be unbiased and inclusive, so a full picture of risks will be available for analysis of future scenarios.

### T&D---AI O/W Nukes

#### It exponentially outweighs nukes on probability and magnitude.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

According to Yampolskiy (Yampolskiy 2016), the probability and seriousness of AI failures will increase with time. We estimate that they will reach their peak between the appearance of the first self-improving AI and the moment that an AI or group of AIs reach global power, and will later diminish, as late-stage AI halting seems to be a low-probability event.

AI is an extremely powerful and completely unpredictable technology, millions of times more powerful than nuclear weapons. Its existence could create multiple individual global risks, most of which we can't currently imagine. We present several dozen separate global risk scenarios connected with AI in this article, but it is likely that some of the most serious are not included. The sheer number of possible failure modes suggests that there are more to come.

#### And it turns their internal links---AI makes nuclear escalation more likely.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

Nuclear weapons are one of the most automated weapon systems. Because they must be launched immediately, almost all decision making has been done in advance. An early warning alert starts a preprogrammed chain of events, where the high-level decision should be made in minutes, which is far from optimal for human decision-making. However, the history of nuclear near misses shows (Blair 2011) that computer mistakes have been one of the main causes, and only quick human intervention has prevented nuclear war, e.g., the actions of Stanislav Petrov in 1983 (Future of Life Institute 2016).

We can imagine failure modes of accidental nuclear war resulting from failure of the nuclear weapons control system. They may be similar to the Russian “dead hand” perimeter system (Bender 2014), arising if a strategic planning AI chooses a dangerous plan to “win” a nuclear war, like a Doomsday weapon (Kahn 1959), blackmail, or a pre-emptive strike.

#### People create evil AI which causes s-risks.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

We could imagine a perfectly aligned AI, which was deliberately programmed to be bad by its creators. For example, a hacker could create an AI with a goal of killing all humans or torturing them. The Foundational Research Institute suggested the notion of s-risks, that is, the risks of extreme future suffering, probably by wrongly aligned AI (Daniel 2017). AI may even upgrade humans to make them feel more suffering, like in the short story “I have no mouth but I must scream” (Ellison 1967).

The controversial idea of “Roko’s Basilisk” is that a future AI may torture people who did not do enough to create this malevolent AI. This idea has attracted attention in the media and is an illustration of “acausal” (not connected by causal links) blackmail by future AI (Auerbach 2014). However, this cannot happen unless many people take the proposition seriously.

#### <<s-risks outweigh>>

### AT: Good Intentions/Benevolent AI---2NC

#### AI with the best intentions will still become deadly.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

7.1. Overview

Here the iconic example is the “smile maximizer,” that is, an AI which has been built to increase human happiness and told to measure success by the number of smiles. It could achieve this goal by tiling the whole universe with printed smiles (Yudkowsky 2008), ignoring human existence and thus probably killing all humans (see Section 6.2, the dangers of AI that ignores humanity).

7.2. AI with incorrectly formulated benevolent goal system kills humans

There are several failure modes which may result from wanting to create a benevolent AI, but when the AI is tries to be benevolent, there is a collective failure: AI interprets commands literally. The is the classical problem of “do what I mean, not what I say.” This could happen with almost all short sets of commands. That is one reason why the human legal system is so large, as it includes many explanations.

AI overvalues marginal probability events. Low-probability events with enormous utility may dominate the AI’s decision making. It could be something like the classical case of Pascal’s mugging (Bostrom 2009). For example, a small probability of infinite suffering of humans in the future may justify killing all the humans now.

Changes to the AI’s world model could make ordinary ideas dangerous. For example, if the AI starts to believe in an afterlife, it could decide to kill humans to send them to paradise.

AI could wrongly understand the desired reference class of “humans.” For example, by including extraterrestrials, unborn people, animals and computers, or only white males. On that basis, it could terminate humanity if it concluded that we are a threat to potential future non-human civilizations.

7.3. AI calculates what would actually be good for humans, but makes a subtle error with large consequences

There is a point of view that AI should not actually behave based on human commands, but instead calculate what humans should ask it. Moreover, that it should not only calculate human values, but envision their upgraded form, which humans could have created if more time and intelligence were available. This point of view is known as coherent extrapolated volition (CEV) (Yudkowsky 2004). Other models, where an AI calculates “goodness” based on some principles, or it extracts the goodness from human history, uploads, or observation of human behavior, are also possible. This could go wrong in subtler ways than destroying civilization, but the results could still be disastrous. Several possible failure modes are listed below: AI may use wireheading to make people happy (Muehlhauser 2011) or redesign their brains so they will be more skilled, but ignore human individuality and will. AI might make us more capable, happier, non-aggressive, more controllable, and more similar. However, as a result, we could lose many important characteristics which make us human, like love or creativity. In another case, AI may give people effective instruments for brain stimulation and some free will—and then people may effectively wirehead themselves. Some human qualities which some regard as bad may be an important part of our human nature, like aggression (Lem 1961), selfishness, and emotions.

AI could replace humans with philosophical zombies, uploading humans without consciousness and subjective experiences (qualia) (Chalmers 2002). If the AI does not have qualia itself, or if its creators deny the existence of qualia, this could be a likely outcome.

AI may protect individuals but destroy small groups and organizations; this would be problematic, as most human values are social. Alternatively, the AI could use some limited interpretation of human values and prevent their natural evolution into some post-human condition. The AI may also fail to prevent aging, death, suffering and human extinction.

Above all, AI could do some incomprehensible good against our will (this idea is from “The Time Wanderers” by (Srugatsky and Strugatsky 1985)). This is bad because we would lose the ability to define our future, and start to live like pets or children, or citizens in paternalistic state. For example, it could put humans in jail-like conditions for benevolent reasons, e.g. to prevent physical injury.

If AI tried to extrapolate human values, it could converge on the most-shared set of human cultures, which could be the set of values of tribal people or even animals (Sarma and Hay 2016). These values could include pleasure from killing, fighting wars, torture, and rape (Pinker 2011). For example, if AI extracted human values from the most popular TV series, it could be “Game of Thrones” (Lubin 2016), and then the “paradise” world it created for us would be utter hell. Even the second most popular show, “The Walking Dead” is about zombies; such a world would also be undesirable. If AI tried to extrapolate human values in a direction away from tribal shared values, it might not converge at all, or it could extrapolate a set of values held only by a specific group of people, like liberal white males or Chinese communists. Problems could also occur when defining the class of “humans.”

#### Having multiple benevolent AI fight each other---extinction.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

There could be different types of benevolent AIs, which would be perfectly fine if each existed alone.

However, conflicts between friendly AIs can be imagined. For example, if the first AI cared only about humans, and the second cared about all living beings on Earth, the first could be pure evil from the point of view of the second. Humans would probably be fine under the rule of either of them. Conflict could also arise between a Kantian AI, which would seek to preserve human moral autonomy based on a categorical imperative, and an “invasive happiness” AI, which would want to build a paradise for everyone.

If two or more AIs aimed to bring happiness to humans, they could have a conflict or even a war about how it could be done. The Machine Intelligence Research Institute (MIRI) (LaVictoire et al. 2014) thinks that such agents could present their source code to each other and use it to create a united utility function. However, source code could be faked, and predicting the interactions of multiple superintelligences is even more complicated than for one superintelligence.

### AT: Limited Goals---2NC

#### If the AI ever determines humanity to be in the way of their goals, we’re dead.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

In this case, the AI-singleton does not act against humans, but moves its actions somewhere else, probably into space. However, it must ensure that humans will not create another AI, or anything else that is a threat to the first AI, so even if it leaves Earth, it would probably leave behind some form of “AI nanny,” which would prevent humans from creating new AIs or space weaponry. This may not appear to be an extinction event in the beginning, merely a reduction of human potential, or “shriek” in Bostrom’s existential risk terminology (Bostrom 2002). Humanity would lose a potentially bright cosmic future, but live a life similar to our current one.

However, as such an AI continues its space exploration and probable astro-engineering, it might not be interested in anything that happens on Earth. Therefore, Earth could suffer from catastrophic consequences of these megascale engineering projects. For example, the AI could build a Dyson sphere around the Sun, shading the Earth.

Alternatively, the AI could expose the Earth to dangerous levels of radioactivity in the exhaust from the AI’s starships.

If humans attempted to create a second AI or use space weapons to destroy a Dyson sphere, the indifferent singleton would stop being indifferent and probably sterilize Earth. AI might extirpate humans in advance if it thinks that humanity could pose even the smallest threat to its future plans. A possible prevention strategy is based on the idea of persuading AI that preserving humanity has a small positive utility for it.

Even if the AI completely left the Solar System, if it prevented humans from creating a second AI and grounded us on Earth, the consequences would not be limited to the loss of future space travel. Additional consequences may be of the extinction variety, as humans would not be able to use AI systems to control any other global catastrophic risks, most importantly the risks of uncontrolled use of synthetic biology (Turchin et al. 2017). In another example, if humans were grounded on Earth we would not be able to build an effective anti-asteroid defense.

#### If they don’t kill us, we will get harvested. ☹.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

Human bodies consist of organic matter, which could be a source of easy energy by oxidation. As R. Freitas wrote, an army of self-replicating nanobots could use all components of the biosphere as fuel as well as building material (Freitas 2000). More advanced AI may use the Earth’s surface to build an initial space exploration infrastructure (e.g., swarms of chemical rockets or railguns), destroying human habitats and spoiling the atmosphere in the process.

Since there are many reasons that keeping humans alive could benefit an AGI, direct killing of humans for their atoms is less likely than was previously thought. Still, the AGI may see humans as a threat, and fully preserving human ways of life would be more expensive to the AGI, e.g., preserving the whole of planet Earth. AI could use the material from the Earth to construct a Dyson sphere or Matrioshka brain (Bradbury 2001), convert the whole planet into computronium (Gildert 2011), or cover the entire surface with photovoltaic cells.

The more advanced an AI in space became, the less it would depend on Earth as a source of material, but it might need materials from the Earth in order to leave the Solar System. Earth is one of the best sources for many chemical elements in the Solar System and its mass is around half that of all other terrestrial planets combined. Because of the complex geology of Earth, which includes water, life, volcanism and plate tectonics, concentrated deposits of many otherwise rare elements have been produced. Asteroid mining is good only for some elements, like gold, but not for all (Bardi 2008). So, large-scale space engineering in the Solar System might require dismantling the Earth for its chemicals.

### AT: Counter-AI---2NC

#### AI will fight each other or team up against us---extinction.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

The risks of war between superintelligent AIs seems under-explored, as most in the AI safety community assume that there will be a hard takeoff (Yudkowsky and Hanson 2008), and as a result, only one AI will exist.

Alternatively, some in the community believe that multiple AIs will be very effective in collaboration and negotiation (Critch 2017) and will merge into one AI. It is clear that human extinction is possible if two or more AIs wage war between each other on Earth.

Bostrom and Yudkowsky wrote that very quick self-improvement of the first AI is most likely, with a rather large lag between the first team which creates AI and other teams (Yudkowsky 2008; Bostrom 2014). However, if at least one of these conditions is not true, there will be many AIs undergoing simultaneous hard takeoff.

If there are multiple AIs, they will likely either peacefully share the world, or wage war until one or a small group of AIs form a singleton. The forms of such AI wars may differ; they could be a cyber war, economic war of attrition, hot war, etc. The type of war will mostly depend on complex game theory and could change from one form to another if the change provides benefit to one of the sides. A hot war would be most dangerous for humans, because its indirect consequences could affect the entire surface of the Earth and all human beings, in the same way that nuclear war between superpowers would create global risks for other countries: nuclear winter and fallout.

AIs at war may use humans and human values for blackmail. For example, non-friendly AI may blackmail friendly AI with threats to release a biological virus that will kill all humans. Thus, the fact that one of the AIs placed value on human wellbeing could make our population vulnerable to attack from an otherwise indifferent opposing AI. Even if there are two supposedly human-friendly and beneficial AIs, their understanding of “good” and the ways to reach it may be incompatible. Historical examples include wars between Christian countries (Reformation).

### AT: We’ll Contain The AI---2NC

#### You will not contain the AI, and we will descend to chaos when it breaches---extinction.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

However, it [AI] still can give bad advice or use other thin information channels (e.g., text interfaces) to create damage outside and increase its own chances of freedom. For example, an oracle AI may be limited to giving short text advice via a very simple interface. But such advice, while seemingly beneficial to humans, may have subtle remote consequences, resulting in the liberation of, and an increase in, the power of the oracle AI (Bostrom 2014).

Stanislav Lem wrote about the risks of oracle AI in his book "Summa Technologia" (Lem 1963). Such AI may give advice that appears to be good in the short term, but its long-term consequences could be catastrophic. In Lem's example, the oracle AI advises humans to use a specific type of toothpaste and, separately, a specific type of anti-baldness treatment. These activate two genes, which are dangerous only in combination. Moreover, the AI did not do it because it had malevolent intent to exterminate humanity, but because it just searched for the best solution for a given goal among many options. However, the goal that humans gave to the AI in Lem's example is dangerous: stop population increase.

AI could stage a global catastrophe of any scale to facilitate its initial breakout from its creators. For example, it could stage a nuclear war, so that its operators release it into the wild, hoping that it will help them in the war. The AI could then create a global risk and demand full power, rightfully claiming that only it could prevent the risk. An AI may also falsely predict an impeding risk and demand to be released from confinement in order to prevent the risk.

4.3. AI risks after it leaves initial confinement but before it takes over the world

The natural strategy for AI after leaving its initial confinement would be to hide somewhere in order to self-improve, acquire robotic infrastructure, and other resources (Yudkowsky 2008). Then it would be equipped to overcome existing defenses.

Basically, AI has two types of enemies: humans and other AIs. Humans would probably search for the leaked AI and try to stop it, using all available means, like shutting down the Internet, globally turning off electricity, or even nuclear strikes. But if the AI is able to escape from its human creators, it will probably be prepared to deal with these human actions.

The second risk is other AIs. The owners of the first AI will still probably have the AI’s source code, so the owners could make a copy of the original AI with the goal of finding and stopping the first runaway AI. This is the most immediate risk for the first AI. Such a second AI may be as powerful as the first AI, and this could be a route to AI war.

Elsewhere, we have shown that an AI that collaborates with its owners will have an advantage (Turchin and Denkenberger 2017), since it would not need to spend resources on hiding and fighting. Thus, a hard takeoff is more probable from a collaborating AI. It could collaborate up until the very late stages and still make the treacherous turn when it is a full-grown superintelligence with a large infrastructure.

Other AIs could be created by other AI teams. There are 2700 narrow AI related startups in the world as of 2017 (Angel.co 2017). The number of AGI projects is not so easy to estimate, as many are personal, secret, in universities, or may come from very effective narrow AI projects. There are around ten main players (like Google), around 100 groups of people or startups dedicated to creating AGI, and probably thousands of individuals. Some data reported by Meuhlhauser (2014) are now obsolete, as the field has grown rapidly in recent years.

We estimate the number of AGI teams as an order of magnitude of 100, that they are all within two years of each other, and that they are distributed linearly in their success timing. Therefore, the median distance between multiple AGI fruition would be approximately seven days. The self-improvement process is difficult because it requires testing of the new versions of the AI (Turchin and Denkenberger 2017), so seven days may not be enough time to gain a decisive advantage. In that case, multiple simultaneous takeoffs will happen, and the dynamic will be highly chaotic. Even if there are two strongest competitors, they could come to fruition almost simultaneously. The historical examples of the telephone patent (Baker 2000) and returning samples from the Moon (The Telegraph 2009) show that the scale of such a difference could be mere hours. The reason for small timing differences is that the first mover provokes the other side to launch their own system, even if it is not fully ready.

Thus, the first AI will not have much time to hide. Its convergent goal will be to prevent the appearance of other AIs in many places; staging a global catastrophe may be the most effective way to do so. As the young AI is not superintelligent and is also time constrained, it cannot spend much time on finding the best and most elegant route. It would probably elect simpler and more brutal routes.

From a technical point of view, a hiding young AI can use only relatively simple means to stage a global catastrophe, that is, to provoke nuclear war, create a rather simple bioweapon or a narrow AI virus to affect many existing robotics or other systems. If it creates more sophisticated technology like its own nanomachines, it would probably be able to take over the world without killing anyone. The risks of such a takeover are discussed in the next section.

#### Leads to enslavement and doomsday devices---it’s try-or-die to prevent.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

4.4. AI enslaves humans during the process of becoming a singleton

Humans may be instrumentally useful for the young AI before it reaches omnipotence. It may need humans, not just as a source of atoms, but as some kind of slaves. The AI could create a brain-infecting virus that converts the humans into slaves, and also permanently damages their autonomy. This period may not last for long, as the AI would soon master nanotechnology and could go forward without humans. It also would not need to enslave all humans but perhaps only a few in order to form the required infrastructure. While slavery appears to be a type of survival option for humans, it is obviously not optimal.

4.5. AI blackmails humans with the threat of extinction to achieve dominance

Herman Khan put forward the idea that an adversary could create a Doomsday weapon for the purpose of global blackmail (Kahn 1959). While no known Doomsday devices were built, such a device would be an embodiment of the doctrine of mutually assured destruction associated with full-scale nuclear retaliation.

A young AI may create Doomsday weapons and use them to blackmail humanity in order to secure world domination. Even a benevolent utilitarian AI may resort to blackmail if it calculates that the expected utility of its victory is greater than the expected loss of utility associated with human extinction (Shulman 2010). Even if the AI has to use its blackmail weapon to exterminate humans in 99% of cases, it could still be positive from the point of view of its utility function. Such situations with unbounded utilities may be regarded as special cases of the failure of friendliness, which will be discussed later.

### T&D---AI Virus Impact---Military AI---2NC

#### Military AI causes nuke wars, WMDs, and totalitarianism---defense can’t keep up---extinction.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

There are a number [of] GCRs associated with military systems. Some potential scenarios: military robotics could become so cheap that drone swarms could cause enormous damage to the human population; a large autonomous army could attack humans because of a command error; billions of nanobots with narrow AI could be created in a terrorist attack and create a global catastrophe (Freitas 2000).

In 2017, global attention was attracted to a viral video about “slaughterbots” (Oberhaus 2017), hypothetical small drones able to recognize humans and kill them with explosives. While such a scenario is unlikely to pose a GCR, a combination of cheap AI-powered drone manufacture and high-precision AI-powered targeting could convert clouds of drones into weapons of mass destruction [WMDs]. This could create a “drone swarms” arms race, similar to the nuclear race. Such a race might result in an accidental global war, in which two or more sides attack each other with clouds of small killer drones. It is more likely that drones of this type would contribute to global instability rather than cause a purely drone-based catastrophe.

AI-controlled drones could be delivered large distances by a larger vehicle, or they could be solar powered; solar-powered airplanes already exist (Taylor 2017). Some advanced forms of air defense will limit this risk, but drones could also jump (e.g., solar charging interspersed with short flights), crawl, or even move underground like worms. There are fewer barriers to drone war escalation than to nuclear weapons. Drones could also be used anonymously, which might encourage their use under a false flag. Killer drones could also be used to suppress political dissent, perhaps creating global totalitarianism. Other risks of military AI have been previously discussed (Turchin and Denkenberger 2018a).

### T&D---AI Virus Impact---Crit Infra---2NC

#### A single hack could collapse society---extinction.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

A narrow AI virus may also affect civilian infrastructure; some, but not all ways in which this could be possible are listed below. Remember that in the case of global catastrophes, the conditions necessary for most catastrophes could exist simultaneously. Several distinctive scenarios of such a catastrophe have been suggested.

For example, autopilot-controlled and hacked planes could crash into nuclear power stations. There are around 1000 nuclear facilities in the world, and thousands of large planes are in the air at every moment—most of them have computerized autopilots. Coordinated plane attacks happened in 2001 and a plane has been hacked (Futureworld 2013). Self-driving cars could hunt people, and it is projected that most new cars after 2030 will have some self- driving capabilities (Anderson 2017).

Elon Musk has spoken about the risks of AI living in the Internet; it could start wars by manipulating fake news (Wootson 2017). Computer viruses could also manipulate human behavior using blackmail, as seen in fiction in an episode of Black Mirror (Watkins 2016). Another example is creating suicide ideation, e.g., the recent internet suicide game in Russia, “Blue Whale” (Mullin 2017), which allegedly killed 130 teenagers by sending them tasks of increasing complexity and finally requesting their suicide.

The IoT will make home infrastructure vulnerable (Granoff 2016). Home electrical systems could have short circuits and start fires; phones could also catch fire. Other scenarios are also possible: home robots, which may become popular in the next few decades, could start to attack people; infected factories could produce toxic chemicals after being hacked by viruses.

Large-scale infrastructure failure may result in the collapse of technological civilization and famine (Hanson 2008; Cole et al. 2016). As industries become increasingly computerized, they will completely depend on proper functioning of computers, while in the past they could continue without them. These industries include power generation, transport, and food production. As the trend continues, turning off computers will leave humans without food, heating, and medication. Many industries become dangerous if their facilities are not intensively maintained, including nuclear plants, spent nuclear fuel storage systems, weapons systems, and water dams. If one compares human civilization with a multicellular organism, one could see that multicellular organisms could die completely, down to the last cell, as the result of a very small intervention. As interconnectedness and computerization of the human civilization grow, we become more and more vulnerable to information-based attacks.

### T&D---AI Virus Impact---Biohacking---2NC

#### Hackers create multipandemics and literally hack your brain.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

Craig Venter recently presented a digital-biological converter (Boles et al. 2017), which could “print” a flu virus without human participation. The genomes of many dangerous biological viruses have been published (Enserink 2011), so such technology should be protected from unauthorized access. A biohacker could use narrow AI to calculate the most dangerous genomes, create many dangerous biological viruses, and start a multipandemic (Turchin et al. 2017). A computer virus could harm human brains via neurointerfaces (Hines 2016).

### T&D---AI Virus Impact---Election Hacking---2NC

#### AI causes election hacking---extinction.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

There is also a group of scenarios in which narrow AI and robotization affect human society in such a way that the human population gradually declines, the role of humans diminishes, and human values are eroded (Joy 2000). This may not directly kill all humans in the short term, but could put them in the situation of “endangered species” in ~100 years. This could happen if no superintelligent AI appears, or if the appearance of superintelligent AI is not revolutionary. One example is the use of cyber warfare to affect elections (e.g., the 2016 US election), which may produce civil wars and global instability. This has some small probability of causing the collapse of civilization.

### T&D---AI Virus Impact---Ecological Niche---2NC

#### Makes humanity useless---extinction.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

An automated economy could purposelessly exist even without humans, like the *Ascending Economy* described by (Alexander 2016). Such a scenario could be an example of bad distributed (and non-agential) superintelligence created by market forces, which does not need humans for its existence. Such a superintelligence could gradually push humans out of existence.

3.4.2. Gradual replacement of humans by robots

From an evolutionary point of view, it is known that the biggest threat to the species is not direct killing of its representatives by predators or disease, but gradual reduction of its ecological niche and strong competition from other species (Clavero and García-Berthou 2005). The analogy here would be if human labor were to lose its value.

### T&D---AI Virus Impact---Value To Life---2NC

#### Makes people lose their self-worth. That’s not good.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

Two catastrophic scenarios are possible: 1) people lose their sense of self-worth because of technologically driven unemployment and 2) the combination of basic income and the feeling of uselessness will attract humans to AI-created addictive drugs, as described below. Genetically modified human-robot hybrids could also replace humans.

#### That cause subjective extinction---we become p-zombies.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

It is conceivable that human-level AGI will be created, perhaps by the mind uploading method (Hanson 2016), but creation of superhuman AI will be postponed because of technical difficulties, or due to a permanent ban.

Many of the risks of human-level AI will be similar to the risks of narrow AI mentioned above, including sophisticated AI viruses, acceleration of dangerous science, and human replacement by the robotic economy. One specific risk is that human uploads will be philosophical zombies (p-zombies). In that case, if everybody was uploaded, the world would appear to be enjoyable, full of robots and virtual reality. But there would be no subjective experiences at all and the world would, in fact, be subjectively dead. This risk appears to be low, as many claim that p-zombies are impossible (Dennett 1978; Yudkowsky 2015). There could be other risks of this type, even subtler.

For example, human uploads could have a slightly different set of subjective experiences, values or behavior.

Christiano suggested “prosaic AI,” which is some combination of already existing technologies, mainly neural nets (Christiano 2016). Such a system would have limited ability to self-improve, but could still be dangerous if it works as a “global brain” or a weapon. One possibility is an AI system which has a model of itself and a survival drive but does not self-improve for some reason. Another possibility is a very large AI system which merges with government structures but does not need to self-improve to reach its goals. This could become the basis of a repressive totalitarian state which ultimately does not need humans, as discussed in Section 3.2.1.

### T&D---AI Virus Impact---Wireheading---2NC

#### Causes psychological dependence on AI---that wireheading causes extinction and kills the value to life.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

Two catastrophic scenarios are possible: 1) people lose their sense of self-worth because of technologically driven unemployment and 2) the combination of basic income and the feeling of uselessness will attract humans to AI-created addictive drugs, as described below. Genetically modified human-robot hybrids could also replace humans.

3.4.3. Superaddictive drug created by narrow AI

AI-powered entertainment combined with brain modification technologies may come close to wireheading (Strugatsky and Strugatsky 1976). Widespread addiction and withdrawal from normal life (via social networks, fembots, virtual reality, designer drugs, games, etc.) would result in lower life expectancy and low fertility. This is already happening to some extent in Japan, where the Hikikomori generation refuses to have families (Saito and Angles 2013). In some sense, Facebook addiction created by the AI-empowered news feed is a mild contemporary example of future, potentially dangerous AI drugs.

### T&D---AI Virus Impact---Totalitarianism---2NC

#### It unironically sends us to *1984*.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

A large global surveillance system could create “computer totalitarianism,” which may work as an Orwellian world government (Orwell 1948). We could call such a system “data-driven” AI in contrast to “intelligence-driven,” self-improving AI.

Narrow AI may be used as a weapon, which could provide a decisive advantage even before the creation of self-improving AI. It could be used for forceful unification of the world under one government with promises to prevent other global risks (including even more complex AIs and existential terrorists). While this idea may have merit (e.g., Goertzel’s AI Nanny (Goertzel 2012)), its application could easily go wrong and create an oppressive global dictatorship, a situation recognized by Bostrom as an existential risk (Bostrom 2002). Such a society would be fragile and could collapse completely, as extremely complex societies often do (Hanson 2008).

### AI Bad---Agriculture---1NC

#### Putting AI on farms would suck---increases vulnerabilities, environmental damage, and discrimination.

Benjamin Ferrer 22, Senior Editor and Journalist at Food Ingredients First, Analysts warn growing AI revolution in farming is not without “huge risks” 5/20/22, https://www.foodingredientsfirst.com/news/ais-agri-food-takeover-analysis-warns-growing-tech-to-table-trend-in-farming-is-not-without-huge-risks.html/micahw

While artificial intelligence (AI) is on the cusp of driving what some refer to as the next “agricultural revolution”, researchers are warning that using some of these new technologies at scale holds huge risks that are not being considered.

Even still, many industry watchers believe these systems are pivotal in confronting the global challenge of feeding our ballooning populations more sustainably.

A new risk analysis, published in the journal Nature Machine Intelligence, warns that the future use of artificial intelligence [AI] in agriculture comes with “substantial potential risks” for farms, farmers and food security that are poorly understood and under-appreciated.

“The idea of intelligent machines running farms is not science fiction. Large companies are already pioneering the next generation of autonomous ag-bots and decision support systems that will replace humans in the field,” highlights Dr. Asaf Tzachor at the University of Cambridge’s Centre for the Study of Existential Risk, first author of the paper.

“But so far no-one seems to have asked the question ‘are there any risks associated with a rapid deployment of agricultural AI?’”

Risk of hacking a food network

The researchers put forward a hypothetical scenario in which the authority for tilling, planting, fertilizing, monitoring and harvesting this field has been delegated to AI.

In this scenario, these algorithms that control drip-irrigation systems, self-driving tractors and combine harvesters are clever enough to respond to the weather and the exact needs of the crop.

These intelligent automated systems would be largely responsible for managing large expanses of crops, being grown for food to feed entire cities’ worth of people.

“Then imagine a hacker messing things up,” the paper’s authors stress

“Despite the huge promise of AI for improving crop management and agricultural productivity, potential risks must be addressed responsibly and new technologies properly tested in experimental settings to ensure they are safe, while securing against accidental failures, unintended consequences and cyber-attacks.”

Employing white hats to identify system failures

In their research, the authors have come up with a catalog of risks that must be considered in the responsible development of AI for agriculture – and ways to address them.

In this assessment, they raise the alarm about cyber-attackers potentially causing disruption to commercial farms using AI, by poisoning datasets or by shutting down sprayers, autonomous drones and robotic harvesters.

To guard against this they suggest that “white hat hackers” help companies uncover any security failings during the development phase, so that systems can be safeguarded against real hackers.

In a scenario associated with accidental failure, the authors suggest that an AI system programmed only to deliver the best crop yield in the short term might ignore the environmental consequences of achieving this, leading to overuse of fertilizers and soil erosion in the long-term.

Meanwhile, the over-application of pesticides in pursuit of high yields could poison ecosystems; while over-application of nitrogen fertilizer would pollute the soil and surrounding waterways.

While AI may help relieve manual labor, it may widen the gaps between commercial and subsistence farmers, the researchers flag.

The authors suggest involving applied ecologists in the technology design process to ensure these scenarios are avoided.

Impact on human labor

Aside from raising farming efficiencies, autonomous AI machine systems can also help improve the working conditions of farmers, relieving them of manual labor.

But without inclusive technology design, socioeconomic inequalities that are currently entrenched in global agriculture – including gender, class and ethnic discriminations – will remain.

“Expert AI farming systems that don’t consider the complexities of labor inputs will ignore, and potentially sustain, the exploitation of disadvantaged communities,” warns Tzachor.

However, small-scale growers who cultivate the majority of farms worldwide and feed large swaths of the so-called Global South are likely to be excluded from AI-related benefits.

“Marginalization, poor internet penetration rates, and the digital divide might prevent smallholders from using advanced technologies, widening the gaps between commercial and subsistence farmers,” warn the researchers.

### AI Bad---Agriculture---2NC

#### SMALL FARMS. They can’t keep up---and would cause child labor which is undesirable. ☹.

Michelle Taylor 22, Editor-in-Chief of the Laboratory Group (Labcompare, Laboratory Equipment, American Laboratory and Forensic), “Researchers Warn of Risks of Using AI in Agriculture,” https://www.laboratoryequipment.com/583705-Researchers-Warn-of-Risks-of-Using-AI-in-Agriculture/micahw

The scientists envision the adoption of advanced technologies worsening the socioeconomic inequities that already permeate global agriculture, including gender, class and ethnic discriminations and child labor. Small-scall farmers, specifically, will be at a heightened disadvantage, the researchers say.

“Small-scale farmers who cultivate 475 of approximately 570 million farms worldwide and feed large swaths of the so-called Global South are particularly likely to be excluded from AI-related benefits,” the researchers write in their paper. “Marginalization, poor Internet penetration rates and the digital divide might prevent smallholders from leveraging such advanced technologies, widening the gaps between commercial farmers and subsistence farmers.”

<<SMALL FARMS GOOD IMPACT CARD>>

### AI Bad---China-US Relations---1NC

#### AI is a major part of why US-China relations fail---they don’t trust each other and further AI development only makes it worse.

Ryan Fedasiuk 22, Research Analyst at Georgetown’s Center for Security and Emerging Technology and an Adjunct Fellow at the Center for a New American Security, “The U.S. and China Need Ground Rules for AI Dangers,” https://foreignpolicy.com/2022/04/27/us-china-artificial-intelligence-dangers/micahw

The threats are bigger, the stakes are higher, and the level of trust between the United States and China is lower today than it was in 2014, when experts from both countries first began discussing the risks posed by artificial intelligence (AI). At a time when about 9 in 10 U.S. adults consider China to be a “competitor” or “enemy,” calls for Washington and Beijing to cooperate on shared challenges routinely fall on deaf ears. But, as laboratories in both countries continue to unveil dramatic capabilities for AI systems, it is more important than ever that the United States and China take steps to mitigate existential threats posed by AI accidents.

As a technology, AI is profoundly fragile. Even with perfect information and ideal operating circumstances, machine learning systems break easily and perform in ways contrary to their intended function. Since 2017, the Global Partnership on AI has logged “more than 1,200 reports of intelligent systems causing safety, fairness, or other real-world problems,” from autonomous car accidents to racially biased hiring decisions. When the stakes are low, the risk of an AI accident can be tolerable—such as being presented with an uninteresting Netflix recommendation or suboptimal driving route. But in a high-pressure, low-information military environment, both the probability and consequences of AI accidents are bound to increase.

Weapon systems put at high alert, for instance, could mistake a routine incident for an attack—and even automatically respond. Some of the Cold War’s most dangerous nuclear warning malfunctions were narrowly avoided because human judgment prevailed. For now, nuclear command and control systems in the United States and China still require that element of human decision-making—but, for instance, shipboard defense systems that might be involved in naval confrontations do not.

Neither side trusts the other on this issue. Over the past six months, I have spoken on a handful of occasions with retired Chinese military leaders about the risks involved with AI systems. They view the U.S. Defense Department’s AI ethics principles and broader approach to “responsible AI” as bad-faith efforts to skirt multilateral negotiations aimed at restricting the development of autonomous weapons. Meanwhile, U.S. observers don’t believe China is serious about those negotiations, given its extraordinarily narrow definition of lethal autonomous weapons systems. (China has called for a ban only on autonomous weapons that cannot be recalled once initiated and which kill with indiscriminate effect.) Both militaries are developing automated target recognition and fire control systems based on AI, and the last substantial discussion among the United Nations Group of Governmental Experts focused on these issues is set to conclude in mid-2022.

### AI Bad---Democracy---1NC

#### More AI means more disinformation---that erodes democracy regardless of intention.

Bradley Honigberg 22, Strategic Communications Consultant with Deloitte's Cyber and Strategic Risk Practice, “The Existential Threat of AI-Enhanced Disinformation Operations,” <https://www.justsecurity.org/82246/the-existential-threat-of-ai-enhanced-disinformation-operations/micahw>

Disinformation operations — covert efforts to deliberately spread false or misleading information — have historically been a distinctively human endeavor. With the rise of instantaneous digital communications, malign actors have increasingly exploited the machine learning systems embedded in our daily lives to precisely target audiences, shape global public opinion, and sow social discord. Today, disinformation operators are expanding their manipulation toolkits to include new AI techniques. AI-generated synthetic media and convincing AI-enhanced chatbots now offer threat actors a growing array of persuasive, tailored, and difficult-to-detect messaging capabilities. While machine learning techniques can also be used to combat disinformation, they will likely remain insufficient to counterbalance the expanding universe of anonymous digital mercenaries. Unless liberal democracies develop whole-of-society counter-disinformation strategies, AI-enhanced disinformation operations will further exacerbate political polarization, erode citizen trust in societal institutions, and blur the lines between truth and lies.

Mapping and Defining the Modern Disinformation Landscape

First, a few quick definitions are in order. AI is a field of research that seeks to build computing technologies that possess aspects of human perception, reasoning, and decision-making. Machine learning, a subset of AI, involves the use of computing power to execute algorithms that learn from data. Algorithms are the recipe for completing programmed tasks; data help these systems “learn” about the world; and computing power is the engine that enables systems to perform specific tasks quickly and accurately. Over the last decade, significant improvements in machine learning capabilities have been enabled by advances in computer processing power, the rise of Big Data, and the evolution of deep learning “neural networks.” (These networks contain cascades of nodes that loosely mimic the neurons in the human brain, which, in combination, can identify patterns in large datasets and encode complex tasks.) While distinct from human intelligence, AI excels at narrow tasks and has exceeded human capabilities in several fields.

As non-human intelligence has increasingly been integrated into the fabric of human activity, digital disinformation has emerged as a potent means of political warfare. Large technology corporations, driven partly by the competitive market for attention and advertising revenue, extract user data to refine their content-selection algorithms and optimize user engagement. As outlined in the Facebook papers, at the core of these influential social networks are recommendation systems that drive users down rabbit holes of progressively more personalized and novel content. A report from Katerina Sedova and her team at the Center for Security and Emerging Technology illustrates how malign actors exploit this attention-centric digital environment to micro-target and mobilize unwitting Internet users by seeding “the information environment with tailored content and hijacking legitimate online forums” through fake human accounts (sock puppets), automated botnets, groups of coordinated humans, and digital advertising. Disinformation operators seek to exploit human biases, heighten emotions, and induce information overload at the expense of rational decision-making. Researchers from Harvard’s Shorenstein Center argue that talented disinformation operators can “enable discriminatory and inflammatory ideas to enter public discourse” as fact by deliberately highlighting differences and divisions in society. Over time, this phenomenon can widen identity-based fissures between social groups, jam the gears of democratic governance, and, in some cases, catalyze violence.

Digital disinformation techniques are diffusing and evolving at a rapid pace. Authoritarian regimes, particularly Russia and China, increasingly pursue new capabilities to project their disinformation operations more precisely at home and abroad. While foreign disinformation campaigns receive the majority of attention, domestic actors are adopting similar tactics, and operations are increasingly being outsourced to a growing transnational disinformation-for-hire industry. Given its proven success and future potential, well-resourced actors will continue to invest in advanced AI capabilities to augment their current disinformation operations.

Democratized Deepfakes and AI-Enhanced Chatbots

Machine learning techniques can generate highly realistic fake images, audio, and video known as “deepfakes.” Generative Adversarial Networks (GANs) make these synthetic media capabilities possible — a technique that generates new synthetic data that becomes increasingly realistic as it learns. A GAN system pits two networks against one another. One network (the discriminator) is trained on a real dataset of interest and then detects whether new data is real or fake. The opposing network (the generator) produces novel data to fool the discriminator. As a result of this iterative competition, the generator improves at creating synthetic content that can be weaponized to mislead, deceive, or influence audiences. This technique has been used to create extraordinarily realistic artificial faces for legions of bot accounts, produce convincing audio for extortion or blackmail, and generate fake content that, when timed strategically, can destabilize governance and geopolitics.

As synthetic media capabilities become more accessible and user-friendly, experts predict that deepfakes will benefit those already in positions of power and influence and pose the most significant risks to communities antagonistic to traditional power structures. In a world replete with manipulated media, powerful individuals and institutions can conveniently dismiss inconvenient facts. This dynamic may perpetuate what Robert Chesney and Danielle Citron call a “liar’s dividend” in which bad actors caught in genuine recordings of misbehavior can dismiss the truth as AI forgery. Beyond the individual harms and misdeeds enabled by this dynamic, this trend will likely accelerate growing cynicism about the possibility and value of distinguishing between fact and fiction. According to a recent report from the United Nations Institute for Disarmament Research, the ability to “portray someone doing something they never did or saying something they never said” through deepfakes could “challenge and influence our perceptions of reality.”

While visual deepfakes have garnered the attention of policymakers, deepfake text may prove even more vexing. Breakthroughs in natural language processing and generation — machine learning algorithms that recognize, predict, and produce languages — have given rise to sophisticated large language models capable of reading, writing, and interpreting text. As Karen Hao explains in MIT’s Technology Review: “By ingesting millions of web-based sentences, paragraphs, and dialogue, these models learn the statistical patterns that govern how each element should be sensibly ordered.” But along with grammatical rules, these models excel at mimicking online discourse and are thus prone to parroting humanity’s most insidious biases.

Capable of writing persuasive and seemingly authentic content that conforms to a specific cultural milieu, large language models can be used to increase the scale and scope of disinformation operations. Early research has found that one model can write articles indistinguishable from those written by journalists (particularly as the partisanship of the content increased), emulate the style of extremist writing, produce racist manifestos from multiple viewpoints, seed new conspiracy narratives, and draft posts that exploit political wedges. Studies have also shown that threat actors can use large language models to streamline the work of human disinformation operators, facilitate micro-targeted propaganda campaigns, and enhance the explosive potential when leaking hacked documents.

Despite these hazards, large language models are being developed and deployed by companies and countries worldwide and are increasingly open-source. Because there is no technology yet capable of comprehensively identifying synthetic text online, malign actors may already be using these models to augment their disinformation operations. As GANs and large language model capabilities advance, machine learning models have begun to shift toward the production of integrated combinations of text, video, audio, and still images, which will enable human-machine teams to produce high-quality and highly personalized disinformation-at-scale.

New machine learning techniques also enable the production of automated social media accounts — commonly called “bots” — that are better at mimicking human behavior, maximizing amplification, and avoiding detection. Conversational AIs are large language models capable of managing the “open-ended nature” of conversations, signaling a near future in which chatbots engage in seamless dialogue with humans. The AI research community typically makes their findings public, so other researchers can reproduce, learn, and build on their work. In turn, open-source training datasets released by bot detection services are equally available to threat actors who use them to develop more human-like bots.

These advances enable savvy disinformation operators to combine AI-powered chatbots with existing social listening and synthetic media capabilities to identify trending topics, develop a pool of human-curated messages, and deliver highly personalized narratives to targeted audiences. It will soon be possible for threat actors to train chatbots to specialize in specific trolling techniques or bring them to life with GANs-generated video skins that impersonate trusted sources. Soon, fully autonomous bot accounts will be produced en masse, improve rapidly with experience, and ceaselessly try to persuade, troll, and manipulate people online. As a 2017 report from the State Department’s Advisory Commission on Public Diplomacy predicts, machines will then process the expanding corpus of bot-generated content, producing a vicious cycle in which devices will talk to, at, and over each other, progressively “drowning out human conversations online.” It is unclear to what extent these fears have been realized over the five years since that report was released – but claims about the prevalence of bots currently operating on social media platforms have already thrown a wrench into the proposed sale of one central platform (Twitter). The continued inability to determine the extent of Twitter’s bot problem, even with a $44 billion deal on the line, illustrates the profound challenge of identifying AI-generated content at scale.

And yet, it seems that the potential deluge of AI-enhanced disinformation has not drowned out human voices yet. Indeed, by our current best assessments, during the highly contentious 2020 U.S. presidential election, there was a notable absence of politically-motivated deepfake content (with some exceptions). Instead, the most substantial ongoing damage caused by synthetic media is happening in the personal sphere, disproportionately impacting women and marginalized communities. For now, simple editing software and techniques like attaching misleading descriptions to existing content are significantly more common than AI-generated synthetic media. As researchers from the Bulletin of the Atomic Scientists point out, manipulated media does not need to convince their audience of their realism to spread widely and influence human behavior.

In the high-stakes realm of geopolitics, authoritarian states have just begun integrating deepfakes and other AI-enabled media into their disinformation toolkits. For example, in the lead-up to its full-scale invasion of Ukraine, the Kremlin reportedly planned to stage a Ukrainian attack on Russian civilians as a pretext for invading — but the plan would have reportedly employed actors and corpses, not deepfakes. In other words, even well-resourced threat actors continue to opt for more traditional forms of deception over AI-generated forgeries. Even when employed, these technologies have not yet been effective. For instance, a deepfake depicting Ukrainian President Volodymyr Zelensky surrendering was uploaded to a hacked Ukrainian news website, but the video was quickly debunked. At the same time, the Kremlin has also pursued more subtle information warfare strategies that AI has augmented. For example, Russia has deployed swarms of fake accounts with AI-generated faces to bolster their credibility and parrot their talking points. Overall, the refinement of synthetic media generation will inevitably augment the disinformation capabilities of malign actors and become an increasingly routine aspect of online life.

Strategies for Combating AI-Enhanced Disinformation

Just as machine learning is used to amplify disinformation operations, other machine learning capabilities can be used to protect the information environment. Stakeholders are developing media provenance technologies to authenticate metadata — information about how, by whom, when, and where a piece of media was created and edited. Katarina Kertysova highlights how AI can identify patterns of words that indicate disinformation by analyzing cues from articles previously flagged as manipulative; similar feature-based detection capabilities can also be applied to identify synthetically-generated images and videos. Social media companies and a new generation of tech start-ups also leverage machine learning alongside human moderators to identify disinformation and bot accounts, although these capabilities are not 100 percent effective. The Defense Advanced Research Projects Agency has an ongoing effort to develop forensic systems to improve abilities to spot inconsistencies in deepfake content.

While authentication and detection tools are in development, they remain imperfect. There are at least two distinct problems confronting these capabilities: first, discerning whether media is synthetically produced, and second, whether the information communicated by the media is true or false. The techniques described above broadly address the first problem, but the second is significantly more challenging to automate. To discern whether media is true or false, an AI needs a sophisticated understanding of, among other things, power, “history, humor, symbolic reference, inference, subtlety, insinuation, and power.” Because detection systems lack these distinctly human abilities, threat hunting still relies primarily on tips from human actors, including government, media, and civil society partners — a detection system that raises its own questions about bias and fairness. Meanwhile, fully autonomous detection systems also make mistakes. They sometimes mistakenly block lawful and accurate content, which may impair freedom of expression and information. Even the most advanced detection capabilities remain susceptible to adversarial examples — “optical illusions” for machine learning models intentionally designed to make them misidentify images and videos. And as discussed above, it is incredibly difficult to determine whether a digital text was created by a human, a machine, or some combination of the two.

The most direct way to combat AI-enhanced disinformation is to focus on the infrastructure that facilitates its distribution. While Congress could pursue legislation that directly regulates social media algorithms, this approach must be carefully tailored to avoid serious constitutional hurdles. Instead, legislation grounded in content-neutral goals such as carefully labeling bot accounts, strengthening data privacy laws, mandating cross-platform interoperability, increasing algorithmic transparency, and fostering fair competition could offer potential avenues for mitigating disinformation and safeguarding online authenticity. The goal of regulation should be to give social media companies incentives to shift away from their ad-centric business models and take on a more significant role in protecting democratic information environments. At the same time, regulations should be careful not to impede AI research and risk weakening the United States’ hand in its technological competition with China.

Beyond these regulatory efforts, societal stakeholders should pursue counter disinformation strategies. Congress could allocate funding for new techniques to detect synthetic media, invest in local news organizations across the country, and require services that sell aggregated consumer information to vet potential purchasers. The U.S. government should leverage allies and partners to share information and best practices for detecting disinformation operations. Blockchain technology — a decentralized ledger to record information that is nearly impossible to alter after it has been created — has strong potential to help verify the provenance of digital content. Platforms and AI researchers should develop a publication risk framework to protect their open-source research from unethical usage and adapt cybersecurity best practices to counter disinformation. Traditional media outlets must develop similar strategies to avoid unintentionally amplifying disinformation operations. Critically, more resources, training, and equipment should be allocated to civil society organizations to cultivate a genuinely whole-of-society counter disinformation strategy.

Open societies must pursue robust and long-term initiatives to help their populations become more balanced and careful consumers of online information. Promoting “cyber citizenship” for all age groups will be the most effective long-term solution for achieving resilience to disinformation. These skills include media literacy, digital ethics, civics, and cybersecurity. The United States should incorporate lessons learned from successful digital media literacy programs worldwide, many of which it supported and funded. Cultivating cyber citizenship skills will help inoculate individuals against disinformation operations, whether AI-powered or not.

More broadly, as the Aspen Institute’s Commission for Information Disorder argues, spreading false or misleading information online is a byproduct of complex structural inequities that have corroded trust between and among communities. To truly address the spread of misinformation and stymie deliberate disinformation operations, open societies must address the widening gaps between the haves and have-nots by investing in their citizens’ long-term development and well-being.

The Existential Threat of AI-Enhanced Disinformation Operations

New AI capabilities are rapidly increasing the volume, velocity, and virality of disinformation operations. As they continue to improve and diffuse, they further threaten to erode trust in democratic governance and encourage citizens to doubt the possibility of truth in public life. The profound cynicism introduced by AI-enhanced disinformation can be used to fuel mob majoritarianism and create new opportunities for illiberal politicians to campaign on promises to restore “order” and “certainty” by curtailing free speech and other civil rights. Such an outcome would hasten what Timothy Snyder has dubbed a “politics of eternity” in which malicious actors “deny truth and seek to reduce life to spectacle and feeling.”

Open societies rely on a shared basis of factuality to function effectively, especially during inflection points like national elections and the organized transitions of power. How we collectively adapt to a world of AI-enhanced disinformation today will determine the future of liberal democracy, basic standards of truth, and our shared perceptions of reality.

### AT: AI Solves Disease---1NC

#### AI fails---COVID proves.

Bhaskar Chakravorti 22, Dean of Global Business at The Fletcher School at Tufts University, Founding Executive Director of Fletcher’s Institute for Business in the Global Context, “Why AI Failed to Live Up to Its Potential During the Pandemic,” Harvard Business Review, https://hbr.org/2022/03/why-ai-failed-to-live-up-to-its-potential-during-the-pandemic/micahw

At the outset, things looked promising. Machines beat humans in raising the early alert about a mysterious new virus out of Wuhan, China. Boston Children’s Hospital’s HealthMap system, which scrapes online news and social media for early signals of diseases, along with a Canadian health news scraper, BlueDot, picked up warning signs. BlueDot’s algorithm even predicted cities most at risk if infected people were to travel, all days before the WHO and weeks before the rest of the world caught up.

As the world officially went into lockdown in 2020, it was clear that AI’s game-changing contribution would be in rapid prediction — diagnosis, prognosis, and forecasting the spread of an emergent unknown disease, with no easy way to test for it in a timely way.

Numerous AI-enabled teams mobilized to seize the opportunity. At New York’s Mount Sinai hospital, for example, a team designed an AI system to quickly diagnose Covid-19 using algorithms trained on lung CT scans data from China. Another group at MIT created a diagnostic using algorithms trained on coughing sounds. A third team, an NYU and Chinese collaboration, used AI tools to predict which Covid-19 patients would develop severe respiratory disease. We had heard for years about AI’s transformative potential, and suddenly there was an opportunity to see it in action.

So, how did these AI-powered Covid predictors work out? Put bluntly, they landed with a thud. A systematic review in The BMJ of tools for diagnosis and prognosis of Covid-19 found that the predictive performance was weak in real-world clinical settings. Another study at the University of Cambridge of over 400 tools using deep-learning models for diagnosing Covid-19 applied to chest x-rays and CT scans data found them entirely unusable. A third study reported in the journal, Nature, considered a wide range of applications, including predictions, outbreak detection, real-time monitoring of adherence to public health recommendations, and response to treatments and found them to be of little practical use.

We can learn from these disappointments as we gear up to build back a better AI, however. There are four places where the fault lines appeared: bad datasets, automated discrimination, human failures, and a complex global context. While they relate to Covid-19 decisions, the lessons are widely applicable.

### AT: AI Solve Disease---2NC

#### Bad datasets

Bhaskar Chakravorti 22, Dean of Global Business at The Fletcher School at Tufts University, Founding Executive Director of Fletcher’s Institute for Business in the Global Context, “Why AI Failed to Live Up to Its Potential During the Pandemic,” Harvard Business Review, https://hbr.org/2022/03/why-ai-failed-to-live-up-to-its-potential-during-the-pandemic/micahw

AI decision-making tools are only as good as the data used to train the underlying algorithms. If the datasets are bad, the algorithms make poor decisions. In the context of Covid, there are many barriers to assembling “good” datasets.

First, the breadth of Covid symptoms underscored the challenge of assembling comprehensive datasets. The data had to be pulled from multiple disparate electronic health records, which were typically locked away within different institutional systems and their corresponding siloes. Not only was each system separate, they also had different data governance standards with incompatible consent and confidentiality policies. These issues were amplified by health care systems spanning different countries, with incompatible patient privacy, data governance, and localization rules that limited the wholesale blending of such datasets.

The ultimate impact of such incomplete and poor-quality data was that it resulted in poor predictions, making the AI decision tools unreliable and untrustworthy.

A second problem arose from the way data was collected and stored in clinical settings. Aggregated case counts are easier to assemble, but they may omit key details about a patient’s history and other demographic, personal, and social attributes. Even finer details around when the patient was exposed, exhibited symptoms, and got tested and the nature of the symptoms, which variant they had been infected with, the medical interventions and their outcomes, etc., are all important for predicting how the virus might propagate. To compound the problems, some datasets were spliced together from multiple sources, introducing inconsistencies and redundancies.

Third, a comprehensive dataset with clues regarding Covid symptoms, how the disease might spread, who is more or less susceptible, and how to manage the disease ought to draw from multiple sources, given its newness. In addition to data from the formal health care settings, there are other critical information sources, datasets, and analyses relevant for predicting the pathways of a novel and emergent disease. Such additional data may be drawn from multiple repositories, effectively tapping into the experiences of people grappling with the disease. Such repositories could include Twitter, professional message boards, analyses done by professionals and amateurs on “open-source” platforms, medical journals, blogs, and news outlets. Of course, once you account for so many disparate sources of relevant data, the process of integration, correcting for wrong or misinformation, fixing inconsistencies, and training algorithms increased the complexity of creating a full dataset.

#### Automated discrimination

Bhaskar Chakravorti 22, Dean of Global Business at The Fletcher School at Tufts University, Founding Executive Director of Fletcher’s Institute for Business in the Global Context, “Why AI Failed to Live Up to Its Potential During the Pandemic,” Harvard Business Review, https://hbr.org/2022/03/why-ai-failed-to-live-up-to-its-potential-during-the-pandemic/micahw

Even when there were data available, the predictions and decisions recommended by health care management algorithms led to potentially highly discriminatory decisions — and concerns that some patients received worse care. This is because the datasets used to train the algorithms reflected a record of historical anomalies and inequities: lower levels of access to quality healthcare; incorrect and incomplete records; and deep-seated distrust in the health care system that led some groups to avoid it.

There are broad concerns about the negative impacts of AI bias, but during the pandemic, the consequences of such bias were severe. For example, consider a pre-Covid study in Science that found that Black patients were assigned the same risk level by an algorithm as white patients, even though the latter were not as sick — leading to inadequate medical care for the Black patients. Looking ahead, as Black and Hispanic Covid-19 patients suffered higher mortality rates than white patients, algorithms trained on such data could recommend that hospitals redirect their scarce resources away from Black and Hispanic patients.

The ultimate impact of such automated discrimination is even more distortionary when we consider that these disadvantaged groups have also been disproportionately affected by the most severe cases of Covid-19 — in the U.S., Black, Hispanic, and Native Americans were about twice as likely to die from the disease as white patients.

#### Human error

Bhaskar Chakravorti 22, Dean of Global Business at The Fletcher School at Tufts University, Founding Executive Director of Fletcher’s Institute for Business in the Global Context, “Why AI Failed to Live Up to Its Potential During the Pandemic,” Harvard Business Review, https://hbr.org/2022/03/why-ai-failed-to-live-up-to-its-potential-during-the-pandemic/micahw

The quality of any AI system cannot be decoupled from people and organizations. Behaviors, from choosing which applications and datasets are used to interpreting the decisions, are shaped by incentives and organizational contexts.

The wrong incentives can be a big problem. Managers overseeing health care systems often had few incentives to share data on patients — data may have been tied to revenues, or sharing it may raise concerns over patient confidentiality. For researchers, rewards were often aligned with sharing data with some select parties but not everyone. Moreover, there were few career incentives to validating existing results, as there is greater glory in producing new findings rather than replicating or validating other studies. This means that study results may not have applied in a wide enough variety of settings, making them unreliable or unusable and causing caregivers to hesitate to use tools that had not been proven in multiple settings. It is particularly risky to experiment with human health.

Then, there’s the issue of data entry errors. Much of the data accumulated on Covid-19 involved environments in which health care workers were operating under pressure and extraordinarily heavy caseloads. This may have contributed to mislabeled and incomplete datasets — with mistakes showing up even in death certificates. In many countries, health care systems were underreporting Covid-19 cases, either because they were encouraged to do so by the authorities, because of unclear guidelines, or simply because staff were overwhelmed.

Even with AI tools on hand, the humans responsible for making decisions often lacked critical interpretive capabilities — from language to context awareness or the ability to spot biases and mistakes. There isn’t, as yet, a uniformly accepted code of ethics, or a checklist, that gives caregivers a sense of when to apply AI tools versus mitigating harms by using judgment. This could lead to inconsistent use or misuse of the AI tools and eventually undermine trust in them.

#### Global complexities + inequalities

Bhaskar Chakravorti 22, Dean of Global Business at The Fletcher School at Tufts University, Founding Executive Director of Fletcher’s Institute for Business in the Global Context, “Why AI Failed to Live Up to Its Potential During the Pandemic,” Harvard Business Review, https://hbr.org/2022/03/why-ai-failed-to-live-up-to-its-potential-during-the-pandemic/micahw

A pandemic, by definition, cuts across different political, economic, and sociocultural systems. This complicates the process of assembling a comprehensive dataset that aggregates across different countries with widely applicable lessons. The pandemic underscored the challenge of deriving universally applicable decision tools to manage human health across all health care settings regardless of geographic location. Appropriate medical interventions depend on many factors, from biology to institutional, sociopolitical, and cultural forces to the local environment. Even if many facets of human biology are common across the world, the other factors vary widely.

For one, there are differences across countries in terms of their policies regarding data governance. Many countries have data localization laws that prevent the data from being transported across borders. There is no international consensus on how health care data should be shared. While the preexisting international network for the sharing of influenza genome sequence data was extended to the sharing of sequences for Covid-19, deeper data-sharing collaborations between countries could have helped with ongoing management of the disease. The absence of broader sharing agreements and governance was a critical barrier.

Second, there were differences between developed and developing countries regarding sharing of health care data. Some researchers argue that genome sequences should be shared on open databases to allow large-scale analyses. Others worry about exploitation; they are concerned that researchers and institutions from poorer countries weren’t given adequate credit and the benefits of the data sharing would be limited to rich countries.

Third, history and the sociopolitical contexts of countries and their ethical frameworks for data sharing even within their own citizenry are different, giving rise to differences in the willingness to have personal data collected, analyzed, and shared for public use. Consider the varied experiences with AI-aided exposure identification and contact tracing apps.

South Korea presented an extreme example of intrusive data collection. The country deployed contact tracing technology together with widespread testing. Its tracking apps were paired with CCTV footage, travel and medical records, and credit card transaction information. Koreans’ willingness to tolerate this level of intrusion can be traced to the country’s history. The previous administration had botched its response to the 2015 MERS outbreak, when it shared no information about hospitals visited by infected citizens. This led to public support for legislation giving health authorities access to data on infected citizens and the right to issue alerts. In contrast, the German government’s contact tracing app was rejected by the public once a highly critical open letter from experts raised fears of state surveillance. As a result, Germany abandoned the centralized model for a decentralized alternative. Again, history provides an explanation. Germans have lived through two notorious surveillance regimes: the Gestapo during the Nazi era and the Stasi during the Cold War. Centrally controlled state data collection was not destined to be popular.

Finally, the data on patients from one country may not be good predictors in other countries. A variety of other factors from race, demographics, socioeconomic circumstances, quality of health care, immunity levels, co-morbidities, etc., make a difference.

### AI Bad---Warming---1NC

#### Development of AI destroys the environment---ecological damages will always outweigh its gains. This is also a pretty good link to the Cap K.

Peter Dauvergne 22, Professor of International Relations in the Department of Political Science at the University of British Columbia, “Is artificial intelligence greening global supply chains? Exposing the political economy of environmental costs,” *Review of International Political Economy*, Vol. 29, No. 3, pp. 696–718, doi:10.1080/09692290.2020.1814381/micahw, TNCs = transnational corporations

The power of artificial intelligence (AI), especially the capacity of machines to learn from big data, has been rising quickly over the past decade. Everywhere, transnational corporations (TNCs) are turning to AI to enhance the productivity of supply chains, increase the efficiency of operations, improve product quality, and boost sales. Business executives and advocates of corporate social responsibility (CSR) are lauding this infusion of AI into global supply chains as a breakthrough toward environmental sustainability. Can AI transform the world’s leading TNCs into forces of sustainability?

My answer in this article is a sharp ‘no’. AI is supercharging the technologies of modern capitalism, akin to what electricity did after the late 1800s. Fundamentally, it is a tool of power, frequently deepening global inequities and the exploitation of natural resources. The world’s most powerful TNCs are deploying this tool to gain business advantages, compete for markets, extract natural resources, cut costs, and grow operations. Leading the charge are technology firms such as Google, Microsoft, and Tencent, electronics manufacturers such as Apple and Samsung, and online retailers such as Alibaba and Amazon. But many other TNCs are also investing in AI to turbocharge the efficiency of profit-making, from automakers to banks to miners to oil companies. In doing so, TNCs appear to be improving environmental management on some efficiency and productivity measures, as CSR reports are quick to highlight. Delving more deeply and critically into the international political economy (IPE) of artificial intelligence, however, reveals that the vast majority of these apparent gains entail costs for marginalized peoples, distant ecosystems, and future generations – costs that CSR rhetoric and metrics are obscuring from consumers, activists, and governments.

Set to infuse the world economy with another US$16 trillion a year by 2030, AI is certainly going to bring socioeconomic benefits over the next decade (PricewaterhouseCoopers, 2017, p. 5). At a micro-scale, the environmental gains can even look impressive. Intelligent automation is improving the energy efficiency of suppliers, factories, and data centers. Learning algorithms are enhancing the efficiency of renewable power grids by more accurately forecasting solar and wind generation (Vinuesa et al., 2020). AI software is reducing food waste by more precisely predicting consumer demand. AI analysis of equipment sensors is anticipating maintenance needs to avoid costly breakdowns and industrial accidents. And AI systems are managing supply chain logistics to reduce expenditures, speed up delivery, and lower per product carbon emissions of transportation (Agrawal et al., 2018, 2019; Davenport, 2018; Iansiti & Lakhani, 2020).

Through branding, messaging, and business metrics, corporate executives and industry analysts are trumpeting the benefits of AI efficiency and productivity, reinforcing a narrative of corporate responsibility, effective private governance, and environmental progress. ‘The intelligence and productivity gains that AI will deliver’, claims the business consulting firm PricewaterhouseCoopers (2018, p. 26), ‘can unlock new solutions to society’s most pressing environmental challenges: climate change, biodiversity, ocean health, water management, air pollution, and resilience, among others’. ‘Utilising AI can have a dramatic effect on supply chains’, argue business analysts Boute and Gijsbrechts (2019, p. 52), ‘helping organisations to benefit from the fastest, cheapest and most sustainable routes for shipping, combining these seamlessly’. Technological innovation and AI, says Google’s 2019 Environmental Report (2019, p. 10), is ‘accelerating our transition to becoming a circular Google that contributes to a sustainable world’. Artificial intelligence offers ‘endless possibilities not only for companies and partners but for everyone to benefit from improved societal impact, social good and sustainability’, argues Gretchen O’Hara (2020), the vice-president of AI Country Strategy & Sustainability Partnership at Microsoft. AI is going to ‘empower and improve every business, every government organization, every philanthropy – basically there’s no institution in the world that cannot be improved with machine learning’, argues Jeff Bezos (2017), the chief executive officer of Amazon. ‘It is a renaissance, it is a golden age’.

As I argue in this article, however, eco-efficiency gains from artificial intelligence are never going to add up to significant progress toward global sustainability, as the profits disproportionality enrich corporate billionaires, as productivity gains across global supply chains hide ecological costs, and as TNCs reinvest savings from cutting waste and optimizing operations into expanding production and consumption. As the inputs and outputs balloon, global supply chains increasingly look more like an elongated hourglass than a chain. Moreover, big tradeoffs are involved in making the middle sections leaner. Robots and software are replacing workers. The infrastructure to support AI – including computers, data centers, smartphones, and high-speed wireless – is raising demand for energy as well as accelerating the mining of coltan, cobalt, and rare earth elements in countries with dismal human rights records. Automated marketing and targeted advertising are ramping up consumption. And rising consumption of smart products, along with growing volumes of consumer waste, are casting shadows of harm over poor neighborhoods, fragile ecosystems, and future generations. Put simply, AI is serving business interests, not planetary interests, and the efficiency and productivity gains from AI are doing far more to accelerate the concentration of wealth and power within leading TNCs than advance global environmental sustainability.

## China Heg Good

### china heg inev – general

#### China rise now – growing infrastructure, wealth, military power prove Washington must adjust accordingly

McCoy 21 – Alfred McCoy, Harrington professor of history at the University of Wisconsin-Madison, Ph.D. in Southeast Asian History from Yale University, M.A. in Asian Studies from the University of California Berkeley, B.A. in European History from Columbia University (“Washington’s Delusion of Endless World Domination”, 3/24/2021, <https://www.thenation.com/article/world/us-foreign-policy-china/>) FGY

China’s Eurasian Strategy

After all that, it seems remarkable that Washington’s current generation of foreign policy leaders, like Britain’s in the 1950s, is so ~~blindingly~~ oblivious to the geopolitics of empire—in this case, to Beijing’s largely economic bid for global power on that same “world island” (Eurasia plus an adjoining Africa).

It’s not as if China has been hiding some secret strategy. In a 2013 speech at Kazakhstan’s Nazarbayev University, President Xi typically urged the peoples of Central Asia to join with his country to “**forge closer economic ties, deepen cooperation, and expand development space in the Eurasian region**.” Through trade and infrastructure “connecting the Pacific and the Baltic Sea,” this vast landmass inhabited by close to three billion people could, he said, become “the biggest market in the world with unparalleled potential.”

This development scheme, soon to be dubbed the **Belt and Road Initiative, would become a massive effort to economically integrate that “world island” of Africa, Asia, and Europe** by investing well more than a trillion dollars—a sum 10 times larger than the famed US Marshall plan that rebuilt a ravaged Europe after World War II. Beijing also established the Asian Infrastructure Investment Bank with an impressive $100 billion in capital and 103 member nations. More recently, China has formed the world’s largest trade bloc with 14 Asia-Pacific partners and, over Washington’s strenuous objections, signed an ambitious financial services agreement with the European Union.

Such investments, almost none of a military nature, quickly fostered the formation of a transcontinental grid of railroads and gas pipelines extending from East Asia to Europe, the Pacific to the Atlantic, all linked to Beijing. In a striking parallel with that 16th century chain of 50 fortified Portuguese ports, Beijing has also acquired special access through loans and leases to more than 40 seaports encompassing its own latter-day “world island”—from the Straits of Malacca, across the Indian Ocean, around Africa, and along Europe’s extended coastline from Piraeus, Greece, to Zeebrugge, Belgium.

With its **growing wealth**, China also built a blue-water navy that, by 2020, already had 360 warships, backed by land-based missiles, jet fighters, and the planet’s second global system of military satellites. That growing force was meant to be the tip of China’s spear aimed at puncturing Washington’s encirclement of Asia. To cut the chain of American installations along the Pacific littoral, Beijing has built eight military bases on tiny (often dredged) islands in the South China Sea and imposed an air defense zone over a portion of the East China Sea. It has also challenged the US Navy’s long-standing dominion over the Indian Ocean by opening its first foreign base at Djibouti in East Africa and building modern ports at Gwadar, Pakistan, and Hambantota, Sri Lanka, with potential military applications.

By now, the **inherent strength of Beijing’s geopolitical strategy should be obvious to Washington foreign policy experts**, were their insights not clouded by imperial hubris. Ignoring the unbending geopolitics of global power, centered as always on Eurasia, those Washington insiders now coming to power in the Biden administration somehow imagine that there is still a fight to be fought, a competition to be waged, a race to be run. Yet, as with the British in the 1950s, that ship may well have sailed.

By grasping the geopolitical logic of unifying Eurasia’s vast landmass—home to 70% of the world’s population—through transcontinental infrastructures for commerce, energy, finance, and transport, Beijing has rendered Washington’s encircling armadas of aircraft and warships redundant, even irrelevant.

As Sir Halford Mackinder might have put it, had he lived to celebrate his 160th birthday last month, the United States dominated Eurasia and thereby the world for 70 years. Now, **China is taking control** of that strategic continent and global power will surely follow.

However, it will do so on anything but the recognizable planet of the last 400 years. Sooner or later, **Washington will** undoubtedly **have to accept the unbending geopolitical reality that undergirds the latest shift in global power and adapt its foreign policy and fiscal priorities accordingly.**

### china heg inev – covid

#### Transition to Chinese-led order is imminent and inevitable – assumes long term trends, Biden, and COVID

Byun 21 – See-Won Byun, professor in the international studies department at San Francisco State University focusing on the politics of China, international relations of East Asia, and international relations theory (“Chinese Views of Hegemony and Multilateralism in the Biden Era”, *The ASAN Forum,*  6/7/2021, <https://theasanforum.org/chinese-views-of-hegemony-and-multilateralism-in-the-biden-era/>) FGY

. Views of the Post-Cold War International Order - Conventional structural perspectives frame mainstream **Chinese** views of the **“international order”** (国际秩序), as “**the most global, long-term**, and **strategic** issue **in world politics.**”9 Official narratives reject hegemony and favor multilateralism in line with a post-Cold War shift to a multipolar order. **In Xi’s post-pandemic world**, “there is no fundamental change in the trend toward a multi-polar world; **economic globalization is showing renewed resilience**; and **the call for upholding multilateralism and enhancing communication and coordination has grown stronger**.”10 As Xi defined it in January, “multilateralism is about having international affairs addressed through consultation and the future of the world decided by everyone working together.”11 **Interpretations of hegemony in this changing structural context have expanded from a primarily military focus to broader forms of expansionist behavior for regional or global dominance**. From a Chinese official’s perspective, US “hegemonism” means “not occupying land but promoting its own system and ideology, in an attempt to meet its own national interests through domination of the world.”12 According to Yang Jiechi, **multilateralism today prevails over** recent pressures of “**unilateralism** and bullying,” “populism and de-globalization,” and “**ideological confrontation**.” In **China’s pursuit of multilateral diplomacy**, “we oppose hegemony and power politics, and oppose any practice of unilateralism in the name of multilateralism.”13 Despite such official claims, China’s multilateralism remains described as “strategic” and “opportunistic.”14 Yang Jiechi made clear in February, “we will resolutely defend our national interests and dignity at multilateral fora when our core and major interests are at stake.”15 Skeptics view China’s multilateral diplomacy as part of counter-hegemonic strategies.16 The “new Chinese multilateralism” that emerged by the 2000s “has to be understood with its combination with multipolarism, the two being used together as a double-track strategy to deal with the United States…and to shape China’s desired future structure of world politics.”17 Xi’s push for global governance reform “is directly linked to counterbalancing the dominance of a liberal-based international order.”18 Especially at the regional level, China-led multilateralism “is an interim arrangement in China’s drive to acquire regional and global dominance.”19 Hegemony and Multipolar Order - Chinese assessments of hegemony and multilateralism have evolved with perceptions of the changing world order. **Studies of the post-Cold War order identify a long-term shift to “multipolarization” and persistent threat of “hegemonism,” with a growing emphasis on sovereignty and non-interference in internal affairs**.20 As Jiang Zemin indicated in 1997, while “the pattern of the world is moving in the direction of multipolarization,” “**hegemonism** and power politics continue to be **the main source of threat to world peace** and stability.”21 Academic interpretations of such trends vary in terms of the dimensions and distribution of global power. But this multipolar transition is commonly linked to perceived changes in US power since the 1990s, when “one superpower, several great powers” characterized the international structure according to Chinese official assessments. **Views of multipolarization** not only **assume** more **global resistance to US demands**, but also **disagreement within the West favoring alignment with Chinese worldviews**. From a historical cyclical perspective, power, interests, and rules shape the international order’s formation, involving “long-term competition and short-term compromise in the pursuit of common values.”22 **Uncertainty** over the postwar liberal international order’s future **has grown with** the clear **fragmentation of Western power**. China’s position in the existing order is viewed through the lens of US hegemony as the “peak form of Western historical hegemony.”23 US political elites advanced the “hegemonic” Bretton Woods system representing their preferences, successfully managing a domestic isolationist tradition and foreign resistance. With the decline in US relative power, US policy shifted from “accepting” China into this dominant order to “rejecting” it.24 In particular, the United States can no longer accept a rising China as a strategic partner or member of the international system since “democratic discipline” has failed there.25 China’s market transition from 1978 drove both US-China conciliation and eventual discord as China advanced its own economic and political agenda.“Two Orders” in US-China Relations Views of US hegemony have varied with shifts in US-China relations since the 1972 Shanghai Communique, which promised that “neither should seek hegemony in the Asia-Pacific region and each is opposed to efforts by any other country or group of countries to establish such hegemony.”26 While Chinese concerns in the 1990s centered on external threats to Taiwan, domestic political stability, and ethnic minority regions, the scope of contention now extends to economic and technological competition. In addition, the transition from Deng’s “keeping a low profile” principle to Xi’s “striving for achievement” shifts China’s external focus from primarily economic gains to political support, raising questions about the normative dimensions of Chinese grand strategy.27 US-China debates in an evolving world order are primarily about rulemaking. “Two orders” form Wang Jisi’s view of current US-China relations, including the CCP-led domestic order challenged by the United States, and the US-led international order challenged by China. With increased interdependence, the United States frowns on the CCP leadership’s rulemaking at home not just for ideological reasons, but more importantly for the implications for US material interests. Conversely, US rulemaking at the global level threatens Chinese interests. The **US quest to “promote global** **democracy**” **defies** China’s insistence on **non-interference** and the “**democratization of international relations**” granting the developing “global majority” a bigger voice.28 Yang Jiechi told Blinken in March, “it is important for the United States to change its own image and to stop advancing its own democracy in the rest of the world.”29 As Wang Jisi argues, “in Sino-US competition and cooperation today, almost everything is connected to the issue of rules.”30 This issue will be the biggest point of future contention, not because the United States fears being displaced by China economically, but because “they are concerned about how they will manage once they have been overtaken.”31 As Wang asked in 1997, “what will China do in global and regional affairs when its international status is enhanced, economic growth sustained, military capabilities improved, and political stability ensured?”32 Current assessments of hegemony and multilateralism offer tentative answers. Current Views of Hegemony and Multilateralism A general decline in Chinese academic interest in hegemony over the past two decades has accompanied a growth in interest in multilateralism, at a notably faster rate since 2016. Journal articles with the keyword “hegemonism” (霸权主义) fell in volume by 83 percent in 2000-2016, and became outnumbered by those with “multilateralism” (多边主义) from 2005 during the Hu Jintao administration.33 In both cases, the number of articles more than doubled in 2016-2019. But in 2019-2020, studies on hegemonism declined by 20 percent while those on multilateralism grew by another 49 percent. While the multilateralism literature amounted to 10 percent of hegemonism studies in 2000 by publication volume, by 2020 it was almost five times greater. A perceived structural shift to a multipolarity contextualizes these trends. From the perspective of China’s international relations theorists like Qin Yaqing, one of the biggest changes in the past century is the end of not just US global hegemony but also hegemony itself as a world order. The current transition to a more pluralistic world of “inclusive multilateralism” points to “a multipolar power structure, multilevel institutional arrangements, and multidimensional ideas.”34 An alternative “one world, two systems” bipolar order lacks the material and institutional conditions for its formation, as well as US and Chinese support. In this changing external environment, **China’s** participation in **global governance** has **progressed in four stages** since the PRC’s founding in 1949: 1) “**anti-hegemonic governance**” under Mao’s revolutionary diplomacy, 2) “**active integration**” after reform and opening, 3) “**constructive participation**,” and 4) the current phase of proposing “**Chinese solutions**.”35 As Chen Zhimin and Zhang Xueying indicate, **China’s** global **role has shifted** from a “revolutionary order-challenger” **to a “reformist order shaper.”**36 According to Yang Jiechi, Xi’s WEF speech this year embodied the need to “contribute China’s wisdom, visions and solutions.”37 US-China power politics is a defining feature of the 21st century international order.38 Bilateral relations since diplomatic normalization in 1978 have evolved from “strategic coordination” to “strategic competition” under the Trump administration.39 Relations have fluctuated with neoliberalism’s rise and fall in the West. The 2008 financial crisis marked the most recent neoliberal crisis and decline in the US-China power gap, compelling new models for bilateral relations since the Obama administration.40 The competitive direction of US China policy is clear in the post-2008 trend of US economic strategy. According to Chen Yu, bipartisan consensus emerged that “the US economic approach to China does not embed China in the hegemonic system under US leadership,” and instead facilitates China’s rapid growth as a “revisionist” challenger to the US hegemonic order.41 China’s international relations journals at **the start of 2021** recognize **a critical transition in the US-led liberal international order**. Current **uncertainty** surrounds a new phase of industrial and technological development, intensified **major-power competition**, **globalization backlash**, and **vast repercussions of the COVID-19 pandemic**. “Unilateralism, protectionism, and hegemony” present major external threats to the international order.42 Xi Jinping’s project of national revival enters a new stage in 2021, marking the 100th anniversary of the CCP’s founding and start of China’s 14th Five Year Plan (2021-2025). Post-Pandemic Debates: National Strategy, Global Governance, and Regional Order

#### China shapes the post-pandemic world order – COVID response, BRI, allies, and growing economic dominance all secure legitimacy

Hamovitz 21 – Lior Hamovitz, B.A. in World Politics at the Leiden University College at The Hague, IB diploma in global politics at UWC Atlantic College, research assistant at The Open University of Israel, editor in chief at the Roosevelt Network at LUC (“Shifting Hegemony: China’s Challenge to U.S. Hegemony During COVID-19”, 9/7/2021, *E-International Relations*, <https://www.e-ir.info/2021/09/07/shifting-hegemony-chinas-challenge-to-u-s-hegemony-during-covid-19/>) FGY

The period of the **COVID-19 pandemic** **has driven political thinkers to reexamine the states’ ability to manage crises** that are local and global at once. Joseph Nye envisions five different **scenarios for the post-coronavirus world order**, three of which **are largely characterized** or majorly influenced **by the rise of China**. In scenario “the end of the globalized liberal order,”[6] Nye focuses on the US’s diminishing position as a leader of the international society, with an atrophy of the collaborative institutions that had propelled and upheld its stance so far. In this scenario, China becomes increasingly involved in setting global rules and norms – a role which up until now had been almost exclusively reserved for liberal democracies. In scenario “a China-dominated world order,”[7] China rises to prominence mainly by closing the economic gap between itself and the US. Its material dominance becomes so overwhelming that the normative international checks and balances are too weak to institutionally resist the standards and reforms China and its major companies instill. In scenario “more of the same,”[8] the rivalry between the US and China is constrained through their cooperation on issues such climate change. While the US remains the largest superpower, its global influence lessens significantly. In fact, authors are dedicating growing attention to the global competition between Beijing and Washington and its implications. When attempting to analyze the reasons behind the US-China trade war of 2018, for example, Min-hyung Kim concludes that its main driving force was ““US fear” about its declining hegemony and China’s rapid rise as a challenger of US hegemony.”[9] Indeed, today it would be rare to find a political thinker who believes China isn’t on the rise. Kishore Mahbubani explores China’s growing geopolitical power vis-à-vis the US, and writes that America has experienced a steady decline in its soft power over recent years – a process exacerbated under the Donald Trump administration – which will challenge its ability to win the ideological battle between itself and China.[10] When debating whether a Cold War situation and consequent American victory can replicate themselves between China and the US, the author emphasizes that **China has already begun taking preemptive measures against** a possible **containment policy** through creating partnerships under the Belt and Road Initiative (BRI)[11] – a largescale global infrastructure strategy developed by China, spanning across almost all parts of the globe. Crucially, the author claims that China has as good a chance as the US in emerging as the dominant state in the world system, and that **American victory is “far from certain.”**[12] Mahbubani even adds that leading strategists and countries are increasingly preparing for the geopolitical contestation between the US and China, which he sees as inevitable.[13] Unlike the Cold War period, however, **American cultural and economic influence have significantly waned globally**, and China’s economic strength is far greater than that of the former USSR.[14] Notably, the **COVID-19 crisis revealed** not only the **shortcomings of the US’s crisis-management**, **but also those of its intertwinement with the liberal democratic order**. Anne Applebaum writes that the lack of clearheaded American guidance during the different stages of the pandemic was so prevalent that “the whole idea of transatlantic cooperation became moot.”[15] As the author describes it, the most salient failure of the system was that the US, led by Trump, had abdicated its international leadership role during the pandemic. Moreover, Applebaum underscores China’s role in undermining the international system. She explains that for years now, China has put explicit effort into trying to integrate itself and instill its autocratic values in multilateral organizations.[16] The partnerships it seeks to build are framed as based on a ‘win-win’ principle, contributing to **China’s growing acceptance into international circles**. Indeed, as the Trump administration was repeatedly sidelining international organizations, particularly the World Health Organization (WHO), China was increasingly collaborating with them. **These growing acceptance and influence need to be understood in parallel to America’s diminishing ones**,[17] and in terms of the emerging competition between “dictatorship” and “democracy.”[18] Reviewing these works, it becomes apparent that scholars are reaching the consensus that China is on the rise – being integrated into international institutions and progressively asserting its economic dominance. That said, while authors’ conceptualizations of the emerging world order acknowledge China’s strengthened position, they fail to adequately account for the increasing appeal of the Chinese model. Scholars today understand that China’s economic and geopolitical prowess, as expressed during the coronavirus pandemic, may aid its accumulation of international power in a manner that will require the strategic attention of the US. However, they seldom consider how China’s model of governance and specific style of leadership have potentially been revealed as more suitable for managing global crises than those of liberal democracies – a revelation that could significantly impact the world order COVID-19 will leave in its wake. As Niall Ferguson writes, **the remarkable speed with which China had been able to contain the virus has allowed it to illustrate the strengths of its model** and shape the pandemic’s narrative in its favor.[19] This paper will attempt to bridge the existing literature gap by highlighting the attractiveness of the Chinese model and leadership approach as part of the country’s global rise, and particularly as part of its growing influence in the MENA. China in the Middle East

#### Coronavirus left an open window for China to secure legitimacy

Böller 21 – Florian Böller, assistant professor of political science and international relations at the Kaiserslautern University of Technology, Germany (“Fast-Track Towards a Hegemonic Transition? COVID-19 and the Decline of US Hegemony”, Hegemonic Transition: Global Economic and Security Orders in the Age of Trump, 8/17/2021, <https://link.springer.com/chapter/10.1007/978-3-030-74505-9_13>) FGY

China’s push to contest the US-led hegemonic order has long been in the making. Enabled by **steady growth of material capabilities** (both economically and militarily) over the last decades, Beijing has tried to enact a leadership role in world politics. In contrast to Russia, which has sought to merely contest the liberal world order and act as a spoiler state (see Loftus in this volume), China has sought to **broaden its influence** within UN institutions in order to shape policies and norms from within the system. This strategy included the successful bid to increase its vote-share within the IMF, where it became the third largest shareholder in 2015. Chinese nationals also claimed leadership positions within the UN, for example, in the Food and Agriculture Organization (FAO), the International Telecommunication Union (ITU), the United Nations Industrial Development Organization (UNIDP), and the International Aviation Organization (ICAO). Overall, Chinese diplomats currently head 4 of 15 UN specialized agencies (see Cheng-Chia & Yang, 2020). This has, in turn, enabled China to deny Taiwan access to the WHO and the ICAO. China’s increasing influence has also become visible within the UN Human Rights Council (UNHRC), which adopted two resolutions in 2018 that reflected China’s preference to circumscribe the scope of human rights in favor of state sovereignty (see Zhao, 2020, pp. 3–4). **Outside established institutions of the liberal world order**, China spearheaded new initiatives, particularly in the economic realm. Led by China and other BRICS members, the Asian Infrastructure and Investment Bank, and the New Development Bank were founded in 2014. Together with China’s Belt and Road Initiative, its ambitious infrastructure and investment project, the hegemonic contender signaled its **intent to translate its economic clout into bargaining power** within global economic institutions (see Wang, 2020). Against this backdrop, the **COVID-19 pandemic presented a “strategic opportunity”** (Gauttam et al., 2020, p. 15) for China to cast itself as a global leader and to promote President Xi Jinping’s vision of a “Community of Shared Future for Mankind”—Xi having described this vision as a doctrine to “position China in the commanding heights of the international competition” (cited in Zhao, 2020, p. 3). While the traditional hegemon and its European allies were mired in the pandemic, the Chinese had successfully put the crisis behind them in a short period of time. This enabled China to broaden its global reach in two key ways. First, China tried to cast itself as a global health soft power, seeking to improve its image in response to a worldwide crisis (see State Council Information Office, 2020). Lauded by coordinated propaganda efforts in Chinese state-controlled media, China began to ship medical aid and PPE to countries fighting COVID-19. They also dispatched medical personnel—in particular to African countries that had already established business ties to Beijing (see Gauttam et al., 2020). Due to the situation caused by the pandemic, **China was able to capitalize on its position as the largest global supplier of epidemic prevention goods** (Fazal, 2020, p. 13). The Chinese government also exploited the opportunity created by the US’ withdrawal from WHO, pledging to step up its financial contribution to the organization. This “mask diplomacy” also exposed existing fault lines within Europe during the early phase of the pandemic, when European solidarity appeared weak in view of national measures (Verma, 2020, p. 207). At the same time, China’s efforts to cast itself as a global health power were hampered by faulty test kits and PPE, as well as by the aggressive rhetoric of its “Wolf Warrior” elite diplomats, who sought to counter Western accusations of a lack of transparency during the early phase of the pandemic (see Harnisch in this volume). China also did not establish itself as a provider of global public goods, as most of the help was authorized on a bilateral basis and even its increased WHO funding fell significantly short of previous US contributions (see Fazal, 2020, p. 4). Second, although not directly related to the pandemic, China also sought to bolster its power position, both in terms of security and economic strength. Here, it seems plausible that the Chinese government was able to **exploit the strategic window of opportunity opened by other states’ preoccupation with domestic priorities**—especially the US, which was in the throes of a contentious presidential election. Several empirical observations highlight China’s increased **post-Corona assertiveness**. In April 2020, the People’s Republic designated new “administrative zones” in the South China Sea, including the Paracel and Spartley Islands which are also claimed by Vietnam. Although territorial disputes have lingered for several years, the new measures can be seen as an attempt to formalize control in this area (Thu, 2020). Another strategy designed to bolster its power position can be detected in its policy toward Hong Kong. Here, the Chinese government imposed a new National Security Law, tightening its control over the Special Administrative Region and thereby undermining the principle of “one country, two systems.” It is important to note that, in 2019, the Hong Kong government had withdrawn an extradition law due to mounting domestic protests. In 2020, however, China pushed the legislation through despite international criticism, thus exposing the increased level of authority exercised by the Chinese government (Rudolf, 2020, p. 7).3 China also escalated its simmering conflict with Australia and implemented new customs against Australian exports. This move was interpreted as a retribution for the Australian government’s calls to investigate the origins of the Corona pandemic and its disapproval of China’s human rights policies (Khalil, 2020). Here, China signaled its intention to retaliate against international criticism and deploy its economic leverage against weaker states. In the realm of trade relations, the new Regional Comprehensive Economic Partnership, signed on November 15, 2020, and including 15 Asian economies, **underscored China’s ability to cooperate within multilateral trade regimes**, while the US, under the Trump presidency, had withdrawn from the Trans-Pacific Partnership spearheaded by the Obama administration (see Petri & Plummer, 2020). In sum, these examples show that Beijing sought to take advantage of this international environment by realizing long-held policy goals within several fields, and that, ultimately, **China’s international position was stronger than it had been in the pre-Corona period.**

#### COVID permanently damaged global perception of US leadership, vastly increasing Chinese legitimacy – expert consensus

Hamovitz 21 – Lior Hamovitz, B.A. in World Politics at the Leiden University College at The Hague, IB diploma in global politics at UWC Atlantic College, research assistant at The Open University of Israel, editor in chief at the Roosevelt Network at LUC (“Shifting Hegemony: China’s Challenge to U.S. Hegemony During COVID-19”, 9/7/2021, *E-International Relations*, <https://www.e-ir.info/2021/09/07/shifting-hegemony-chinas-challenge-to-u-s-hegemony-during-covid-19/>) FGY

According to Yan’s theory, political leadership is derived of four sources: authority, capability, morality and power.[53] Yan explains his intention with the latter, power, through its Chinese equivalent quanli – meaning “legitimate coercive rights or duty.”[54] Indeed, Yan sees power as the type of coercion which enforces behavior.[55] As his argument holds, political leadership becomes the key component of “the attractiveness of a country’s government model, which influences other countries’ actions without the use of hard power.”[56] Given that this paper is distinctly interested in understanding China’s challenge to American hegemony in terms of the country’s cooptation abilities and the attractiveness of its governance model, rather than its coercive potential, the following segments will focus on examining how this challenge manifested during the coronavirus pandemic using the sources of morality, capability and authority only. Morality – **Morality** is the most pertinent concept for Yan’s moral realism, and mainly **refers to whether a country’s behavior follows** the nationally and **internationally agreed upon norms of action**.[57] Admittedly, with the coronavirus’ far-reaching impacts, it is difficult to outline the international norms countries should have adhered to, and whether they did so or not. Still, a brief glance at past crises could reveal previous courses of action from leading states. Most significantly, during the financial crisis of 2008 and the 2014 Ebola outbreak, the US and other great powers ensured to collaborate with one another in finding a resolution for these global challenges. Campbell and Doshi write that whereas, in the past, US governments would assemble a coalition of states to overcome these joint challenges, former President Trump’s policies during the COVID-19 were anything but collaborative.[58] As scholars agree, the **absence of American leadership became glaring during** the **COVID**-19.[59] When examining how China’s moral behavior throughout the coronavirus pandemic could help it rise globally, it is thus crucial to also contrast it with the immoral behavior – in Yan’s terms – of the US. Primarily, with the outbreak of the virus in the US, then President **Trump stayed loyal to** his long-proclaimed policy of **“America First.”** While countries around the world battled with the first wave of the pandemic, struggling to procure necessary medical supplies and expertise, the American government adopted an almost surprisingly nationalistic response. Rather than acknowledging the public health risks of the novel virus, the COVID-19 was framed in the US as a blatant and specific attack on the country’s sovereignty.[60] Furthermore, essentially without warning or an established agreement, the US closed its borders to incoming travelers from Europe, conveying that its sole governance focus during this crisis was the country itself.[61] In fact, in late May of 2020, the Trump administration even decided to begin withdrawing US funding and WHO membership, citing the organization’s alleged control by China as the reason.[62] This decision was criticized widely, and was blamed for being an attempted distraction from America’s own failings in its response to the outbreak. Global health experts further argued that a withdrawal of funds during this difficult global crisis would be unimaginable and disastrous, **accusing the US government of destructively disengaging with institutions** pertinent for the crisis’s resolution.[63] As Francis Fukuyama put it, rather than supporting and galvanizing international institutions, President Trump antagonized and attacked them.[64] Global public health professionals explained that the US’ withdrawal would be damaging not only to the organization and the international contamination efforts, but also specifically harmful to American citizens. They warned that a withdrawal would mean disconnecting the US from key channels of information, leaving the country to fight on its own and the citizens vulnerable to infection.[65] In Yan’s terms, this type of behavior could be deemed flagrantly immoral, both domestically and internationally, as the US’s decision not to follow cooperation norms would mean an almost direct risk for both communities is has a responsibility for: the global and the local.[66] **China’s moral behavior during the pandemic therefore greatly contrasts with the US’s response.** Xi Jinping, head of the Chinese Communist Party (CCP), had capitalized precisely on the isolationism Trump espoused during the pandemic, and made conscious efforts to counterbalance this approach by increasing China’s participation in the global response to the virus.[67] He embarked on a markedly diplomatic campaign assembling international leaders and health experts seeking to find a resolution for all.[68] Some even describe **China’s approach as uniquely dedicated to championing the global battle against the coronavirus**, **proactively initiating and promoting international cooperation through funding and participating in multilateralism**.[69] It is this comparison between the behaviors of the US and China towards international institutions and fellow states that can highlight the moral leadership Beijing has demonstrated in the time of the coronavirus crisis. As Yan explains, such a display of morality, accompanied by material resources, can portray a state as a humane authority and consequently propel its influence and even its legitimacy.[70] **China’s morality during the pandemic’s outspread, and the absence of such moral adherence from the US, is thus a key contributing factor to the challenge it is increasingly posing to US hegemony.** Capability – Capability in Yan’s work is conceptualized as strength.[71] The comprehensive capability of a state, subsequently, can be divided into four domains: culture, economy, military and politics. In this model, political capability shapes the other three elements, and is largely determined by a country’s ability and willingness to reform, as well as the execution of reform in practice. Therefore, political capability is both material and nonmaterial in its nature.[72] Yan clarifies that political leadership is a crucial factor shaping political capability, and political capability ought to be understood as driving a country’s comprehensive capability.[73] Competent or incompetent leadership can accordingly alter the relative capability of a great power.[74] This clarification becomes pertinent when considering Yan’s argument that changes in leading states’ capabilities can directly influence their relationship with other states and the configuration of the international system.[75] Analyzing China’s demonstrated capability during the coronavirus crisis, and the US’s shortcomings, could then indicate possible changes to the current world order. Perhaps the most relevant starting point for examining China’s capabilities throughout its pandemic response is by looking at how its leadership efforts were being perceived. As previously mentioned, in a speech given in late January 2020 by WHO Director General Tedros Adhanom, he publicly applauded China’s work in combatting the spread of the novel virus. He declared that China’s response to the virus was impressively rapid and has set “a new standard for outbreak response,”[76] also mentioning China’s commitment to aiding to and working with other countries. Adhanom praised China for having invested itself in protecting not only its own citizens, but also people around the world.[77] Notably, Adhanom was not alone in his praises. By the end of 2020, China was commended for having responded efficiently, quickly and thoroughly to the pandemic’s spread – by implementing the necessary measures to contain the virus through advanced technologies and firm policies.[78] These successes were further emphasized in contrast to Europe’s and the US’s continued struggles with their pandemic response. In Beijing’s eyes, these were clear indicators of the superiority of its model of governance and indeed, scientists agree that China possesses marked systemic advantages in crises such as this one, due to its ability to concentrate governmental power.[79] Undeniably, the **US’s** apparent **inadequacy** **in tackling the coronavirus’ threat**, as well as its **inward-looking policy approach**, have been **an asset for Beijing’s pursuit of global leadership.**[80] Deborah Welch Larson explains that highlighting areas of superiority in relation to a dominant state can directly improve an aspiring great power’s international status.[81] The repeated **use of the term “incompetent” when referring to** **the** **American President** and his administration’s virus response was thus an unsurprising advantage for Xi. The American government’s handling of the virus was even framed at times as a “catastrophic policy blunder,”[82] and what might be **“one of the greatest failures of presidential leadership in generations.”**[83] These harsh analyses should not be overlooked. Political experts like Mireya Solís highlight that the pandemic has truly revealed that leadership can be measured in terms of competent governance.[84] The incompetence of the American administration during the pandemic took many forms and was largely a consequence of an open refusal to form coherent policies based on the advice of experts. The leadership vacuum in the international community reflected the local vacuum in the US, where state officials and governors were left scrambling to find a solution their President refused to provide.[85] It became apparent that the American government was temporally incapable, and frequently unwilling, to contain the extent of the coronavirus crisis. As the absence of American guidance grew noticeable, the Chinese capacity to handle national and international crises received increasing attention. In the simplest of terms, Xi understood that providing the international system with much needed global goods would not only shed a positive light on the country’s material capabilities, but also strengthen the view of its leadership abilities.[86] Whereas in the beginning stages of the pandemic’s outbreak one might have thought that Xi’s leadership aspirations would be diminished, due to the country’s blundered initial response, China’s rapid recovery came to stand in stark contrast to the West’s continued struggle. While lockdowns were being lifted in Wuhan and businesses could return to nearly full operation, Western cities remained deeply entangled with the growing effects of the pandemic. **Leaders** from Europe and even the US **began to seek the advice and aid of China**, marking Xi Jinping triumphant and burnishing his credentials as a leader.[87] This triumph is not a minor one. The distribution of power in the international arena, Yan explains, depends on the relative capability of states.[88] The demonstration of comprehensive capabilities, especially vis-à-vis the deterioration of those of a dominant state, could then exponentially aid a rising power fulfill its aspirations.[89] Overall, throughout the coronavirus pandemic, Beijing has been able to demonstrate precisely those necessary capabilities which Washington lacked. Fukuyama emphasizes the failings of former President Trump in handling the crisis, saying that he blocked the country from being able to effectively operate, and pointing to his incompetence as the primary cause for the US’s inadequate response. Most significant within Yan’s framework, Fukuyama stresses that even when the crisis necessitated it, Trump was unwilling to change his governance approach.[90] The willingness to reform is at the heart of Yan’s perception of how a country’s capabilities manifest, and the American administration’s refusal to do so therefore accentuates the flaws in its model of governance.[91] In fact, even at the time of writing the book, prior to the outbreak of the pandemic, Yan claimed that the US’s political leadership seems incapable of implementing needed reforms domestically, which prevents it from being able to answer the closing of capability gaps between itself and China.[92] China’s successful role in the global arena during COVID-19 has consequently made the inadequacies of the US “painfully obvious.”[93] Authority – Auhority, quanwei in Chinese, is connotated in Yan’s work with “prestige or popular trust.”[94] As a result, authority can propel actors to follow a certain idea due to their trust in it, and thus uses the confidence of others as its source. Furthermore, international authority is greatly derived of a country’s strategic credibility: the consistency between the promises it makes and its practical actions, especially when it comes to honoring its commitments towards allies.[95] Having authority is pertinent for a hegemon, as it is intricately tied with states’ voluntary will to fulfill the wishes of the dominant state.[96] As Forman et al. put it, after its initial stumble, China has consistently portrayed responsible leadership domestically by recognizing the severity of the situation and implementing measures to halt the spread of the coronavirus.[97] Certainly, in the early days of the COVID-19’s outbreak, China attempted to silence word of the novel virus’ spread and was accused of withholding vital information that could have helped contain the pandemic. Nevertheless, **Beijing was able to rapidly recuperate**.[98] From **mass-testing**, to **social distancing**, to the **use of advanced technologies**, China seemed profoundly dedicated to battling the virus. The authors add that **China was** in fact **“one of the few countries showing signs of solidarity and providing support to other countries.”**[99] Indeed, already in the early stages of the pandemic, Beijing showed its benevolence by sending medical supplies to other states and continues to do so today as it distributes vaccines in states with lower- and middle-income, claiming that it is simply fulfilling the role a great power such as itself should.[100] In Yan’s model, this consistency between China’s words and actions is important not only morally; it is key to basing a country’s international authority. Conversely, the seeming ‘double standard’ of the US is harmful for its status within the international system and the authority it seeks to have.[101] Moreover, former President **Trump’s rhetorical inconsistencies were not the only factor damaging the US’s authority** during the COVID-19. The trustworthiness of the superpower was further impaired by the seeming refusal of the former president and his administration to listen to the advice of public health experts, let alone adhere to it. The mayor of Miami, Francis Suarez, publicly expressed his frustration with the negligent leadership on the side of the president. Acknowledging that mask-wearing would have been instrumental for the containment of the coronavirus’ spread, Suarez said that people saw no reason to do so, as their own president was not following these measures nor recognizing their value. In a rather reflecting statement, he added lamentably that people follow those who are meant to be leaders.[102] Notably, Suarez was far from being the only political figure in the country to express dismay at the administration’s behavior in the time of the outbreak. A senator from New Jersey said that “to call Trump’s response to COVID chaotic [and] incoherent doesn’t do it justice,”[103] and that it is harming America and American lives. These calls were joined by a letter to Congress that was signed by over 30,000 global health and international law experts, who protested the Trump administration’s decision to withdraw from the WHO, pointing to the direct cost it would have on the lives of citizens, as well as the lives of people around the world.[104] Even in later stages of the pandemic, in September of 2020, the American government refused to join COVAX, the Vaccine Global Access initiative, and was unwilling to commit itself to vaccine aid to its allies. As Yanzhong Huang writes, this American approach allowed China to fill a leadership position the US had essentially abdicated.[105] Yan himself agrees that an approach which disregards the value of global alliances undermines international leadership.[106] Welch Larson also admits that former President Trump saw alliances as a burden to the state,[107] and Solís adds that such an approach, especially during a time like that of the coronavirus pandemic, puts the US in a precarious position globally. She explains that the large policy swings in the US between one administration and the next are causing noticeable damage to the credibility of the country.[108] Yan points to the untrustworthiness of political leaders and state policies as a significant obstacle to their ability to establish themselves as an international authority. The reverberations of this lack of trust are felt in the unwillingness of fellow states to collaborate for the resolution of common challenges and threats.[109] In the age of the COVID-19 pandemic, a global crisis which solidified the importance of global governance, the hesitance to trust a major power is more than problematic; it is **shedding a concerning light on future cooperation prospects**. As the US stumbled with forming a coherent stance on the novel virus, China was able to gain trust, in Yan’s terms, by asserting policies that were in line with the advice of experts and by conveying its desire to work collaboratively. Apart from this increased trust, China also ensured to present its model of governance as that which allowed it to be a reliable source of expertise and aid during the global crisis.[110] In the eyes of Beijing, the central cause for the failure of Western democracies to contain the virus at home was their ineffective governmental model. The authoritarian system in place in China had been imperative in enabling the CCP to take the needed measures against the virus while also safeguarding the country’s economy, showcasing the strengths of its design. The ways in which liberal democracies, especially the US, stumbled in their response and containment efforts served as proof, as far as China was concerned, that these countries are unequipped to handle crises of the sort.[111] As some concede, much of the confusion and uncertainty which were sown in the US and globally derived of American institutions showing their inadequacy, encouraging distrust in the government.[112] That is a primary reason why the pandemic has revealed Washington as isolationist when it matters most, and ill-prepared to lead the international community’s response. Precisely because such a significant amount of the legitimacy the US typically enjoys at home and abroad flows from its domestic policies and international contributions, the COVID-19 pandemic has become a test the country sorely failed.[113] Speaking of China’s crisis governance during the coronavirus’ phases, Asian policy scholars argue that the centralized model of China and its strong bureaucratic institutions were highly effective in containing the spread of the pandemic.[114] These observations were repeatedly shared, singling the Chinese grid governance as particularly suitable for pandemic outbreaks.[115] If the confidence of followers is the source of authority, as Yan claims, then China’s authority may have spiked during the pandemic.[116] While Beijing built a strong case for why fellow states should see it as a reliable figurehead in such public health global challenges, Washington all but left an ‘open door’ for another leader to take over.

#### COVID response legitimized Chinese health diplomacy

Gauttam et. Al 20 – Priya Gauttam, research scholar at the University of Punjab Bathhinda, M.A. in political science at the University of Punjab, B.A. in social sciences at the University of Rajasthan (“COVID-19 and Chinese Global Health Diplomacy: Geopolitical Opportunity for China’s Hegemony?”, 2020, <https://journals.sagepub.com/doi/pdf/10.1177/0976399620959771>) FGY

The outbreak of COVID-19 pandemic has not only impacted the world healthcare system, but it, rather, likely will **change the post-COVID geopolitical world order**. The scale and substance of the pandemic right now seem beyond the control of the impacted countries, maybe it is for the time being? Several conspiracy theories have been floated to make someone a scapegoat and divert attention from the gravity of the grim situation(s). Blame game has become the order of the day. The pandemic has caused a severe loss of men, materials and consequently a severe economic slump and stagnation in the geo-economic world order even critical than the 1930s. Concomitantly, the geopolitical world has become more uncertain due to the changing of power equations. It has become a double whammy for the people as well as for countries. The poor countries had not only seriously affected by COVID-19 pandemic, rather the developed countries were also become unable to provide the required healthcare facilities to the affected people. The outbreak of the novel coronavirus pandemic has put the entire world at an inflection point. The first case of the novel coronavirus was initially detected in late December 2019 in Wuhan (Duarte, 2020). The World Health Organization (WHO) declared the outbreak of the coronavirus pandemic as a Public Health Emergency of International Concern on 30 January 2020 and WHO Director General recognized it as a ‘Pandemic’ on 11 March 2020 (WHO, 2020a). It has impacted 216 countries/territories worldwide, resulting in the death of 788,503 people by 21 August 2020 (Worldometer, 2020). The **COVID-19 pandemic** has not only exposed the status of the healthcare system of the world but also **triggered a geopolitical debate about the hegemon of the world** in terms of major powers. The term hegemony has been derived from the Greek word ‘Hegemonia’ that refers to the leadership and rule (Mowle & Sacko, 2007). Liberal theorists like Keohane (1984, p. 34) have defined hegemony, ‘as a situation, in which one state is powerful enough to maintain, and willing to do so, the essential rules governing inter-state relations’. He further argued that hegemony can be preserved less through coercion and more through consent by exercising the leadership in such a way. Cox (as cited in Schmidt, 2018) is one of the leading neo-Gramscians who had argued that coercion and consent are the two important characteristics of hegemony. **China’s hegemonic power has been expanding**, given its massive size of economy, demographic dividend, large geographical size, modernized military, nuclear power, sophisticated science and technology, a large pool of human resources and its position as the world’s manufacturing hub. China has been expanding its hegemonic influence through the consent and coercive measures. The current **COVID-19 pandemic crisis has created a strategic opportunity** and the same was used by **China to expand its leadership through the health diplomacy as a soft power tool**. Moreover, health diplomacy has helped China to project its image as a benevolent world leader in many Asian, African and Latin American countries. Given this critical situation, many countries have been accepting the Chinese medical support without any coercion, giving consent to Chinese projects like One Belt One Road (OBOR) and market access. In this backdrop, the main argument of this article is that China’s strategic influence has been expanding, thus, intensifying the battle for hegemonic influence between China and the USA. A number of conspiracy theories have been doing rounds in the geopolitical narratives, particularly from the USA and China, over the outbreak of the novel coronavirus. The officials from China and the USA have been blaming each other for the origin of the coronavirus pandemic. The strategic competition between both the countries has been going on in terms of ‘Blame Game’ and ‘War of Words’. The Western media has raised suspicions on the Chinese rhetoric of emergence of the COVID-19 pandemic from the seafood market. They, however, claimed that the virus could have emerged and originated from the Institute of Virology (Wuhan) (Economic Times, 2020a). Moreover, President Donald Trump has also been using the term ‘Chinese Virus’ and has claimed China’s institute of virology as an epicentre of the COVID-19 pandemic (Matthews, 2020). On the contrary, China claimed that the virus did not originate from Wuhan but, rather possibly from the USA as a bioweapon (Davidson, 2020). Soon after the outbreak of the pandemic in Wuhan, the epicentre of the pandemic had shifted to the USA; meanwhile, **China** has not only **portrayed the image of a successful country** **to combat the virus**, but, rather, it is also ready to help the world at large. The world has experienced the USA as a world hegemon since the Cold War, consistently providing leadership during the crisis/calamities/ pandemics, etc. However, during the current situation of COVID-19 pandemic, both the USA and EU have been remained at the crossroads. Moreover, Trump's unilateral decision of imposing travel ban on the EU people further strained the Transatlantic relations. China has **exploited the opportunity out of the emergency by providing massive healthcare** and **medical aid** to more than 100 countries. In this backdrop, would the global health diplomacy employed by China likely provide an edge, that is, geopolitical space to change the existing status quo and turn China as a hegemon in the post-COVID-19 world order? The main objectives of this article are, first, to analyse how China has made health diplomacy as part of its soft power diplomacy and, second, would the health diplomacy provide China with a geopolitical opportunity to expand its hegemonic influence? The article has been divided into the following sections: Section I discusses the introduction of the article. Section II examines how the COVID-19 pandemic has severely affected the world’s healthcare system. Section III analyses the theoretical concept—how health diplomacy is embedded in the framework of soft power for a nation? Section IV describes and discuss the role of health diplomacy in China’s foreign policy pre- and post-outbreak of the COVID-19 pandemic. Section V examines the response of the USA and the EU to deal with the pandemic in its own region as well as other affected countries. Section VI analyses the current status of China and the USA in the world, and how the pandemic has provided geopolitical space for the former’s hegemonic status?

#### Health diplomacy vastly increased China’s soft power

Gauttam et. Al 20 – Priya Gauttam, research scholar at the University of Punjab Bathhinda, M.A. in political science at the University of Punjab, B.A. in social sciences at the University of Rajasthan (“COVID-19 and Chinese Global Health Diplomacy: Geopolitical Opportunity for China’s Hegemony?”, 2020, <https://journals.sagepub.com/doi/pdf/10.1177/0976399620959771>) FGY

Global **health diplomacy has become the most striking feature of China’s foreign** policy. Since 1949, China has been using health diplomacy as a soft power tool in its foreign policy. Under the leadership of Deng Xiaoping (1978–1992), China has designed its comprehensive health diplomacy that includes both **bilateral and multilateral medical and health cooperation**. Fravel and Medeiros (2003, p. 22) have argued that under Xiaoping’s strategic view, ‘peace and development were the two major themes of today’s world…**Beijing has embarked on a new road to economic modernization** **and** **reoriented its foreign policy to heighten the diplomatic relations’**. Under Deng Xiaoping, the Chinese foreign policy had stood for ‘a low profile, do something and concentrating on establishing a favourable external climate for domestic economic growth (Chang, 1991; Suisheng, 2010; Xu & Du, 2015). However, given the outbreak of the severe acute respiratory syndrome—SARS (2003) in China and its inability to handle the same had significantly dented its global image. Moreover, it had highlighted the major shortcomings of China’s healthcare system. Chan et al. (2012, p. 203) argued that SARS has caused a loss to the Chinese economy to the tune of US$ 6.1 billion or gross domestic product (GDP) contraction of about 0.5 per cent in 2003. It had compelled the Chinese government to increase its budget on public health. President Hu Jintao (2002–2012) had played an active role in designing health diplomacy with the tag line of ‘Harmonious Society’ (Goldizen, 2016). The calls for ‘peaceful development’ and ‘harmonious world’ have been used by China to project itself as a benevolent country in the post-SARS world. The same was substantiated by the argument of Goldizen (2016) who noted that China’s improved preparedness had become evident, particularly in the context of an effective control of the 2009 H1N1 epidemic and 2013 avian influenza outbreak (H7N9). Under the incumbent President Xi Jinping, the world has been witnessing a paradigmatic shift in China’s foreign policy from the strategy of low profile to strive for the hegemonic role (Jisi, 2011; Lanteigne, 2019; Pei, 2018; Rühlig, 2018; Xuetong, 2011; Yan, 2014). Under the incumbent regime, global health diplomacy has emerged as an important element of Chinese foreign policy. Although the Chinese healthcare diplomacy is veiled in altruism, the same is primarily used for expanding the geopolitical and geo-economic influences. Xi Jinping’s ‘China Health Vision 2030’, announced in 2016, has given pivotal importance to healthcare policies locally and globally (Tan et al., 2017). Along with these policy measures, President Xi Jinping had expressed his commitment in January 2017 to construct a ‘Health Silk Road’ (HSR) by signing a memorandum of understanding with the WHO (Lancaster & Rubin, 2020). The primary objectives of HSR include the organization of the high-level regional health officials’ forums, the establishment of a Belt and Road Public Health Network for coordinated response to public health emergencies, and capacity building and professional training (Bing, 2020). Therefore, the outbreak of the novel coronavirus pandemic paves the new roads for China’s global health diplomacy, which is, of course, a rhetorical extension of its Belt and Road Initiative (BRI, Lancaster et al., 2020). Since the COVID-19 pandemic outbreak, **China has been providing medical aid to many countries, including the USA and EU** under its global health diplomacy to recast itself as a responsible global health leader. Since 1949, the People’s Republic of China (PRC) has been aggressively pursuing health diplomacy. The African continent was China’s first floor test for its health diplomacy to attain its geopolitical ambitions. China sent its very first medical team to Algeria under the direction of the former Premier Zhou Enlai on 6 April 1963 (Jing et al., 2011). Since then, China has been providing medical aid in terms of physicians, hospital buildings and clinic construction, and educating and training the African medical personnel. With the introduction of ‘African Policy’ in 2006, China has highlighted again how health diplomacy has been figuring in its foreign policy in the twenty-first century vis-à-vis this region. The main focus of this policy included the promotion of effective malaria treatment, sending medical teams and equipment, training of physicians and supporting the research on traditional medicine to treat and prevent HIV/AIDS. During the 2006 African Cooperation Forum (CACF), China had pledged to double its aid to Africa by 2009 and also offered preferential loans of US$5 billion to the continent (Youde, 2010). By the end of 2010, China had sent 1,700 medical workers to 48 African countries (Wharton, 2011). From the earlier discussion, it is crystal clear that the Chinese government has been exercising its health diplomacy for the developing countries in general, and particularly in the African continent. Now, the question is what benefit does the Chinese government hope to gain from these soft power engagements with the recipient countries? A Pew Global Attitudes Project Survey (2014) has shown that both the USA and China now have almost equal geopolitical influences in African states (Simmons, 2014). Sending doctors to African countries has helped **China to build its benevolent image among the local leaders as well as with the common people**. When Africans see that the Chinese doctors have saved the lives of their people, it creates a benevolent and **favourable image of China** in the hearts and minds of the common people. Indeed, in this background, it is a challenging situation for the USA to maintain its dominance in the region. Furthermore, through these medical aid programmes, **the Chinese government has portrayed per se as the only country that can work in the interests of the developing countries**. Apart from bilateral cooperation, **China has expanded its influence in international health affairs and further enhanced its cooperation with international and regional organizations**, such as UNICEF, World Bank, ASEAN, Great Mekong Sub-region, Shanghai Cooperation Organisation (SCO), etc.

#### COVID response boosted Chinese sphere of influence in the EU and with NATO allies

Gauttam et. Al 20 – Priya Gauttam, research scholar at the University of Punjab Bathhinda, M.A. in political science at the University of Punjab, B.A. in social sciences at the University of Rajasthan (“COVID-19 and Chinese Global Health Diplomacy: Geopolitical Opportunity for China’s Hegemony?”, 2020, <https://journals.sagepub.com/doi/pdf/10.1177/0976399620959771>) FGY

China had realized the power of WHO during the SARS outbreak in 2003, when WHO issued several travel advisories against unnecessary travel to Guangdong province without taking any prior consent of China and also put the latter in the spotlight for spreading infectious diseases in many countries. Chan et al. (2012, p. 4) have argued that ‘perhaps this stance has invoked the Chinese government to realize the political importance of the WHO and to increase its participation in global health governance’. China has nominated its citizen Margaret Chan for the election of the WHO Director-General held in 2006 and won the same. The victory of Chan was widely believed as a diplomatic triumph for China, as it was substantiated by the management of the Hong Kong issue and the successful implementation of China’s ‘One Country, Two Systems’ policy (Shen, as cited in Chan et al., 2012). Concomitantly, Beijing had also blocked Taiwan’s attempt to seek WHO membership. Given the importance of international organizations in general, and the WHO in particular, China had begun to participate more actively in global health governance as well. Given the outbreak of the COVID-19 pandemic, **China has used global health diplomacy to build its benevolent image** and to seek a **fertile ground for its geopolitical influence in several regions such as Africa, Asia and Europe**. China has made the best use of its health diplomacy by providing medical aid to the African countries. As per the report of Mwangi (2020), China had sent 5.4 million facemasks and more than one million test kits and thousands of protective suits to African countries as early as March. China had also sent medical teams to several African countries such as Algeria, Nigeria, Zimbabwe, the Democratic Republic of the Congo, Ethiopia, Burkina Faso, Sudan, Djibouti and Côte d’Ivoire to combat against the COVID-19 pandemic. Additionally, medical experts from more than 30 African countries have conducted webinars with Chinese counterparts on how to efficiently handle the coronavirus outbreak in the continent (Olander, 2020). Lina Benabdallah (as cited by Jevans Nyabiage in SCMP News, 2020) said that, ‘**Covid-19 had provided an opportunity for Beijing** to show it was not only a goods provider but also an **expert on pandemic management and global health’**. The above-mentioned developments show that **China has been emerging as a high-profile humanitarian aid provider**, which was at one point of time the monopoly of the USA. Asian countries have remained an important part of Chinese global health diplomacy. Chinese medical experts had visited many ASEAN countries like Indonesia, Malaysia, the Philippines, Thailand, Cambodia, Laos and Myanmar. A considerable amount of material aid has been provided by the Chinese government as well as private businessmen. Medical knowledge and expertise have been shared with the ASEAN countries via video conferencing. ASEAN SecretaryGeneral Dato Lim Jock Hoi had expressed appreciation by saying that, ‘With such aid, China and the Association of Southeast Asian Nations, demonstrate that we support one another even at the community and individual levels in ensuring that we stay safe and healthy’ (ASEAN, 2020). The South Asian countries such as Bangladesh, Nepal, Pakistan, Maldives, Sri Lanka and Afghanistan were the major recipients of the medical aid. The list included the testing kits, personal protective equipment (PPE), masks and other medical supplies (Pal & Bhatia, 2020). Recently, Chinese Foreign Minister Wang Yi had joined a virtual conference with his counterparts from Afghanistan, Nepal and Pakistan to discuss a fourpoint plan to contain the COVID-19 pandemic, boost economic recovery and resumption of the BRI infrastructure projects (Times of India, 2020). China has donated over 400,000 masks, 500 prefabricated rooms with beds, desks and chairs, and a waste disposal facility worth €1 million, and it has sent medical experts to Iran (Stojanovic, 2020). Moreover, China’s Foreign Affairs Ministry has urged the USA to remove sanctions on Iran by stating that it will hamper Iran’s response to the epidemic and also restrict delivery of humanitarian aid by the UN and other organizations (Economic Times, 2020). In reciprocation of China’s generosity, the Iranian Ambassador to China tweeted, ‘China is undoubtedly the most experienced in the fight against the coronavirus and is more determined to help us’ (Gupta & Singh, 2020). This shows the goodwill on the part of Iran for Chinese humanitarian aid. **China has left no stone unturned to exploit the geopolitical opportunity**, given the hostile relations between the USA and Iran. Given the outbreak of the COVID-19 pandemic, the European continent has been a battlefield for China and the USA. The USA had imposed travel bans on the Europeans, whereas **China had openly supported the cause of Europeans by providing substantial medical and financial aid.** Under the global health diplomacy, not only China but also its company like Huawei and businessman Jack Ma have generously provided medical aid to several European countries such as the Czech Republic, Spain, Italy, Belgium, France, Serbia, Hungary, etc. Stojanovic (2020) has observed that amidst the coronavirus pandemic, **several Eastern European countries** such as Serbia, Hungary and the Czech Republic had **appreciated China for its medical aid. On the contrary, these countries had criticized the EU for its delayed, inert bureaucratism and the US isolationism apropos pandemic.** China’s medical aid to Serbia included a medical team with expertise in combating the COVID-19 pandemic, 1000 rapid test kits and other medical supplies in the first batch of 16 tons of donations (Xinhua, 2020). Serbian President Aleksandar Vucic had appreciated Xi Jinping for medical aid. He said that ‘They have proven as friends in the most difficult times when we fight for the lives of the Serbian people’ (Vuksanovic, 2020). He further made a statement that, ‘European solidarity does not exist. Only China can help’ (Vuksanovic, 2020). The Hungarian government has acknowledged and appreciated the Chinese government for providing medical aid. According to Xinhua (2020), China has provided 80,000 + 41,000 surgical masks, 15,000 KN95 masks and 300 protective suits to Hungary. The Hungarian Prime Minister Viktor Orban had appreciated China and criticized the EU for the latter’s inability to fight against the coronavirus pandemic (Stojanovic, 2020). Italy, Spain, the Netherlands and Slovakia have also appreciated China for its medical aid. **Beijing has offered medical aid to Turkey**, which is the second most affected country in the Western region by the COVID-19 pandemic. Beijing had provided 50,000 rapid detection kits and has shared medical knowledge with Turkey via video conferences to treat the patients suffering from the COVID-19 pandemic (Gupta & Singh, 2020). However, the Chinese government had faced criticism from the Turkish people and health experts due to its faulty masks and equipment. Hence, unlike Iran, China’s medical aid had received a mixed response from Turkey. China has been using the ongoing pandemic as an opportunity to push forward its ‘Health Silk Road’ diplomacy to expand its geopolitical and geostrategic influences. Moreover, the Chinese government has been using its global health diplomacy to overcome the allegations made by the USA for not preventing the virus from turning into a dangerous global pandemic. This kind of **soft power projection by Beijing is further intensifying rivalry between the USA and China** and also **accelerating their race to win the title of hegemon in the post-COVID-19 world order**. Recently, Chinese President Xi Jinping has expressed his desire in a telephonic conversation with the Italian Prime Minister Giuseppe Conte that he wanted to establish a ‘Health Silk Road’ as part of China’s ambitious BRI project (FMPRC, 2020). The Communist Party of China is well aware of the importance of Iran and Turkey as a gateway to Western markets for its BRI project. Therefore, China has been trying hard to expand its influence in both countries through its health diplomacy. Wong (2020) has argued that notwithstanding criticism from some European countries, given the faulty and low-standard medical equipment, the contribution of healthy combination of medical supplies such as facemasks, sanitizers and financial aid has **helped Beijing to curry favours and has won hearts and minds of one-half of a divided Europe**. Consequently, **several countries from the region have already extended their whole-hearted support to the Chinese BRI**, which aims to expand China’s geo-economic influence in the European countries.

### china heg inev – middle east

#### China has already outpaced the US in the Middle East – key to arm sales, oil, energy security, alliances, and military capabilities

Hamovitz 21 – Lior Hamovitz, B.A. in World Politics at the Leiden University College at The Hague, IB diploma in global politics at UWC Atlantic College, research assistant at The Open University of Israel, editor in chief at the Roosevelt Network at LUC (“Shifting Hegemony: China’s Challenge to U.S. Hegemony During COVID-19”, 9/7/2021, *E-International Relations*, <https://www.e-ir.info/2021/09/07/shifting-hegemony-chinas-challenge-to-u-s-hegemony-during-covid-19/>) FGY

When attempting to explore the meanings of US-China competition for the Middle East, a significant factor scarcely considered is China and the MENA’s historical and ideological relationship. Daniel Markey writes that although since the end of the Cold War China’s ties with the Middle East have largely been motivated by the Gulf’s energy resources, the country’s history with the MENA dates far back.[20] Iran and China, for example, share a historical bond of social and cultural exchange which was largely enabled by Persian settlement in the Chinese territory. The extension of the emotional connection between the two former empires grew further as they experienced the humiliation of their own dissolution, and the contrasting sight of the rise of European imperialism.[21] The prominent argument Markey develops is that **Middle Eastern leaders today are attracted to Beijing**’s “model of growth without political freedom.”[22] As Iran and China still view themselves within the context of their respective long histories of power and cultural significance, they sentiments of resentment towards the West. While their political motivations often diverge, their worldview is still similar in its illiberal values, allowing them to form “mutually beneficial collaboration.”[23] This ideological relationship is doubtlessly crucial for Beijing’s global and regional ambitions. In an endeavor to elucidate China’s growing bonds with the Middle East, Michael Clarke writes that **China’s foreign policy is becoming progressively informed by the wish to combat American hegemony** and its geopolitical implications, and to **build “a viable strategic and economic alternative to the current US-led international order.”** [24] As Chinese security concerns grow, both in and because of the MENA, and American geopolitical influence in the region decreases, China is encouraged to act out an agenda aimed at reshaping regional dynamics to suit its own interests.[25] Clarke states that China perceives the US hegemony as constraining its foreign policy ambitions, both globally and in the Middle East, and holds that the American ‘geopolitical resolve’ has fluctuated. These two elements have factored into China’s approach, which **seeks to leverage its non-Western identity** and **sparse interference in regional politics** to the country’s advantage. [26] Progressively, the American primacy in the Middle East came to be viewed by Beijing as a pivotal obstacle for its diplomatic and strategic regional prospects. This recognition, partnered with China’s desire to expand its economic growth and promote anti-hegemonic ideology, profoundly shape the country’s interest in the MENA: weapon sales, its own energy security, and relationships with certain “rogue” regimes.[27] Now, although China is still reliant on oil-prices which are in part modulated by the US, Salman et al. write that Beijing’s dependence on Middle Eastern countries’ oil is preventing it from risking their relationship, even at the cost of being unaccommodating towards Washington.[28] **With the understanding that America’s** **control over Middle Eastern oil** and **crucial naval routes are granting it global preponderance** that is of strategic risk to China, **the country began to specifically engage with Iraq, Iran and Saudi Arabia**.[29] The ties between Iran and China were further solidified by the signing of a military cooperation agreement, and Chinese missiles and technology have by now even found their way into Yemen and Lebanon, with strategic cooperation only expected to grow as China’s military capacities advance.[30] The importance of these bonds in shaping the post-pandemic world order cannot be understated, as China intertwines itself with MENA geopolitical dynamics. As Clarke argues, China sees itself as able to bring stability to the region through the evening out of imbalanced economic development and incremental mitigation of the US’s geopolitical power.[31] However, although scholars recognize the tightening economic and strategic relationships between China and the MENA, only few seem to pay explicit attention to the growing Chinese legitimacy in the region, and how it is undermining the US’s long-standing hegemony. This paper aims to address the existing gap overlooking how **China’s model of ‘peace through development’ rather than ‘liberal peace’ is gaining increasing legitimacy from Middle Eastern leaders, who find a wealthy and non-interfering hegemon an appealing replacement for the American alternative**.[32] The global hegemonic stagnation of the US, specifically during the COVID-19 pandemic, will further be linked to Middle Eastern political dynamics. By bringing these two bodies of literature together, this paper seeks to elucidate the MENA’s relevance for understanding the grander picture of the burgeoning US-China competition.

#### China’s ahead in every sphere – Iraq oil, Afghanistan peace process, naval power, tech, alliances

Anderlini 20 – Jamil Anderlini, Asia Editor of the Financial Times, responsible for all coverage of Asia, former Beijing Bureau Chief (“China’s Middle East strategy comes at a cost to the US”, 9/8/2020, <https://www.ft.com/content/e20ae4b9-bc22-4cb5-aaf6-b67c885c845c>) FGY

Even the architects of Operation Iraqi Freedom were convinced Iraqi oil revenues would quickly fund reconstruction of a US client state that would help redraw the contours of the Middle East in America’s favour. But if oil and influence were the prizes, then it seems China, not America, has ultimately won the Iraq war and its aftermath — without ever firing a shot. **Today China, the world’s largest importer of crude oil, is Iraq’s biggest trading partner.** Only Russia sells more oil to Beijing. In the first half of this year, Iraqi oil shipments to China increased almost 30 per cent from a year earlier and accounted for more than a third of Iraq’s total exports. During a visit to Beijing last year, Adel Abdul Mahdi, then Iraq’s prime minister, described Sino-Iraqi relations as poised for a “quantum leap” and his electricity minister wrote “China is our primary option as a strategic partner in the long run.” Meanwhile, **Iraqi oil exports to the US nearly halved in the first half of the year** and the Pentagon plans to reduce its remaining troops in Iraq by a third in the coming months. A **similar dynamic is playing out in Afghanistan, as America’s longest war finally draws to a close**. Afghan and Pakistani officials tell the Financial Times that **Beijing is effectively in control of the peace process** and is promising the Taliban lavish energy and infrastructure investment once the US has left for good. China’s influence is rapidly growing across the Middle East at a time when American commitment is being questioned by regional allies and US politicians alike. Beijing is the biggest foreign investor in the region and has sealed strategic partnerships with all Gulf states apart from Bahrain. Most investment has gone to traditional US allies, many of them also eager customers of Chinese military technology. China’s first ever overseas military base was established in Djibouti three years ago. But Beijing is also investing heavily in commercial ports that could easily be converted to naval use in other strategic locations, including Pakistan’s Gwadar and Oman’s Duqm port on either side of the Gulf of Oman. Along with the Strait of Malacca between Malaysia and Indonesia’s island of Sumatra, China considers the Strait of Hormuz and the Bab al-Mandab Strait as critical to its economic and military survival since the bulk of its energy imports are shipped through these strategic chokepoints. As Sino-US relations deteriorate, Beijing’s goal of increasing control of these waterways and reducing America’s ability to cut them off in a conflict has taken on greater urgency. **It is the main reason why China has built a navy that is now bigger, if not more advanced, than that of the US.** Until recently, Beijing had followed a hands-off policy in the Middle East of being a friend to everyone but allies with none. The success of this has been on display as it negotiates a $400bn investment and security pact with Iran while assisting Iran’s enemy Saudi Arabia with its nuclear programme. And it fully supports the Palestinian cause while charming Israel into sharing state of the art **technology** and leasing key strategic ports to Chinese state enterprises. But perhaps the most powerful sign of China’s rising influence in the region is the fact that almost every Muslim-majority country has supported the incarceration of as many as 2m Muslims in re-education camps in western China. In public statements and joint letters to the UN, countries including Saudi Arabia, Egypt, Kuwait, Iraq and the UAE have all praised the camps and suppression of Islam in the region of Xinjiang as necessary “counterterror and deradicalisation” efforts that have brought “happiness, fulfilment and security”. In the US, two successive presidents have been elected on promises to extricate the country from Middle Eastern entanglements. In the wake of the shale oil revolution, with America now virtually self-sufficient in energy, the rationale for pouring more blood and treasure into the sand looks thin. Washington’s resistance to playing regional policeman while other countries, particularly China, reap all the benefits has been evident for a while.

#### Middle East – Chinese geopolitical dominance is already secured– vaccine diplomacy, BRI, 5G, military alliances – American attempts to reestablish dominance cause great power draw-in

Hamovitz 21 – Lior Hamovitz, B.A. in World Politics at the Leiden University College at The Hague, IB diploma in global politics at UWC Atlantic College, research assistant at The Open University of Israel, editor in chief at the Roosevelt Network at LUC (“Shifting Hegemony: China’s Challenge to U.S. Hegemony During COVID-19”, 9/7/2021, *E-International Relations*, <https://www.e-ir.info/2021/09/07/shifting-hegemony-chinas-challenge-to-u-s-hegemony-during-covid-19/>) FGY

Yan Xuetong asserts that a humane authority derives its power and legitimacy from the way it is being perceived by others: as a benevolent state, able to meet the economic and security needs of fellow countries.[118] Indeed, during **the COVID-19 pandemic, China made concerted efforts to display its benevolence** and its ability to rise to the occasion as a global leader in times of crisis. These **efforts were particularly pronounced in the Middle East**, as President Xi capitalized on the opportunity to strengthen existing relationships and build new ones through medical diplomacy and generous aid.[119] China’s vaccine diplomacy in the area, for example, is said to have helped it reap “soft-power dividends” with local BRI countries and had regional leaders feeling grateful. These sentiments are important to highlight, as they could translate into increased cooperation and allegiance.[120] The **leadership vacuum created by the US during the pandemic was palpable in the Middle East** and exacerbated by the practical needs of MENA states. Even countries like Jordan, a close ally of the US, found themselves in cooperating with China. The Chinese vaccine distributed by Sinopharm became the backbone of the Kingdom’s inoculation program and subsequently made medical experts in the country reevaluate their previous notions on Chinese-produced pharmaceuticals altogether.[121] Indeed, Chinese vaccines were being purchased and used not only by states predisposed to seek non-American solutions, but also by the US’s own allies, including the United Arab Emirates (UAE) and Egypt. With China, alongside Russia, having incrementally chipped away at American clout in the region, analysts believe its vaccine diplomacy was an attempt both to further establish itself as an adept scientific leader and to expedite its influence within the Middle Eastern order.[122] Importantly, it seems this attempt was successful. MENA countries’ vaccine purchases were arguably driven by diplomatic considerations, which in turn reflect China’s growing regional prevalence. As Steven Cook confirms, **China’s prestige in the MENA is undoubtedly growing** – a significant feat in an area which has long been predominantly under the influence of the US. Like in other parts of the world, this upswing was in part propelled by the absence of American guidance, its devaluing of science, and unwavering inward focus.[123] Likewise, Bamo Nouri and Inderjeet Parmar write how, as the pandemic progressed, **Washington’s dominance in the MENA was being increasingly challenged in ways which may not be easily reversible.** They recognize a realignment of powers within the region, accelerated by the political necessities of the COVID-19. Middle Eastern countries, the authors argue, had to find new ways to operate both independently and collaboratively “as the international co-operative instruments of the US-led liberal order seem[ed] absent and ineffective during the crisis.”[124] Notably, this absence has not only pushed China forward, **due to the zero-sum nature of political power**,[125] but also strengthened its alliance with Iran. With surmounting pressure on Iran by US sanctions and its domestic coronavirus crisis, China became instrumental for the country’s ability to tackle the spread of the pandemic, aiding in the form of crucial medical supplies and training. It should come as no surprise then that this help greatly contributed to China’s soft power in the MENA.[126] The lack of activity and declining influence of the US in the time of this crisis, and the subsequent vacuum these formed, may lead in the long term to a ‘China-oriented’ order supported by the country’s diplomacy and humanitarian aid. Nouri and Parmar explain that because of the **coercive means by which the US historically approached the region**, and its leadership failure during the pandemic, its ability to influence local dynamics in the MENA is on the decline. The Trump administration’s choice to persist in these ways during a global crisis which necessitated effective and responsive leadership only served to push Middle Eastern countries into partnerships which exclude the US.[127] Arab countries’ choice to purchase Chinese vaccines is therefore only a small indication of the brewing partnership between Beijing and the Middle East.[128] In terms of Yan’s framework, China has been specifically able to demonstrate its morality, capability and authority in the MENA region, and thus gain growing legitimacy for itself and its governance model. As quickly became apparent during the crisis, China was more than willing to adhere to international norms of aid and cooperation and demonstrate the type of moral behavior Yan claims are necessary for a state’s rise. In the Middle East, this was exemplified both in statements and action. The Chinese Foreign Minister, Wang Yi, marveled at the solidarity between China and the MENA during the stages of the pandemic, and expressed that these times of crisis highlight the shared stake of countries around the world. True to these words, China had collaborated with all Arab states in the region, including those in conflict situations like Syria and Palestine. It sent out medical supplies, hosted dozens of joint meetings with the Arab League and had Chinese medical experts visit Arab countries nearly 100 times.[129] According to Yan, moral behavior can directly contribute to the legitimacy of a state and its leadership, and thereby increase its influence upon others.[130] In the specific context of MENA, China has importantly been able to assert its commitment to regional norms and demonstrate a morality simultaneously consistent with the international system as well as the local one. Alongside its donations and medical contributions, **Beijing reaffirmed its “respect for sovereignty and territorial integrity, non-aggression and non-interference in internal affairs”**[131] in a joint statement with Qatar. Moreover, China was able to boost its strategic credibility in the region and the perception of its capabilities. Its rapid economic recovery from the financial effects of the virus’ outbreak had been contrasted with the lag of the US, and made economies in the Gulf increasingly reliant on China for developments in areas such as telecommunications.[132] In terms of the vaccine, many Middle Eastern states had placed their trust, sometimes exclusively, in Chinese-produced shots.[133] This trust is of great significance for the vindication of China as an increasingly legitimate player in all realms of crisis-resolution, and illuminates the seeming superiority of its authoritative model in combating such challenges.[134] In Yan’s understanding, this trust attests to the capacity of a state to attract an international following.[135] As the theoretical framework of this Capstone project holds, legitimacy is one of the two pillars upon which hegemony stands. China’s growing image as a competent leader by MENA countries, and the legitimation of its model considering the practical success it has had in aiding the region to combat the spread of the coronavirus, can have lasting reverberations for China’s position within the Middle East. US-China Competition in a Post-Pandemic Middle East – While it is difficult to predict in which ways China’s rise will manifest globally in the post-pandemic era, there are several indicators which could suggest why the MENA region should come under scrutiny. Throughout recent years and increasingly so during the COVID-19 crisis, Beijing and its model have received broadening legitimacy in the Middle East. Perhaps the most glaring example of the type of support China is receiving in the region is the **overwhelming endorsement of its BRI plans**. Countries across the MENA, from **Egypt to Saudi Arabia to Iran, have all committed themselves** to some form of participation in the Initiative.[136] And the support does not end there. Countries in the Gulf are defying US pressure and **hiring the Chinese giant Huawei to build 5G infrastructure** in their respective states. Even Israel, the US’s longstanding ally, is resisting pressures from Washington asking it to limit economic ties with China, who invests hundreds of millions of dollars in the country’s tech sector yearly.[137] As Eyck Freymann succinctly put it: “These countries agree on almost nothing — but they all want closer ties with China.”[138] Although it could appear, at surface level, that the majority of the MENA’s interactions with China are limited to economic and infrastructural endeavors, the reality of these relationships is far more complex. **The gradual embrace of China into the Middle East is in part driven by its opposition to external interference in sovereign state affairs**.[139] Regional leaders are heard being increasingly vocal about their cooperation with China, citing strategic partnerships as motivating these newfound bonds.[140] As many thinkers readily admit, **US influence is waning in the Middle East**, a fact which gives leeway for China to strengthen its own ties with local leaders and states. The most prominent feature Beijing seeks to emphasize in the MENA is its model of governance and development, one that differs greatly from the Western-connotated model of ‘liberal peace,’ and rather focuses on stability, aid and investment instead of democratic reform. This model is extremely attractive in a region where development without democracy could be precisely what leaders seek.[141] Indeed, the decline of the US as a regional hegemon has much to do with its policy choices, and the MENA’s dissatisfaction with American policies had only been intensified during the tenure of former President Trump. While Middle Eastern state leaders previously disagreed with the political decision-making of President Obama, but at the very least understood it, it was the Trump administration’s “wildly inconsistent”[142] policies that sowed serious doubt about the US’s ability to continue serving the same position it had long represented in the region. These inconsistencies can be described in terms of sudden policy swings, public internal disagreements, and mixed messaging to local leaders. Most notably, the Trump administration’s withdrawal from the Iran nuclear deal (JCPOA) not only capsized years of multilateral diplomatic efforts, it also “cast profound doubt on the reliability of any U.S. commitments.”[143] As Yan writes, when a country’s strategic credibility is questioned and its government deemed unreliable, its ability to be an interstate leader can be short-lived.[144] Due to increasing uncertainty about the US’s intentions as well as cooperation abilities, regional leaders are progressively turning towards China to secure their economic and strategic interests, a move which has been more than welcomed by Beijing. As the region turns even more turbulent than before, with intra-regional disputes and growing domestic challenges to state leaders, it is naturally less inclined to shape its priorities around the interests of the US in the way it did before. The MENA is becoming less amenable to the control America attempts to exert upon it as it sees a country struggling to commit to neither economic nor political shared objectives.[145] Like **Biden’s national security adviser** Jake Sullivan **says, Xi Jinping is pitching the autocratic model as an effective problem-solving mechanism more overtly than ever before.** With China’s rise in the international arena in general, and in the Middle East in particular, the US will have to find new ways to demonstrate its democratic model works. [146] A testament to the extent of China’s legitimization in the Middle East, a predominantly Muslim region, is the marginal backlash it has received from local leaders over its treatment of the Uyghur people. Over recent years, more and more reports have been surfacing, documenting the incarceration of around 1.5 million Uyghurs in ‘re-education’ camps in the northwest Chinese region of Xinjiang where they live.[147] The Uyghurs are a Muslim minority in the country, who are said to have long suffered from suppression of their ethnic identity and even persecution at the hands of the Chinese government. From destroying sacred mosques and temples, to forcefully attempting to assimilate them into the Chinese political culture and re-balance the demographic in Xinjiang through Han migration, it has become gradually apparent that China set itself the distinct mission of controlling the region at any cost.[148] In the camps, the ‘re-education’ of children and adults takes the form of severing the Uyghurs’ linguistic and cultural links to their ethnic identity; a process conducted under strict and invasive surveillance.[149] From China’s end, these measures are being justified through Confucian notions of fostering social harmony, accompanied by a claimed necessity to counter the potential of Xinjiang becoming a ‘breeding ground’ for domestic terrorism.[150] Beijing has been able to frame this Muslim minority, because of their ethno-religious identity, under the umbrella of the international War on Terror, and render the Uyghurs a dangerous population seeking to harm the Chinese people.[151] Surprisingly, China seems to have been able to carry out these policies with little to no criticism from Muslim leaders in the Middle East – arguably a testament of its growing regional influence and legitimacy. The Saudi Crown Prince has praised China for its crackdown on the terroristic potential of the Uyghurs and was remarkably not the only one.[152] His statement was echoed by leaders from Kuwait, Iraq, Egypt, and the UAE, who sent a formal letter to the UN conveying that China’s necessary ‘counter-terrorism’ efforts in Xinjiang have brought “happiness, fulfilment and security”[153] to the region. Iran, Oman and Syria have further expressed their public support for Beijing’s right and need to ‘de-radicalize’ the Xinjiang area from Uyghur hostilities, in staunch support of China’s sovereignty rights.[154] Even Tukey, who had previously been a proponent of the Uyghur strife, seeing as they are a Turkic people with an Istanbul-based diaspora, has by now gone quiet on the issue. Moreover, there are even allegations that Erdogan’s Tukey had arrested Uyghur people at China’s request – a move fueled by the country’s growing reliance on Chinese money for its weakened economy.[155] Considering MENA countries’ emblematic pan-Muslim sentiments and backing of Muslim minorities worldwide, their overwhelming siding with China’s repressive policies against the Uyghurs cannot be cast as anything but a powerful symbol of the legitimacy and influence Beijing is cultivating in the Middle East.[156] Some writers, in fact, have already begun addressing the MENA region as being ‘**post-US**,’ and claim that China can be crowned the biggest winner of this transition.[157] Already being the largest consumer of regional oil, it is now also the only country which has significant economic and political ties with all of the most powerful actors in the Middle East. For Washington, this reality means that “the Middle East is reemerging as an arena of great-power competition.”[158] Indeed, the alliances that China is forming in the region, especially with Iran and anti-American militias is concerning for the US and poses threats to its own assets and partnerships in the region. During the Trump presidency, harsh US pressures on the Iranian Republic have only empowered state hard-liners that are considered enthusiastically pro-China. One can expect this bolstered partnership between the two states would serve, among other outcomes, to allow Iran to up its nuclear deal negotiation bargain with the Biden administration.[159] No less substantial, **America’s more committed allies like certain Gulf countries and Israel are reluctant to take any side** in this budding geopolitical rivalry between China and the US. While the contentions between the two great powers are not exclusive to the Middle East, and even span to maritime competition, the MENA is seemingly opening itself up to Chinese engagement. From states to organizations like Hezbollah, to Shiite factions in Iraq, all of which are developing intertwinements with Beijing, the US is facing heightened threats to its regional allies and to its own strategic assets. **The importance of protecting these would be a determining factor in America’s engagement with China in the MENA in coming years**.[160] An aspect which should further not be undermined is how crucial the Middle East is to President Xi’s global aspirations. China’s route to becoming the center of the global economy involves the ability to secure access to oil and shipping lanes in the MENA. These have fundamental importance for its geostrategic objectives.[161] There is a lot at stake for China, and it would be willing to travel great lengths in order to continue its expansion. In light of its worsening relationship with the US, **China sees it as paramount to secure waterways which the US may later try to cut off in conflict**. For this reason, its navy has exponentially grown and is now bigger than its American counterpart, if not more advanced.[162] With the Levant expected to become instrumental for the success of Xi’s BRI, China is developing close ties with states that would assist the fulfillment of its ambitions. Through extremely generous loans and aid packages to Arab countries, priced at over twenty billion dollars, as well as promises for extensive employment possibilities for the local population, China has been able to assert its soft power in the region and foment an environment that would openly welcome expansionism in the form of the BRI.[163] Consequentially, China’s growing entanglements in the Middle East are almost bound to come at a certain price; one which would weaken its ability to stay neutral in regional disputes. Indeed, the importance of the Middle East for China’s BRI prospects means it is re-envisioning the political order of the region, and actively attempting to create one that is multipolar, adhering to its touted model of developmental peace rather than the West’s democratic peace. Because of the inherent volatility of the MENA, and China’s interests within it, the country may find itself driven into involvement in security questions it has up until now avoided – largely due to the US’s own regional role in defending strategic assets important to both actors.[164] With decreasing American military engagement in the region, a process accelerated during the Trump administration, China may find it difficult to be detached from the MENA’s conflicts.[165] The UAE and Saudi Arabia, for example, are growing concerned that nuclear negotiations between Iran and the US could bolster the Islamic Republic’s assertiveness, or alternatively cause America to entirely abandon the cause. Either way, these sentiments have the potential to propel states to form strengthened military ties with Beijing, which include hosting its military and naval bases in their territories.[166] Gulf countries recognize that China seeks to increase its involvement with the region, and that its wish to protect energy and security assets would only drive it to military advancement in the MENA.[167] Overall, it remains unknown how the surmounting challenges China has confronted the US with over recent years, and particularly during the COVID-19 pandemic, would manifest in the Middle East. Nevertheless, it appears that China and MENA countries are growing inextricably closer, in ways which may necessitate a re-engagement of the US in a region it has long sought to gradually withdraw from.[168] China’s rising need to secure energy and strategic assets in the region may eventually necessitate that it mires itself in the geopolitical conflicts of the Middle East. **If that is to happen, there might be little choice for the US but to find new ways to reestablish its military and political dominance over the region, even at the cost of turning the MENA into a great-power rivalry locus.**

### china heg inev – tech

#### China tech leadership now – Huawei and 5G are the lynchpin of Gulf economies

Zinser 20 – Sophie Zinser, researcher focusing on China’s role in the Middle East, South and Central Asia (“China’s Digital Silk Road Grows With 5G in the Middle East”, 12/16/20, <https://thediplomat.com/2020/12/chinas-digital-silk-road-grows-with-5g-in-the-middle-east/>) FGY

“New Value Together” was the slogan for the 40th annual GITEX Technology Week, the only in-person global technology show of 2020 held December 6 to 10 at the Dubai World Trade Center. Its organizer is known across the Middle East – particularly the GCC countries – **as the region’s leader in 5G and cloud computing: Huawei**. The global telecoms supplier and mobile phone manufacturer made headlines throughout 2020 – most recently in Southeast Asia with a blitz of deals monopolizing Indonesia’s 5G network – for its role in a growing global 5G movement. **Eleven telecom firms including those in the Gulf Cooperation countries (GCC) of the UAE, Saudi Arabia, Bahrain, Kuwait, and Oman have signed massive 5G contracts with Huawei over the last year**. By 2025, GCC countries will house much of the world’s growing 5G subscribers. Huawei has jumped on the bandwagon to capitalize on what they perceive as a promising future for 5G in the Middle East. The company’s leadership has been bullish on the Middle East since September 2019. And the region’s $164 billion annual market for information and communication technology (ICT) products is a good reason for Huawei’s enthusiasm. Over the last year, there has been a surge in publicly administered cloud services in the Gulf worth nearly $3 billion. This Gulf government-led push is confirming for Huawei that 5G-enabled cloud computing in the GCC is an increasingly lucrative market. But what impact has this recent growth in 5G had on the everyday lives of the 54 million people living in the GCC? Not much. Locally, 5G is mostly being implemented widely only insofar as to enable a more rapid pace of downloads to smartphones and quicker analog communications. As of December 1, Huawei’s new P40 PRO 5G phone is available for consumer purchase in the UAE. But analysts remain optimistic on the potential of 5G to positively impact multiple industries in the GCC, specifically energy usage optimization, cloud computing, ultrafast broadband, and internet of things (IoT) innovation, including self-driving cars, transportation, and factory equipment. In response, Huawei has been relentlessly extending its digital footprint across the Middle East despite Western efforts to curtail its global expansion. The United States has repeatedly expressed security concerns over Huawei’s presence in international markets. Since 2018, U.S. policymakers have been actively attempting to hinder the company and its China-side competitor ZTE’s expansion abroad, especially within the European Union. The Trump administration’s pressure on Huawei – specifically its recent ploy to curb critical semiconductor technology sales to the Chinese company – has sparked global discussions about data privacy and security-related drawbacks to international reliance on Huawei’s toolkit. **While the U.S. government’s efforts to halt Huawei’s expansion have succeeded domestically and in parts of Europe, the Gulf market has come out unscathed**. This is perhaps due to the region’s highly sensitive position in geopolitics. Given a heavy reliance on China’s oil market as well as the significant U.S. military and diplomatic presence, there is no incentive for Gulf economies to become a proxy war zone for the world’s two largest superpowers. But **COVID-19 has made Gulf economies increasingly reliant on China as the nation’s economy recovers faster than the United States’ from the global recession. Since COVID-19 restrictions lifted in China, Chinese policymakers have undertaken major steps to develop what they are calling “industrial internet” of global telecommunications providers at far cheaper prices than their Western competitors in the sector**. Saudi Telecom Company (STC) reported a jump of over 1,000 percent in bandwidth due to the surge in remote education. They are currently scrambling to secure necessary network infrastructure to keep pace with the demands of Saudi’s ambitious Vision 2030 strategy. Similarly, Qatar is preparing to host in 2022 what it hopes will be the first 5G World Cup. The event’s reliance on a critical partnership between British telecom giant Vodafone and Huawei may be jilted from the U.K.’s recent ban on Huawei products, making the battle for 5G in the region over the next few years ever more relevant. Huawei’s aforementioned growth in global 5G has occupied much of the 2020 conversation on Chinese companies comprising China’s Digital Silk Road (DSR) initiative. The phrase DSR was initially launched in a government white paper in 2015 as an extension of China’s Belt and Road Initiative (BRI), a global strategy for Chinese-led infrastructure development. Now the DSR is a widely used moniker for Chinese data and telecoms activity abroad. According to Fudan University, the DSR policy itself is comprised of five key aspects: with infrastructure at its core, the DSR relies on expanding influence to trade, finance, and “people’s hearts,” all geared toward shaping policies abroad. These include cybersecurity, digital governance, and data sharing practices across the developing world. Both the BRI and DSR act in practice as catch-all monikers for economic and policy decisions that Chinese government actors and corporations make. The ambiguity of DSR’s branding makes potentially disparate policies across many Chinese companies – each with varying levels of Chinese government involvement – look cohesive. Even within those companies China’s hybridized structure of state-owned and private enterprises makes top-level decision-making incentives difficult for outsiders to disentangle. No single company or government entity is totally emblematic of China’s DSR, even Huawei. But U.S. 5G operations are still lagging behind that of Asia in the Middle East. The Japan Center for Economic Research predicts that given its performance in light of COVID-19, the Chinese economy will surpass that of the United States before 2030**. With rollout of 5G in the U.S. lagging in pace behind that of Asia, Huawei and its peer companies’ current moves into Middle Eastern markets could chart a course for Asian dominance in the region’s future.**

### china rise peaceful

#### China rise will be peaceful if the US accommodates – ignore outdated perceptions of Power Transition theory

Gwadabe & Ahmad 21 – Nasa’l Muhammad Gwadabe, professor at the Department of History & International Studies at Sultan Zainal Abidin University, Ph.D. in international relations from Sultan Zainal Abidin University, M.Sc. in international relations from Zirve University; Abdullahi Ayoade Ahmad, senior lecturer and faculty of law and international relations at Sultan Zainal Abidin University, Ph.D. in international relations from Sultain Zainal Abidin University (“The Declining Hegemony of the United States and the Growing Influence of China: A Critical Perspective on Power Transition Theory in the 21st Century”, Austral Brazilian Journal of Strategy & International Relations, January 2021, DOI: [10.22456/2238-6912.102434](http://dx.doi.org/10.22456/2238-6912.102434) ) FGY

This paper explored the prospects of peace or war between the declining United States and rising China. **Many scholars** of international security and pundits **believed that the rise of China would be conflictual** (Allison 2017; Campbell 2008; Wang 2018). **On the contrary**, this paper argues that **China** **could surpass the United States as an economy**, but there is **no indication of armed confrontation between the two nations**. This is because, in the 21st century, there are changing trends in international relations and global politics. Besides, **China** has not reached the stage of power maturity yet. Therefore, **as rational state**, it **would not prematurely plunge itself into conflict with the United States**. Because the outcome of armed confrontation between China and the United States will be a setback for the world in general and particularly a bigger problem for China at this critical stage of her growth.

More so, in today’s world nations are intertwined by the forces of globalisation which created inexorable **economic interdependence**, rapid advancement in **military technology**, and the concept of **Mutually Assured Destruction (MAD)** due to the advent and proliferation of weapons of mass destruction. These factors have **necessitated a revisit and a critical evaluation of the Power Transition theory**, which was propounded in mid-20th century to make it applicable in the contemporary international system.

Generally, the problem is that after World War II the new global order was structured to serve the western powers while the rest of the world was left out. Although China is a permanent member of the United Nation Security Council, still, that will not be a fair share for rising China. Thus, if United States could act strategically to incorporate China into the camp of nations that are getting a reasonable fair share of the system through multilateral approaches, then the prospect of the transition to be peaceful will increase. Though China is not a liberal democracy, facilitating and accelerating the exposure of China to the global norms and practices within the framework of international law could make her less violent and moderately ambitious during the transition. This strategy can let the two nations to have some common interests of mutual benefit. Therefore, if China can benefit from these norms and practices, then, challenging the established Pax Americana status quo will be counterproductive. Zhu (2005) added that **if the United States could accommodate some of the significant interests of China the prospect of peaceful coexistence will increase**. He, however, maintained that for the world to achieve this harmonious transition, the **United States has to sacrifice some** her interests and **benefits** it has been enjoying as the hegemony. This will finally create an international atmosphere of cooperation and fair competition for a better world.

All in all, Abramo Organski propounded the Power Transition theory in the 20th century. Therefore, the definite assumption of the theory of the escalation of armed confrontation during power transition might not have substantial validity in the 21st century as a result of the nuclear balance of terror, rapid advancement in military technology, and complex economic interdependence brought about by the forces of globalisation. Consequently, the **present-day Power Transition theorists need to revisit the theory to accommodate contemporary factors to make it fit adequately in the discourse of international relations and global politics of the 21st-century international system.**

#### China has sufficient economic and military power and has integrated into the LIO

Karim & Susanto 21 – Moch Faisal Karim, assistant professor in International Relations at the Bina Nusantara University, Ph.D. in politics and international studies from the University of Warwick, M.A. in international security at the University of Nottingham, B.A. in international relations at the University of Indonesia, research coordinator and Foreign Policy & International Politics subject content coordinator, managing editor for the Journal of ASEAN Studies, former advisory staff for the Chairman of Foreign Affairs and Defense Committee at the House of Representatives for the Republic of Indonesia; Alfiani Gracia Susanto, faculty member at the International Relations Department at the Bina Nusantara University (“Power Transition and the United States-China Trade War”, Contemporary Chinese Political Economy and Strategic Relations, vol. 7, iss. 1, April 2021, <https://www.proquest.com/docview/2578203541?pq-origsite=gscholar&fromopenview=true>) FGY

3.3.Trade war as a Sign of Power Transition

According to power transition theory, war is possible if competing countries have similar political, economic, and military capabilities (Organski and Kugler, 1980). These relatively equal capabilities can also be referred to as power parity, which is an important aspect that determines the conditions during power transition (Zhu, 2006). The United States and China are the world's two largest economies. U.S. GDP grew from US$19.485 trillion in 2017 to US$20.529 trillion in 2018, while China's GDP grew from US$12.31 trillion to US$13.895 trillion over the same period (World Bank, 2021). This shows that the two countries are approaching power parity (see Figure 3).

A hegemonic war is a war to determine which country will become the dominant state to control the system (Gilpin, 1983). This potential for this type of war between China and the U.S. is not only driven by power parity, but also driven by the fact that China is a state that belongs to the second type of national characteristics; that is, the powerful and dissatisfied (Feng, 2009). According to the power transition theory, if rising power identifies with this type, then transition is most likely through war. Meanwhile, if the rising power comes from a state that can be identified as the powerful and the satisfied, the power transition period is more likely to be peaceful (Organski, 1958).

As mentioned before, China started its economic reforms in 1978 under Deng Xiaoping. This wide-reaching financial reform means that **China is currently experiencing a significant economic** rise, with its economy growing by an average of 9.5 percent per year (Morrison, 2014). In this period of reform and industrialization, China is seen to be **integrated into the current liberal international** order by joining several international organizations, such as WTO and the UN. However, in the integration process, China often encounters problems with other states due to differences in common international values, rules, and norms with the country's internal domestic (Weinhardt and ten Brink, 2020). This leaves China involved in violations of international rules and contestation influenced by its domestic preferences. Weinhardt and ten Brink (2020) explained that two types of contestation are faced by China: frame contestation (rules validity contestation) and claim contestation (action contestation; rules violation).

In economic sectors dominated by state owned companies, such as steel, China tends to break the rules and even question the rules' validity. In the steel sector, for example, China is involved in both frame contestation and claim contestation because this sector is a crucial one directly dominated by the state. Thus, it will be impossible for China to pressure this sector to fully conform to WTO rules because they contradict its domestic rules and preferences (ibid.).

In sectors that are quite important to the country but are not directly dominated by the government, such as agriculture, China tends to bend the rules to argue that they are not a developed country but a developing country. China is involved in claim contestation in the agricultural sector because it considers agriculture alleviates poverty for small-scale farmers in areas that are not economically competitive, thus increasing development indicators. China claims that the existing rules are too focused on developed countries, so, according to China, they are allowed to bend the rules to make them more suitable for developing countries, including themselves (ibid.).

In a competitive sector like information and technology (IT), China tends to comply fully with international rules (Yang and Qu, 2020). By complying, China will become more developed in this sector and obtain more opportunities and profits in the international market (Weinhardt and ten Brink, 2020).

With its growing economic might, China appears to have motivations to **replace the U.S. as a global hegemon**. China's actions relating to international trade signal its dissatisfaction with the current international order, where China calls into question the order's validity in several sectors, in line with their domestic preferences.

China's motivation to replace the U.S. are **reflected in its global initiatives**, notably the Belt and Road Initiative (**BRI**). BRI is a Chineseled initiative to promote connectivity and strengthen partnerships in Asia, Europe, and Africa. China is trying to build **infrastructure to connect countries in the world** through sea and land routes and increase trade traffic. Through this initiative, China argues that it seeks to build shared interest and responsibility communities and promote cooperation in all fields. China claims that BRI promotes mutual trust in politics, economic integration, and cultural inclusiveness among the countries that are members (State Council, PRC, 2015).

The giant BRI initiative is seen as Chinese statecraft that will help it to **achieve its goals of expanding its global influence** on politics and economy. At least two thirds of all countries or around 139 countries in the world have joined this initiative (Sacks, 2021). China is also investing in port development to support its objective to deepen trade links with the world (Chatzky and McBride, 2020). However, despite benefits such as improved infrastructure that can increase the rate of global trade, the drawbacks of BRI could also be dangerous. For example, China provides low-interest loans to states involved, and ultimately these loans can leave countries deep in debt. In some cases, China even requires the countries involved to use the services of Chinese companies on local inftastrcutre initiatives instead of local companies (ibid.).

China's second global initiative is known as the Made in China 2025 Strategic Plan. In this plan, China aims that by 2025, they will have 70 percent self-sufficiency in the high-tech industry (ibid.). It will no longer depend on other countries' technology and will even be able to promote Chinese high-tech producers in the global market. The aim is to increase the productivity and efficiency of China's industries, in turn boosting China's industries further and improving their economic competitiveness (Sutter, 2020). The strategic plan, which inspired by Germany's industrial 4.0 development plan, aims to catch China up with the technological capabilities of the West and perhaps even to surpass the capabilities of Western countries. However, the Chinese government later re-framed the Made in China 2025 Strategic Plan as an aspirational and unofficial one, following significant attention from leaders of Western states, who judged the plan as demonstrating China's ambition to become a global leader (McBride and Chatzky, 2020).

In the military sector, China is also hying to increase its defense power through various efforts. China initiated a project entitled Civil Military Integration (CMI), intending to harmonize its civil and defense technology development to achieve efficiency, innovation, and growth. In addition, China has strengthened the People's Liberation Army (PLA) through an array of training and evaluation programs (Office of the Secretary of Defense, US, 2020). China is also noted to have increased its defense budget to maximize and accelerate the development of its military capabilities, including an increase in ownership of fighter jets, aircraft carriers, and anti-satellite missiles, **leading China to become the country with the world's second-largest defense budget,** behind the United States (Funaiole et al., 2021).

#### China’s rise will be peaceful – interdependence checks conflict

Huwaidin & Antwi-Boateng 21 – Mohamed Bin Huwaidin, associate professor in the Department of Government and Society at the United Arab Emirates University; Osman Antwi-Boateng, associate professor of political science & international relations in the Department of Government and Society at the United Arab Emirates University, Ph.D. in international relations (“The Rise of China as a Hegemonic Power: The Case for a Partial Peaceful Rise”, *Journal of Regional Security*, 7/13/2021, <https://aseestant.ceon.rs/index.php/jouregsec/article/view/31562/19564>) FGY

The peace argument attempts to refute the war argument, especially regarding further development of the China-threat theory articulated mainly by advocates of offensive rea-ism. Sensing the danger, supporters of this argument counter the Thucydides trap analogy by emphasizing China’s peaceful rise. “China sees itself as a member of the global community of common destiny. It does not seek alliances or expansion. There is no cause for fear as **China has neither the interest, nor the need, to challenge the United States for leadership by launching a war.**”24 This argument regards China as a responsible state committed to achieving its own development without harming other states. It assumes that economic interdependence will restrain China – the rising power – from confronting the US, the established power. Liberals argue that interdependence is one of the main pillars of peaceful international relations. They also argue that perpetual peace can be partially achieved by creating interdependence. Liberals believe that the more interdependent states are, the more peaceful they will become.25 As such, **economic interdependence will compel China to become sensitive to the costs of alienating its economic partners**, and to the small benefits afforded by aggressive military postures relative to the larger benefits associated with trade and financial interdependence. This argument has been posited by a number of scholars. Ikenberry argues that **China’s rise will be peaceful** because **China is benefiting from the current international system, as it is rising by working inside the international institutions** such as the UN, WTO, IMF and World Bank,26 and it is greatly benefiting from the current liberal international order.27 Bi-jian argues that China’s rise to great-power status will not result from following “the path of Germany leading up to World War I or those [paths] of Germany and Japan leading up to WWII, when these countries violently plundered resources and pursued hegemony. China will also not follow the path of the great powers vying for global domination during the Cold War. China will instead, **transcend ideological differences** to strive for peace, development, and cooperation with all countries of the world.”28 Gill similarly argued in his book, Rising Star, that **China is applying a** **new security concept that** **stresses cooperation among states in their pursuit of common objectives**. China will rise peacefully and play a positive role in building a harmonious region and world.29 In accordance with this argument, China will help to stabilize the region. Bingguo also stressed that China will “stick to the path of peaceful development” and “will not engage in invasion, plundering, war, or expansion.” It is by making others feel safe that China’s security can be achieved.30The capitalist peace theory argues that trade, investments and financial openness reduce the risk of war.31 Countries are less likely to have military disputes if there is a greater degree of economic cooperation among them. Weede favored this theory in explaining China’s rise. He discovered that “China’s positive response to the opportunity of exploiting its comparative advantages within a global market ... demonstrate[s] that a **capitalist peace between China and the West is feasible**.”32 The **deepening economic relations between the US and China have increased the interdependency level** among the two powers further minimizing the possibility of a violent confrontation. Bilateral trade reached $560 billion in 2020, in which China enjoys a huge trade surplus of about $311 billion.33 More than $60 billion in direct investment flowed between the two states in 2016.34Additionally, China holds over $1.1 trillion in US treasury bonds.35 This makes **China the US’s largest foreign creditor**. American investments and technologies are crucial to China’s development, and the American market is very important for Chinese goods. In other words, the two economies complement each other’s needs. While the US produces high-tech products, China mostly produces products that meet the needs of average consumers such as electrical machinery, furniture, toys, sport equipment and food products. Therefore, in this sense, the relationship is not one of competitors but of counterparts. Thus, **any decision to move toward a military confrontation would undermine the economies of both countries**. This **would cause great economic and political pain to China, whose political regime depends on its capacity to provide better economic and social conditions for its massive population**. Building a wealthy, strong, and civilized social country with Chinese characteristics, is the main theme of Deng Xiaoping’s theory of development, and Xi Jinping’s idea of development.36 To achieve this objective, China will need peaceful and cooperative international relationships, principally with the US. China is benefiting from the existing international system in building a vibrant economy that has lifted mil-lions of its citizens out of poverty and legitimized the ruling Chinese Communist Party in a post-Communist world. There is no reason for China to destroy this system. Instead, it must capitalize on the existing international system of trade, investment, technology, and security. That does not mean that China will not work to adjust some existing norms to advance its development. This is particularly evidenced by China’s efforts to establish the Asian Infrastructure Investment Bank to advance its Belt and Road Initiative and properly to counter the US-led World Bank and the US/Japan-led Asian Development Bank. The same motivation of challenging the US-led status quo has led China to launch the ambitious Belt and Road Initiative, which aims at creating a new system based on Chinese principles while working in parallel with the US-dominated system. Similarly, the 2013 Carnegie Foundation Report that assessed US-Japan-China relations argued against a full-scale military confrontation by China intent upon expelling the US from that region. Instead, the report concluded that the economic interdependence among the three countries would motivate them to resolve their disputes peacefully.37Jerden and Hagstrom noted that China’s rise has been accommodated, rather than balanced against it,by Japan.38 Steinfeld has argued that China’s rise does not constitute a threat to the West because it is deeply involved in international economic systems that have been created and defined by the West.39 Therefore, the tensions are manageable. Yang opposes the war argument and asserts that it is overruled by nuclear deterrence and geographical constraints. He believes that mutual nuclear deterrence makes “China’s rise different from previous examples of violent rising of great powers and this difference explains the peacefulness of China as a rising great power.”40 Dellios and Ferguson argue thar **China has good intentions** to achieve harmonious world by becoming a responsible state.41

#### Rising threats force cooperation and prevent direct conflict

Huwaidin & Antwi-Boateng 21 – Mohamed Bin Huwaidin, associate professor in the Department of Government and Society at the United Arab Emirates University; Osman Antwi-Boateng, associate professor of political science & international relations in the Department of Government and Society at the United Arab Emirates University, Ph.D. in international relations (“The Rise of China as a Hegemonic Power: The Case for a Partial Peaceful Rise”, *Journal of Regional Security*, 7/13/2021, <https://aseestant.ceon.rs/index.php/jouregsec/article/view/31562/19564>) FGY

Another major factor contributing to China’s peaceful rise is that the **US faces many global challenges that necessitate cooperation with many leading powers, including China**. **Terrorism, nuclear proliferation, climate change, trade and pandemics are issues of significant importance to both powers**, thereby providing additional **impetus to maintaining cordial relations**. China may not provide full cooperation on these issues, but its **non-collaboration could make things more difficult**. Meanwhile, **China understands that global problems cannot be resolved without US involvement** since it is the only power capable of providing global public goods. For example, China realizes that it is in its own interest to cooperate with the US on the war on terror in order to secure its oil supply and deny support for Muslim extremist groups in China. Furthermore, China is not yet a military superpower, thereby favoring its peaceful rise. Its omnidirectional capabilities will not allow it to win a military confrontation against the US. Globally, the balance of power still tilts in favor of the US, which has about 800 military bases around the world, including two major bases in Japan and South Korea. Aditionally, China has only one officially recognized overseas military base that was opened in Djibouti in 2017. It has a space station manned by the People’s Liberation Army in Argentina, and unconfirmed military presence in Tajikistan and Cambodia. China’s capacity to project power effectively in places far away from its territory is therefore limited. Some even think that China does not have the capability to conquer Taiwan because of Taiwan’s advanced military capabilities and a possible US intervention, which could inflict political, economic and military damage on China.42 Furthermore, East Asian states have not submitted to China and have shown the resolve to resist if threatened by China.43Shambaugh described China as a partial power, or one that lacks real global hard and soft powers compared to the US, although this is changing. According to him, China is no match for the US’ comprehensive global influence and power as evident in its unmatched hard and soft power.44 China is unlikely to confront the US militarily until its military power overtakes the latter. This is manifested in China’s improvements in its military-to-military ties with the US, undertaken to reduce the risk of US misconceptions about China’s strategic military and security intentions.45 However, this does not mean that China will not continue to enhance its military capabilities and challenge the US politically. This attitude is evidenced by its ongoing assertive policies in East Asia with regard to its territorial claims, and its efforts to establish a security presence in places along the Belt and Road Initiative, particularly in Central and South Asia. Although, there are several of contentious issues between China and the US that borders on their respective national security interests, none seem so unamendable to diplomatic or peaceful resolution to trigger a rising China to wage war against the United States. Al-though Fearon acknowledges “issue indivisibilities,” whereby certain national security interests are so paramount that that they are not easily amendable to bargaining, war is not always inevitable.46 Fearon argues that due to the complexities of issues that States bargain over in international relations, **side payments and issue linkages are possible in averting war**. Fearon adds that “War-prone international issues may often be effectively indivisible, but the cause of this indivisibility lies in domestic political and other mechanisms rather than in the nature of the issues themselves.”4

#### China will adjust to international norms, prevents hegemonic transition wars

Huwaidin & Antwi-Boateng 21 – Mohamed Bin Huwaidin, associate professor in the Department of Government and Society at the United Arab Emirates University; Osman Antwi-Boateng, associate professor of political science & international relations in the Department of Government and Society at the United Arab Emirates University, Ph.D. in international relations (“The Rise of China as a Hegemonic Power: The Case for a Partial Peaceful Rise”, *Journal of Regional Security*, 7/13/2021, <https://aseestant.ceon.rs/index.php/jouregsec/article/view/31562/19564>) FGY

The fourth factor that is likely to lead to **China’s** partial peaceful rise is the fact that its **rise is occurring in an international political arena governed by norms and international organizations that have largely been successful at serving as buffers against hegemonic wars**. Indeed, the aforementioned avenues have created an enabling environment for potential antagonists to fraternize and cooperate on a plethora of mutually beneficial issues, thereby diminishing the prospects of violent confrontations. Politically and economically, **China has shown the proclivity toward participating and working within international** **organizations** dominated by the US in order to achieve its interests. It is instructive to know that China, as a permanent member of the UN Security Council, is a major beneficiary of a hegemonic arrangement that confers veto power on itself and four other great powers. In a peaceful rise, the r**ising power accommodates itself to the rules and structures of international society**, while at the same time, other great powers accommodate some changes in those rules and structures by way of adjusting to the new disposition of power and status. But **if this is not happening, then the rising power moves to a partial peaceful rise where an environment of suspicion starts to build up.** Consequently, the rising power will not hesitate to use its capabilities to challenge some aspects of the established international system, particularly on issues that it deems inimical to its strategic interests and foreign policy priorities, but **without getting itself in great war**. This is evidenced by China’s vetoing of US-backed UN resolutions calling for sanctions against Bashar Assad for Chemical Weapons usage, and also in their shielding of the Burmese regime from any accountability for its human rights abuses against the Rohyngya people. In the economic arena, China’s willingness to undertake a long list of reforms as a condition of admission into the US-led World Trade Organization in 2011 is a testament to China’s recognition of the importance of international organizations to its foreign policy goals. Besides **China demonstrating a willingness to work in US-dominated international organizations for its benefits, it has not departed from initiating its own Chinese-dominated international organizations**. This is evidenced by its role in the creation of the Asian Infrastructure Investment Bank in 2015 to which it provided $50 billion of the bank’s $100 billion seed money. Similarly, China was a major advocate of the establishment of the New Development Bank in 2015, which involves the BRICS States made up of Brazil, Russia, India, China and South Africa. China contributed $41 billion toward its initial capitalization. Such multilateral economic initiatives, coupled with Chinese massive bilateral trade arrangements, financial assistance and infrastructure funding around the world, has given rise to what experts now refer to as the “Beijing Consensus.” The latter has now become a competing alternative to the US-led neoliberal economic ideology dubbed the “Washington Consensus.”

### us decline inev

#### Domestic illiberal networks make decline inevitable

Cooley & Nexon 20 – Alexander Cooley, professor of political science at Barnard College, director of Columbia University’s Harriman Institute, Ph.D. advisor at Columbia University, faculty member of the Saltzman Institute for War & Peace Studies, M.A. and Ph.D. in political science from Columbia University; Daniel H. Nexon, professor in the School of Foreign Service and the Department of Government at Georgetown University, Ph.D. and M.A. in political science at Columbia University (“How Hegemony Ends: The Unraveling of American Power, July/August 2020, <https://www.foreignaffairs.com/articles/united-states/2020-06-09/how-hegemony-ends?check_logged_in=1&utm_medium=promo_email&utm_source=lo_flows&utm_campaign=registered_user_welcome&utm_term=email_1&utm_content=20220701>) FGY

CENTRIFUGAL FORCES

Another important shift marks a break from the post–Cold War unipolar moment. The **transnational civil society networks** that stitched together the liberal international order **no longer enjoy the power and influence they once had**. **Illiberal competitors now challenge them** in many areas, including gender rights, multiculturalism, and the principles of liberal democratic governance. Some of these centrifugal forces have **originated in the** **United States** and western European countries themselves. For instance, the U.S. lobbying group the National Rifle Association worked transnationally to successfully defeat a proposed antigun referendum in Brazil in 2005, where it built an alliance with domestic right-wing political movements; over a decade later, the Brazilian political firebrand Jair Bolsonaro tapped into this same network to help propel himself to the presidency. The World Congress of Families, initially founded by U.S.-based Christian organizations in 1997, is now a transnational network, supported by Eurasian oligarchs, that convenes prominent social conservatives from dozens of countries to build global opposition to LGBTQ and reproductive rights.

Autocratic regimes have found ways to limit—or even eliminate—the influence of liberal transnational advocacy networks and reform-minded NGOs. The so-called color revolutions in the post-Soviet world in the first decade of this century and the 2010–11 Arab Spring in the Middle East played a key role in this process. They alarmed authoritarian and illiberal governments, which increasingly saw the protection of human rights and the promotion of democracy as threats to their survival. In response, such regimes curtailed the influence of NGOs with foreign connections. They imposed tight restrictions on receiving foreign funds, proscribed various political activities, and labeled certain activists “foreign agents.”

Some governments now sponsor their own NGOs both to suppress liberalizing pressures at home and to contest the liberal order abroad. For example, in response to Western support of young activists during the color revolutions, the Kremlin founded the youth group Nashi to mobilize young people in support of the state. The Red Cross Society of China, China’s oldest government-organized NGO, has delivered medical supplies to European countries in the midst of the COVID-19 pandemic as part of a carefully orchestrated public relations campaign. These regimes also use digital platforms and social media to disrupt antigovernment mobilization and advocacy. Russia has likewise deployed such tools abroad in its information operations and electoral meddling in democratic states.

Some of the forces **driving the unraveling of the liberal order have originated in the United States itself**.

Two developments helped accelerate the illiberal turn in the West: the Great Recession of 2008 and the refugee crisis in Europe in 2015. Over the last decade, **illiberal networks**—generally but not exclusively on the right—have **challenged the establishment consensus within the West**. Some groups and figures **question the merits of continued membership in** major institutions of the liberal order, such as the European Union and **NATO**. Many right-wing movements in the West receive both financial and moral support from Moscow, which backs “dark money” operations that promote narrow oligarchic interests in the United States and far-right political parties in Europe with the hope of weakening democratic governments and cultivating future allies. In Italy, the anti-immigrant party Lega is currently the most popular party despite revelations of its attempt to win illegal financial support from Moscow. In France, the National Rally, which also has a history of Russian backing, remains a powerful force in domestic politics.

These developments **echo the ways in which “counter-order” movements** have **helped precipitate the decline of hegemonic powers in the past**. Transnational networks played crucial roles in both upholding and challenging prior international orders. For example, Protestant networks helped erode Spanish power in early modern Europe, most notably by supporting the Dutch Revolt in the sixteenth century. Liberal and republican movements, especially in the context of the revolutions across Europe in 1848, played a part in undermining the Concert of Europe, which tried to manage international order on the continent in the first half of the nineteenth century. The rise of fascist and communist transnational networks helped produce the global power struggle of World War II. Counter-order movements achieved political power in countries such as Germany, Italy, and Japan, leading those nations to break from or try to assail existing structures of international order. But **even less successful counter-order movements** can still **undermine the cohesion of hegemonic powers and their allies**.

**Not every illiberal or right-wing movement that opposes the U.S.-led order seeks to challenge U.S. leadership** or turns to Russia as an exemplar of strong cultural conservatism. Nonetheless, such **movements are helping polarize politics in advanced industrial democracies and weaken support for the order’s institutions.** One of them has even captured the White House: **Trumpism, which is best understood as a counter-order movement with a transnational reach that targets the alliances and partnerships central to U.S. hegemony.**

#### Great-power competition, domestic divisions, COVID, and mistrust make decline inevitable regardless of military dominance

Cooley & Nexon 20 – Alexander Cooley, professor of political science at Barnard College, director of Columbia University’s Harriman Institute, Ph.D. advisor at Columbia University, faculty member of the Saltzman Institute for War & Peace Studies, M.A. and Ph.D. in political science from Columbia University; Daniel H. Nexon, professor in the School of Foreign Service and the Department of Government at Georgetown University, Ph.D. and M.A. in political science at Columbia University (“How Hegemony Ends: The Unraveling of American Power, July/August 2020, <https://www.foreignaffairs.com/articles/united-states/2020-06-09/how-hegemony-ends?check_logged_in=1&utm_medium=promo_email&utm_source=lo_flows&utm_campaign=registered_user_welcome&utm_term=email_1&utm_content=20220701>) FGY

CONSERVING THE U.S. SYSTEM

**Great-power contestation**, the **end of the West’s monopoly on patronage**, and the **emergence of movements that oppose the liberal international system** have all altered the global order over which Washington has presided since the end of the Cold War. In many respects, the **COVID-19 pandemic** seems to be further accelerating the **erosion of U.S. hegemony**. China has increased its influence in the World Health Organization and other global institutions in the wake of the Trump administration’s attempts to defund and scapegoat the public health body. **Beijing and Moscow** are portraying themselves as **providers of emergency goods** and medical supplies, including to European countries such as Italy, Serbia, and Spain, and even to the United States. Illiberal governments worldwide are using the pandemic as cover for restricting media freedom and cracking down on political opposition and civil society. Although the United States still enjoys **military supremacy**, that dimension of U.S. dominance is especially **ill suited to deal with this global crisis** and its ripple effects.

**Even if the core of the U.S. hegemonic system**—which consists mostly of long-standing Asian and European allies and rests on norms and institutions developed during the Cold War—**remains robust**, and even if, as many champions of the liberal order suggest will happen, the United States and the European Union can leverage their combined economic and military might to their advantage, the fact is that **Washington will have to get used to an increasingly contested and complex international order**. There is no easy fix for this. **No amount of military spending can reverse** the processes driving the **unraveling of U.S. hegemony**. Even if Joe Biden, the presumptive Democratic nominee, knocks out Trump in the presidential election later this year, or if the Republican Party repudiates Trumpism, the disintegration will continue.

The key questions now concern how far the unraveling will spread. Will core allies decouple from the U.S. hegemonic system? How long, and to what extent, can the United States maintain financial and monetary dominance? The most favorable outcome will require a clear repudiation of Trumpism in the United States and a commitment to rebuild liberal democratic institutions in the core. At both the domestic and the international level, such efforts will necessitate alliances among center-right, center-left, and progressive political parties and networks.

**What U.S. policymakers can do is plan for the world after global hegemony**. If they help preserve the core of the American system, U.S. officials can ensure that the United States leads the strongest military and economic coalition in a world of multiple centers of power, rather than finding itself on the losing side of most contests over the shape of the new international order. To this end, the United States should reinvigorate the beleaguered and understaffed State Department, rebuilding and more effectively using its diplomatic resources. Smart statecraft will allow a great power to navigate a world defined by competing interests and shifting alliances.

U.S. policymakers must plan for the world after global hegemony.

**The United States lacks both the will and the resources to consistently outbid China and other emerging powers** for the allegiance of governments. It will be **impossible to secure the commitment of some countries** to U.S. visions of international order. Many of those **governments have come to view the U.S.-led order as a threat to their autonomy**, if not their survival. And some governments that still welcome a U.S.-led liberal order now contend with populist and other illiberal movements that oppose it.

Even at the peak of the unipolar moment, Washington did not always get its way. Now, for the U.S. political and economic model to retain considerable appeal, the United States has to first get its own house in order. China will face its own obstacles in producing an alternative system; Beijing may irk partners and clients with its pressure tactics and its opaque and often corrupt deals. A reinvigorated U.S. foreign policy apparatus should be able to exercise significant influence on international order even in the absence of global hegemony. But to succeed, Washington must recognize that the world no longer resembles the historically anomalous period of the 1990s and the first decade of this century. **The unipolar moment has passed, and it isn’t coming back.**

#### The trade war indicates US recognition of its status as a declining power – transition is inevitable

Karim & Susanto 21 – Moch Faisal Karim, assistant professor in International Relations at the Bina Nusantara University, Ph.D. in politics and international studies from the University of Warwick, M.A. in international security at the University of Nottingham, B.A. in international relations at the University of Indonesia, research coordinator and Foreign Policy & International Politics subject content coordinator, managing editor for the Journal of ASEAN Studies, former advisory staff for the Chairman of Foreign Affairs and Defense Committee at the House of Representatives for the Republic of Indonesia; Alfiani Gracia Susanto, faculty member at the International Relations Department at the Bina Nusantara University (“Power Transition and the United States-China Trade War”, Contemporary Chinese Political Economy and Strategic Relations, vol. 7, iss. 1, April 2021, <https://www.proquest.com/docview/2578203541?pq-origsite=gscholar&fromopenview=true>) FGY

For the United States, imposing tariffs on trade with China was justified by argument that the U.S. was attempting their trade deficit. Moreover, the United States considered that China was using illegal and unfair trade practices to acquire U.S. technology and was failing to protect intellectual property rights, in addition to attempting to weaken U.S. national security and international status (Lai, 2019; Liu and Woo, 2018). For example, China was seen to conduct unfair trade practices by providing subsidies to Chinese companies to sell commodities at lower prices. Thus, besides aiming to fix U.S. trade deficit, this measure was also seen as a financial 'fine' for China. On the other hand, through the lens of the power transition theory, increased tariffs can also be seen as a preventive measure that the United States considers capable of containing China's economic rise and increased influence.

The current **U.S.-China trade war indicates** that the **world is** potentially **in a** not-peaceful **power transition**. The **United States as a hegemon feels the need to implement a preventive war** (in this case, a trade war in the form of increasing tariffs on China's products) so that China's economic growth can be limited. However, this action is a measure of protectionism that violates the WTO rules (CNBC, 15th September 2020). As a rising power and the world's second-largest economy, **China feels capable of fighting back** against the U.S. by increasing tariffs for American products. This reciprocal action occurred in several rounds, until finally, the two states were involved in a trade war that has had far-reaching effects on the global economy as a whole.

As can be seen from World Bank data, global economic growth in 2019 only reached 2.6 percent, the lowest figure since 2008, despite projections of 3.3 percent (World Bank, 2019). This decline in the global economic growth rate has the potential to significantly disrupt global financial stability. In fact, global economic stability is one of the international public goods that the United States as a hegemon should fulfill.

The United States claims that the cheap Chinese products and its trade deficit with China are hurting local firms and causing reduced employment opportunities in the U.S. The U.S. argument is that an increase in price will cause a drop in consumer interest in Chinese-made products, instead causing them to turn towards local products. Thus, this policy is also seen as a protectionist measure by the United States for their local companies and workers.

The introduction of higher tariffs by the U.S. was followed by its withdrawal from several international agreements and organizations, such as the Trans Pacific Partnership (TPP), the Iran Nuclear Deal, the Paris Agreement, the U.N. Educational, Scientific and Cultural Organization (UNESCO), and the U.N. Human Rights Council (Narine, 2018; Wolfe, 2018; Zhang et al., 2017). The Trump administration saw these schemes as detrimental to the U.S. because many countries became 'free riders', even though these international schemes are formed based on liberal values, which the U.S. tends to promote globally (Karim, 2020).

The **United States' withdrawal from various international organizations** and agreements illustrates its **reluctance to provide international public goods** as the hegemon. According to Ikenberry and Nexon (2019), to create stability, the **international system needs a country that is willing and able to act as a quasi-intemational government and provides public goods for the international community** by mobilizing their resources, both economic and military. Through this explanation, it can be concluded that a hegemon must be willing to make sacrifices to mobilize its resources to create public goods and create international stability. The trade war started by the U.S. has the potential to disrupt one of these public goods - global economic stability - because of the trade war's extremely broad impact on the decline in global economic growth as a whole.

The **United States has thus abandoned its role as the provider of public goods and has turned into a consumer of public goods** (Zhang et al., 2017). International organizations and agreements can facilitate cooperation between countries to produce public goods in international policies. Collaboration between countries can also create complex interdependence between countries that are needed to maintain international peace, security, and stability, which are also a part of international public goods. In the context of international trade, the United States' withdrawal from the TPP can be seen as a decrease in their commitment to promoting free trade in the international system. According to the United States, the TPP did not benefit them; in fact, it caused losses (Narine, 2018). With this, it can be seen that the U.S., as a hegemon, refuses to devote its resources to providing international public goods to create free trade. This **decline in the United States' role can ultimately be seen as a decline in US global hegemony.**

**China has so far responded to the decline in U.S. hegemony by using its position as a rising power and taking an active role in the international system**. In the United Nations Human Rights Council, which under Trump was abandoned by the U.S., China seemingly took an important role in promoting human rights, which are one of the essential values of the liberal world order (Cooley and Nexon, 2020). In addition, China has shown its significant influence in the international health sector by becoming a provider of health goods for other countries while facing the COVID-19 pandemic. This contrasts with the United States' decision to cut off funding to the World Health Organization (WHO) because the US considers China to have dominant influence over the organization (The BMJ, 1st June 2020).

The decline in U.S. hegemony and China's increasing role shows that the world is indeed in a power transition period, though the United States itself has tried to maintain its position as a global leader by attempting to suppress China's rise through the implementation of a trade war. By understanding the conditions explained above, **we can see that the international system's power transition is inevitable**. As a rising power, China seeks to be in the dominant position in the system, which can be seen in their global initiatives. The United States, as the current hegemon, tries to hold China's economic rise by imposing tariffs on its trade with China before China gets too strong to contain. This later became a trade war. In addition, the fact that the United States' global influence is declining while that of China is increasing, **further triggers the power transition**.

#### Loss of European confidence hamper effectiveness at containing China’s rise

Krastev & Leonard 21 – Ivan Krastev, chair of the Centre for Liberal Strategies, Sofia, and a permanent fellow at the Institute for Human Sciences in Vienna, & Mark Leonard, co-founder and director of the European Council on Foreign Relations (“The crisis of America power: How Europeans see Biden’s America, 1/19/2021, <https://ecfr.eu/publication/the-crisis-of-american-power-how-europeans-see-bidens-america/>) FGY

**Most Europeans’ view of America as politically broken and likely to soon be overtaken by China as a global power appears to affect public perceptions of the value of the transatlantic alliance in ways that could have a significant impact on the Biden team.** We noticed four profound changes. Firstly, the move towards greater self-reliance. One of the most striking findings of ECFR’s survey is that at least 60 per cent of respondents in every surveyed country – and an average of 67 per across all these countries – believe that they cannot always rely on the US to defend them and, therefore, need to invest in European defence. Interestingly, 74 per cent of British respondents hold this view – a higher share than in any other national group. ECFR’s opinion poll also reveals a change in threat perceptions across Europe, most dramatically in Germany. During the cold war, Germany felt threatened by invasion and was, therefore, wedded to the Atlantic alliance. But, nowadays, Germans seem to have caught up with the French (whose country has the strongest military in the EU and is a long-time proponent of European defence integration) in feeling less of a need than other Europeans for the US security guarantee. Currently, only 10 per cent of respondents in France and Germany say that their country needs the American security guarantee “a great deal” to be safe from military invasion. Only in Poland do a substantial number of respondents (44 per cent) believe that they need this guarantee “a great deal”. Therefore, it seems that Germany’s – and Europe’s – transatlantic policy in the years to come could be influenced not only by the country’s increasing economic ties with China but also by the fact that over half of the German public does not now see US military power as an existential guarantee of its security. The second big surprise is around the question of geopolitical alignment. Biden has called for the US and Europe to form a united front against China and thereby shape its rise. But ECFR’s poll shows that, in today’s Europe, there is no dream of a return to a bipolar world in which the West would face off against China and its allies as it once did against the Soviet Union. **Troubled by doubts about America and influenced by Trump’s focus on narrowly defined national interests**, European voters have started to think differently about the nature of the transatlantic alliance. In 2019 ECFR conducted a pan-European poll that indicated that a large majority of respondents in all surveyed countries wanted to remain neutral (rather than align with Washington) in a conflict between the US and China or Russia. Many people around Biden may have hoped that his victory in the November election would have changed that dynamic. They may have assumed that Europeans’ shift towards neutrality could be explained by their mistrust of, and disgust with, Trump. However, ECFR’s latest poll shows that political change in Washington does not appear to have fundamentally altered respondents’ calculus about geopolitical alignment. At least half of the electorate in every surveyed country would like their government to remain neutral in a conflict between the US and China. This even applies in Denmark and Poland, the two countries with the highest proportions of people who would like to take the United States’ side – 35 per cent and 30 per cent respectively. This may reflect the fact that, although both Europeans and Americans are toughening up their approaches to China, their long-term goals are somewhat different. While Americans want to do so to decouple from and contain China, Europeans (above all Germans) still hope to bring China back into the rules-based system. Europe’s unwillingness to side with the US also comes out in respondents’ views on a conflict between the US and Russia: in no surveyed country would a majority want to take Washington’s side. Amazingly, only 36 per cent of respondents in Poland and 40 per cent in Denmark say that their country should side with the US in such a scenario. Across the 11 surveyed countries, just 23 per cent of respondents hold this view – while 59 per cent want their country to remain neutral. In Denmark and Poland, neutrality is the preferred option of 47 per cent and 45 per cent of voters respectively. This shift in perceptions might have as much to do with power as anything else. What Europeans love about the memory of cold war 1.0 is that they were on the winning side; the fear in many European countries is that cold war 2.0 might have a different outcome. The growing mistrust about Washington’s reliability and power is changing the nature of the transatlantic alliance. America’s cold war coalitions took the form of a Catholic marriage. They were meant to be monogamous, with no possibility of divorce. After four years of Trump, the alliance looks like a more casual arrangement – an open marriage in which bringing in other players is the key to not being exploited. Europeans no longer trust America to defend Europe and would express little solidarity with the US if it became involved in a conflict with other great powers. Reading ECFR’s survey, Washington will also have no reasons to trust European publics’ readiness to conduct a joint transatlantic foreign policy. The third consequence of changing perceptions of power is a desire to be less sentimental in dealings with the US. A perverse effect of Trump’s term in power is that, by ruthlessly focusing on the national interest, he has encouraged other players – including Europeans – to concentrate more on protecting their own interests at the expense of focusing on the broader common interests of the democratic West. This is reflected in many Europeans’ desire to invest in defending themselves. There has also been a marked change in how people regard the transatlantic economic relationship. Among the eight countries in which ECFR asked voters about this issue, pluralities in Germany (37 per cent), France (48 per cent), Great Britain (37 per cent), and Italy (42 per cent) think that their country should be tougher with the US on economic issues such as international trade, the taxation of multinational companies, and the regulation of digital platforms. Poland is the predictable outlier on this point, with just one in ten voters saying that their country should become tougher with the US on economic issues. This prevailing mistrust is also changing the ways that Europeans relate to one another – the fourth big policy consequence that comes out of our poll. As they no longer see Washington as a reliable partner, Europeans are looking to one another more than they once did. This raises the issue of whether Berlin will replace Washington as the ‘go-to’ capital. Given the size and importance of the ‘In Europe We Trust’ group, it is not surprising that respondents in France, Spain, Denmark, the Netherlands, Portugal, and Hungary were most likely to choose Germany as the most important country to build a good relationship with, above the US (while, for their part, 38 per cent of Germans chose France as their most important ally, and only 35 per cent preferred the US). Only respondents in Great Britain (55 per cent), Poland (45 per cent), Italy (36 per cent), and Sweden (36 per cent) are more likely to rank the US first over Germany on this measure; but, in Sweden, an almost equal share, 35 per cent, rank Germany above the US. As he left office early in the twenty-first century, Bill Clinton declared that the key task for Americans would be “to create a world we would like to live in when we are no longer the world’s only superpower”. It is fair to say that the US and Europe have failed to do this. As Biden enters the White House, the US is no longer the only superpower. And the world he governs in – marked by the rise of authoritarian powers and the spread of nationalism and inequality – is not the one that either Americans or Europeans would prefer to live in. Since the disastrous 2003 war in Iraq and the 2008 global financial crisis, Washington has been facing up to the end of the unipolar moment. Trump and his predecessor, Barack Obama, are probably the most different American presidents one can imagine. But their analyses of America’s position in the world had much more in common than most people recognise. Both of them understood that America’s ambition to remain the world’s only superpower was unsustainable. Both acknowledged the centrality of geo-economics in the twenty-first century. And both recognised that they would need to work with political regimes that did not share America’s values and norms. But their responses to this situation were strikingly different. Obama was convinced that the best way to preserve America’s leadership was to embed Washington in a diverse and well-developed network of military and trade alliances. This is why the Obama administration’s negotiations on the Transatlantic Trade and Investment Partnership went hand in hand with its quest to seal a Trans-Pacific Partnership. Obama hoped that, by using these tools, America would gain the upper hand over China and reinvent its role for the future. Trump’s bet was that, if the international order had stopped working for America, it was in Washington’s interest to act as the disrupter-in-chief and to organise the world around asymmetrical bilateral relations with other powers. While the US remains the most powerful country in the world, it can still dictate terms to any other player – providing them with deals one at a time. While Obama believed that America’s strength lay in its networked alliances, Trump believed that they were chains that kept America down. The Biden administration is coming to power at a moment when Trump’s “America’s First” policy has failed to provide Washington with greater global influence, while a return to Obama’s strategy is not viewed as realistic because of America’s unreliability and waning power. A majority of Europeans doubt that Biden can put Humpty Dumpty back together again. Alliances are born of interests and values but, like any other human relationship, they are sustained or broken by the prevailing moods of the partners. So, what does ECFR’s new opinion poll reveal about the future of the transatlantic relationship in the post-Trump world? The good news is that there is widespread optimism among Europeans after the 2020 US election that the transatlantic partnership has a future. **The bad news is that Europeans are skeptical about America’s efforts to regain its influence and contain the rise of China.** “Without the Cold War, what’s the point of being an American?”, Harry “Rabbit” Angstrom, the novelist John Updike’s late-twentieth-century everyman, asked as the “long twilight struggle” was winding down. Many people in America now see the prospect of a new cold war as giving their foreign policy a new focus. But Europeans are asking themselves exactly the opposite question: “what is the point of being a European if the cold war has returned?”. The perspective of a new cold war with China is deeply unattractive to the Europeans we surveyed. It is not that Europeans are pro-China. A previous ECFR poll has shown that Europeans are not attracted by the Chinese model, and the pandemic has made clear China’s hegemonic ambitions. But Europeans appear keen to forge their own path rather than fall into line behind America’s China policy. The largest number of those surveyed in this and previous polls seem to support the idea of a more sovereign and autonomous Europe. However, while European leaders tend to view European sovereignty as reflecting a desire to play a more important role in global politics – regardless of whether they support the idea – that is not the case for a large number of European citizens. There is a substantial group for whom ‘European sovereignty’ is code for a drive towards neutrality in the escalating competition between the US and China. For these citizens, European sovereignty is not a grand entry into international politics but an emergency exit from the bipolar world of tomorrow. It is an application for early retirement from great power competition. This is where public opinion will have an impact on elite politics. During the cold war, European governments were willing to face down public opposition to align with a US that defended them from the Soviet Union. But each president since the end of the cold war has found it harder to persuade European leaders to spend political capital on their alliance with Washington. Europeans were certainly more willing to patch over their differences with Obama than those with George W Bush, but this did not extend to real concessions on the management of the 2008 financial crisis or increases in defence spending. While all European governments will try to build a close relationship with the Biden administration, they will not feel that they have public support to make major concessions on high-profile issues of national importance. The main lesson of ECFR’s poll is for the Biden team. The new American administration has a clear idea of how Trump’s four years have changed America, but they should be aware of the Trump effect on Europe’s geopolitics of emotions. Although Europeans will not mourn Trump’s electoral defeat, his legacy will persist long after he has left the White House. Even as Biden seeks to overturn the isolationism and unpredictability of the Trump administration, he will be hampered by policies that made America seem volatile, selfish, and weak. There is now a unique opportunity to revive and transform the transatlantic alliance – but one cannot seize this with unconvincing promises of restoration and bipolarity. A new transatlanticism is needed – one based on a common understanding that the **US-Europe alliance is not enough to reshape the world**. Leonard Cohen once sang “The mist leaves no scar / On the dark green hill”. But our poll shows that **Trump was no fog; he has left scars. And Biden’s presidency will be marked by them.**

#### Biden’s Afghanistan withdrawal undermined NATO, EU, and Middle Eastern alliances, leaving power vacuum for China and Russia to fill in

Leung 21 – Kandis Leung, contributor at The Palatinate (“The war in Afghanistan and the decline of US hegemony: will China and Russia become the final beneficiaries?”, 9/12/2021, <https://www.palatinate.org.uk/the-war-in-afghanistan-and-the-decline-of-us-hegemony-will-china-and-russia-become-the-final-beneficiaries/>) FGY

US President Joe Biden made a statement on 14th August: “In our nation’s more than 20 years of war in Afghanistan, the United States has sent its best young men and women, invested nearly $1 trillion, trained more than 300,000 Afghan soldiers and police, equipped them with the most advanced military equipment and maintained their air force as part of the longest war in US history.” On 15th August, the Taliban entered the capital Kabul and the global public was shocked and dismayed. The fleeing of President Ghani announced the complete failure of 20 years of US policy in Afghanistan. Firstly, the US expended enormous human and material resources and failed to achieve the goal of establishing democracy, rebuilding Afghanistan, and destroying the Taliban. The Taliban troops were met with no decent resistance from the Afghan government. With twenty years of dedication wasted, everything appears to be back to square one. Secondly, the miscalculation of the Afghanistan military forces was confusing. The CIA estimated that the Taliban would take 18 months to take over all of Afghanistan and at least three months to capture the capital city of Kabul. Yet, it took the Taliban less than a month to sweep across the country. The US military was stationed in Afghanistan not for just a year or two, but for 20 years. Whether it was a CIA intelligence failure or an optimistic estimate from Biden about the Afghan government’s military strength, it should not have happened. The US should have had a correct evaluation of the corruption of the Afghan government, the failure to implant democracy in Afghanistan, and the strength of the Taliban. The failure of intelligence was indeed a significant mistake. Thirdly, the US hastily withdrew its troops from Afghanistan, giving the impression that it is self-serving and only cares about itself at critical moments. The US ignored the great danger to those Afghans who had cooperated with the US military and the military from other countries. **This has been met with discontent and complaints** from the Afghan people and criticism from within the United States and across the world. **The withdrawal is a blow for NATO and Europe**. **Unprecedented doubts arise about the US’s credibility and ability to keep its word**. Tony Blair, who ordered the UK military into the country 20 years ago, publicly criticised Joe Biden’s justification for the pullout as ‘imbecilic’. 457 British soldiers were killed in action. Blair said the withdrawal of the US was ‘tragic’ and ‘unnecessary’, and the decision of the US to abandon Afghanistan makes “every jihadist group around the world cheering”; German President Steinmeier also sharply criticized the decisions from the US: “The desperate scene at Kabul Airport is a disgrace to the West.” This incident has revealed the extent of NATO’s dependence on the United States. As Trump correctly pointed out, many European NATO countries still fall far short of the target of spending 2% of GDP on defence. The **US withdrawal from Afghanistan has made European countries realize that it is time to stop relying on US military power** and instead they must take a more serious approach to their defence responsibilities. While the outrage over the US pullout from Afghanistan grew, the power distribution in Afghanistan shifted. Sohail Shaheen, a spokesman for the Taliban’s political office in Doha, Qatar, told British media (Sky News) they received ‘political support’ from Russia, China, and Pakistan. So while the world is condemning the US for its irresponsibility, China, Russia, and Pakistan are trying to establish a good relationship with Afghanistan. The influence of China, Russia and Pakistan is expected to expand in Afghanistan. Zhu Yongbiao, a Chinese government expert on Central Asia and a professor at Lanzhou University, stated that “China has benefited from [the US’s] irresponsible behaviour, which has harmed the US’s worldwide image and the relationship between Washington and its allies”. Arkady Dubnov, a Moscow-based political analyst and expert on Central Asia, offered a similar view. “We can align our interests (with China) in terms of anti-Americanism,” he said. “What is good for us is bad for the Americans, and what is bad for us is good for the Americans. The situation now is not good for the Americans, so it’s good for us.” **China and Russia may become the final beneficiaries.**

#### Trump permanently depleted American legitimacy – China’s COVID response cemented their leadership

McCoy 21 – Alfred McCoy, Harrington professor of history at the University of Wisconsin-Madison, Ph.D. in Southeast Asian History from Yale University, M.A. in Asian Studies from the University of California Berkeley, B.A. in European History from Columbia University (“American Hegemony is Ending With a Whimper, Not a Bang”, 1/29/2021, <https://www.thenation.com/article/world/us-foreign-policy-china/>) FGY

THE DECLINE AND FALL OF YOU-KNOW-WHICH GREAT POWER

If that were all, then we could chalk up a few significant wins for China and just wait for Biden’s foreign-policy team to try to even the score. But there’s far more happening that suggests those treaties were a clear manifestation of deeper, more troubling trends.

When empires decline and fall, they **seldom collapse in the sort of sudden apocalypse** portrayed in a monumental series of paintings entitled “The Course of Empire” by another denizen of the Catskill Mountains, the renowned artist Thomas Cole. His 1836 painting in that series, now appropriately enough hung at the Smithsonian Museum in Washington, shows a “savage enemy” plundering a grand imperial capital whose inhabitants, debased by years of luxurious living, can only flee in terror while women are raped and buildings burn.

Empires, however, usually experience a **long, less dramatic decline** before they fall in the Roman fashion, thanks to events whose logic only becomes apparent years or even decades later, as historians try to sort through the rubble. So it’s likely to be in what, until mid–last week, was (and still in many ways remains) Donald Trump’s America, where the signs of decline are as erratic as they are omnipresent.

The most telling harbinger of that decline, Trump himself, is now in exile at his Mar-a-Lago Club in Florida. Ten years ago in an essay for TomDispatch titled “Four Scenarios for the End of the American Century by 2025,” I suggested that **US global hegemony would end not with** Thomas Cole’s **apocalyptic bang** but instead with the whimper of empty populist rhetoric. “Riding a political tide of disillusionment and despair,” I wrote in December 2010, “a far-right patriot captures the presidency with thundering rhetoric, demanding respect for American authority and threatening military retaliation or economic reprisal. The world pays next to no attention as the American Century ends in silence.”

Trump’s election in 2016 made all too real what, until then, had only seemed to me a troubling possibility. With a legerdemain worthy of that 19th century showman P.T. Barnum’s bag of bunkum (like the supposed Cardiff Giant or the Fiji Island Mermaid), Trump’s TV show The Apprentice presented The Donald as a self-made billionaire of extraordinary financial savvy. Who better to rescue America from the job losses, stagnant wages, and foreign competition brought on by economic globalization? But Trump had cheated his way into an Ivy League college; many of his businesses had gone bankrupt; and his much-vaunted entrepreneurial flair came down essentially to frittering away a $400 million inheritance from his father. As journalist H.L. Mencken predicted back in 1920, America had finally come to the point where “the plain folks of the land will reach their heart’s desire at last and the White House will be adorned by a downright moron.”

Once in office, **Trump** soon **bent the nation** (but not the world) to his will, **rupturing time-tested alliances, tearing up treaties, denying incontrovertible climate science**, and demanding respect for American authority with a thundering, if largely empty, rhetoric that threatened military retaliation or economic reprisals globally. Despite the manifest inanity of his policies, the Republican Party capitulated, corporate tycoons applauded, and nearly half the American public cleaved to their newfound savior.

As with all sellout shows, the best was saved for last. When the Covid-19 pandemic struck with full force in March 2020, Trump turned up at the Centers for Disease Control (CDC) in Atlanta, donning a MAGA hat, to proclaim his “natural ability” when it came to medical science, while distinguished doctors stood by like studio extras in mute testimony to his otherwise risible claims. As the pandemic began climbing toward its terrible, still developing toll, Trump hijacked White House briefings by medical experts to promote a succession of crackpot claims—wearing a mask was merely “politically correct”; Covid-19 was just another flu that “becomes weaker with warmer weather”; hydroxychloroquine was a cure; and shining ultraviolet “light inside of the body” or injecting “disinfectant” were possible treatments. A surprising number of Americans started drinking bleach to protect themselves from the virus, forcing months of public health warnings.

After nearly a century in which the United States had been a world leader in promoting public health, the Trump administration, to escape blame for its own escalating failures, walked out of the World Health Organization. Lending the country the aura of a failed state, the CDC itself, once the world’s gold standard in medical research, bungled the development of a coronavirus test and so forfeited any serious, nationwide attempt to successfully track and trace the disease (the most effective means of controlling it).

While smaller nations like New Zealand, South Korea, and even impoverished Rwanda effectively curbed Covid-19, by the end of Trump’s term the **United States already had experienced more than 400,000 deaths and 24 million infections—significantly above any other developed nation’s death rate and a full quarter of the world’s total cases.** Meanwhile, **Beijing mobilized a rigorous public health campaign** that quickly contained the virus to just 4,600 deaths in a population of 1.4 billion. In only four months, **China virtually eliminated the virus** (despite periodic new local breakouts) and **had its economy humming** along with a 5 percent increase in gross domestic product, which accounted for 30 percent of global growth last year. Meanwhile, after 11 months of an incessant pandemic, the United States remained mired in a crippling recession. This striking disparity in state performance only **accelerated China’s quest to surpass the United States** **as the world’s largest economy and, with all that financial clout, become its preeminent power.**

#### January 6 broadly discredited US diplomatic signaling

McCoy 21 – Alfred McCoy, Harrington professor of history at the University of Wisconsin-Madison, Ph.D. in Southeast Asian History from Yale University, M.A. in Asian Studies from the University of California Berkeley, B.A. in European History from Columbia University (“American Hegemony is Ending With a Whimper, Not a Bang”, 1/29/2021, <https://www.thenation.com/article/world/us-foreign-policy-china/>) FGY

A TRAGICOMIC ENCORE

It was, however, President Trump’s bid for an encore that would prove truly extraordinary when it came to imperial decline. During its 70 years as a global hegemon, **Washington’s public promotion of democracy has been the signature program that has helped legitimate its global leadership** (no matter the CIA-style interventions it launched or the colonial-style wars it continually fought).

While the Cold War often compromised that commitment in particularly striking ways, following its end Washington has spent 30 years officially promoting fair voting and democratic transitions, with leaders like former president Jimmy Carter flying off to capitals on five continents to oversee and encourage free elections. Suddenly, the world watched in slacked-jaw amazement as, on January 6 on the White House ellipse, the **president denounced a fair American election** as fraudulent and sent a mob of 10,000 white nationalists, QAnon conspiracists, and other **Trumpsters off to storm the Capitol**, where Congress was ratifying the transition to a new administration.

Adding to this failed-state aura, the country’s once-formidable national security apparatus crumpled like a Third World constabulary as right-wing militiamen breached the frail security cordon around the Capitol and stormed its halls as if they were a lynch mob hunting for congressional leaders. House majority leader Steny Hoyer’s desperate calls to a dawdling Pentagon and Maryland Governor Larry Hogan’s dangerously delayed mobilization of his state’s National Guard, caused by the US military’s compromised chain of command, only seemed to echo the sort of tropical coup scenarios I witnessed in Manila, the capital of the Philippines, during the 1980s.

When Congress was finally back in session, the **Capitol still rang with Republican calls**, in the name of national unity, for forgetting what the president had incited. In that way, Republican congressional representatives seemed to echo the kind of impunity that has long protected fallen military juntas in Asia or Latin America from any accounting for their countless crimes. This attempt, in other words, to perpetuate a would-be autocrat’s power through a (failed) coup was the sort of spectacle that many millions living in Asia, Africa, and Latin America have experienced in their own fragile states but never expected to see in America.

Suddenly, our **supposedly exceptional nation seemed tragically ordinary**. The shimmering dome of the Capitol once symbolized the vitality of this nation’s democracy, inspiring others to follow its principles or at least acquiesce to its power. **This country now looks tattered and tired**, caught like others before it between forgetting in the name of unity or demanding the powerful be held accountable for high crimes that will otherwise haunt the nation. Instead of aspiring to America’s ideals or entrusting their security to its power, **many nations will likely find their own way forward, cutting deals with all comers, starting with China.**

Despite an aura of overwhelming strength, empires, even ones as powerful as America’s, often prove surprisingly fragile and their decline regularly comes far sooner than anyone could have imagined—particularly when the cause is not Thomas Cole’s “savage enemy” but their own self-destructive instincts.

Today, in the era of a 78-year-old president, a veritable Rip Van Biden, Americans and the **rest of the world are, it seems, waking up in a new age. It could well be a daunting one.**

### at: biden solves sustainability

#### Biden’s “cooperation” is conditional at best but entrenches Trump-era antagonism at worst – makes Chinese lead inevitable due to loss of allied support

Byun 21 – See-Won Byun, professor in the international studies department at San Francisco State University focusing on the politics of China, international relations of East Asia, and international relations theory (“Chinese Views of Hegemony and Multilateralism in the Biden Era”, *The ASAN Forum,*  6/7/2021, <https://theasanforum.org/chinese-views-of-hegemony-and-multilateralism-in-the-biden-era/>) FGY

The envisioned trajectory of US-China relations in the Biden era includes continuity, adjustment, and stabilization.59 Most anticipate a return to multilateralism and short-term easing of tensions.60 Widespread criticism of Trump’s unilateralism and enduring “Trumpism” prevails, **emphasizing Washington’s “irreversible”** competitive turn.61 As Tian Feilong indicates, “the new US-China relationship is centered on competition and conflict,” starting with the trade war and extending to a more comprehensive “new Cold War.” 62 **Trumpism catalyzed the long-term** qualitative **change in bilateral relations**, and **the Biden leadership may only bring temporary adjustments**. Others project targeted and balanced adjustments with a continuation of Trump’s tough policy tone, urging Beijing to maintain “strategic rationality.”63 Especially given the level of economic interdependence, while “joint containment” with allies may replace “unilateral confrontation,” “conditional cooperation” will replace “direct confrontation.”64 For optimists, the Biden era opens an opportunity for pushing relations “back to the future” rather than “returning to the past” pattern of US China strategy guided by neoliberal ideology.65 The long-term stabilization of bilateral ties depends on building institutional mechanisms for grounding the relationship within this critical timeframe. Multilateralism is not just “the only correct path” of post-pandemic global development, but also requires US-China cooperation.66 The Trump-Biden Transition: Change and Continuity - Biden’s overarching diplomatic goal is to restore US global leadership after the damage of Trumpism, what Zhao Minghao terms a quest to renew the “West” in the face of rising challengers like China and Russia.67 This task relies primarily on reengaging allies, placing values at the center of US foreign policy, and building a “community of democratic nations.” Major-power competition remains a central force, through enhanced deterrence tools like NATO and US technological competitiveness. As **Biden pursues post-pandemic cooperation** on global health and environmental threats, the United States will only “selectively return” to multilateralism.According to Liu Guozhu, Biden’s national security strategy **seeks to** not just reverse Trump’s withdrawal from multilateralism but also “**dominate the global governance system with US values and principles**.”68 The key task of “**de-Trumping”** domestic and foreign affairs **comes with** an **enduring deterioration in US-China relations**. This trend **extends to US relations with other major-powers**, as evidenced by the “long-term freeze” in US-Russia ties.69 The **“misalignment of strategic goals” between the United States and Europe** makes it difficult for the Biden administration to restore their traditional alliance.70 But while the waning of the West reflects “European anxiety,” **European partners may support** the long-term consolidation of **multilateralism**.71 Soon after RCEP’s signing, the upgrading of ASEAN-EU relations into a strategic partnership at the end of 2020 signified a mutual willingness to uphold multilateralism.72 According to Fu Ying, China and Europe’s “common interest in upholding multilateralism” is especially important at a time when “Europe needs space for independent thinking” amid US-China competition.73 The **Biden** leadership **inherits Trump’s designation of China as a** strategic competitor and **revisionist power**. There are differences in the means of competition including multilateral mechanisms and the US alliance system Biden seeks to revamp. But under current conditions, China will more effectively respond to US strategy and actively shape the relationship. From this perspective, Wu Xinbo identifies three models of interaction in the next four years: 1) an ideal scenario of competition and cooperation, 2) competition-led relations, and 3) the worst-case scenario of competition-conflict.74 While most studies accentuate the second pattern, perceptions of US policy change and continuity in the Biden era depend on issue areas. Preliminary reviews center on four areas: Washington’s Indo-Pacific strategy, “technological nationalism,” economic competition, and US domestic politics. While domestic concerns remain in rehabilitating the economy, controlling the pandemic, and relieving social grievances, bipartisan consensus reinforces views of continuity on key foreign policy issues.75 **Despite Biden’s stronger emphasis on multilateralism, continuity outweighs** **adjustments** in Asia-Pacific security policy, with no substantive actions in the short term on regional economic integration. Trump’s tough policy tone resonates in economic relations with China, and especially science and technology competition.

### misc/nato bad – r/c axis

#### Russia/China axis is effective

Cooley & Nexon 20 – Alexander Cooley, professor of political science at Barnard College, director of Columbia University’s Harriman Institute, Ph.D. advisor at Columbia University, faculty member of the Saltzman Institute for War & Peace Studies, M.A. and Ph.D. in political science from Columbia University; Daniel H. Nexon, professor in the School of Foreign Service and the Department of Government at Georgetown University, Ph.D. and M.A. in political science at Columbia University (“How Hegemony Ends: The Unraveling of American Power, July/August 2020, <https://www.foreignaffairs.com/articles/united-states/2020-06-09/how-hegemony-ends?check_logged_in=1&utm_medium=promo_email&utm_source=lo_flows&utm_campaign=registered_user_welcome&utm_term=email_1&utm_content=20220701>) FGY

THE GREAT-POWER COMEBACK

Today, other great powers offer rival conceptions of global order, often autocratic ones that appeal to many leaders of weaker states. The **West no longer presides over a monopoly of patronage**. New **regional organizations** and **illiberal transnational networks contest U.S. influence**. Long-term **shifts in the global economy**, particularly the **rise of China**, **account for many of these developments**. These changes have transformed the geopolitical landscape.

In April 1997, Chinese President Jiang Zemin and Russian President Boris Yeltsin pledged “to promote the multipolarization of the world and the establishment of a new international order.” For years, many Western scholars and policymakers downplayed or dismissed such challenges as wishful rhetoric. Beijing remained committed to the rules and norms of the U.S.-led order, they argued, pointing out that China continued to benefit from the current system. Even as Russia grew increasingly assertive in its condemnation of the United States in the first decade of this century and called for a more multipolar world, observers didn’t think that Moscow could muster support from any significant allies. **Analysts in the West** specifically **doubted that Beijing and Moscow could overcome decades of mistrust** and rivalry to cooperate against U.S. efforts to maintain and shape the international order.

Such skepticism made sense at the height of U.S. global hegemony in the 1990s and even remained plausible through much of the following decade. But the 1997 declaration now looks like a blueprint for how Beijing and Moscow have tried to reorder international politics in the last 20 years. China and Russia now directly contest liberal aspects of the international order from within that order’s institutions and forums; at the same time, they are building an alternative order through new institutions and venues in which they wield greater influence and can de-emphasize human rights and civil liberties.

At the United Nations, for example, the **two countries routinely consult on votes** and initiatives. As permanent members of the UN Security Council, they have coordinated their opposition to criticize Western interventions and calls for regime change; they have **vetoed Western-sponsored proposals** on Syria and efforts to impose sanctions on Venezuela and Yemen. In the UN General Assembly, between 2006 and 2018, China and Russia voted the same way 86 percent of the time, more frequently than during the 78 percent voting accord the two shared between 1991 and 2005. By contrast, since 2005, China and the United States have agreed only 21 percent of the time. Beijing and Moscow have also **led UN initiatives to promote new norms**, most **notably in the arena of cyberspace**, that privilege national sovereignty over individual rights, limit the doctrine of the responsibility to protect, and **curtail the power of Western-sponsored human rights resolutions**.

China and Russia have also been at the forefront of **creating new international institutions** and regional forums that **exclude the United States and the West more broadly**. Perhaps the most well known of these is the BRICS grouping, which includes Brazil, Russia, India, China, and South Africa. Since 2006, the group has presented itself as a dynamic setting for the discussion of matters of international order and global leadership, including building alternatives to Western-controlled institutions in the areas of Internet governance, international payment systems, and development assistance. In 2016, the BRICS countries created the New Development Bank, which is dedicated to **financing infrastructure projects** in the developing world.

China and Russia have each also pushed a **plethora of new regional security organizations**—including the Conference on Interaction and Confidence Building Measures in Asia, the Collective Security Treaty Organization, and the Quadrilateral Cooperation and Coordination Mechanism—and economic institutions, including the Chinese-run Asian Infrastructure Investment Bank (AIIB) and the Russian-backed Eurasian Economic Union (EAEU). The Shanghai Cooperation Organization (SCO)—a security organization that promotes cooperation among security services and oversees biennial military exercises—was founded in 2001 at the initiative of both Beijing and Moscow. It added India and Pakistan as full members in 2017. The net result is the emergence of parallel structures of global governance that are dominated by authoritarian states and that compete with older, more liberal structures.

Critics often dismiss the BRICS, the EAEU, and the SCO as “talk shops” in which member states do little to actually resolve problems or otherwise engage in meaningful cooperation. But most **other international institutions are no different.** Even when they prove unable to solve collective problems, regional organizations **allow their members to affirm common values** and boost the stature of the powers that convene these forums. They generate denser diplomatic ties among their members, which, in turn, make it easier for those members to build military and political coalitions. In short, these organizations **constitute a critical part of the infrastructure of international order**, an infrastructure that was dominated by Western democracies after the end of the Cold War. Indeed, this new array of non-Western organizations has brought transnational governance mechanisms into regions such as Central Asia, which were previously disconnected from many institutions of global governance. Since 2001, most Central Asian states have joined the SCO, the Russian-led Collective Security Treaty Organization, the EAEU, the AIIB, and the Chinese infrastructure investment project known as the Belt and Road Initiative (BRI).

China and Russia are also now pushing into areas traditionally dominated by the United States and its allies; for example, China convenes the 17+1 group with states in central and eastern Europe and the China-CELAC (Community of Latin American and Caribbean States) Forum in Latin America. These groupings provide states in these regions with **new arenas for partnership and support** while also **challenging the cohesion of traditional Western blocs**; just days before the 16+1 group expanded to include the EU member Greece in April 2020, the European Commission moved to designate China a “systemic rival” amid concerns that BRI deals in Europe were undercutting EU regulations and standards.

Beijing and Moscow appear to be **successfully managing their alliance of convenience**, defying predictions that they would be unable to tolerate each other’s international projects. This has even been the case in areas in which their divergent interests could lead to significant tensions. **Russia vocally supports China’s BRI**, despite its inroads into Central Asia, which Moscow still considers its backyard. In fact, since 2017, the Kremlin’s rhetoric has shifted from talking about a clearly demarcated Russian “sphere of influence” in Eurasia to embracing a “Greater Eurasia” in which Chinese-led investment and integration dovetails with Russian efforts to shut out Western influence. Moscow followed a similar pattern when Beijing first proposed the formation of the AIIB in 2015. The Russian Ministry of Finance initially refused to back the bank, but the Kremlin changed course after seeing which way the wind was blowing; Russia formally joined the bank at the end of the year.

**China has also proved willing to accommodate Russian concerns** and sensitivities. China joined the other BRICS countries in abstaining from condemning Russia’s annexation of Crimea in 2014, even though doing so clearly contravened China’s long-standing opposition to separatism and violations of territorial integrity. Moreover, the Trump administration’s trade war with China has given Beijing additional incentives to support Russian efforts to develop alternatives to the Western-controlled SWIFT international payment system and dollar-denominated trade so as to undermine the global reach of U.S. sanctions regimes.

## Hypersonic Prolif Good

### 1nc – hypersonics

#### Hypersonics breed parity – prolif prevents nuke war.

Fergusson 19 Douglas Fergusson, submitting this article as his Political Science Master’s thesis at Carleton University, honors political science bachelor’s from the University of Manitoba. [Hypersonic Glide Vehicles: Implications for Strategic Stability in the Coming Hypersonic Era, https://curve.carleton.ca/system/files/etd/da8f23af-05a9-47cf-b1e8-0133feb628c5/etd\_pdf/848feb7fcbada363e031834c3ff05c90/fergusson-hypersonicglidevehiclesimplicationsforstrategic.pdf]

If one concedes the modest assumptions associated to the technological theory, then it is clear that hypersonic glide vehicles are a technology that will in all likelihood stabilize the strategic relationship between those who have them into the near future. If one concedes that the purpose of nuclear deterrence since the 1960s is based not upon avoiding and deterring a limited nuclear war per se, but rather a general nuclear exchange then it becomes increasingly obvious that hypersonic glide vehicles are stabilizing. If one concedes that no matter the current technological gap between the United States, and Russia and China that the current strategic relationship is one of MAD, and premised upon MAD, then it is clear that hypersonics are stabilizing. If one concedes that it is plausible that strategic escalation offers decision makers the ability to refocus their interests and avoid escalation into general nuclear war, then hypersonics are stabilizing. The question remains, however, as it does with most strategic literature, what exactly should decision makers do knowing this information. Studies on strategic stability were born during the Cold War, and the aim of these studies was to describe what a strategically stable relationship looked like, and what to do if particular technologies, doctrines, or postures undermined this strategic stability. Thus it was also tied intimately towards arms control and its associated literature. Since the goal of deterrence is to avoid nuclear war than states should pursue strategies and their related technologies that foment the most strategically stable relationship; because stability relates to the state in which general nuclear war is least likely to occur- not that cannot occur for a variety of political and other reasons in a stable relationship, but that a stable relationship has less risk of war than an unstable relationship. This is also the period when MAD became intimately tied81 to strategic stability between great powers. Although much has changed since the Cold War, the fundamental strategic relationship between the great powers today is one of deterrence premised upon MAD. Moreover, technological development in one way or another can never truly be stopped it seems; and thus it is still the responsibility of the strategic studies discipline to examine the effects of new technologies, doctrines, and postures of the great powers; and from those studies make educated prescriptions about policy direction. The spectre of a general nuclear war still haunts the modern world, even if most have forgotten it. Much has been made in the past 30 years describing a new international security relationship, one in which MAD had receded into the background of international peace and security. Understandably, developments such as 9/11 and other security concerns shifted the focus of strategic studies. Still, if one looks closely the threat of nuclear conflict remained prescient in the strategic maneuverings of states since the end of the Cold War. Much of Russian and Chinese aggression in their respective spheres of influence is still guaranteed by nuclear weapons. Although counterfactual, it is not hard to imagine the United States acting differently with these countries had not both had nuclear weapons-i.e. Ukraine, Syria, South China sea etc. Still, the old strategic study of nuclear and strategic deterrence is coming into view and as such the revival of the study of strategic stability is natural in this sense. Indeed, the development of hypersonic weapons in general, and hypersonic glide vehicles in particular, represents the first major technological development of these weapons since the Cold War. As with technologies in the Cold War such as ABM and MIRV, each new technology must be studied so that educated policy decisions can be82 made by the great powers moving forward. Thus the implications of whether or not hypersonic glide vehicles are stabilizing or not is directly relevant to whether the states that have or will have them in the near future, should either unilaterally, bilaterally, or multilaterally control them; or conversely, adopt and implement them on mass. Under comprehensive examination of all the factors that relate to strategic stability, it becomes evident that hypersonic glide vehicles will stabilize the relationship between the three great powers. Similar to their MIRV counterparts during the Cold War hypersonic glide vehicles are a particular response by states to increase the parity of their strategic relationships, and make their threats of assured destruction credible. Hyperglides offset ballistic missile defences and offer the ability for increased restraint when compared to their ICBM counterparts in their utilization as escalatory devices. They are better placed to escalate for the purposes of de-escalation and thus induce increased stability to a strategic relationship. The theoretical matrix indicates that it is highly plausible that moving forward these weapons will stabilize rather than de-stabilize the strategic relationships between the three great powers. Theoretically, and historically- if MIRVs are indeed a similar case- then it is plausible that hyperglides will only serve to stabilize the strategic balance between the great powers. Interestingly, this paper argues contrary to the majority of current strategic opinion concerning hypersonic glide vehicles. It is likely that the discrepancy arises from the recognition that there are two ways to interpret the goal of modern strategic deterrence. Most of the community, at least implicitly, seems to reflect the belief that strategic deterrence is directed toward avoiding any strategic exchange. Similar to their historic counterparts during the Cold War, they overvalue the weight of counterforce83 against the other dimensions of stability. Ultimately, American, Russian, and probably Chinese deterrence is not in fact directed towards avoiding any strategic exchange but rather directed toward avoiding a general war, and the civilizational costs associated. American strategy since the 1960s is an implicit proponent of the notion that escalation can be utilized to de-escalate before falling into a general war. So too, modern Russian strategy has adopted an escalate to de-escalate strategy for the purposes of not falling into an general war.159 Deterrence deals with perception and psychology, indicating that if the United States, and Russia believe that credible deterrence is one that allows for escalation then both implicitly believe in the ability for escalatory strategies to de-escalate a conflict. This means inherently that counterforce weapons have a positive impact on credibility, and through credibility to MAD and stability. A theory that does not take into account the strategic doctrines and beliefs at least generally of the parties involved would fail to provide decision makers with policy decisions that will be enacted. Thus policy prescriptions should seek to understand the strategic balance as it is and provide the best advice it can regarding policy to positively impact the perceived stability of the relationship. Deterrence is unique psychologically, because it relates to the recognition that if states believe a relationship is stable it is more stable. In this sense counterforce targeting is stabilizing because the great powers believe it to be stabilizing. In any case it is the failure of the majority of hyperglide literature to properly understand the goal of modern deterrence and thus they accidentally claim that weapons systems, such as hyperglides, de-stabilize the relationship when in fact they stabilize it. Recognizing then that hyperglides positively affect strategic stability, it is the position of this paper that this technology should be readily adopted by all the great powers. Indeed, they should not be controlled until their strategic aim has been met, and increased forces would overrun on costs. If that becomes the case, states should seek to control them on the back end laying out as they did with SALT I and the Vladivostok Accords, the strategic limits and boundaries of the relationship once all three parties are satisfied with their forces. In this regard, after full deployment the parties can engage one another and add increased stability by setting the upper limits of what the relationship will look like; and in so doing more readily cement the strategic stability between them. This should not be confused with the actual control of the weapons; as any control before great power strategic parity has been achieved would a) not be possible because the Chinese and Russians would not agree to being so inferior and b) cementing disparity as it exists now would potentially over time begin to shift the relationship from parity to supremacy and in said shift the relationship would be de-stabilized. At its heart, arms control should not be about refusing technological innovations. Rather, it should be directed toward controlling the affects that arms have on strategic relationships; meaning both that if a technology undermines the relationship it should be limited and controlled, and if a technology seeks to create a more stable relationship it should be adopted fully to each party’s extent and then have boundaries set, once all parties are convinced of the stability of the relationship vis-à-vis that technology. Hyperglide vehicles will stabilize the relationship, which over the past 30 years has become neglected; bringing increased85 stability to the relationship and decreasing the likelihood of war. As such the great powers should welcome this technology and its beneficial effects on strategic stability.

### 2nc – overview

#### Crisis stability – outweighs and turns the risk of miscalc by enforcing technical limitations.

Fergusson 19 Douglas Fergusson, submitting this article as his Political Science Master’s thesis at Carleton University, honors political science bachelor’s from the University of Manitoba. [Hypersonic Glide Vehicles: Implications for Strategic Stability in the Coming Hypersonic Era, https://curve.carleton.ca/system/files/etd/da8f23af-05a9-47cf-b1e8-0133feb628c5/etd\_pdf/848feb7fcbada363e031834c3ff05c90/fergusson-hypersonicglidevehiclesimplicationsforstrategic.pdf]

Having unearthed the answer to that question it becomes important to ask the connected question: what is the hyperglides utility in escalation, and how might this plausibly impact credibility? Hyperglides are much better than their traditional ICBM counterparts in the realm of escalation and controlled reprisal because they are more penetrable and survivable; moreover, their maneuverability has unique impacts on the strategic decision making of an adversary, which offers unique firebreaks to the escalation ladder. What is unique about hyperglide vehicles in the escalation ladder relates directly to their speed and maneuverability. Since the hyperglide can maneuver during most of its flight, it is relatively unclear to the receiving party precisely what is being targeted. For instance, imagine that the Russian Federation in a crisis launched an escalate to de-escalate strike against the United States, coming over the North pole. In a one off shot, prudence and patience among the American general staff should be warranted until after the missile has struck its target. For instance, a hypersonic glide vehicle coming over the north pole directed generally toward the central United States, could be targeting any series of targets; USSTRATCOM, in Omaha Nebraska, a US air base outside Minot, or even an uninhabited area in northern Manitoba. Each of these three targets sends a different deterrence message to the United States. Each of these three hypotheticals, and any series of others illustrates the utility of these systems in escalatory strikes to send71 different messages. When coupled with the speed of the systems, and target indistinguishability it should induce control and command to patience. Inevitably their maneuverability means that it would be unclear until almost the last moments of flight as to what the particular response should be. In each case the response would change, because the signal and associated costs change. Striking STRATCOM is not the same in a strategic sense as striking northern Manitoba. Finally, the speeds of current hyperglide vehicles is roughly half that of current ICBMs.154 This means that the average flight time of a intercontinental hypersonic vehicle is roughly 45-60 minutes as compared to the traditional ICBMs 30 minute flight time. Increased time and the inability of actors to recognize the target further induces command and control to patience. Fundamentally, the speed of the vehicles offers decision makers roughly one third to twice as much time to comprehend the best response and the likely effects that response will have on one’s adversary. This induces decision makers to a better decision and offers them more time to consider the big strategic picture and the costs associated with improper retaliation and escalation. The target necessitates the response such that a different target induces a different response, which means it would be imprudent to act before the target has been struck. The speed offers precious resources in the form of time for leadership to formulate the best response to the escalatory strike; it gives them more time to consider what their responses effect will have and thus in total examination increases the likelihood that commanders will properly perceive the costs and benefits of further aggression on both sides, such that a general nuclear war is more avoidable than was previously the case with traditional ICBMs. In this sense, hyperglides have a unique utility on the escalatory ladder when compared to their ICBM siblings.

#### Damage limitation – without hypersonics, retaliatory strikes are total war.

Fergusson 19 Douglas Fergusson, submitting this article as his Political Science Master’s thesis at Carleton University, honors political science bachelor’s from the University of Manitoba. [Hypersonic Glide Vehicles: Implications for Strategic Stability in the Coming Hypersonic Era, https://curve.carleton.ca/system/files/etd/da8f23af-05a9-47cf-b1e8-0133feb628c5/etd\_pdf/848feb7fcbada363e031834c3ff05c90/fergusson-hypersonicglidevehiclesimplicationsforstrategic.pdf]

HGVs and their Impact on Credibility Before we can understand the overarching impact of the weapon on credibility writ large we must first ask: are hyperglides likely to serve a counter-force or countervalue role, and how might this plausibly impact credibility? Into the near future, hypersonic glide vehicles will be primarily designated as especially useful counter-force weapons. Technological limitations, arising out of the fact that these systems are still being tested and perfected by the relative powers at play, suggests that the early utility of these weapons will be as precision strike, strategic missiles, that will be utilized to reliably destroy critical infrastructure in one off attacks for the purposes of escalate to deescalate. It is entirely plausible that in a crisis, an adversary seeking to escalate to deescalate would utilize one of these missile systems thanks to their increased penetrability and survivability. The utilization of a traditional ICBM for a one shot escalate to deescalate attack risks being shot down by BMD system, and in so doing fails to send the proper escalatory message to one’s adversary. Without hyperglides an adversary might be incentivized to shoot not one but three traditional ICBMs and thus send a message that does not escalate to de-escalate but rather escalates in the extreme. The ability of hyperglides to reliably strike whichever target it so chooses while frustrating BMD makes them particularly useful as counterforce weapons in the near future. As a counterforce weapon, these systems stabilize the strategic relationship because they provide the technical means for an actor to send the proper escalatory messages and put a firebreak on the conflict. Counterforce weapons, while incentivizing war actually seek to stop escalation into a general strategic exchange, and in so doing stabilize the relationship. Their increased survivability after launch indicates to one’s adversary that they cannot protect themselves, offering incentives for the party attacked to consider further aggression and the costs associated with such action. There’s no strategic benefit at the moment or projected into the near and medium future for hyperglides to be utilized as counter-value weapons- it would be cheaper to build massive amounts of cheaper ICBMs and SLBMs to fulfill this role. In any case the targeting of counter-value assets is destabilizing because it removes any incentives for the other party to not respond strategically. Indeed, counter-force weapons provide the unique capability to escalate to70 de-escalate and send the strategic signals necessary to one’s adversary that escalation into the counter-value domain is unwanted by both parties. In this regard then hypersonic glide vehicles stabilize the strategic relationships because they make the prospect of a general war less likely.

#### Credibility – beyond parity, hypersonics restore “the heart of MAD.”

Fergusson 19 Douglas Fergusson, submitting this article as his Political Science Master’s thesis at Carleton University, honors political science bachelor’s from the University of Manitoba. [Hypersonic Glide Vehicles: Implications for Strategic Stability in the Coming Hypersonic Era, https://curve.carleton.ca/system/files/etd/da8f23af-05a9-47cf-b1e8-0133feb628c5/etd\_pdf/848feb7fcbada363e031834c3ff05c90/fergusson-hypersonicglidevehiclesimplicationsforstrategic.pdf]

Recognizing their strategic implications, it is possible now to inquire of hyperglides, what their likely impact will be on the broader conceptual notions surrounding credibility. What are the plausible impacts of the weapon on communication capability, and political will? Hyperglides offer a unique capability that communicates a very real and credible threat to one’s adversary. The inability to defend against these systems, due to their capabilities, offers a credible deterrent. While they have direct impacts on the capability, it is also their impact on political will that engenders the increasing credibility of one’s deterrent. In regard to specifically political will, hyperglides provide instruments that are actually useable for the purposes of deterring a general nuclear war. The inability to stop them from hitting targets, and their precision as weapons gives actor’s a host of viable decisions for their utilization as escalatory weapons. In this sense, their credibility is directly related to their usability. Hypersonic glide vehicles represent soon, and for the near future a weapon that is uniquely useable. In the tradition of Herman Khan, a weapons system that is unusable has no deterrence effect.155 Credible deterrence requires that political actors actually be able to use them. In this sense, then hyperglides provide the necessary delivery systems to actually use one’s weapons, and thus provide a credible deterrent to one’s enemy. Hyperglides are flexible weapons that provide increased credibility to a state’s deterrent. The positive effects of hyperglides on credibility have a correlating positive affect on stability. Such that it can be argued in this regard that hypersonic glide vehicles are stabilizing. HGVs and their Impact on the Deterrence Relationship Understanding the impacts of this new technology on credibility it is now possible to examine more broadly its affects on the strategic deterrence relationship between the three great powers. Recognizing the foundational relationship between the three great powers is one of MAD, we must inquire as to the effects of hyperglides on this strategic balance. We ask hyperglides first: do hypersonic glide vehicles enhance the assured destruction capability of each party? In a general sense, hypersonic glide vehicles are stabilizing to the deterrence relationship because they enhance the assured destruction capability of the nations who hold them. The Americans already retain relatively complex BMD mid-course defences against ICBMs, and both the Chinese and Russians are investing in their own complex mid-course ballistic defence programs.156 The enhanced assured destruction capability arises from the maneuverability and unusual altitudes in particular. At their core hypersonic glide vehicles are increasingly survivable when compared to older missile systems, enhancing the overall destructive effect of a states deterrent by ensuring that once launched these missiles will hit their target. The capabilities of these new missiles threaten adversaries with destruction, which lies at the heart of MAD. They make each of the states more vulnerable to attack than they would be without these systems. This increased mutual vulnerability of states to these systems ensures that each party will retain an assured destruction capability into the near future. Having enhanced the destructive capability of each state who will hold them, the next question that has to be answered is: do hyperglides undermine the ability of the other party’s assured destruction capability? Hyperglides do not and will not have the capability to undermine the assured destruction capability of any of the three great powers into the near future. The majority of these states’ assured destruction capability either exist underwater-in the form of SSBNs-, or on land- in the form of mobile ICBM launchers. Whatever worries exist about their ability to take out the assured destruction capability of states, such as China must recognize that this problem can be remedied doctrinally with the adoption of a launch-on-warning posture. This indicates that they do not in a comprehensive sense undermine assured retaliatory capability of the three great powers.

### at: arms racing

#### No arms racing.

Fergusson 19 Douglas Fergusson, submitting this article as his Political Science Master’s thesis at Carleton University, honors political science bachelor’s from the University of Manitoba. [Hypersonic Glide Vehicles: Implications for Strategic Stability in the Coming Hypersonic Era, https://curve.carleton.ca/system/files/etd/da8f23af-05a9-47cf-b1e8-0133feb628c5/etd\_pdf/848feb7fcbada363e031834c3ff05c90/fergusson-hypersonicglidevehiclesimplicationsforstrategic.pdf]

In any case returning to the specific affects of hyperglides on arms race stability, they do not have any greater de-stabilizing features than traditional ICBMs. They cannot sufficiently threaten submarine targets, and into the near future their will not be enough of them to even threaten ICBM targets. In their inability to threaten the core of states’ retaliatory capability it would irresponsible to suggest that they are de-stabilizing. To suggest they are de-stabilizing is to suggest that all ICBMs are de-stabilizing, which is neither true theoretically or historically speaking. In the realm of deterrence, perception matters, such that for a technology to de-stabilize a relationship it needs to be perceived as de-stabilizing a relationship. Clearly ICBMs have not been considered as such; and therefore it would be imprudent to suggest that hyperglides will be. If they mimic ICBMs as they look to be doing, they will in fact stabilize the arms race.

### at: bmd destabilizing

#### BMD doesn’t trigger war now BUT does deter rogue states.

Fergusson 19 Douglas Fergusson, submitting this article as his Political Science Master’s thesis at Carleton University, honors political science bachelor’s from the University of Manitoba. [Hypersonic Glide Vehicles: Implications for Strategic Stability in the Coming Hypersonic Era, https://curve.carleton.ca/system/files/etd/da8f23af-05a9-47cf-b1e8-0133feb628c5/etd\_pdf/848feb7fcbada363e031834c3ff05c90/fergusson-hypersonicglidevehiclesimplicationsforstrategic.pdf]

39 BMDs are not inherently de-stabilizing. For them to be de-stabilizing to a peer-to-peer competitor they have to at a minimum threaten or be perceived to threaten an adversary’s retaliatory capability. In this sense a limited BMD capacity is not de-stabilizing because it lacks the requisite capability to threaten a peer adversary’s deterrent. The current U.S. BMD program is designed for rogue states in part of a larger deterrence by denial framework. Its limited capacity does not actually threaten Chinese or Russian deterrent threats at the moment.

### at: mad impossible

#### Hypersonics prolif stabilizes MAD for decades.

Fergusson 19 Douglas Fergusson, submitting this article as his Political Science Master’s thesis at Carleton University, honors political science bachelor’s from the University of Manitoba. [Hypersonic Glide Vehicles: Implications for Strategic Stability in the Coming Hypersonic Era, https://curve.carleton.ca/system/files/etd/da8f23af-05a9-47cf-b1e8-0133feb628c5/etd\_pdf/848feb7fcbada363e031834c3ff05c90/fergusson-hypersonicglidevehiclesimplicationsforstrategic.pdf]

Hypersonic glide vehicles represent one of the first major strategic weapons developments since the end of the Cold War. These missiles, which are capable of carrying both nuclear and non-nuclear payloads threaten to alter the strategic balance of terror that has kept that great powers at peace since the late 1940’s. Whether nuclear or non-nuclear these strategic weapons systems were developed in a strategic environment by the Russians and Chinese to bring increasing parity to their relationship with the United States. Their maneuverability, speed, and altitude make them impervious to ballistic missile defences now and into the near future, ensuring the continued survival of an assured destruction capacity for the three great powers. A stable strategic balance has served as the foundation for peace between the great powers since the advent of mass nuclear weapons; hypersonic glide vehicles foster a stable strategic balance now and into the near future, and as such it should be no surprise that these weapons will most likely be neither controlled nor abandoned by the three great powers. Instead, it is likely these missiles will serve as the new basis for mutually assured destruction and the corresponding strategic stability between the great powers into the coming decades.

### at: counterforcing escalation

#### No counterforcing crises from hypersonics – enemy arsenals are large enough that they feel secure – BUT obviously BMD mops up ICBMs which threatens them.

Fergusson 19 Douglas Fergusson, submitting this article as his Political Science Master’s thesis at Carleton University, honors political science bachelor’s from the University of Manitoba. [Hypersonic Glide Vehicles: Implications for Strategic Stability in the Coming Hypersonic Era, https://curve.carleton.ca/system/files/etd/da8f23af-05a9-47cf-b1e8-0133feb628c5/etd\_pdf/848feb7fcbada363e031834c3ff05c90/fergusson-hypersonicglidevehiclesimplicationsforstrategic.pdf]

Turning finally to the specific impacts of hypersonic glides vehicles on arms race and crisis stability we can ask two questions. First we ask, do hypersonic glide vehicles undermine the retaliatory capability of peer-to-peer competitors? In regards to75 hyperglides they do not and will not have any specific impact on the strategic retaliatory capability of actors in the near to medium future. Inevitably, they are designed to target counterforce weapons, and the cost, technical characteristics, and initial deployments, will lack the capability to threaten the major powers retaliatory capability into the near future. The Russians, Americans, and Chinese all understand that the primary retaliatory capability of their states’ exist in their ICBM and SLBM assets. The Russians currently deploy 1,420 strategic nuclear warheads on a series of platforms. The Chinese currently deploy 280 strategic nuclear warheads deployed on a series of platforms. The Americans for their part currently deploy 1,328 strategic nuclear warheads on a series of platforms. Much is made by Keir Lieber and others about the capability of a U.S. counterforce weapons in the modern era, however they disregard the particular realities that arise in a crisis.157 It may be true that much of the adversarial capabilities in a general non-crisis sense could be targeted; but the size of adversarial strategic forces allow them to adopt particular strategies to offset such counter-force capabilities. It would be relatively easy to adopt in a crisis a, launch on warning posture, which would disable the American confidence of a successful pre-emptive strike.158 So in this sense the U.S. counterforce capabilities in fact do not threaten the retaliatory capability of the Russian Federation and China in any real sense.

## IOT/Blockchain Bad

### Crypto Bad---1NC

#### Cryptocurrencies get weaponized by terrorist organizations – uniquely hard to attribute

Dion-Schwarz et. Al 19 – Cynthia Dion-Schwarz, Ph.D., research staff member at the Institute for Defense Analyses, staff member in the Office of the Secretary of Defense (“Terrorist Use of Cryptocurrencies: Technical and Organizational Barriers and Future Threats”, *RAND Corporation,* 2019, <https://www.rand.org/content/dam/rand/pubs/research_reports/RR3000/RR3026/RAND_RR3026.pdf>) FGY

Given the key role of funding in supporting terrorist operations, counterterrorism efforts—in particular, the subfield of counterterrorism finance (CTF)—often focus on tracking the flow of money through bank accounts and preventing financial transactions that might be used to support attacks and other terrorist activities. However, the success of CTF strategies in reducing terrorist access to fiat (i.e., government-issued) currencies has raised concerns that **terrorist organizations might increase their use of such digital cryptocurrencies as Bitcoin to support their activities**. Bitcoin is both a protocol for securely storing and transmitting tokens (virtual coins) and the name of the unit of value in the system. Bitcoin revolves around a public ledger called the blockchain, which is maintained by an online peer-to-peer network that tracks transactions and maintains a complete history of verified transactions. Media reports have outlined the notion that some, or even many, **terrorist organizations have unlimited, untraceable sources of digital money**, such as Bitcoin, which will be used to undermine the successes of CTF.1 Policymakers also have raised concerns about terrorist use of digital currencies.2 However, the challenge posed by cryptocurrencies extends beyond Bitcoin. Many new cryptocurrencies have emerged in the past few years, including such alternative currencies (altcoins) as Omni Layer (MasterCoin), BlackCoin, and Monero, which are touted as more private and secure than Bitcoin. Zcash is another **cryptocurrency** that **offers a higher degree of privacy and provides the potential ability to use and transfer currency offline**, which could make it **difficult for law enforcement to trace illicit transactions**.

#### Circumvents all defense – lack of funding in the squo inhibits operations but crypto stops shortages

Dion-Schwarz et. Al 19 – Cynthia Dion-Schwarz, Ph.D., research staff member at the Institute for Defense Analyses, staff member in the Office of the Secretary of Defense (“Terrorist Use of Cryptocurrencies: Technical and Organizational Barriers and Future Threats”, *RAND Corporation,* 2019, <https://www.rand.org/content/dam/rand/pubs/research_reports/RR3000/RR3026/RAND_RR3026.pdf>) FGY

Terrorists require significant funding to carry out attacks and other activities. Indeed, there is reason to believe that, **if terrorist groups were better funded overall**, there might be **more-frequent, more-successful, and larger attacks**.1 There are several reasons that support this belief. First, more funds for operations would presumably lead to increased funding for the structures that enable these attacks, which include recruiting and training attackers and inspiring potential lone wolves. Second, groups facing less monetary pressure (i.e., those that are better funded) also might be more willing to take risks, such as larger or riskier attacks.2 Lastly, and perhaps more contentiously, **increased funds can be used directly for additional and larger attacks.** It might be difficult to directly link increased funds to terrorist attacks, although in specific documented cases, “the literature often describes **shortages of cash as a problem for terrorist operations**.”3 It is therefore plausible that the relative lack of attacks, and especially the lack of higher-cost large attacks, is partly because of overall funding constraints. Since the September 11, 2001, terrorist attacks (9/11), law enforcement agencies have developed and implemented several successful approaches for preventing the flow of fiat (i.e., government-issued) currencies to terrorist groups. In particular, as intelligence and counterterrorism agencies have identified finance strategies employed by terrorist organizations, they have been able to curtail terrorist fundraising.4 However, the success of **counterterrorism finance** (CTF) **strategies** in reducing terrorist access to fiat currencies has **raised concerns that terrorist organizations might increase their use of such digital cryptocurrencies as Bitcoin to support their activities**.5 Bitcoin is both a protocol for securely storing and transmitting tokens (virtual coins) and the name of the unit of value in the system. Bitcoin revolves around a public ledger called the blockchain, which is maintained by an online distributed network of computers that track transactions and maintain a complete history of verified transactions. Any user of the system can participate in all aspects of its operations, including all transactions, and no single participant has control. To support anonymity and transaction ownership, Bitcoin transaction participants are identified by a unique string of random numbers rather than by a name or other personal information. Furthermore, the challenge posed by cryptocurrencies extends beyond Bitcoin. Many **new cryptocurrencies have emerged**, all with differing properties tailored for different audiences, some of **which might align with terrorists’ needs**. These include such other alternative currencies (“altcoins”) as Omni Layer (MasterCoin), BlackCoin, and Monero, which are touted as more private and secure than Bitcoin and therefore are seemingly tailor-made for illicit activities.6 Another cryptocurrency is Zcash, which uses transactions that are not identified by any owner, thereby offering a higher degree of privacy. Zcash also offers a higher degree of privacy, which could make it even more difficult for law enforcement to trace illicit transactions and could be extended to allow offline use and transfer of the currency. Other types of cryptocurrencies have been proposed, including Hawk, which aims to allow fully private contracts and transactions on the Ethereum blockchain. Like Bitcoin, the Ethereum blockchain is a distributed computing platform and operating system. Increased use of cryptocurrencies by terrorists could undermine the successes of CTF. Although terrorist organizations have sometimes been reluctant to adopt new methods when old methods are effective, **CTF pressures can create incentives for terrorists to innovate**, as we have seen in other domains.7 **We** might **expect terrorist groups to expand their use of cryptocurrencies** in cases where their access to alternative financial systems is limited, or where cryptocurrency provides significant benefits over alternatives. Some research has been conducted on the use of cryptocurrencies by criminals and terrorist organizations, but such research has largely focused on Bitcoin and other first-generation cryptocurrencies (with some notable exceptions).8 Policymakers also have focused more attention on terrorists’ potential use of digital currencies, including Bitcoin. For example, in January 2018, a bill was introduced in Congress to ask the U.S. Treasury Department to “prioritize the investigation of terrorist and illicit use of new financial technology, including digital currencies,” among other provisions.9 There is thus a great need to understand the full potential for terrorist use of cryptocurrencies, including options for identifying and tracking their use, the sophistication and technological capability of terrorist groups, and the potential for such use to increase in the future, given expected technological developments.

#### Rogue actors exploit market instability – new illicit trade markets skirt US-led counterterror efforts

Dudley et. Al 19 – Colonel Sara Dudley, chief of staff at the United States Army Special Operations Command, MBA from Harvard Business School, M.A. in financial integrity from Case Western Reserve University School of Law, former financial management officer at USSOCOM (“Evasive Maneuvers: How Malign Actors Leverage Cryptocurrency”, 2019, <https://ndupress.ndu.edu/Portals/68/Documents/jfq/jfq-92/jfq-92_58-64_Dudley-et-al.pdf>) FGY

Combining Generates National Security Threats. A breakdown in international financial market transactions in USD and in the applications of international sanctions combine to generate a noteworthy national security threat. At the moment, **malign actors hiding illegal transactions in cryptocurrency markets**, or renegade companies skirting sanctions to generate short-term profit, **represent a general nuisance to the overall maintenance of the international financial system**. However, if rogue state actors cooperate to establish their own secondary market system of cryptocurrency transactions to trade among themselves, the **effectiveness of using the global financial system** to thwart these regimes **would be significantly challenged.**35 Unless rogue states coordinate to support all import and export transactions inside a single cryptocurrency, they would still need to convert open market cryptocurrencies to fiat currency. Currently, the cryptocurrency space displays wild fluctuations in value and demonstrates the instability of speculative investments and early market normalization. Since the value of each competing cryptocurrency remains purely based on investor confidence, currency prices tend to increase and decrease rapidly. **Rogue nations releasing national digital currency tied to underlying assets** presents a **contemporary equivalent to the gold standard**. If developed, trust among rogue actors in other digital marketplaces could allow for the free flow of illicit trade and funding among participant nations. Disconcertingly similar to the Cold War model, one could imagine this type of alternative market system leading to independent states choosing to operate in one or multiple marketplaces. This type of parallel digital market system **challenges both nonkinetic (financial markets) and kinetic (DOD) means by which the United States might disrupt illicit actor funding**. As of July 28, 2018, open market cryptocurrencies represent under 1 percent of currency assets internationally, hence they do not represent an immediate financial market threat. However, this growing revolution in the establishment of cryptocurrencies harkens back to concepts introduced by Frederick Hayek in his 1976 essay, “Denationalisation of Money.” Hayek proposed the need to remove the central bank monopoly over issuance of currency, which is the organizing principle of current cryptocurrencies. While the USD emerged as the stable world currency of choice, the functioning of U.S. Federal Reserve monetary policy as the de facto World Bank leaves many countries dissatisfied. If rogue states coordinated their efforts to counter this actuality with support of a supranational cryptocurrency standard for trade and exchange, this technology could present a significant challenge to one of the primary tools used by the U.S. Government and the international community to counter continuously evolving gray area threats and activities of rogue nations and violent extremist organizations. The current instability in cryptocurrency marketplaces presents a window of opportunity for the United States to prepare for the revolution in international financial payment systems

#### Cryptocurrency is structurally vulnerable to cooption by malign actors – lack of safeguards and attribution

Dudley et. Al 19 – Colonel Sara Dudley, chief of staff at the United States Army Special Operations Command, MBA from Harvard Business School, M.A. in financial integrity from Case Western Reserve University School of Law, former financial management officer at USSOCOM (“Evasive Maneuvers: How Malign Actors Leverage Cryptocurrency”, 2019, <https://ndupress.ndu.edu/Portals/68/Documents/jfq/jfq-92/jfq-92_58-64_Dudley-et-al.pdf>) FGY

While the international financial community certainly has shown both intrigue and aversion to the potential disruptions in world monetary markets, distributed ledger technology also introduces challenges pertaining to national security. The presence of various middlemen, such as financial institutions, afforded governments the ability to track and trace malign activity through the traditional financial system ledgers. With cryptocurrencies, **reputable banks no longer validate an individual’s credentials** and record his information with each transaction. Rather, anonymity in cryptocurrencies protects point-to-point transactions captured between digitized wallets and encryption keys. This **change in the traditional process for managing financial transactions undermines regulatory anti–money laundering** efforts performed by financial institutions, which are intended to thwart players attempting to **skirt sanctions** and **finance terror groups**. While perhaps not immediately obvious to the casual observer, nonstate actor use and increasing state actor pursuit of cryptocurrencies extend the competitive space into the international financial domain and spotlight cryptocurrency as a national security issue that should concern the Department of Defense (DOD) and Intelligence Community.4

The **rapid growth of weakly regulated financial and technology markets creates vulnerabilities** for safeguarding the international financial system from malign actors. Hence, the nexus of crime, **corruption**, and terrorism finds refuge in these emergent financial systems.5 Aside from the benefits of cryptocurrencies, which include providing an attractive means for malign actors to conceal illicit funding and business, and to earn currency by mining, the technology attributes alone attract malfeasance. While the distributed blockchain ledger remains resistant to cyber criminals, the storage of the digital coins (that is, private key encryptions) remains a system weakness.

While pointed out earlier that traditional ledger systems are vulnerable, **theft of cryptocurrencies requires less hacking skill** than penetrating the centralized ledger systems, which banks have hardened. Secure digital storage of the private and public key information associated with cryptocurrency exists outside the blockchain within individual computers, exchange markets, and businesses established to provide offline, or cold-storage. Similar to a brokerage house converting shares of a company into cash for a seller, cryptocurrency exchanges support the transition of the digital currency back into a fiat currency like the USD. Theft of the encryption keys for a coin gives a criminal carte blanche to spend it without the need for identification. Due to the need to secure the encryption keys from theft by hackers, some exchanges and separate businesses now exist to safeguard the encryption keys offline in the equivalent of digital safe deposit boxes. The introduction of these cryptocurrency technologies disrupts not only financial markets but also efforts to monitor and maintain the integrity of financial exchange. The **anonymity of use, low barriers to entry, and weak regulation and limited legal jurisdiction in the cryptocurrency marketplace represent an opportune platform for illicit actors**. The initial forays of criminal, corrupt, and terror networks into the cryptocurrency markets foreshadow the future challenges of starving large-scale, bad actors of funding.

### IOT Bad---1NC

#### The IoT is terrible --- laundry list.

Jason Bloomberg 07/2014 [President of Intellyx, Wired, “7 Reasons why the Internet of Things is Doomed,” https://www.wired.com/insights/2014/07/7-reasons-internet-things-doomed///ZW]

To paraphrase the immortal Facebook sage, there are three things in this world I hate: 1. Articles about buzzwords; 2: Irony; and 3: Lists. Let us therefore proceed with all due irony to list our derogations of one of the buzziest: the Internet of Things, known to aficionados and curmudgeons alike as the IoT. The IoT explosion is rather curious if you think about it, as the Internet has been with us now for nigh on two decades, and everything connected to it has always been some kind of thing. But now it seems every kind of thing from dishwashers to doorknobs require an Internet connection, since after all, we all know our dishwashers have long harbored a pent up desire for scintillating conversation with our doorknobs. Today, the IoT itself is a Thing – a Thing Worth Talking About it seems, from all the conferences, confabs, and conversations it elicits. Because as we all know, where there’s attention, buckets of cash soon follow, and even the most egregious ideas end up with their piece of the pie if only the caterwauling is loud enough. Yet while hype is good for business in the short term, there’s this annoying little problem we call reality that has an inconvenient habit of throwing water all over our Wicked Witch of Inflated Expectations. So, get me a bucket, and here goes. Security We all know the everyday computer gear that vendors have been churning out for the aforementioned two decades have matured sufficiently to prevent any kind of security breach, so it should be no problem at all to transfer that unbreakable technology to the various sensors and controls we now want to scatter about our homes, our cars, and our factories. What’s that you say? Even our most mature, robust technology simply rolls over and kowtows any time a script kiddie with a free hacker tool decides to poke around a bit? Today that selfsame kiddie has no problem at all hacking our baby monitors and laptop cameras, which should send a chill up the spine of any online porn aficionado or parent (and for all you porn-loving parents, fuggedaboutit). Today, the most common IoT sensor is the lowly RFID tag, found in everything from store merchandise to warehouse equipment to passports to that “security” (ahem) badge that gets you into your office at night. And what kind of security does that tag sport? Nada. Nothing. Zilch. And you don’t even have to touch the thing to hack it. Simply being in the general vicinity is good enough. Not like your passport is ever in the general vicinity of lowlife like you find in passport lines at airports. Be afraid. Be very afraid. Privacy – And No, That’s Not the Same as Security Even if you can somehow secure that baby monitor and keep the perv down the street from spying on your little bubby boo, there’s still the problem that a lot of these IoT devices are supposed to spy on you. Why do you think there are so many buckets of cash pouring into the IoT hope-to-be-a-market? The Big Corporations don’t expect to make a big profit on the devices themselves, oh no. News flash: the Big Money in IoT is in Big Data. As in, Big Data about everything those sensors are learning about you and your nasty habits that you hide from your neighbors. The value of Big Data, after all, aren’t the data themselves. “Fred’s car told Fred’s thermostat to turn on Fred’s hot tub” doesn’t interest anybody but Fred and perhaps his hot date (if he’s lucky). The value in Big Data, you see, are in the patterns. What shows you watch. What apps you use. Which ads influence your buying behavior. The more IoT you have, the more Big Data they collect, and the more Big Data they collect, the more they know about how you behave. And once they know how you behave, they know how to control how you behave. And that brings us to #3. Digital Fatigue Remember back in the good old days, when the trusty old rabbit ears picked up three stations, and phones were attached to the wall? You do? Consider yourself old then. But it’s not just us gray hairs who actually used rabbit ears who pine for the good old days of not being quite so wired as we are today. You don’t have to follow all the angry tweets about Facebook’s latest mind control scheme to realize that people are getting fed up. Too much social media, too many smartphones, too many YouTube videos to watch, too many apps to download, too much of everything digital and wired and online. We can’t even go for a lovely stroll in Antarctica for heaven’s sake without checking Twitter every five minutes. What the hell is wrong with us, anyway? Now along comes the IoT, promising to connect the Internet to our eyeglasses and our wristwatches and our thermostats and our appliances and our streetlights and on and on. Can’t we just download a big-ass OFF switch so we can hear ourselves freakin’ THINK for once? Please? Ecosystems Ecosystems? How could there be anything wrong with a back-to-nature, tree-hugging ecosystem? Well, I’m not talking about natural ecosystems here. I’m talking about their evil twin, technology ecosystems. Case in point: smartphone ecosystems. In this corner we have Apple iPhone. It has its own programming environment with its own throng of developers coding apps for the iPhone App Store that only run on the iPhone. And in that corner: Google Android, with all the same stuff, only it all requires Google under the covers. Both Apple and Google, of course, make billions of dollars this way (yes, Billion with a B, Dr. Evil!) But consumers have to choose: which ecosystem do they want to sell their soul to? Because once we consumers pick a side, it’s very difficult to cut the ties that bind us to our choice. And for all you Windows Phone or BlackBerry fans out there? Sorry Charlie, you bet on the nag that went lame in the back stretch. With the IoT we’re back to square one, and the Apples and Googles of the world know that the spoils will go to the winners of the ecosystem wars. Only now it’s anybody’s game again, so we have a plethora of vendors, both large and small, jumping into the fray and trying to establish a foothold, in hopes of either creating their own ecosystem (for the startups) or extending their existing one (for the behemoths). Don’t be fooled. Sure, all the IoT techies may be talking about open standards, in the hopes that all my doohickeys can seamlessly interoperate with all of your gewgaws. But open standards are nothing more than big sticks for beating weaker ecosystems into submission – and that turns us, the poor consumer, into collateral damage. No Killer App One day nobody heard of an iPad. The next day everybody wanted an iPad. The day after that, everybody had an iPad. That’s what we mean by a Killer App: something everybody wants the moment they hear about it. So far, the IoT has no Killer App. Are you lining up for Google Glass? What about a refrigerator that orders milk, or a car that turns on your hot tub? No? Didn’t think so. Of course, the Killer App could be just around the corner. They have a nasty habit of appearing on the market suddenly with no warning, after all. But so far, we ain’t got nuttin’. Enterprises Will Mess Things Up Sure, Web Scale companies and cash-rich Silicon Valley startups are all over the IoT. But what about your bank or big box retailer or manufacturer? Sure, they want to play with the cool kids too. If only it weren’t for all that legacy technology that’s weighing them down! As I wrote about in my previous Cortex newsletter, established enterprises may attempt to relegate their IoT efforts to their swashbuckling Digital Transformation initiatives, thus separating them from the mundanities of their existing technology. Only one problem: their existing technology is what runs their business. Digital Transformation may be the frosting, but the existing business, legacy and all, is the cake. Sorry, folks. No playing with the cool kids until you finish your homework, and while you’re at it, eat all your Brussels sprouts too. For an enterprise to succeed with the IoT or any other part of their Digital Transformation initiative, there are no shortcuts – only hard work. But even hard work will get you nowhere if you’re not working on the right problems. Architecture, anyone? Vendors Smell Blood in the Water, Only the Blood Is Yours The answer to many of these problems (or at least, a hint at how we might come up with an answer) is to put the consumer in control of the IoT. Let the consumer control the security of each device. Let us determine what data the devices upload to the Big Companies. Let us set the priorities for the standards efforts. Let us turn the damn things off when we need some peace and quiet already. In your dreams! There’s no way to fix all the problems of IoT because fixing the problems means putting the consumer in control, and the consumer would promptly turn off precisely those features that are making the VCs, entrepreneurs, and pundits salivate. Remember, the Big Money is in using the IoT to control (or at least, influence) consumer behavior – and if we as consumers could simply turn off those features that let the Big Companies make money off of us, then they’d have no reason to build out the IoT in the first place. Do I really think the Internet of Things is doomed, or do I believe there are solutions to these problems? I consider myself an optimist, especially when it comes to technological progress, but my core prediction is that the IoT will struggle to find its way. It will eventually arrive, but not in the forms that people envision today. The battle for who will control the IoT, the vendors or the customers, will bring to a head many of the concerns people have over the influence technology already has in our lives. And what about the Industrial Internet? The IoT includes M2M, right? No, not Mary Tyler Moore, M2M is Machine-to-Machine, as in factory equipment and power plant turbines and locomotives and such. Sorry to disappoint – but the Industrial Internet is really quite different than the IoT this article has been skewering. The difference? Nobody in their right mind would actually put a turbine or a locomotive on the Internet – that is, the phishing-crazy, porn-laden, NSA-targeted Internet we all know and love. That’s what private networks are for. Right? In the end, the IoT is a tool, just as all technology are tools. Tools can be used well or poorly, for good or for evil. And people are always going for the big bucks by building a better mousetrap – but the best mousetrap in the world won’t sell if your customers have a weasel infestation, of if they simply like their mice the way they are, thank you very much. And anyway, all this hullabaloo about the IoT misses the entire point. Whether we talk about the things we’re connecting to the IoT, or the IoT itself, never forget that tools themselves are just things – and this story isn’t really about things at all. Peel away all the buzzwords and hype, and you’ll find that the Internet of Things is the Internet of People – an extraordinarily powerful communication and commerce tool, but a tool in human hands nevertheless. Be careful with that thing or you’ll put someone’s eye out.

### IOT Bad---2NC

#### IOT devices have bad security systems--- risks mass data leaks.

Richard van Hooijdonk 03-07-2019 [International keynote speaker Richard van Hooijdonk is a regular guest on radio and television programs. With his international research team, he investigates tech trends like robotics, drone technology, autonomous transport systems, internet of things, biotech, nanotech, neurotech, blockchain, and 3D and 4D printing, Tech Target IOT Agenda, “The hidden dangers of IOT devices,” https://www.techtarget.com/iotagenda/blog/IoT-Agenda/The-hidden-dangers-of-IoT-devices//ZW]

Gradually, almost without anyone realizing it, IoT devices have become an indispensable part of our everyday routine, bringing unprecedented levels of convenience and making our lives easier and more enjoyable. Aimed not only at adults, but also children and pets, IoT devices come in all shapes and sizes, ranging from smart TVs, thermostats, locks and security cameras to children’s toys, baby monitors and pet trackers. The way things are going, almost every device in our homes could soon be equipped with sensors and connected to the internet. However, all that convenience comes with one major drawback. IoT devices are notorious for their lack of security, mostly because manufacturers tend to neglect that aspect in the rush to get their products to the market as soon as possible and capitalize on this new opportunity. Implementing strong security features is very expensive and time-consuming, so manufacturers will often choose not to go through with it, leaving these devices exposed to attacks from the outside. The number of IoT devices could reach 28.5 billion by 2022 The number of IoT devices has increased exponentially in recent years, and this trend shows no signs of slowing down anytime soon. In fact, networking hardware company Cisco predicted that there will be 28.5 billion connected devices in the world by 2022. Even today, it would be very difficult to find a household that doesn’t have at least one connected device. Cisco also estimated that the average number of connected devices per person will grow to 3.6 by 2022. North America is expected to spearhead the trend with 13.4 connected devices per person, followed by Western Europe with 9.4. As the number of IoT devices increases, so does the number of cyberattacks directed at them. According to cybersecurity company Kaspersky Lab, there were three times more attacks on connected devices in the first half of 2018 than there were in the entire 2017. Previously, in the period between 2016 and 2017, the number of attacks increased 10 times, indicating a troubling upward trend that’s set to become even more pronounced in the coming years as IoT devices become more ubiquitous. How dangerous are unsecured IoT devices? There are a number of ways manufacturers can leave IoT devices vulnerable to hackers, but the most common involves assigning weak default login credentials. Even worse, those credentials often can’t be changed, and even if they can, users are rarely prompted to do so. This allows hackers to easily obtain them, sometimes with nothing more than a web search, and take control of the compromised device. The infamous Mirai botnet attack of 2016 still serves as the best example of just how dangerous unsecured IoT devices can be. It was the most disruptive distributed denial-of-service (DDoS) attack in history, in which hackers gained control of more than 100,000 poorly secured IoT devices and used them to launch a sustained assault on the leading DNS provider Dyn, taking down numerous important websites in the process, such as Twitter, Netflix, Amazon and CNN. However, IoT devices aren’t used just to launch DDoS attacks. Hackers are also increasingly using them to attack consumers directly and steal their personal data or use their systems to mine cryptocurrencies. Princeton University recently conducted a comprehensive study of more than 50 consumer IoT devices, including smart TVs, security cameras, smart lightbulbs, smart smoke detectors, sleep monitors, smart blood pressure monitors and children’s toys. The study revealed that many of the devices tested lack even basic encryption and authentication features, allow attackers to infer user behavior from encrypted traffic metadata, or communicate with third parties without users’ knowledge. Regulatory issues The lack of regulation is one of the biggest issues associated with IoT devices, but things are starting to change in that regard as well. The U.S. government was among the first to take the threat posed by unsecured IoT devices seriously, introducing a number of IoT-related bills in Congress over the last couple of years. It all began with the IoT Cybersecurity Improvement Act of 2017, which set minimum security standards for connected devices obtained by the government. This legislation was followed by the SMART IoT Act, which tasked the Department of Commerce with conducting a study of the current IoT industry in the United States. Furthermore, California recently became the first U.S. state to pass an IoT cybersecurity bill, which will require manufacturers to equip all connected devices with reasonable security features. While the bill doesn’t make it clear what those reasonable security features are exactly, it does specify that devices that allow access from outside of a local area network need to have either a unique default password or prompt users to choose their own during setup. Although it’s been criticized by some cybersecurity experts for being too vague and simplistic, it nevertheless marks an important step towards making IoT devices more secure. Other governments are also stepping up their efforts to protect consumers from this growing threat. The UK government released the Code of Practice for consumer IoT security in October 2018, which sets forth guidelines for improving the security of consumer IoT products and associated services. Similarly, in November 2018, Germany’s Federal Office for Information Security published its suggestions for minimum security standards and features required for broadband routers. The number of IoT devices continues to increase at a rapid pace, and it’s becoming increasingly clear that this technology is here to stay. While they provide numerous benefits, IoT devices also come with a variety of security and privacy concerns. Until manufacturers raise their standards and invest more in implementing strong security features, businesses and consumers will have to do their own part to ensure that the devices they bring into their workplaces and homes aren’t a security risk. The best way to do that is to purchase IoT devices exclusively from manufacturers with a proven track record when it comes to security; use unique, strong passwords for each device; and always keep software and firmware updated. Even that won’t be enough to completely eliminate the threat, but it will at least minimize it.

#### Escalating cyberattacks on IOT causes escalation.

Trend Micro 07-21-2021 [Trend Micro, “IoT Security Issues, Threats, and Defenses,” https://www.trendmicro.com/vinfo/us/security/news/internet-of-things/iot-security-101-threats-issues-and-defenses//ZW]

The internet of things (IoT) has grown so broad that the development of its security had to quickly keep up. This article discusses the basics of IoT security in order to help frame what it is, why it is necessary, and how it can be achieved. What are IoT devices? We begin by defining the “things” in the internet of things, because the diversity in IoT devices makes the IoT’s scope so broad and its security challenging. The main characteristics of an IoT device is that they are able to connect to the internet and interact with its environment through the collection and exchange of data. Devices commonly have limited computing capacity and only a few specific functions. Because devices are so diverse, there are countless ways IoT can be used and applied to different environments. For regular users, smart homes demonstrate just how accessible IoT devices are. Users can update their home’s security system (through smart locks, IP cameras, and motion sensors) or improve their entertainment system (through a smart TV, smart speakers, and connected game consoles) by simply buying such devices. IoT devices are also often portable and can be connected to any network. A typical example is how users bring their devices from their homes to the office (e.g. smart watches and e-readers). While diversity can give users countless devices to choose from, it is one of the reasons behind the fragmentation of the IoT and carries many of its security concerns. The lack of industry foresight and standardization has given rise to compatibility issues that also complicate the matter of security. The portability of devices presents a greater possibility of threats poisoning more than one network. Compounding to these concerns are other factors that IoT security must address. What are the security issues in the IoT? While IoT devices play a huge role in the discussion of IoT security, placing all the focus on this aspect of the IoT does not provide a full picture of why security is necessary and what it entails. There are many factors that make IoT security critical today. Threats and risks IoT security is critical largely because of the expanded attack surface of threats that have already been plaguing networks. Adding to these threats are insecure practices among users and organizations who may not have the resources or the knowledge to best protect their IoT ecosystems. These security issues include the following: Vulnerabilities**.** Vulnerabilities are a large problem that constantly plague users and organizations. One of the main reasons IoT devices are vulnerable is because they lack the computational capacity for built-in security. Another reason that vulnerabilities can be so pervasive is the limited budget for developing and testing secure firmware, which is influenced by the price point of devices and their very short development cycle. Vulnerable standard components also affect millions of devices, as demonstrated by Ripple20 and URGENT/11. Aside from the devices themselves, vulnerabilities in web applications and related software for IoT devices can lead to compromised systems. Malware operators are on the lookout for such opportunities and are knowledgeable even about older vulnerabilities. Malware. Despite the limited computing capacity of most IoT devices, they can still be infected by malware. This is something cybercriminals have used to great effect in the past few years. IoT botnet malware are among the most frequently seen variants, as they are both versatile and profitable for cybercriminals. The most notable attack was in 2016, when Mirai took down major websites and services using an army of ordinary IoT devices. Other malware families include cryptocurrency mining malware and ransomware. Escalated cyberattacks**.** Infected devices are often used for distributed-denial-of-service (DDoS) attacks. Hijacked devices can also be used as an attack base to infect more machines and mask malicious activity, or as an entry point for lateral movement in a corporate network. While organizations may seem like the more profitable targets, smart homes also see a surprising number of unforeseen cyberattacks. Information theft and unknown exposure**.** As with anything dealing with the internet, connected devices increase the chances of exposure online. Important technical and even personal information can be unknowingly stored and targeted in these devices. Device mismanagement and misconfiguration. Security oversights, poor password hygiene, and overall device mismanagement can assist in the success of these threats. Users may also simply lack the knowledge and the capability to implement proper security measures, wherein service providers and manufacturers may need to help their customers achieve better protection. Emerging issues The lack of industry foresight gave little time to develop strategies and defenses against familiar threats in growing IoT ecosystems. Anticipating emerging issues is one of the reasons research on IoT security must be done continuously. Here are some of the emerging issues that need to be monitored: Complex environments**.** In 2020, most U.S. households had access to an average of 10 connected devices. This research paper defined complex IoT environments as an interconnected web of at least 10 IoT devices. Such an environment is nearly impossible for people to oversee and control because of its elaborate web of interconnected functions. An overlooked misconfiguration in such a scenario can have dire consequences and even put the physical household security at risk. Prevalence of remote work arrangements**.** The Covid-19 pandemic has usurped many expectations for the year 2020. It brought about large-scale work-from-home (WFH) arrangements for organizations around the globe and pushed heavier reliance on home networks. IoT devices also proved useful for many users’ WHF setups. These changes have highlighted the need to reexamine IoT security practices. 5G connectivity**.** The transition to 5G comes with much anticipation and expectations. It is a development that will also enable other technologies to evolve. At present, much of the research on 5G remains largely focused on how it will affect enterprises and how they can implement it securely. The possible consequences of IoT attacks Aside from the threats themselves, their consequences in the context of the IoT can be much more damaging to deal with. The IoT has the unique capability of affecting both virtual and physical systems. Cyberattacks on IoT ecosystems could have far more unpredictable effects because they translate more easily into physical consequences. This is most prominent in the field of industrial internet of things (IIoT), where past cyberattacks had already demonstrated cascading consequences. In the healthcare industry, IoT devices are already being utilized to remotely monitor patients’ vital signs and has proven very helpful during the pandemic. Attacks on such devices can expose sensitive patient information or even endanger their health and safety. In the smart home, exposed devices could allow cybercriminals to monitor the household, compromise security devices like smart locks, and turn devices against their owners, as was the case when a baby monitor and a smart thermostat were hacked in separate attacks. How to secure the IoT There is no instant fix that can answer the security issues and threats laid out in this article. Specific strategies and tools may be necessary for properly securing more specialized systems and aspects of the IoT. However, users can apply a few best practices to reduce risks and prevent threats: **Assign an administrator of things.** Having a person act as an administrator of IoT devices and the network can help minimize security oversights and exposures. They will be in charge of ensuring IoT device security, even at home. The role is critical especially during this time of WFH setups, where IT experts have limited control in securing home networks that now have a stronger influence on work networks. **Regularly check for patches and updates.** Vulnerabilities are a major and constant issue in the field of the IoT. This is because vulnerabilities can come from any layer of IoT devices. Even older vulnerabilities are still being used by cybercriminals in order to infect devices, demonstrating just how long unpatched devices can stay online. **Use strong and unique passwords for all accounts.** Strong passwords help prevent many cyberattacks. Password managers can help users create unique and strong passwords that users can store in the app or software itself. **Prioritize Wi-Fi security.** Some of the ways users can do this include enabling the router firewall, disabling WPS and enabling the WPA2 security protocol, and using a strong password for Wi-Fi access. Ensuring secure router settings is also a big part of this step. **Monitor baseline network and device behavior.** Cyberattacks can be difficult to detect. Knowing the baseline behavior (speed, typical bandwidth, etc.) of devices and the network can help users watch for deviations that hint at malware infections. **Apply network segmentation.** Users can minimize the risk of IoT-related attacks by creating an independent network for IoT devices and another for guest connections. Network segmentation also helps prevent the spread of attacks, and isolate possibly problematic devices that cannot be immediately taken offline. **Secure the network and use it to strengthen security.** IoT devices can place networks at risk, but networks can also serve as levelled ground through which users can implement security measures that cover all connected devices. **Secure IoT-cloud convergence and apply cloud-based solutions.** The IoT and the cloud are becoming increasingly integrated. It is important to look at the security implications of each technology to the other. Cloud-based solutions can also be considered to deliver added security and processing capabilities to IoT edge devices. **Consider security solutions and tools.** A large hurdle that users face in trying to secure their IoT ecosystems is the limited capacity in which they can implement these steps. Some device settings might have restricted access and are difficult to configure. In such cases users can supplement their efforts by considering security solutions that provide multi-layered protection and endpoint encryption. **Take into consideration the different protocols used by IoT devices.** To communicate, IoT devices use not only internet protocols, but also a huge set of different networking protocols, from the well-known Bluetooth and Near Field Communication (aka NFC), to the lesser-known nRF24, nRFxx, 443MHz, LoRA, LoRaWAN and optical, infrared communication. Administrators must understand the whole set of protocols used in their IoT systems in order to reduce risks and prevent threats. **Secure the heavy use of GPS.** Some IoT devices and applications use GPS heavily, which carries potential security concerns. Organizations, in particular, need to be wary of cases where GPS signals can be jammed or even faked, especially if they use positioning systems for manufacturing, monitoring, and other functions. If these positioning systems are crucial to a company, means of monitoring the GPS signal should then also exist in the company. Another option would be for the company to use other positioning systems as well, such as Real-Time Kinematic (RTK) or Differential GNSS (DGNSS or DGPS). Aside from employing these security practices, users should also be aware of new developments in the technology. IoT security has been given heavier consideration in recent times. Research is continually being done on how to secure specific industries, monitor IoT-related threats, and prepare for upcoming gamechangers such as 5G. Users must understand that the IoT is an active and developing field, therefore its security will always have to transform and adapt to its changes.

#### Vulnerabilities in critical infrastructure could be exploited.

Tom Brewster 03-20-2014 [Writing for the Guardian, The Guardian, “There are real and present dangers around the Internet of Things,” https://www.theguardian.com/technology/2014/mar/20/internet-of-things-security-dangers//ZW]

As with any buzz topic in the tech world, there’s a lot of bunkum around the Internet of Things. And in the security sphere, there’s much unnecessary FUD - Fear, Uncertainty and Doubt – spread by industry vendors to get people suitably scared so they splash cash on purportedly necessary protection.  Take the case of the spamming refrigerator. Researchers suggested the smart fridge had been compromised to relay reams of annoying emails, as often happens to normal PCs. Yet Symantec discovered the fridge was simply on the same network and using the same IP address as a hacked Windows PC, which was really the thing responsible for the spam. Digital listeria this was not. Yet there are reasons to be fearful of the Internet of Things (IoT), a name covering the networks of embedded devices, from smart meters to connected automobiles, which communicate with each other in an automated fashion to help make our lives more efficient. Such connected, autonomous machines have been around for years, but the reason it is now on the tips of tech firms’ PR tongues every day is that the number of connected devices is escalating rapidly into new areas, like toothbrushes and bathtubs. According to Gartner estimates, the IoT will consist of 26 billion units by 2020, and by that time the industry will be worth $300 billion. The problem is that many of the manufacturers of these machines are not taking the secure-by-design approach. “They are learning on the job at this point in time,” says Gunter Ollmann, chief technology officer at IOActive, a consultancy firm that has done much research on IoT security. Hacking vehicles There are a handful of real and present threats. In automobiles, trucks are a major concern. Many contain standardised code to manage vehicles, such as the control area network (CAN) bus protocol, used for internal communications between devices in a vehicle. “CAN messages that control physical attributes are standardised. Therefore, if you figure out a hack for one manufacturer others will be quite similar if not identical,” says Chris Valasek, director of security intelligence for IOActive.  One of the functions that has understandably worried onlookers in the trucking and security industries is the kill switch that powers the vehicles down. “Some fleets use the GPS tracking and ‘check-out’ systems to control access to the trucks when they are in depots or secure overnight storage locations to prevent the truck being stolen,” Ollmann adds. “The open architecture of the trucks CAM bus has made it much easier for the integration of fleet tracking and control technologies like these. But conceptually, any wireless technology that can receive remote commands and affect the operation of a truck is a potential target for researchers and targets. What if someone figures out the master shutdown code for all the trucks, and they get all the trucks in London to stop at 7am?” It’s a nasty thought, but this isn’t science fiction. Trucking companies are working with Ollmann and his team to close off any potential flaws that could lead to disaster. “We’re working with some of them and doing additional research on this now … they’re worried about it.” The car industry is alive to the problems too, at least in its more progressive corners. When Valasek and noted security researcher Chris Miller showed on video how they could hack a car when inside the vehicle (below), it gave rise to both mirth and misery in the car industry.  Tesla has reacted the most positively. Having recruited some noted security pros, including former Apple “hacker princess” Kristin Paget, it has set up a vulnerability disclosure programme rewarding researchers for uncovering flaws. It’s similar to bug bounty programmes run by major software firms, like Facebook, Google and Microsoft. Evidently, the Rubicon has been crossed.  Hacking the home The home is a viable target too, amusingly highlighted by the discovery of a hackable Japanese smart toilet last year. More recently, IOActive detailed flaws in home automation kit made by Belkin, including switches to turn electrical devices on and off, which could have been used to cause real-world damage, possibly a fire. Those vulnerabilities were eventually addressed, but Ollmann says there are numerous flaws in connected home technologies from other manufacturers that will be disclosed in the near future. TVs that run Google’s Android operating system are vulnerable to many of the same attacks that affect smartphones. MWR Infosecurity, a consultancy, has tested out an Android exploit on a Kogan TV running Android. The attack took advantage of a documented weaknesses that allow hackers to use of a piece of code known as a JavaScriptInterface, included in ad libraries to let further actions be initiated on Android machines. In theory, anyone hacking a TV in this way could take photos, if the TV had a built-in camera, or create invasive applications to spy on viewers. That weakness has been found in numerous ad libraries used by many of the world’s top free apps. “It should affect any TV running Android and definitely if they’re running apps which use the flawed ad networks,” says David Chismon, researcher at MWR.  Home routers are ridden with vulnerabilities too, as uncovered by digital security non-profit Team Cymru in March. It found a network of 300,000 home and office routers had been compromised, thanks to worrying weaknesses in the devices’ software, from predictable or non-existent passwords to flaws in the web applications used to control them. The hackers decided to use these security holes to redirect victims to whatever website they wanted when they started using the internet.  Taking over industrial controls Connected, and therefore hackable, devices can also be found in control systems running nations’ critical infrastructure. Researchers across the world have been panicking about supervisory control and data acquisition (SCADA) systems, used to monitor and manage industrial machines, from nuclear power plants to oil and gas pipelines.   SCADA machines produced by various manufacturers have been shown to contain various weaknesses, like those exploited by Stuxnet, the infamous malware that disrupted centrifuges at an Iranian nuclear plant. What’s worrying is that more vulnerabilities continue to emerge.  In January, the US government’s Industrial Control Systems Cyber Emergency Response Team (ICS-CERT) issued a warning about a buffer overflow vulnerability, a type of weakness that allows an outside hacker to write code to a device and which has been largely eradicated from modern systems. The Guardian knows of one major security firm that is aware of a number of theoretical flaws, ones that could be used to play with the power controls on SCADA systems, but they do not currently have the right labs to test the potential for real-world impact. This is another key problem: the threat is poorly understood, with many apparent vulnerabilities that may or may not be exploited to endanger critical infrastructure. “We keep seeing small examples of attacks that may or may not be cyber attacks against SCADA systems, but it’s still a theoretical threat in terms of spectacular and long lived degradation of a specific service,” says Steve Santorelli, a researcher at Cymru. His outlook for the future of SCADA-like machines is not optimistic, though. “The internet is not secure frankly, in any way at all. That matters when it comes to control systems.”  Send in the Cavalry Santorelli has a similarly bleak prospectus for IoT in general. “Someone asked me recently: is my fridge going to DDoS me and, frankly the answer is, yes … probably,” he adds. “Anything with an IP address is a commodity in the underground economy, to be bought or bartered for if there is a way to make money from it.”u “The privacy and criminal implications are diverse and they need to be at the heart of the design of these new technologies. The bottom line is that we’ve never truly seen security be at the heart of a new technology and anything that connects to the internet will be inherently insecure by its very nature. The future is not looking bright.”= Time to batten down the hatches and prepare for cybergeddon then? Perhaps not. Help is on the way, even if it’s not from government. A movement started by noted security professional Josh Corman has been gathering pace in recent months, since it was first conceived at last year’s DEFCON hacking convention. Its name is I Am The Cavalry. Its intention is to act as a hub for vulnerability research that affects four areas: medical devices, automobiles, home services and public infrastructure. The plan is to give altruistic researchers a place to share their findings in a pro bono fashion, in the hope that the weaknesses will be covered off by whatever manufacturers are affected. I Am The Cavalry will act as a hyperactive middleman, coordinating vulnerability disclosures and pushing for more than just quick fixes. It wants to encourage total cultural change to instil security across organisations’ processes. It’s an ambitious plan, born out of a sense of responsibility in a world ridden with hackable technologies. But will researchers really give away their secrets for free, especially the most technically gifted who can make millions by selling just a handful of the most serious flaws to nation states? Corman believes the ethical side of the hacking community will come out in force. “I’m not making an economic argument yet,” he says. “Our role and what sets us apart is that we’re speaking to those who have something in them ... that altruistic gene. We’re describing something that is a shared risk and a shared concern and if that appeals to someone, they should gravitate to us.” Praise for Tesla Even ahead of its formation as an official organisation (it is consulting with lawyers on whether to become an educational foundation or an industry association), I Am The Cavalry has already facilitated some vulnerability disclosures. Corman says the body has had successes in both the car and medical industries, but can’t disclose whom they involved. He has also been invited to consult with car manufacturers in the US and Europe, and is particularly impressed with the way in which Tesla has responded to the problems at hand.  “We are very encouraged to see such a policy [at Tesla]. A fear we’ve had as a research community is that we would have a 10-15 year learning curve where this new industry was in the denial and lawsuit stage towards researchers,” says Corman. “If this is an indicator of how the rest of the automotive industry will respond in kind, this will dramatically accelerate the maturity and the engagement of white hat researchers who wish to help.” As a sign of his sway with mandarins walking the murky halls of power, Corman has already met with Senator Ed Markey of Massachusetts, who recently urged car makers to act on cyber security issues, and others on Capitol Hill to discuss the weaknesses that urgently need addressing. Despite limited “in the wild” attacks, Internet of Things threats are real. As connected devices proliferate, the hope is that they do so securely. If they volunteer for the Cavalry, that might just happen. Then we can go about our quotidian lives feeling a little less insecure.

#### Public utilities and healthcare devices get hacked.

Trend Micro 09-17-2015 [Trend Micro, “FBI Warns Public on the Danger of the Internet of Things,” https://www.trendmicro.com/vinfo/us/security/news/internet-of-things/fbi-warns-public-on-dangers-of-the-internet-of-things//ZW]

The FBI has a rather different approach towards the Internet of Things, saying that users should deal with IoT devices with caution; otherwise they should keep it off the internet. In a Public Service announcement issued last week, the law enforcement agency discussed the potential security risks of using interconnected devices such as smart light bulbs, connected cars, smart fridges, wearables, and other home security systems. The PSA included network connected printers as well as fuel monitoring systems. According to the PSA’s list of IoT risks, cybercriminals can take advantage of system and human vulnerabilities by exploiting these weaknesses with IoT’s deficient security capabilities and patching difficulties. The FBI also cited that the lack of consumer awareness can open windows of opportunities for attackers to not only execute online attacks, but threaten the physical safety of consumers as well. It’s Not Just Smart Devices or Home Security Systems Anymore Since the conception of IoT, we’ve seen several incidents that involved attacks on smart home systems and devices, and the prevalent smartification process could only mean new security challenges. With the new developments in public-facing technologies, risks and actual attacks aren't limited to IoT devices, and are becoming widespread among public utilities as well. Car hacking, or the exploitation of vulnerabilities in new built-in automotive smart systems, has become an eye-opening reality for many security researchers and consumers. According to German security specialist Dieter Spaar, vulnerabilities in the BMW ConnectedDrive technology could allow attackers to gain control of vehicles and enable them to remotely access related function apps. Last July, vehicle security researchers Chris Valasek and Charlie Miller demonstrated how a Jeep Cherokee’s brakes and other critical control systems can be remotely controlled by anyone with an internet connection. According to Valasek and Miller, they can easily take control of the vehicle by sending data to its interconnected entertainment system and navigation system via a mobile phone network. In response to this, Chrysler announced the recall of 1.4 million vehicles that may be affected by the security hole. As if hacking vehicles isn’t enough, attackers have also begun targeting healthcare devices, traffic light controls, and energy or industrial systems like gas-tank-monitoring systems. Last month, Trend Micro published a research paper that discussed the possible risks that internet-facing components could come up against. It was noted that the type of attack would depend on the sophistication of the systems, as less complex ones can limit what attackers could do. The real-world implications of these incidents and findings highlight the lack of security surrounding interconnected devices and prove that attackers are scaling more security walls within the IoT landscape. **How We Can Prepare for IoT-related Risks?** While smart devices and systems are making life easier for its users, the steady adoption of the Internet of Things and the integration of more smart systems into critical infrastructures are making many industries and consumers more vulnerable to attacks—possibly with life-threatening repercussions. With cybercriminals looking past desktops and mobile devices, consumers must be more careful when it comes to the security of internet-connected devices and systems. While we look to law enforcement agencies to help fight against possible attacks, we must remind and teach ourselves about the risks and dangers of insecure devices and systems. In addition to the tips in the article entitled “What to Consider When Buying a Smart Device”, here a few more ways to improve the security of your devices against possible IoT threats: Enable all security features on all smart devices Always update the device firmware Use secure passwords Close any unused ports on devices and routers Utilize encryption for all networks and devices

## Nuclear Meltdowns Good

### 1NC---Meltdowns Good

#### Meltdowns are not existential – every worst-case scenario didn’t even come close

Shellenberger 19 [Michael Shellenberger, Michael is an author and the founder of a nonprofit research organization called Environmental Progress, 3-11-2019, accessed on 7-18-2022, Forbes, "It Sounds Crazy, But Fukushima, Chernobyl, And Three Mile Island Show Why Nuclear Is Inherently Safe", https://www.forbes.com/sites/michaelshellenberger/2019/03/11/it-sounds-crazy-but-fukushima-chernobyl-and-three-mile-island-show-why-nuclear-is-inherently-safe/?sh=5ce20b571688 mimou]

Many pro-nuclear people came to believe that the accident was proof that the dominant form of nuclear reactor, which is cooled by water, is fatally flawed. They called for radically different kinds of reactors to make the technology “inherently safe.”

But now, eight years after Fukushima, the best-available science clearly shows that Caldicott’s estimate of the number of people killed by nuclear accidents was off by one million. Radiation from Chernobyl will kill, at most, 200 people, while the radiation from Fukushima and Three Mile Island will kill zero people.

In other words, the main lesson that should be drawn from the worst nuclear accidents is that nuclear energy has always been inherently safe.

The Shocking Truth

The truth about nuclear power’s safety is so shocking that it’s worth taking a closer look at the worst accidents, starting with the worst of the worst: Chernobyl.

The nuclear plant is in Ukraine which, in 1986, the year of the accident, was a Soviet Republic. Operators lost control of an unauthorized experiment that resulted in the reactor catching fire.

There was no containment dome, and the fire spewed out radioactive particulate matter, which went all over the world, leading many to conclude that Chernobyl is not just the worst nuclear accident in history but is also the worst nuclear accident possible.

Twenty-eight firefighters died after putting out the Chernobyl fire. While the death of any firefighter is tragic, it’s worth putting that number in perspective. [Eighty-six firefighters died in the U.S.](https://apps.usfa.fema.gov/firefighter-fatalities/fatalityData/list?deathYear=2018&offset=80&max=10) in 2018, and 343 firefighters died during the September 11, 2001 terrorist attacks.

Since the Chernobyl accident, 19 first responders have died, according to the [United Nations](http://www.unscear.org/docs/publications/2008/UNSCEAR_2008_Annex-D-CORR.pdf), for ”various reasons” including tuberculosis, cirrhosis of the liver, heart attacks, and trauma. The U.N. concluded that “the assignment of radiation as the cause of death has become less clear.”

What about cancer? By 2065 there may be 16,000 thyroid cancers; to date there have been [6,000](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3107017/). Since thyroid cancer has a mortality rate of just one percent — it is an easy cancer to treat — expected deaths may be 160.

The World Health Organization claims on its web site that Chernobyl could result in the premature deaths of 4,000 people, but according to Dr. Geraldine Thomas, who started and runs the Chernobyl Tissue Bank, that number is based on a disproven methodology.

“That WHO number is based on LNT,” she explained, using the acronym for the “linear no-threshold” method of extrapolating deaths from radiation.

LNT assumes that there is no threshold below which radiation is safe, but that assumption has been discredited over recent decades by multiple sources of data.

Support for the idea that radiation is harmless at low levels comes from the fact that people who live in places with higher background radiation, like Colorado, do not suffer elevated rates of cancer.

In fact, residents of Colorado, where radiation is higher because of high concentrations of uranium in the ground, enjoy some of the [lowest cancer rates](https://coloradosun.com/2019/02/04/colorado-skin-cancer-rates/) in the U.S.

Even relatively high doses of radiation cause far less harm than most people think. Careful, large, and long-term studies of survivors of the atomic bombings of Hiroshima and Nagasaki offer compelling demonstration.

Cancer rates were [just 10 percent higher](https://www.sciencedaily.com/releases/2016/08/160811120353.htm) among atomic blast survivors, most of whom never got cancer. Even those who received a dose 1,000 times higher than today’s safety limit saw their lives cut short by an average of 16 months.

But didn’t the Japanese government recently award a financial settlement to the family of a Fukushima worker who claimed his cancer was from the accident?

It did, but for reasons that were [clearly political,](https://www.forbes.com/sites/michaelshellenberger/2018/09/06/top-scientist-says-japans-decision-to-financially-reward-fukushima-worker-is-not-based-on-science/) and having to do with the Japanese government’s consensus-based, conflict-averse style, as well as lingering guilt felt by elite policymakers toward Fukushima workers and residents, who felt doubly aggrieved by the tsunami and meltdowns.

The worker’s cancer was highly unlikely to have come from Fukushima because, once again, the level of radiation workers received was far lower than the ones received by the Hiroshima/Nagasaki cohort that saw (modestly) higher cancer rates.

What about Three Mile Island? After the accident in 1979, Time Magazine ran a cover story that superimposed a glowing headline, “Nuclear Nightmare,” over an image of the plant. Nightmare? More like a dream. What other major industrial technology can suffer a catastrophic failure and not kill anyone?

Remember when the Deepwater Horizon oil drilling rig caught on fire and [killed 11](https://www.britannica.com/event/Deepwater-Horizon-oil-spill-of-2010) people? Four months later, a Pacific Gas & Electric natural gas pipeline exploded just south of San Francisco and [killed eight](https://abc7news.com/news/pg-e-receives-maximum-sentence-for-2010-san-bruno-explosion/1722674/) people sleeping in their beds. And that was just one year, 2010.

The worst energy accident of all time was the 1975 collapse of the Banqiao hydroelectric dam in China. It collapsed and killed between [170,000](https://timeline.com/structural-failure-banqiao-china-7a402a25bb65) and [230,000 people](https://www.ozy.com/flashback/230000-died-in-a-dam-collapse-that-china-kept-secret-for-years/91699).

Nuclear’s worst accidents show that the technology has always been safe for the same, inherent reason that it has always had such a small environmental impact: the high energy density of its fuel.

Splitting atoms to create heat, rather than than splitting chemical bonds through fire, requires tiny amounts of fuel. A single Coke can of uranium can provide enough energy for an entire high-energy life.

When the worst occurs, and the fuel melts, the amount of particulate matter that escapes from the plant is insignificant in contrast to both the fiery explosions of fossil fuels and the daily emission of particulate matter from fossil- and biomass-burning homes, cars, and power plants, which [kill seven million people](https://www.who.int/airpollution/en/) a year.

#### But, we’ll concede the plan solves global meltdowns --- that saves the nuclear power industry

Energy Fair, 12 [Energy Fair, THE FINANCIAL RISKS OF INVESTING IN NEW NUCLEAR POWER PLANTS, www.energyfair.org.uk, March 2012 Energy Fair Email: nuclearsubsidies@gmail.com Phone: +44 (0) 1248 712962, +44 (0) 7746 290775 Web: www.energyfair.org.uk 23rdMarch 2012, http://www.nirs.org/neconomics/risks\_of\_nuclear\_investment\_published.pdf]

Political risk. Apart from the risk that politicians may decide to withdraw some or all of the subsidies for nuclear power, it is vulnerable to political action arising from events like the nuclear meltdowns in Fukushima. That disaster led to a sharp global shift in public opinion against nuclear power and it led to decisions by politicians in several different countries to close down nuclear power stations and to accelerate the roll-out of alternative sources of power. The next nuclear disaster—and the world has been averaging one such disaster every 11 years—is likely to lead to even more decisive actions by politicians, perhaps including the closing down of nuclear plants that are still under construction or are relatively new.

#### Nuclear energy is expensive, inefficient, and risks extinction through nuclear proliferation and environmental degradation

Jaczko 19 (Gregory Jaczko served on the Nuclear Regulatory Commission from 2005 to 2009, and as its chairman from 2009 to 2012. The author of "Confessions of a Rogue Nuclear Regulator," he is the founder of Wind Future LLC and teaches at Georgetown University and Princeton University.; “I oversaw the U.S. nuclear power industry. Now I think it should be banned.”; The Washington Post; May 17, 2019; <https://www.washingtonpost.com/outlook/i-oversaw-the-us-nuclear-power-industry-now-i-think-it-should-be-banned/2019/05/16/a3b8be52-71db-11e9-9eb4-0828f5389013_story.html>) Accessed 11/11/21//eleanor

Before the accident, it was easier to accept the industry’s potential risks, because nuclear power plants had kept many coal and gas plants from spewing air pollutants and greenhouse gases into the air. Afterward, the falling cost of renewable power changed the calculus. Despite working in the industry for more than a decade, I now believe that nuclear power’s benefits are no longer enough to risk the welfare of people living near these plants. I became so convinced that, years after departing office, I’ve now made alternative energy development my new career, leaving nuclear power behind. The current and potential costs — in lives and dollars — are just too high. Nuclear plants generate power through fission, the separation of one large atom into two or more smaller ones. This atomic engine yields none of the air pollutants produced by the combustion of carbon-based fuels. Over the decades since its inception in the 1950s, nuclear power has prevented hundreds of fossil-fuel plants from being built, meaning fewer people have suffered or died from diseases caused by their emissions. But fission reactors have a dark side, too: If the energy they produce is not closely controlled, they can fail in catastrophic ways that kill people and render large tracts of land uninhabitable. Nuclear power is also the path to nuclear weapons, themselves an existential threat. As the certainty of climate change grew clearer, nuclear power presented a dilemma for environmentalists: Was the risk of accidents or further spread of nuclear weapons greater than the hazard of climate change? In the late 2000s, the arguments in support of nuclear power were gaining traction with Congress, academia and even some environmentalists, as the Chernobyl accident faded into the past and the effects of climate change became harder to ignore. No new plants had been proposed in decades, because of the industry’s dismal record of construction oversight and cost controls, but now utilities were beginning to pitch new reactors — as many as 30 around the country. But the Fukushima Daiichi crisis reversed that momentum. A massive release of radiation from that plant, as its four reactors failed, lasted for months. The world watched as hydrogen explosions sent huge chunks of concrete into the air — a reminder that radiation was streaming, unseen, from the reactor core. More than 100,000 people were evacuated from their homes and their communities. Most have not returned, because only select areas have been remediated, making the surrounding region seem like a giant chessboard with hazardous areas next to safer ones. The crisis hobbled the Japanese economy for years. The government estimated that the accident would cost at least $180 billion. Independent estimates suggest that the cost could be three times more. There were obvious ramifications for the entire industry: Could what happened in Japan happen elsewhere? This accident consumed my work at the NRC for the next six months. I assured the public of the safety of U.S. plants, because I did not have enough information or a legal basis at that point to say otherwise. But I also promised to thoroughly review the safety measures we had in place and to swiftly implement any necessary reforms the agency identified. Agency staffers soon produced a reasonable set of plant improvements that would reduce the chance of a similar accident here. The staff found weaknesses in the programs for dealing with fires, earthquakes and flooding — the kinds of natural disasters that could trigger a catastrophe like Fukushima. Yet after the disaster, my fellow commissioners, as well as many in Congress and the nuclear industry, fretted that the proposed new U.S. reactors might never be built, because Fukushima would focus too much attention on the potential downsides. Westinghouse and the new plant owners worried that acknowledging the need for reforms would raise even more concern about the safety of reactors. The industry wanted the NRC to say that everything was fine and nothing needed to change. So my colleagues on the commission and supporters of the industry pushed to license the first of these projects without delay and stonewalled implementation of the safety reforms. My colleagues objected to making the staff report public. I ultimately prevailed, but then the lobbying intensified: The industry almost immediately started pushing back on the staff report. They lobbied the commission and enlisted allies in Congress to disapprove, water down or defer many of the recommendations. Within a year of the accident at Fukushima — and over my objections — the NRC implemented just a few of the modest safety reforms that the agency’s employees had proposed, and then approved the first four new reactor licenses in decades, in Georgia and in South Carolina. But there was a problem. After Fukushima, people all over the world demanded a different approach to nuclear safety. Germany closed several older plants and required the rest to shut down by 2022. Japan closed most of its plants. Last year, even France, which gets about 80 percent of its electricity from nuclear power, proposed reducing that figure to 50 percent by 2035, because safety could not be guaranteed. Trying to make accidents unlikely wasn’t enough. And here in the United States, those four new reactors — the vanguard of the “nuclear renaissance” — still haven’t opened. The South Carolina companies building two of the reactors canceled the project in 2017, after spending $9 billion of their customers’ money without producing a single electron of power. The construction company behind the utilities, Westinghouse, went bankrupt, almost destroying its parent company, the global conglomerate Toshiba. The other two reactors licensed while I chaired the NRC are still under construction in Georgia and years behind schedule. Their cost has ballooned from $14 billion to $28 billion and continues to grow. History shows that the expense involved in nuclear power will never change. Past construction in the United States exhibited similar cost increases throughout the design, engineering and construction process. The technology and the safety needs are just too complex and demanding to translate into a facility that is simple to design and build. No matter your views on nuclear power in principle, no one can afford to pay this much for two electricity plants. New nuclear is simply off the table in the United States. After I left the NRC in 2012, I argued that we needed new ways to prevent accidents altogether. When a reactor incident occurs, the plant should not release any harmful radiation outside the plant itself. I was not yet antinuclear, just pro-public-safety. But nuclear proponents still see this as “antinuclear.” They knew, as I did, that most plants operating today do not meet the “no off-site release” test. I think a reasonable standard for any source of electricity should be that it doesn’t contaminate your community for decades. Coal and natural gas do not create this kind of acute accident hazard, though they do present a different kind of danger. Large dams for hydroelectric power could require evacuation of nearby communities if they failed — but without the lasting contamination effect of radiation. And solar, wind and geothermal energy pose no safety threat at all. For years, my concerns about nuclear energy’s cost and safety were always tempered by a growing fear of climate catastrophe. But Fukushima provided a good test of just how important nuclear power was to slowing climate change: In the months after the accident, all nuclear reactors in Japan were shuttered indefinitely, eliminating production of almost all of the country’s carbon-free electricity and about 30 percent of its total electricity production. Naturally, carbon emissions rose, and future emissions-reduction targets were slashed. Would shutting down plants all over the world lead to similar results? Eight years after Fukushima, that question has been answered. Fewer than 10 of Japan’s 50 reactors have resumed operations, yet the country’s carbon emissions have dropped below their levels before the accident. How? Japan has made significant gains in energy efficiency and solar power. It turns out that relying on nuclear energy is actually a bad strategy for combating climate change: One accident wiped out Japan’s carbon gains. Only a turn to renewables and conservation brought the country back on target. What about the United States? Nuclear accounts for about 19 percent of U.S. electricity production and most of our carbon-free electricity. Could reactors be phased out here without increasing carbon emissions? If it were completely up to the free market, the answer would be yes, because nuclear is more expensive than almost any other source of electricity today. Renewables such as solar, wind and hydroelectric power generate electricity for less than the nuclear plants under construction in Georgia, and in most places, they produce cheaper electricity than existing nuclear plants that have paid off all their construction costs. In 2016, observing these trends, I launched a company devoted to building offshore wind turbines. My journey, from admiring nuclear power to fearing it, was complete: This tech is no longer a viable strategy for dealing with climate change, nor is it a competitive source of power. It is hazardous, expensive and unreliable, and abandoning it wouldn’t bring on climate doom. The real choice now is between saving the planet and saving the dying nuclear industry. I vote for the planet.

#### Warming causes Extinction

Kareiva 18, Peter, and Valerie Carranza. "Existential risk due to ecosystem collapse: Nature strikes back." Futures 102 (2018): 39-50. (Ph.D. in ecology and applied mathematics from Cornell University, director of the Institute of the Environment and Sustainability at UCLA, Pritzker Distinguished Professor in Environment & Sustainability at UCLA)

In summary, six of the nine proposed planetary boundaries (phosphorous, nitrogen, biodiversity, land use, atmospheric aerosol loading, and chemical pollution) are unlikely to be associated with existential risks. They all correspond to a degraded environment, but in our assessment do not represent existential risks. However, the three remaining boundaries (**climate change**, global **freshwater** cycle, **and** ocean **acidification**) do **pose existential risks**. This is **because of** intrinsic **positive feedback loops**, substantial lag times between system change and experiencing the consequences of that change, and the fact these different boundaries interact with one another in ways that yield surprises. In addition, climate, freshwater, and ocean acidification are all **directly connected to** the provision of **food and water**, and **shortages** of food and water can **create conflict** and social unrest. Climate change has a long history of disrupting civilizations and sometimes precipitating the collapse of cultures or mass emigrations (McMichael, 2017). For example, the 12th century drought in the North American Southwest is held responsible for the collapse of the Anasazi pueblo culture. More recently, the infamous potato famine of 1846–1849 and the large migration of Irish to the U.S. can be traced to a combination of factors, one of which was climate. Specifically, 1846 was an unusually warm and moist year in Ireland, providing the climatic conditions favorable to the fungus that caused the potato blight. As is so often the case, poor government had a role as well—as the British government forbade the import of grains from outside Britain (imports that could have helped to redress the ravaged potato yields). Climate change intersects with freshwater resources because it is expected to exacerbate drought and water scarcity, as well as flooding. Climate change can even impair water quality because it is associated with heavy rains that overwhelm sewage treatment facilities, or because it results in higher concentrations of pollutants in groundwater as a result of enhanced evaporation and reduced groundwater recharge. **Ample clean water** is not a luxury—it **is essential for human survival**. Consequently, cities, regions and nations that lack clean freshwater are vulnerable to social disruption and disease. Finally, ocean acidification is linked to climate change because it is driven by CO2 emissions just as global warming is. With close to 20% of the world’s protein coming from oceans (FAO, 2016), the potential for severe impacts due to acidification is obvious. Less obvious, but perhaps more insidious, is the interaction between climate change and the loss of oyster and coral reefs due to acidification. Acidification is known to interfere with oyster reef building and coral reefs. Climate change also increases storm frequency and severity. Coral reefs and oyster reefs provide protection from storm surge because they reduce wave energy (Spalding et al., 2014). If these reefs are lost due to acidification at the same time as storms become more severe and sea level rises, coastal communities will be exposed to unprecedented storm surge—and may be ravaged by recurrent storms. A key feature of the risk associated with climate change is that mean annual temperature and mean annual rainfall are not the variables of interest. Rather it is extreme episodic events that place nations and entire regions of the world at risk. These extreme events are by definition “rare” (once every hundred years), and changes in their likelihood are challenging to detect because of their rarity, but are exactly the manifestations of climate change that we must get better at anticipating (Diffenbaugh et al., 2017). Society will have a hard time responding to shorter intervals between rare extreme events because in the lifespan of an individual human, a person might experience as few as two or three extreme events. How likely is it that you would notice a change in the interval between events that are separated by decades, especially given that the interval is not regular but varies stochastically? A concrete example of this dilemma can be found in the past and expected future changes in storm-related flooding of New York City. The highly disruptive flooding of New York City associated with Hurricane Sandy represented a flood height that occurred once every 500 years in the 18th century, and that occurs now once every 25 years, but is expected to occur once every 5 years by 2050 (Garner et al., 2017). This change in frequency of extreme floods has profound implications for the measures New York City should take to protect its infrastructure and its population, yet because of the stochastic nature of such events, this shift in flood frequency is an elevated risk that will go unnoticed by most people. 4. The combination of positive feedback loops and societal inertia is fertile ground for global environmental catastrophes **Humans** are remarkably ingenious, and **have adapted** to crises **throughout** their **history**. Our doom has been repeatedly predicted, only to be averted by innovation (Ridley, 2011). **However**, the many **stories** **of** human ingenuity **successfully** **addressing** **existential risks** such as global famine or extreme air pollution **represent** environmental c**hallenges that are** largely **linear**, have immediate consequences, **and operate without positive feedbacks**. For example, the fact that food is in short supply does not increase the rate at which humans consume food—thereby increasing the shortage. Similarly, massive air pollution episodes such as the London fog of 1952 that killed 12,000 people did not make future air pollution events more likely. In fact it was just the opposite—the London fog sent such a clear message that Britain quickly enacted pollution control measures (Stradling, 2016). Food shortages, air pollution, water pollution, etc. send immediate signals to society of harm, which then trigger a negative feedback of society seeking to reduce the harm. In contrast, today’s great environmental crisis of climate change may cause some harm but there are generally long time delays between rising CO2 concentrations and damage to humans. The consequence of these delays are an absence of urgency; thus although 70% of Americans believe global warming is happening, only 40% think it will harm them (http://climatecommunication.yale.edu/visualizations-data/ycom-us-2016/). Secondly, unlike past environmental challenges, **the Earth’s climate system is rife with positive feedback loops**. In particular, as CO2 increases and the climate warms, that **very warming can cause more CO2 release** which further increases global warming, and then more CO2, and so on. Table 2 summarizes the best documented positive feedback loops for the Earth’s climate system. These feedbacks can be neatly categorized into carbon cycle, biogeochemical, biogeophysical, cloud, ice-albedo, and water vapor feedbacks. As important as it is to understand these feedbacks individually, it is even more essential to study the interactive nature of these feedbacks. Modeling studies show that when interactions among feedback loops are included, uncertainty increases dramatically and there is a heightened potential for perturbations to be magnified (e.g., Cox, Betts, Jones, Spall, & Totterdell, 2000; Hajima, Tachiiri, Ito, & Kawamiya, 2014; Knutti & Rugenstein, 2015; Rosenfeld, Sherwood, Wood, & Donner, 2014). This produces a wide range of future scenarios. Positive feedbacks in the carbon cycle involves the enhancement of future carbon contributions to the atmosphere due to some initial increase in atmospheric CO2. This happens because as CO2 accumulates, it reduces the efficiency in which oceans and terrestrial ecosystems sequester carbon, which in return feeds back to exacerbate climate change (Friedlingstein et al., 2001). Warming can also increase the rate at which organic matter decays and carbon is released into the atmosphere, thereby causing more warming (Melillo et al., 2017). Increases in food shortages and lack of water is also of major concern when biogeophysical feedback mechanisms perpetuate drought conditions. The underlying mechanism here is that losses in vegetation increases the surface albedo, which suppresses rainfall, and thus enhances future vegetation loss and more suppression of rainfall—thereby initiating or prolonging a drought (Chamey, Stone, & Quirk, 1975). To top it off, overgrazing depletes the soil, leading to augmented vegetation loss (Anderies, Janssen, & Walker, 2002). Climate change often also increases the risk of forest fires, as a result of higher temperatures and persistent drought conditions. The expectation is that **forest fires will become more frequent** and severe with climate warming and drought (Scholze, Knorr, Arnell, & Prentice, 2006), a trend for which we have already seen evidence (Allen et al., 2010). Tragically, the increased severity and risk of Southern California wildfires recently predicted by climate scientists (Jin et al., 2015), was realized in December 2017, with the largest fire in the history of California (the “Thomas fire” that burned 282,000 acres, https://www.vox.com/2017/12/27/16822180/thomas-fire-california-largest-wildfire). This **catastrophic fire** embodies the sorts of positive feedbacks and interacting factors that **could catch humanity off-guard and produce a** true **apocalyptic event.** Record-breaking rains produced an extraordinary flush of new vegetation, that then dried out as record heat waves and dry conditions took hold, coupled with stronger than normal winds, and ignition. Of course the record-fire released CO2 into the atmosphere, thereby contributing to future warming. Out of all types of feedbacks, water vapor and the ice-albedo feedbacks are the most clearly understood mechanisms. Losses in reflective snow and ice cover drive up surface temperatures, leading to even more melting of snow and ice cover—this is known as the ice-albedo feedback (Curry, Schramm, & Ebert, 1995). As snow and ice continue to melt at a more rapid pace, millions of people may be displaced by flooding risks as a consequence of sea level rise near coastal communities (Biermann & Boas, 2010; Myers, 2002; Nicholls et al., 2011). The water vapor feedback operates when warmer atmospheric conditions strengthen the saturation vapor pressure, which creates a warming effect given water vapor’s strong greenhouse gas properties (Manabe & Wetherald, 1967). Global warming tends to increase cloud formation because warmer temperatures lead to more evaporation of water into the atmosphere, and warmer temperature also allows the atmosphere to hold more water. The key question is whether this increase in clouds associated with global warming will result in a positive feedback loop (more warming) or a negative feedback loop (less warming). For decades, scientists have sought to answer this question and understand the net role clouds play in future climate projections (Schneider et al., 2017). Clouds are complex because they both have a cooling (reflecting incoming solar radiation) and warming (absorbing incoming solar radiation) effect (Lashof, DeAngelo, Saleska, & Harte, 1997). The type of cloud, altitude, and optical properties combine to determine how these countervailing effects balance out. Although still under debate, it appears that in most circumstances the cloud feedback is likely positive (Boucher et al., 2013). For example, models and observations show that increasing greenhouse gas concentrations reduces the low-level cloud fraction in the Northeast Pacific at decadal time scales. This then has a positive feedback effect and enhances climate warming since less solar radiation is reflected by the atmosphere (Clement, Burgman, & Norris, 2009). The key lesson from the long list of potentially positive feedbacks and their interactions is that **runaway climate change,** and runaway perturbations have to be taken as a serious possibility. Table 2 is just a snapshot of the type of feedbacks that have been identified (see Supplementary material for a more thorough explanation of positive feedback loops). However, this list is not exhaustive and the possibility of undiscovered positive feedbacks **portends** even greater **existential risks**. The many environmental crises humankind has previously averted (famine, ozone depletion, London fog, water pollution, etc.) were averted because of political will based on solid scientific understanding. We cannot count on complete scientific understanding when it comes to positive feedback loops and climate change.

#### Nuclear Proliferation causes Nuclear War.

Kroenig 15 (Matthew Kroenig; Associate Professor and International Relations Field Chair in the Department of Government and School of Foreign Service at Georgetown University; 2015, “The History of Proliferation Optimism: Does It Have a Future?”; *Journal of Strategic Studies*, Volume 38, Issue 1-2)

The spread of nuclear weapons poses at least six severe threats to international peace and security including: nuclear war, nuclear terrorism, global and regional instability, constrained US freedom of action, weakened alliances, and further nuclear proliferation. Each of these threats has received extensive treatment elsewhere and this review is not intended to replicate or even necessarily to improve upon these previous efforts. Rather the goals of this section are more modest: to usefully bring together and recap the many reasons why we should be pessimistic about the likely consequences of nuclear proliferation. Many of these threats will be illuminated with a discussion of a case of much contemporary concern: Iran’s advanced nuclear program. Nuclear War The greatest threat posed by the spread of nuclear weapons is nuclear war. The more states in possession of nuclear weapons, the greater the probability that somewhere, someday, there will be a catastrophic nuclear war. To date, nuclear weapons have only been used in warfare once. In 1945, the United States used nuclear weapons on Hiroshima and Nagasaki, bringing World War II to a close. Many analysts point to the 65-plus-year tradition of nuclear non-use as evidence that nuclear weapons are unusable, but it would be naïve to think that nuclear weapons will never be used again simply because they have not been used for some time. After all, analysts in the 1990s argued that worldwide economic downturns like the Great Depression were a thing of the past, only to be surprised by the dot-com bubble bursting later in the decade and the Great Recession of the late 2000s.48 This author, for one, would be surprised if nuclear weapons are not used again sometime in his lifetime. Before reaching a state of MAD, new nuclear states go through a transition period in which they lack a secure-second strike capability. In this context, one or both states might believe that it has an incentive to use nuclear weapons first. For example, if Iran acquires nuclear weapons, neither Iran, nor its nuclear-armed rival, Israel, will have a secure, second-strike capability. Even though it is believed to have a large arsenal, given its small size and lack of strategic depth, Israel might not be confident that it could absorb a nuclear strike and respond with a devastating counterstrike. Similarly, Iran might eventually be able to build a large and survivable nuclear arsenal, but, when it first crosses the nuclear threshold, Tehran will have a small and vulnerable nuclear force. In these pre-MAD situations, there are at least three ways that nuclear war could occur. First, the state with the nuclear advantage might believe it has a splendid first strike capability. In a crisis, Israel might, therefore, decide to launch a preventive nuclear strike to disarm Iran’s nuclear capabilities. Indeed, this incentive might be further increased by Israel’s aggressive strategic culture that emphasizes preemptive action. Second, the state with a small and vulnerable nuclear arsenal, in this case Iran, might feel use them or lose them pressures. That is, in a crisis, Iran might decide to strike first rather than risk having its entire nuclear arsenal destroyed. Third, as Thomas Schelling has argued, nuclear war could result due to the reciprocal fear of surprise attack.49 If there are advantages to striking first, one state might start a nuclear war in the belief that war is inevitable and that it would be better to go first than to go second. Fortunately, there is no historic evidence of this dynamic occurring in a nuclear context, but it is still possible. In an Israeli–Iranian crisis, for example, Israel and Iran might both prefer to avoid a nuclear war, but decide to strike first rather than suffer a devastating first attack from an opponent. Even in a world of MAD, however, when both sides have secure, second-strike capabilities, there is still a risk of nuclear war. Rational deterrence theory assumes nuclear-armed states are governed by rational leaders who would not intentionally launch a suicidal nuclear war. This assumption appears to have applied to past and current nuclear powers, but there is no guarantee that it will continue to hold in the future. Iran’s theocratic government, despite its inflammatory rhetoric, has followed a fairly pragmatic foreign policy since 1979, but it contains leaders who hold millenarian religious worldviews and could one day ascend to power. We cannot rule out the possibility that, as nuclear weapons continue to spread, some leader somewhere will choose to launch a nuclear war, knowing full well that it could result in self-destruction. One does not need to resort to irrationality, however, to imagine nuclear war under MAD. Nuclear weapons may deter leaders from intentionally launching full-scale wars, but they do not mean the end of international politics. As was discussed above, nuclear-armed states still have conflicts of interest and leaders still seek to coerce nuclear-armed adversaries. Leaders might, therefore, choose to launch a limited nuclear war.50 This strategy might be especially attractive to states in a position of conventional inferiority that might have an incentive to escalate a crisis quickly to the nuclear level. During the Cold War, the United States planned to use nuclear weapons first to stop a Soviet invasion of Western Europe given NATO’s conventional inferiority.51 As Russia’s conventional power has deteriorated since the end of the Cold War, Moscow has come to rely more heavily on nuclear weapons in its military doctrine. Indeed, Russian strategy calls for the use of nuclear weapons early in a conflict (something that most Western strategists would consider to be escalatory) as a way to de-escalate a crisis. Similarly, Pakistan’s military plans for nuclear use in the event of an invasion from conventionally stronger India. And finally, Chinese generals openly talk about the possibility of nuclear use against a US superpower in a possible East Asia contingency. Second, as was also discussed above, leaders can make a ‘threat that leaves something to chance’.52 They can initiate a nuclear crisis. By playing these risky games of nuclear brinkmanship, states can increase the risk of nuclear war in an attempt to force a less resolved adversary to back down. Historical crises have not resulted in nuclear war, but many of them, including the 1962 Cuban Missile Crisis, have come close. And scholars have documented historical incidents when accidents nearly led to war.53 When we think about future nuclear crisis dyads, such as Iran and Israel, with fewer sources of stability than existed during the Cold War, we can see that there is a real risk that a future crisis could result in a devastating nuclear exchange. Nuclear Terrorism The spread of nuclear weapons also increases the risk of nuclear terrorism.54 While September 11th was one of the greatest tragedies in American history, it would have been much worse had Osama Bin Laden possessed nuclear weapons. Bin Laden declared it a ‘religious duty’ for Al- Qa’eda to acquire nuclear weapons and radical clerics have issued fatwas declaring it permissible to use nuclear weapons in Jihad against the West.55 Unlike states, which can be more easily deterred, there is little doubt that if terrorists acquired nuclear weapons, they would use them.56 Indeed, in recent years, many US politicians and security analysts have argued that nuclear terrorism poses the greatest threat to US national security.57 Analysts have pointed out the tremendous hurdles that terrorists would have to overcome in order to acquire nuclear weapons.58 Nevertheless, as nuclear weapons spread, the possibility that they will eventually fall into terrorist hands increases. States could intentionally transfer nuclear weapons, or the fissile material required to build them, to terrorist groups. There are good reasons why a state might be reluctant to transfer nuclear weapons to terrorists, but, as nuclear weapons spread, the probability that a leader might someday purposely arm a terrorist group increases. Some fear, for example, that Iran, with its close ties to Hamas and Hizballah, might be at a heightened risk of transferring nuclear weapons to terrorists. Moreover, even if no state would ever intentionally transfer nuclear capabilities to terrorists, a new nuclear state, with underdeveloped security procedures, might be vulnerable to theft, allowing terrorist groups or corrupt or ideologically-motivated insiders to transfer dangerous material to terrorists. There is evidence, for example, that representatives from Pakistan’s atomic energy establishment met with Al-Qa’eda members to discuss a possible nuclear deal.59 Finally, a nuclear-armed state could collapse, resulting in a breakdown of law and order and a loose nukes problem. US officials are currently very concerned about what would happen to Pakistan’s nuclear weapons if the government were to fall. As nuclear weapons spread, this problem is only further amplified. Iran is a country with a history of revolutions and a government with a tenuous hold on power. The regime change that Washington has long dreamed about in Tehran could actually become a nightmare if a nuclear-armed Iran suffered a breakdown in authority, forcing us to worry about the fate of Iran’s nuclear arsenal. Regional Instability The spread of nuclear weapons also emboldens nuclear powers, contributing to regional instability. States that lack nuclear weapons need to fear direct military attack from other states, but states with nuclear weapons can be confident that they can deter an intentional military attack, giving them an incentive to be more aggressive in the conduct of their foreign policy. In this way, nuclear weapons provide a shield under which states can feel free to engage in lower-level aggression. Indeed, international relations theories about the ‘stability-instability paradox’ maintain that stability at the nuclear level contributes to conventional instability.60 Historically, we have seen that the spread of nuclear weapons has emboldened their possessors and contributed to regional instability. Recent scholarly analyses have demonstrated that, after controlling for other relevant factors, nuclear-weapon states are more likely to engage in conflict than nonnuclear-weapon states and that this aggressiveness is more pronounced in new nuclear states that have less experience with nuclear diplomacy.61 Similarly, research on internal decision-making in Pakistan reveals that Pakistani foreign policymakers may have been emboldened by the acquisition of nuclear weapons, which encouraged them to initiate militarized disputes against India.62 Currently, Iran restrains its foreign policy because it fears major military retaliation from the United States or Israel, but with nuclear weapons it could feel free to push harder. A nuclear-armed Iran would likely step up support to terrorist and proxy groups and engage in more aggressive coercive diplomacy. With a nuclear-armed Iran increasingly throwing its weight around in the region, we could witness an even more crisis prone Middle East. And in a poly-nuclear Middle East with Israel, Iran, and, in the future, possibly other states, armed with nuclear weapons, any one of those crises could result in a catastrophic nuclear exchange.

#### Power plants uniquely increase the risk of water shortages

Smith 15 [Allen Smith, Allen Smith holds a J.D. from Vermont Law School, with dual Land Use and Climate Law Certificates. He has also served as a board fellow with the Stowe Land Trust, and was heavily involved with the Food & Agriculture Law Society, where he was a 3L Senator., 6-30-2015, accessed on 7-19-2022, Vermont Journal of Environmental Law, "Nuclear Energy and Drought: A Recipe for Disaster", https://vjel.vermontlaw.edu/nuclear-energy-and-drought-a-recipe-for-disaster mimou]

A proposed nuclear facility in Green River, UT would have consumed about 53,000 acre feet of water annually from the Green River (a valuable tributary to the severely depleted Colorado River) to cool its reactors and [generate steam to power its turbines](http://insideclimatenews.org/news/20120417/nuclear-power-plant-utah-blue-castle-green-river-colorado-river-water-war-sec-climate-change-drought). That’s enough water to supply 200,000 people a year, roughly the size of Tacoma, WA. When thinking about the scarcity of available freshwater in the world and the increased drought-like conditions in many parts of the country, those numbers add up to major impacts not just to our economy, but our survival. Just look at the increasing amount of tension and war-like conditions currently developing between local communities and their government over water supply in politically unstable areas such as the Middle East.

The Southwest Nuclear Project Electric Generating Station (SNPEGS) near Bay City, TX is right along the Colorado River and uses water from the river to power each unit and cool the reactors. Two proposed additional units in 2010 were turned down due to [financial constraints](http://www.dallasnews.com/business/energy/20110419-nrg-ends-project-to-build-new-nuclear-reactors.ece). The proposed project would have piped tens of thousands acre-feet of water each year from the Colorado River, [decreasing the amount of fresh water remaining in the river](https://www.google.com/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8#q=www.nukefree.org%20south%20texas%20nuclear%20plant). Given that a number of other interests had previously gained access to the Colorado River and aggressively used up the water, the ecological effect would have been devastating. Though SNPEGS does not directly discharge wastewater into the Colorado River, wastewater discharge and the effect on water quality remains an issue in many other regions throughout the US, and is especially problematic in fragile, drought-prone areas. The combination of drought-depleted rivers and the negative effect on water quality makes the outlook on future water security extremely bleak.

Image credit to cleantechnica.com

In 2006, the Department of Energy warned that consumption of water for electricity production could more than double by 2030 to 7.3 billion gallons per day in the US if developers continue to build new power plants with evaporative cooling, an amount [equal to the entire country’s water consumption for 1995](http://scholarship.law.wm.edu/cgi/viewcontent.cgi?article=1040&context=wmelpr). The three stages of nuclear fuel cycle—uranium milling and mining, plant operation, and nuclear waste storage—all consume, withdraw, and contaminate water supplies. Due to this large need for water resources, most nuclear facilities cannot even operate during drought conditions, and in some cases can actually cause water shortages.

The reality around nuclear energy and water should cause both consumers and producers to take caution around expanding nuclear energy or relying on it as a “clean” form of energy in drought-prone regions like the American Southwest, California, and Texas, especially when rivers are at high risk of being drained of their remaining water. The impact of climate change will only worsen drought and stress on water resources and create more tension throughout the world. Thus, if the other environmental costs of nuclear don’t dissuade people enough from using it as a “clean energy alternative,” the cumulative effect on water security should tip the scales against expanding this form of energy in the U.S.

#### Conflicts coming over water scarcity---extinction

Daniel Darling 19, senior international military markets analyst at Forecast International Incorporated, an aerospace and defense consulting firm located in Newtown, Connecticut, where he covers the Europe and Asia-Pacific markets, “The Coming Wars over Water,” The National Interest, 4/14/19, https://nationalinterest.org/blog/buzz/coming-wars-over-water-52147

But another looming issue confronting global leaders involves the earth’s most precious resource: water. In many regions of the globe—from Northern Africa to the Middle East to Central and South Asia—efforts to manage internal freshwater supplies or conserve transboundary water agreements are under strain as scarcity rises in parallel with population growth, consumption and warming temperatures. A World Bank study on the global water picture in 2016 noted that entire regions may see their gross domestic product decline by up to 6 percent by 2050 due to water-related losses in agriculture, health, income and property. The areas highlighted consist of many of the world’s largest population concentrations, regions with developing economies, intensive and unsustainable agricultural practices and high occurrences of drought. Dam-building and its downstream effects across national borders—as in the case of Ethiopia’s Grand Ethiopian Renaissance Dam and China’s water diversion project from the Yarlung Tsangpo River in southern Tibet—threaten to escalate tensions or redefine national claims over disputed regions. Such disputes could mushroom across the globe in the face of broader demographic and resource shifts. According to the Pacific Institute’s water conflict chronology database, eighteen water-related incidents occurred in 2018 alone, ranging from violence erupting at protests over water management to outright fighting between competing communities over access to water and herding rights. These incidents appear destined to become more a norm than an outlier as water resources are consumed faster than rainfall replenishment in some areas and limitations exacerbate longstanding tensions, be they ethnic, tribal or national-based. Delicate tradeoff systems between nations located upstream and downstream of major rivers threaten to be undone by disruptions, as in the case of Central Asian countries sharing parts of the Fergana Valley. In addition, scarcity issues may create internal security pressures by leading to radicalization amongst vulnerable population sectors. With water a vital and finite resource, the world’s industrialized nations are naturally protective of local supply and place a premium on water security in instances where water flows across shared borders. When mixed with political disputes or rivalries, resource pressures may act as a catalyst for armed conflict. Wars over water resources are not without precedent. The Six-Day War of 1967, for instance, was in part an Israeli military response to a Syrian attempt to dam the Yarmuk River, a tributary of the Jordan River, a crucial water source for Israel. Another potential flashpoint exists in one of the world’s most tense arenas: the border between India and Pakistan. There the potential repudiation of a water-sharing agreement brokered by the World Bank in 1960, the Indus Waters Treaty, would serve to further damage relations between Pakistan and India, potentially sending the two rivals spiraling into a conflict that might draw in other nations. The treaty remains in place despite two wars conducted over that time between the neighboring rivals. This is a credit to the cornerstone of the agreement: the rational self-interest of both signatories. With water at a premium for both, any war over it would threaten the supply of each actor, thus ostensibly negating the pretense for armed conflict. But with Pakistan facing declining water availability and blaming its situation on India's “water terrorism,” the potential for crisis increases. India, which plans for a presumptive “collusive threat” on both its northeast and northwest borders from China and Pakistan, must tread carefully in order to avoid reciprocity from Beijing should the latter turn its back on water rationality. While India holds an upstream riparian advantage over Pakistan in regards to the Sutlej, Beas and Ravi Rivers, so too does China as it relates to major rivers flowing into India from Tibet. Considering Pakistan’s water vulnerability—which involves exploding population growth, poor water utilization and infrastructure maintenance, and unsustainable usage patterns—any threat by India to abrogate the treaty or maximize its use of water from any of the rivers covered under the IWT would be seen by Islamabad as tantamount to an act of war. Factor in Pakistan’s strategic alignment with China and any outbreak of conflict might draw Beijing into the scrum, thereby resulting in India confronting the two-front war its planners most fear. Under this scenario, in which three nuclear-armed nations conduct military operations at some level of intensity, the rest of the world would be left scrambling to mediate the crisis at zero hour.

### 2NC---Meltdowns Solve

#### Wave of nuclear power coming now but a major meltdown can halt progress

Rapier 22 [Robert Rapier, Robert Rapier is a chemical engineer in the energy industry. , 2-13-2022, accessed on 7-20-2022, Forbes, "Nuclear Power’s Future Is Looking Brighter", https://www.forbes.com/sites/rrapier/2022/02/13/nuclear-powers-future-is-looking-brighter/?sh=433295af2f0d mimou]

France [recently announced](https://www.theguardian.com/world/2022/feb/10/france-to-build-up-to-14-new-nuclear-reactors-by-2050-says-macron) it would build up to 14 new nuclear reactors by 2050. This marked a policy reversal, as President Emmanuel Macron had promised four years ago to move away from nuclear power and close 12 nuclear reactors. But the country got a reality check this winter when some of its nuclear power plants went offline, and it was forced to turn to coal as a result.

France will construct six new nuclear reactors, and study the possibility of an additional eight. "Given the electricity needs, the need to also anticipate the transition and the end of the existing fleet, which cannot be extended indefinitely, we are going to launch today a program of new nuclear reactors," Macron said.

But the vast majority of new nuclear power construction over the next five years will take place in the Asia Pacific region. This is important, because this is the area of the fastest growth in carbon dioxide emissions.

China, already a major nuclear power, has nearly [20 new nuclear reactors](https://world-nuclear.org/information-library/current-and-future-generation/plans-for-new-reactors-worldwide.aspx) that will be under construction within the next five years. India, which is one of the world’s largest and fastest-growing energy consumers, isn’t yet a major nuclear power producer. However, with eight new nuclear reactors that will commence construction by 2027, it is making a firm commitment toward becoming one.

More nuclear power in China and India could help supply growing energy demands without a continued explosion in the region’s carbon dioxide emissions. In fact, it may be the only solution that can reasonably achieve this objective.

In the U.S. — the world’s largest nuclear power producer — nuclear power generation has been flat for the past two decades. But that should change this year with the commissioning of Southern’s Vogtle Units 3 and 4. These will be the first new nuclear units built in the United States in more than three decades.

There are admittedly still a lot of headwinds for the industry in the wake of previous nuclear disasters like Chernobyl in 1986 and the 2011 Fukushima nuclear disaster. Another major disaster has to be avoided, because it would be a huge setback for this critical tool for producing firm, scalable power with a low carbon footprint.

But, with the current slate of nuclear plants under construction, there is at least some hope that nuclear is regaining acceptance, and can make a growing contribution toward arresting the growth of global carbon emissions.

#### Margin for error is razor thin – even the smallest accident will take down the industry

Stevens 22 [Harry Stevens, Harry Stevens is a graphics reporter at The Washington Post. He was part of a team at The Post that won the 2020 Pulitzer Prize for Explanatory Reporting, 4-28-2022, accessed on 7-20-2022, The Washington Post, "Who's afraid of elemental power?", https://www.washingtonpost.com/business/interactive/2022/nuclear-power-fear/ mimou]

Wang believes we are at the dawn of a new atomic age. Just last week, the Biden administration [pledged $6 billion](https://archive.ph/o/Nx8E7/https:/www.washingtonpost.com/business/2022/04/19/biden-administration-launches-6-billion-nuclear-plant-bailout/?itid=lk_inline_enhanced-template) to save financially strapped nuclear power plants, framing the decision as a part of the administration’s strategy to fight climate change. [China](https://archive.ph/o/Nx8E7/https:/www.world-nuclear.org/information-library/country-profiles/countries-a-f/china-nuclear-power.aspx?itid=lk_inline_enhanced-template) and [Russia](https://archive.ph/o/Nx8E7/https:/world-nuclear.org/information-library/country-profiles/countries-o-s/russia-nuclear-power.aspx?itid=lk_inline_enhanced-template) are building new reactors, and [Britain is funding small modular reactors](https://archive.ph/o/Nx8E7/https:/www.reuters.com/business/sustainable-business/britain-commits-283-mln-rolls-royce-small-nuclear-reactors-2021-11-08/?itid=lk_inline_enhanced-template) as it struggles to eliminate carbon emissions. Even France, which already gets about two-thirds of its electricity from nuclear plants, is [planning a “rebirth”](https://archive.ph/o/Nx8E7/https:/www.france24.com/en/europe/20220210-announcing-new-reactors-macron-puts-nuclear-power-at-heart-of-carbon-neutral-push?itid=lk_inline_enhanced-template)of its nuclear industry.

But even if the world eventually embraces nuclear power, the margin for error will be razor thin. When a coal mine collapses or a natural gas pipeline leaks, the public ignores it or quickly moves on. But if anything goes wrong with a nuclear reactor, no matter how minimal the damage, nuclear fear will reignite, with severe consequences for the industry.

[Much has been made](https://archive.ph/o/Nx8E7/https:/www.washingtonpost.com/world/2022/03/31/nuclear-power-plant-ukraine-danger/?itid=lk_inline_enhanced-template) in recent weeks of Ukraine’s 15 nuclear reactors, eight of which remain active. Even in a war zone, these reactors pose little risk. Their containment structures are built to withstand a plane crash and to seal in radioactive gases, should they somehow lose power.

“Even in a worst-case scenario, there would be no release of radiation to the public,” according to [a report from the Breakthrough Institute](https://archive.ph/o/Nx8E7/https:/thebreakthrough.org/issues/energy/faq-ukraine-nuclear-power-plants?itid=lk_inline_enhanced-template), the think tank focused on technological solutions to environmental problems where Wang has worked since 2019. Still, the very existence of Ukraine’s nuclear power plants engenders fearful memories of the catastrophe at Chernobyl, even though the somewhat ill-conceived graphite-moderated nuclear reactor that melted down in 1986 bears little similarity to the pressurized-water reactors currently operating in Ukraine.

#### Even near misses halt the industry for years

Bukszpan 14 [Daniel Bukszpan, Daniel Bukszpan is a freelance writer for CNBC.com, 01-29-2014, accessed on 7-18-2022, CNBC, "11 Nuclear Meltdowns and Disasters", https://www.cnbc.com/2011/03/16/11-Nuclear-Meltdowns-and-Disasters.html mimou]

The worst nuclear accident in U.S. history took place on March 28, 1979 at the Three Mile Island plant in Pennsylvania. A cooling system failed, causing a partial meltdown, but a full meltdown was averted and there were no fatalities. However, despite the positive outcome and despite the passage of more than 30 years, the incident remains fresh in the minds of those who are old enough to remember it.  
  
The effect of the accident on the U.S. nuclear power industry was major. The meltdown gave many Americans second thoughts about the risks of using nuclear power, and the construction of new reactors, which had been steadily increasing since the 1960s, slowed substantially. Over 50 nuclear plant construction projects were cancelled in just four years, and the number of ongoing projects declined from 1980 until 1998.

#### Meltdowns cause a shift away from nuclear into wind and solar – find better card

Paillere and Donovan 21 [Henri Paillere and Jeffrey Donovan, IAEA Department of Nuclear Energy, 3-11-2021, accessed on 7-18-2022, Iaea, "Nuclear Power 10 Years After Fukushima: The Long Road Back", https://www.iaea.org/newscenter/news/nuclear-power-10-years-after-fukushima-the-long-road-back mimou]

Following efforts to strengthen nuclear safety and with global warming becoming ever more apparent, nuclear power is regaining a place in global debates as a climate-friendly energy option. That is due to its vital attributes: zero emissions during operation, 24/7 availability, a small land footprint and the versatility to decarbonize [‘hard-to-abate’ sectors](https://www.iaea.org/fr/newscenter/news/iaea-data-animation-the-game-changing-power-of-nuclear-energy-to-reduce-greenhouse-gas-emissions) in industry and transportation. But even as technology-neutral organizations such as the Intergovernmental Panel on Climate Change (IPCC) and the International Energy Agency (IEA) recognize nuclear power’s ability to address major global challenges, the extent to which this clean, reliable and sustainable source of energy will achieve its full potential remains uncertain.

The Fukushima Daiichi accident and public acceptance in some countries continue to cast a shadow over nuclear power’s prospects. Furthermore, in some major markets, nuclear power lacks a favourable policy and [financing](https://www.iaea.org/sites/default/files/18/07/financing-np-0418.pdf) framework that recognize its contributions to climate change mitigation and sustainable development. Without such a framework, nuclear power will struggle to deliver on its full potential, even as the world remains as dependent on fossil fuels as it was three decades ago.

Impact on electricity generation

The biggest immediate blow to nuclear electricity generation came in Japan. With public confidence in nuclear power at record low levels following the accident, authorities suspended operations at 46 of the country’s 50 operational power reactors. Nuclear energy, a strategic priority since the 1960s, supplying almost a third of Japan’s electricity, was suddenly shelved. In 2019, nuclear power provided only 7.5% of Japan’s electricity. Just nine nuclear power reactors have resumed operation.

Meanwhile, public and government opinion turned against nuclear power in some other countries as well. Germany, less than three months after the accident, decided to phase out nuclear power entirely by 2022. All but six of the country’s 17 power reactors have since been permanently shut down. Nuclear power produced about 12% of the country’s electricity in 2019 compared with around 25% before the accident at Fukushima Daiichi, while coal-fired plants remained the largest source of electricity, according to the IEA. Elsewhere, Belgium confirmed plans to exit nuclear power by 2025. In Italy, a government-backed plan to bring back nuclear power, shuttered since 1990, fizzled. And countries such as Spain and Switzerland decided not to build new nuclear plants. Between 2011 and 2020, some 48 GWe of nuclear capacity was lost globally as a total of 65 reactors were either shut down or did not have their operational lifetimes extended.

The immediate effect was a decline in global nuclear electricity generation through 2012. At the same time, efforts to deploy other low carbon sources, such as variable wind and solar, intensified as countries looked for new ways to address the climate crisis. Still, nuclear energy remained the world’s second largest source of low carbon electricity after hydro, providing at the time about 40% of all low carbon power.

#### A single accident wipes out the global industry

**Koplow**, United Nations Environment Programme's Working Group on Economic Instruments, MBA – Harvard, and Vancko, project manager – nuclear/climate @ UCS, **‘11**

(Doug and Ellen, “Nuclear Power: Still Not Viable without Subsidies,” Union of Concerned Scientists, February)

Second, a single negative event can wipe out decades of gains. Although the risk of nuclear acci­dents in the United States is considered quite low, it is not zero.6 Plausible accident scenarios generate catastrophic damages, with corresponding levels of financial loss. This characteristic creates a large dis­connect between private interests (which highlight an absence of catastrophic damages thus far) and public interests (which must consider the damage that would be caused in the case of even a moder­ate accident, as well as the inadequacy of financial assurance mechanisms or insurance-related price signals to address the challenge).

Unlike car accidents, where one event generally has no impact on the perceived risk to unrelated drivers or auto companies, risks in the nuclear sector are systemic. An accident anywhere in the world will cause politicians and plant neighbors everywhere to reassess the risks they face and ques­tion whether the oversight and financial assurance are sufficient. Generally, the cost implications of such inquiries will be negative for reactor owners.

### 2NC---No Meltdowns Impact

More updated ev

#### No risk of existential meltdowns

Shatzkin 21 [Mike Shatzkin, Founder of the Idea Logical Company, 11-19-2021, accessed on 7-20-2022, OurEnergyPolicy, "No, nuclear power is not actually 'dangerous’ - OurEnergyPolicy", https://www.ourenergypolicy.org/no-nuclear-power-is-not-actually-dangerous/ mimou]

So, in the history of nuclear power in the Western world, covering a combined 19,000 years of operation experience from some 442 reactors in about 28 countries plus about 200 reactors that have been shut down temporarily or permanently, we have had two “incidents” that caused zero deaths and almost no measurable personal or environmental injury from radiation. The only real catastrophe that was “caused” by nuclear power took place in blatant disregard of safety protocols and a reactor prone to instability and illegal to be built anywhere today and ever in the West. Stunningly, more people would have died from the additional fossil fuel pollution had the Chernobyl plant, with a total generation of [271,261 GWh](https://de.nucleopedia.org/wiki/Kernkraftwerk_Tschernobyl), never been built: At [28.67 deaths per TWh of electricity from the alternative, coal](https://doi.org/10.1021/es3051197), the total number of lives saved is 7,777. This is in about seven decades of nuclear power generation. Our three exceptions notwithstanding, nuclear energy has produced an immense amount of energy for us in a sustainable and efficient manner, with virtually no health risks to humans and to the environment. So, why is nuclear energy still classified by many as “dangerous”?

We will now turn to where nuclear waste goes and why people incorrectly perceive it as dangerous.

Let’s start with this. Throughout the history of nuclear power, waste has been stored at the site of the plant in a [deep pool of water or in “dry casks.”](https://world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-waste/storage-and-disposal-of-radioactive-waste.aspx) This is true for hundreds of nuclear reactors across the globe. In that time, there have been no deaths, no injuries, and no disruptions of society caused by radiation leakage of any kind.

Nuclear skeptics have observed that this is not a “permanent” solution because the waste remains radioactive for many years. This is true. It is also true that:

The radioactivity of spent nuclear fuel (SNF) drops continuously, making it, like all nuclear waste, [less dangerous over time](https://world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-wastes/radioactive-wastes-myths-and-realities.aspx). Coming fresh out of a reactor, SNF is rich in fission products with a very short half-life. This means that much of the radioactivity happens in the first weeks, hours, or even seconds after a reactor has been shut off. Radioactive isotopes of Xenon and Iodine, for example, decay first, and give off quite a bit of radiation and heat. Cesium and Strontium isotopes dominate as radiation sources in the next phase, but after 300 years they are pretty much gone, too. (Note: each atom of a radioactive, or unstable, isotope can be “radioactive” only once, during its decay.) SNF contains other radioactive elements with half-lives of thousands of years, such as Plutonium and even heavier elements. But, due to their relative stability, they are also not very dangerous. Toxic, as heavy metals, yes, but not very radioactive. (Rule of thumb: Highly radioactive = gone quickly, and low radioactivity = sticking around for much longer.)

The radiation itself is easily stopped by shielding, though some gamma rays make it past any shielding. However, their destructive energy, already quite harmless on the outside of spent nuclear fuel containers, drops by the inverse square of the distance until finally absorbed by matter. What that means is that the “danger zone” around spent nuclear fuel is very small, measured in feet or yards, not miles.

#### No impact to nuclear meltdowns – emprics and safeguards

WNA 14 – World Nuclear Association, “Safety of Nuclear Power Reactors”; Responsible for 95% of the World's Nuclear Power Outside Of The U.S., As Well As The Vast Majority Of World Uranium, Conversion And Enrichment Production, April; <http://www.world-nuclear.org/info/safety-and-security/safety-of-plants/safety-of-nuclear-power-reactors/>; mbc

To achieve optimum safety, nuclear plants in the western world operate using a 'defence-in-depth' approach, with multiple safety systems supplementing the natural features of the reactor core. Key aspects of the approach are: high-quality design & construction, equipment which prevents operational disturbances or human failures and errors developing into problems, comprehensive monitoring and regular testing to detect equipment or operator failures, redundant and diverse systems to control damage to the fuel and prevent significant radioactive releases, provision to confine the effects of severe fuel damage (or any other problem) to the plant itself. These can be summed up as: Prevention, Monitoring, and Action (to mitigate consequences of failures).The safety provisions include a series of physical barriers between the radioactive reactor core and the environment, the provision of multiple safety systems, each with backup and designed to accommodate human error. Safety systems account for about one quarter of the capital cost of such reactors. As well as the physical aspects of safety, there are institutional aspects which are no less important - see following section on International Collaboration.The barriers in a typical plant are: the fuel is in the form of solid ceramic (UO2) pellets, and radioactive fission products remain largely bound inside these pellets as the fuel is burned. The pellets are packed inside sealed zirconium alloy tubes to form fuel rods. These are confined inside a large steel pressure vessel with walls up to 30 cm thick – the associated primary water cooling pipework is also substantial. All this, in turn, is enclosed inside a robust reinforced concrete containment structure with walls at least one metre thick. This amounts to three significant barriers around the fuel, which itself is stable up to very high temperatures.These barriers are monitored continually. The fuel cladding is monitored by measuring the amount of radioactivity in the cooling water. The high pressure cooling system is monitored by the leak rate of water, and the containment structure by periodically measuring the leak rate of air at about five times atmospheric pressure.Looked at functionally, the three basic safety functions in a nuclear reactor are: to control reactivity, to cool the fuel and to contain radioactive substances. The main safety features of most reactors are inherent - negative temperature coefficient and negative void coefficient. The first means that beyond an optimal level, as the temperature increases the efficiency of the reaction decreases (this in fact is used to control power levels in some new designs). The second means that if any steam has formed in the cooling water there is a decrease in moderating effect so that fewer neutrons are able to cause fission and the reaction slows down automatically. In the 1950s and 1960s some experimental reactors in Idaho were deliberately tested to destruction to verify that large reactivity excursions were self-limiting and would automatically shut down the fission reaction. These tests verified that this was the case. Beyond the control rods which are inserted to absorb neutrons and regulate the fission process, the main engineered safety provisions are the back-up emergency core cooling system (ECCS) to remove excess heat (though it is more to prevent damage to the plant than for public safety) and the containment. Traditional reactor safety systems are 'active' in the sense that they involve electrical or mechanical operation on command. Some engineered systems operate passively, eg pressure relief valves. Both require parallel redundant systems. Inherent or full passive safety design depends only on physical phenomena such as convection, gravity or resistance to high temperatures, not on functioning of engineered components. All reactors have some elements of inherent safety as mentioned above, but in some recent designs the passive or inherent features substitute for active systems in cooling etc. Such a design would have averted the Fukushima accident, where loss of electrical power resulted is loss of cooling function. The basis of design assumes a threat where due to accident or malign intent (eg terrorism) there is core melting and a breach of containment. This double possibility has been well studied and provides the basis of exclusion zones and contingency plans. Apparently during the Cold War neither Russia nor the USA targeted the other's nuclear power plants because the likely damage would be modest. Nuclear power plants are designed with sensors to shut them down automatically in an earthquake, and this is a vital consideration in many parts of the world. (See Nuclear Power Plants and Earthquakes paper) Severe accident management In both the Three Mile Island (TMI) and Fukushima accidents the problems started after the reactors were shut down – immediately at TMI and after an hour at Fukushima, when the tsunami arrived. The need to remove decay heat from the fuel was not met in each case, so core melting started to occur within a few hours. Cooling requires water circulation and an external heat sink. If pumps cannot run due to lack of power, gravity must be relied upon, but this will not get water into a pressurised system – either reactor pressure vessel or containment. Hence there is provision for relieving pressure, sometimes with a vent system, but this must work and be controlled without power. There is a question of filters or scrubbers in the vent system: these need to be such that they do not block due to solids being carried. Ideally any vent system should deal with any large amounts of hydrogen, as at Fukushima, and have minimum potential to spread radioactivity outside the plant. Filtered containment ventilation systems (FCVSs) are being retrofitted to some reactors which did not already have them, or any of sufficient capacity, following the Fukushima accident. The basic premise of a FCVS is that, independent of the state of the reactor itself, the catastrophic failure of the containment structure can be avoided by discharging steam, air and incondensable gases like hydrogen to the atmosphere. The Three Mile Island accident in 1979 demonstrated the importance of the inherent safety features. Despite the fact that about half of the reactor core melted, radionuclides released from the melted fuel mostly plated out on the inside of the plant or dissolved in condensing steam. The containment building which housed the reactor further prevented any significant release of radioactivity. The accident was attributed to mechanical failure and operator confusion. The reactor's other protection systems also functioned as designed. The emergency core cooling system would have prevented any damage to the reactor but for the intervention of the operators. Investigations following the accident led to a new focus on the human factors in nuclear safety. No major design changes were called for in western reactors, but controls and instrumentation were improved significantly and operator training was overhauled. At Fukushima Daiichi in March 2011 the three operating reactors shut down automatically, and were being cooled as designed by the normal residual heat removal system using power from the back-up generators, until the tsunami swamped them an hour later. The emergency core cooling systems then failed. Days later, a separate problem emerged as spent fuel ponds lost water. Analysis of the accident showed the need for more intelligent siting criteria than those used in the 1960s, and the need for better back-up power and post-shutdown cooling, as well as provision for venting the containment of that kind of reactor and other emergency management procedures. Nuclear plants have Severe Accident Mitigation Guidelines (SAMG, or in Japan: SAG), and most of these, including all those in the USA, address what should be done for accidents beyond design basis, and where several systems may be disabled. See section below. In 2007 the US NRC launched a research program to assess the possible consequences of a serious reactor accident. Its draft report was released nearly a year after the Fukushima accident had partly confirmed its findings. The State-of-the-Art Reactor Consequences Analysis (SOARCA) showed that a severe accident at a US nuclear power plant (PWR or BWR) would not be likely to cause any immediate deaths, and the risks of fatal cancers would be vastly less than the general risks of cancer. SOARCA's main conclusions fall into three areas: how a reactor accident progresses; how existing systems and emergency measures can affect an accident's outcome; and how an accident would affect the public's health. The principal conclusion is that existing resources and procedures can stop an accident, slow it down or reduce its impact before it can affect the public, but even if accidents proceed without such mitigation they take much longer to happen and release much less radioactive material than earlier analyses suggested. This was borne out at Fukushima, where there was ample time for evacuation – three days – before any significant radioactive releases. In 2015 the Canadian Nuclear Safety Commission (CNSC) released its Study of Consequences of a Hypothetical Severe Nuclear Accident and Effectiveness of Mitigation Measures. This was the result of research and analysis undertaken to address concerns raised during public hearings in 2012 on the environmental assessment for the refurbishment of Ontario Power Generation's (OPG's) Darlington nuclear power plant. The study involved identifying and modelling a large atmospheric release of radionuclides from a hypothetical severe nuclear accident at the four-unit Darlington power plant; estimating the doses to individuals at various distances from the plant, after factoring in protective actions such as evacuation that would be undertaken in response to such an emergency; and, finally, determining human health and environmental consequences due to the resulting radiation exposure. It concluded that there would be no detectable health effects or increase in cancer risk. A fuller write-up of it is on the World Nuclear News website. A different safety philosophy: Early Soviet-designed reactors The April 1986 disaster at the Chernobyl nuclear power plant in Ukraine was the result of major design deficiencies in the RBMK type of reactor, the violation of operating procedures and the absence of a safety culture. One peculiar feature of the RBMK design was that coolant failure could lead to a strong increase in power output from the fission process ( positive void coefficient). However, this was not the prime cause of the Chernobyl accident. It once and for all vindicated the desirability of designing with inherent safety supplemented by robust secondary safety provisions. By way of contrast to western safety engineering, the Chernobyl reactor did not have a containment structure like those used in the West or in post-1980 Soviet designs. The accident destroyed the reactor, and its burning contents dispersed radionuclides far and wide. This tragically meant that the results were severe, with 56 people killed, 28 of whom died within weeks from radiation exposure. It also caused radiation sickness in a further 200-300 staff and firefighters, and contaminated large areas of Belarus, Ukraine, Russia and beyond. It is estimated that at least 5% of the total radioactive material in the Chernobyl-4 reactor core was released from the plant, due to the lack of any containment structure. Most of this was deposited as dust close by. Some was carried by wind over a wide area. However, the problem here was not burning graphite as popularly quoted. The graphite was certainly incandescent as a result of fuel decay heat - sometimes over 1000°C - and some of it oxidised to carbon monoxide which burned along with the fuel cladding. About 130,000 people received significant radiation doses (i.e. above internationally accepted ICRP limits) and continue to be monitored. About 4000 cases of thyroid cancer in children have been linked to the accident. Most of these were curable, though about nine were fatal. No increase in leukaemia or other cancers have yet shown up, but some is expected. The World Health Organisation is closely monitoring most of those affected. The Chernobyl accident was a unique event and the only time in the history of commercial nuclear power that radiation-related fatalities occurred. The main positive outcome of this accident for the industry was the formation of the World Association of Nuclear Operators (WANO), building on the US precedent. The destroyed unit 4 was enclosed in a concrete shelter which is being replaced by a more permanent structure. An OECD expert report on it concluded that "the Chernobyl accident has not brought to light any new, previously unknown phenomena or safety issues that are not resolved or otherwise covered by current reactor safety programs for commercial power reactors in OECD Member countries. In other words, the concept of 'defence in depth' was conspicuous by its absence, and tragically shown to be vitally important. Apart from the RBMK reactor design, an early Russian PWR design, the VVER-440/V-230, gave rise to concerns in Europe, and a program was initiated to close these down as a condition of EU accession, along with Lithuania’s two RBMK units. See related papers on Early Soviet Reactors and EU Accession, and RBMK Reactors. However, after the US Atomic Energy Commission published General Design Criteria for Nuclear Power Plants in 1971, Russian PWR designs conformed, according to Rosatom. In particular, the VVER-440/V-213 Loviisa reactors in Finland were designed at that time and modified to conform. The first of these two came on line in 1977. A broader picture – other past accidents There have been a number of accidents in experimental reactors and in one military plutonium-producing reactor, including a number of core melts, but none of these has resulted in loss of life outside the actual plant, or long-term environmental contamination. Elsewhere (Safety of Nuclear Power info paper appendix) we tabulate these, along with the most serious commercial plant accidents. The list of ten probably corresponds to incidents rating 4 or higher on today’s International Nuclear Event Scale (Table 4). All except Browns Ferry and Vandellos involved damage to or malfunction of the reactor core. At Browns Ferry a fire damaged control cables and resulted in an 18-month shutdown for repairs; at Vandellos a turbine fire made the 17-year old plant uneconomic to repair. Mention should be made of the accident to the US Fermi-1 prototype fast breeder reactor near Detroit in 1966. Due to a blockage in coolant flow, some of the fuel melted. However no radiation was released off-site and no-one was injured. The reactor was repaired and restarted but closed down in 1972. The well-publicized criticality accident at Tokai Mura, Japan, in 1999 was at a fuel preparation plant for experimental reactors, and killed two workers from radiation exposure. Many other such criticality accidents have occurred, some fatal, and practically all in military facilities prior to 1980. A review of these is listed in the References. In an uncontained reactor accident such as at Windscale (a military facility) in 1957 and at Chernobyl in 1986, (and to some extent: Fukushima in 2011,) the principal health hazard is from the spread of radioactive materials, notably volatile fission products such as iodine-131 and caesium-137. These are biologically active, so that if consumed in food, they tend to stay in organs of the body. I-131 has a half-life of 8 days, so is a hazard for around the first month, (and apparently gave rise to the thyroid cancers after the Chernobyl accident). Caesium-137 has a half-life of 30 years, and is therefore potentially a long-term contaminant of pastures and crops. In addition to these, there is caesium-134 which has a half-life of about two years. While measures can be taken to limit human uptake of I-131, (evacuation of area for several weeks, iodide tablets), high levels of radioactive caesium can preclude food production from affected land for a long time. Other radioactive materials in a reactor core have been shown to be less of a problem because they are either not volatile (strontium, transuranic elements) or not biologically active (tellurium-132, xenon-133). Accidents in any field of technology provide valuable knowledge enabling incremental improvement in safety beyond the original engineering. Cars and airliners are the most obvious examples of this, but the chemical and oil industries can provide even stronger evidence. Civil nuclear power has greatly improved its safety in both engineering and operation over its 55 years of experience with very few accidents and major incidents to spur that improvement. The Fukushima Daiichi accident is the first since Three Mile Island in 1979 which will have significant implications, at least for older plants. Scrams, Seismic shutdowns A scram is a sudden reactor shutdown. When a reactor is scrammed, automatically due to seismic activity, or due to some malfunction, or manually for whatever reason, the fission reaction generating the main heat stops. However, considerable heat continues to be generated by the radioactive decay of the fission products in the fuel. Initially, for a few minutes, this is great - about 7% of the pre-scram level. But it drops to about 1% of the normal heat output after two hours, to 0.5% after one day, and 0.2% after a week. Even then it must still be cooled, but simply being immersed in a lot of water does most of the job after some time. When the water temperature is below 100°C at atmospheric pressure the reactor is said to be in "cold shutdown". European "stress tests" and US response following Fukushima accident Aspects of nuclear plant safety highlighted by the Fukushima accident were assessed in the 143 nuclear reactors in the EU's 27 member states, as well as those in any neighbouring states that decided to take part. These comprehensive and transparent nuclear risk and safety assessments, the so-called "stress tests", involved targeted reassessment of each power reactor’s safety margins in the light of extreme natural events, such as earthquakes and flooding, as well as on loss of safety functions and severe accident management following any initiating event. They were conducted from June 2011 to April 2012. They mobilized considerable expertise in different countries (500 man-years) under the responsibility of each national Safety Authority within the framework of the European Nuclear Safety Regulators Group (ENSREG). The Western European Nuclear Regulators' Association (WENRA) proposed these in response to a call from the European Council in March 2011, and developed specifications. WENRA is a network of Chief Regulators of EU countries with nuclear power plants and Switzerland, and has membership from 17 countries. It then negotiated the scope of the tests with the European Nuclear Safety Regulators Group (ENSREG), an independent, authoritative expert body created in 2007 by the European Commission comprising senior officials from the national nuclear safety, radioactive waste safety or radiation protection regulatory authorities from all 27 EU member states, and representatives of the European Commission. In June 2011 the governments of seven non-EU countries agreed to conduct nuclear reactor stress tests using the EU model. Armenia, Belarus, Croatia, Russia, Switzerland, Turkey and Ukraine signed a declaration that they would conduct stress tests and agreed to peer reviews of the tests by outside experts. Russia had already undertaken extensive checks. (Croatia is co-owner in the Krsko PWR in Slovenia, and Belarus and Turkey plan to build nuclear plants but have none now.) The reassessment of safety margins is based on the existing safety studies and engineering judgment to evaluate the behaviour of a nuclear power plant when facing a set of challenging situations. For a given plant, the reassessment reports on the most probable behaviour of the plant for each of the situations considered. The results of the reassessment were peer-reviewed and shared among regulators. WENRA noted that it remains a national responsibility to take or order any appropriate measures, such as additional technical or organisational safety provisions, resulting from the reassessment.    The scope of the assessment took into account the issues directly highlighted by the events in Fukushima and the possibility for combination of initiating events. Two 'initiating events' were covered in the scope: earthquake and flooding. The consequences of these – loss of electrical power and station blackout, loss of ultimate heat sink and the combination of both – were analysed, with the conclusions being applicable to other general emergency situations. In accident scenarios, regulators consider power plants' means to protect against and manage loss of core cooling as well as cooling of used fuel in storage. They also study means to protect against and manage loss of containment integrity and core melting, including consequential effects such as hydrogen accumulation. Nuclear plant operators start by documenting each power plant site. This analysis of 'extreme scenarios' followed what ENSREG called a progressive approach "in which protective measures are sequentially assumed to be defeated" from starting conditions which "represent the most unfavourable operational states." The operators have to explain their means to maintain "the three fundamental safety functions (control of reactivity, fuel cooling confinement of radioactivity)" and support functions for these, "taking into account the probable damage done by the initiating event." The documents had to cover provisions in the plant design basis for these events and the strength of the plant beyond its design basis. This means the "design margins, diversity, redundancy, structural protection and physical separation of the safety relevant systems, structures and components and the effectiveness of the defence-in-depth concept." This had to focus on 'cliff-edge' effects, e.g. when back-up batteries are exhausted and station blackout is inevitable. For severe accident management scenarios they must identify the time before fuel damage is unavoidable and the time before water begins boiling in used fuel ponds and before fuel damage occurs. Measures to prevent hydrogen explosions and fires are to be part of this. Since the licensee has the prime responsibility for safety, they performed the reassessments, and the regulatory bodies then independently reviewed them. The exercise covered 147 nuclear plants in 15 EU countries – including Lithuania with only decommissioned plants – plus 15 reactors in Ukraine and five in Switzerland. Operators reported to their regulators who then reported progress to the European Commission by the end of 2011. Information was shared among regulators throughout this process before the 17 final reports went to peer-review by teams comprising 80 experts appointed by ENSREG and the European Commission. The final documents were published in line with national law and international obligations, subject only to not jeopardising security – an area where each country could behave differently. The process was extended to June 2012 to allow more plant visits and to add more information on the potential effect of aircraft impacts. The European Commission adopted, with ENSREG, the final stress tests Report on April 26, 2012 and issued the same day a joint statement underlining the quality of the exercise. The full report and a summary of the 45 recommendations were published on www.ensreg.eu. Drawing on the peer reviews, the EC and ENSREG cited four main areas for improving EU nuclear plant safety: Guidance from WENRA for assessing natural hazards and margins beyond design basis. Giving more importance to periodic safety reviews and evaluation of natural hazards. Urgent measures to protect containment integrity. Measures to prevent and mitigate accidents resulting from extreme natural hazards. The results of the stress tests pointed out, in particular, that European nuclear power plants offered a sufficient safety level to require no shutdown of any of them. At the same time, improvements were needed to enhance their robustness to extreme situations. In France, for instance, they were imposed by ASN requirements, which took into account exchanges with its European counterparts. A follow-up European action plan was established by ENSREG from July 2012. The EU process was completed at the end of September 2012, with the EU Energy Commissioner announcing that the stress tests had showed that the safety of European power reactors was generally satisfactory, but making some other comments and projections which departed from ENSREG. An EC report was presented to the EU Council in October 2012. In the USA the Nuclear Regulatory Commission (NRC) in March 2012 made orders for immediate post-Fukushima safety enhancements, likely to cost about $100 million across the whole US fleet. The first order requires the addition of equipment at all plants to help respond to the loss of all electrical power and the loss of the ultimate heat sink for cooling, as well as maintaining containment integrity. Another requires improved water level and temperature instrumentation on used fuel ponds. The third order applies only to the 33 BWRs with early containment designs, and will require 'reliable hardened containment vents' which work under any circumstances. The industry association, NEI, told the NRC that licensees with these Mark I and Mark II containments “should have the capability to use various filtration strategies to mitigate radiological releases” during severe events, and that filtration “should be founded on scientific and factual analysis and should be performance-based to achieve the desired outcome.” All the measures are supported by the industry association, which has also proposed setting up about six regional emergency response centres under NRC oversight with additional portable equipment. In Japan similar stress tests were carried out in 2011 under the previous safety regulator, but then reactor restarts were delayed until the newly constituted Nuclear Regulatory Authority devised and published new safety guidelines, then applied them progressively through the fleet. Severe Accident Management In addition to engineering and procedures which reduce the risk and severity of accidents, all plants have guidelines for Severe Accident Management or Mitigation (SAM). These conspicuously came into play after the Fukushima accident, where staff had immense challenges in the absence of power and with disabled cooling systems following damage done by the tsunami. The experience following that accident is being applied not only in design but also in such guidelines, and peer reviews on nuclear plants will focus more on these than previously. In mid-2011 the IAEA Incident and Emergency Centre launched a new secure web-based communications platform to unify and simplify information exchange during nuclear or radiological emergencies. The Unified System for Information Exchange on Incidents and Emergencies (USIE) has been under development since 2009 but was actually launched during the emergency response to the accident at Fukushima.

#### No impact to meltdowns

Drum, 11 (Kevin, Political Blogger for Mother Jones, "Nukes and the Free Market", March 14, [www.motherjones.com/kevin-drum/2011/03/nukes-and-free-market](http://www.motherjones.com/kevin-drum/2011/03/nukes-and-free-market))

We’re currently told that the death toll in Japan will be at least 10,000 people of whom approximately **zero seem to have perished in nuclear accidents**. What happens when a tsunami hits an offshore drilling platform or a natural gas pipeline? What happens to a coal mine in an earthquake? How much environmental damage is playing out in Japan right now because of gasoline from cars pushed around? The main lesson is “try not to put critical infrastructure near a fault line” but Japan is an earthquakey country, so what are they really supposed to do about this?¶ This is a good point: energy sources of all kind cause problems. Sometimes the problems create screaming headlines (nuke meltdowns, offshore oil explosions, mining disasters) and sometimes they don't (increased particulate pollution, global warming, devastation of salmon runs). **But the dangers are there for virtually every type of energy production**.¶ Still, it's worth pointing out that **the problem with nuclear power isn't** so much **its immediate capacity to kill people**. As Matt points out, no one has died in Japan from the partial meltdowns at its damaged nuclear plants, and **it's unlikely anyone ever will**. The control rods are in place, and even in the worst case the containment vessels will almost certainly restrict the worst damage.

### 2NC---Renewable Tradeoff Impact

#### Nuclear power is coming now but the transition ignores regulations and hurts the climate

Benshoff 22 [Laura Benshoff, Laura is a reporter covering energy and climate for NPR's National desk., 6-30-2022, accessed on 7-18-2022, National Public Radio, "Nuclear power is gaining support after years of decline. But old hurdles remain", https://www.npr.org/2022/06/30/1108264499/nuclear-power-gains-support-years-decline-hurdles mimou]

Nuclear power coming now

Now, an influx of investment from the government and the private sector is changing the trajectory of the aging U.S. nuclear fleet and spurring development of new nuclear technology.

But many of the same old hurdles to scaling up nuclear power remain. Nuclear is the largest source of zero-emissions power in the U.S.

One factor in the newfound appreciation for nuclear power is worsening climate change. Nuclear currently contributes nearly one-fifth of all electricity generated in the U.S., according to the [U.S. Energy Information Administration](https://www.eia.gov/tools/faqs/faq.php?id=427&t=3), and is the biggest single source of power that does not directly create carbon emissions, although wind power eclipsed it briefly for the first time ever [earlier this year](https://www.npr.org/2022/04/14/1092806582/wind-power-energy-source).

In an effort to stave off more closures, the federal government began subsidizing older nuclear plants, opening up a $6 billion fund authorized in 2021's Infrastructure Investment and Jobs Act this year. That law also set aside an additional [$2.477 billion for research and development](https://www.energy.gov/ne/advanced-reactor-demonstration-program) of advanced nuclear reactor technology.

"Have no doubt, President Biden is serious about doing everything possible to get the U.S. to be powered by clean energy," Assistant Secretary for Nuclear Energy Kathryn Huff told conference attendees. "Nuclear energy is really essential to this," she said.

\*\*Image Omitted\*\*

"President Biden is serious about doing everything possible to get the U.S. to be powered by clean energy ... And nuclear energy is really essential to this," Assistant Secretary for Nuclear Energy Kathryn Huff said. Laura Benshoff/NPR

States across the country have also rolled out more nuclear-friendly stances.

More than half of all states include nuclear power in their plans to reduce carbon emissions from electricity generation, according to an [Associated Press survey](https://apnews.com/article/climate-technology-business-nuclear-power-environment-and-nature-cfb21ab68a9e7005cc08873f2a5a7031).

Some, like New York, were already funding older plants to stay open. In light of California's grid stability issues, Gov. Gavin Newsom started [exploring options](https://www.latimes.com/environment/story/2022-04-29/california-promised-to-close-its-last-nuclear-plant-now-newsom-is-reconsidering) to keep the Diablo Canyon nuclear plant open, which is otherwise set to close by 2025.

Even major fossil fuel producer West Virginia recently repealed its ban on nuclear power. Republican delegate Brandon Steele, who represents a district in the southern, coal-producing part of the state, said diversifying energy production is good for business and energy security.

"If West Virginia can be a major producer, that serves the energy needs of the entire country and contributes to our national security," he said.

His argument cuts against the climate case for nuclear power. Steele tells NPR that he hoped bringing more nuclear and renewable energy to his state would help increase demand for coal, by increasing the overall demand for energy.

"[Nuclear is] a good complement to our coal-fired power. It's not a replacement, it's a complement," he said.

West Virginia currently has[zero nuclear reactors](https://www.eia.gov/energyexplained/nuclear/us-nuclear-industry.php#:~:text=The%20two%20new%20reactors%20that,to%20come%20online%20before%202023.). But Steele said the hope is to get in on the ground floor of advanced nuclear technology that's currently under development.

When it comes to new nuclear technology, the industry has "a tendency to overpromise and underdeliver"

Despite this momentum, if nuclear energy is going to grow even its boosters admit some things need to change.

When it comes to new nuclear technology, the industry has "a tendency to overpromise and underdeliver," [said John Hopkins, president and CEO of NuScale Power/NuScale Corp](https://www.nuscalepower.com/about-us/leadership/john-hopkins), a publicly traded company working on advanced nuclear technology. His company was the first to receive federal approval for a small modular reactor design, but the first plant is not expected to be up and running until 2029.

"I want to get one module in the ground and prove we're commercially viable and we're going to do it on schedule," Hopkins told attendees during a panel at the Nuclear Energy Assembly in June.

That means cutting costs. Nuclear power has grown more expensive over time, according to the [2021 World Nuclear Industry Status Report](https://www.worldnuclearreport.org/IMG/pdf/wnisr2021-lr.pdf).

By contrast, solar and wind power cost less and continue to come down in price, and when combined with long-term energy storage, could make nuclear power even less viable long-term, said Elgie Holstein, senior director for strategic planning for the Environmental Defense Fund.

"This is tough competition for these aging nuclear power plants," he said.

Edwin Lyman, director of nuclear power safety with the Union of Concerned Scientists, said nuclear's "unique liabilities and risks, both with regards to safety and security" also must be a part of any discussion over its usefulness. He points to the 2011 meltdown at a plant in Fukushima, Japan, and Russia's shelling of Europe's [largest nuclear power plant](https://publicintegrity.org/national-security/ukraine-in-crisis/russia-captures-largest-nuclear-plant-in-europe-now-what/) in[Zaporizhzhia, Ukraine](https://www.npr.org/2022/03/11/1085427380/ukraine-nuclear-power-plant-zaporizhzhia), earlier this year as examples of what can go wrong. There is also still no model for disposing of nuclear waste long-term, although Finland has created the[first permanent repository](https://www.science.org/content/article/finland-built-tomb-store-nuclear-waste-can-it-survive-100000-years) for its spent fuel.

In the race to figure out a way to transition off carbon, energy experts differ on how much nuclear power should play a part. Many models for lowering greenhouse gas emissions rely on [keeping steady](https://gspp.berkeley.edu/faculty-and-impact/centers/cepp/projects/2035-electric-decarbonization-modeling-study) the amount of nuclear power that exists now, if not growing it. But alternative ones, such as a recent [Stanford University study](https://web.stanford.edu/group/efmh/jacobson/Articles/I/21-USStates-PDFs/21-USStatesPaper.pdf), show a path to zero carbon emissions without any nuclear power.

Jason Bordoff, director of the Center for Global Energy Policy at Columbia University, said skepticism is warranted regarding any new energy technology, "whether it's green hydrogen, long-duration storage, or advanced nuclear."

#### Nuclear power is way too costly and inefficient to solve climate change – investments directly trade off with better renewables

Schneider and Rueter 21 [Mycle Schneider and Gero Rueter, Mycle Schneider is the initiator and lead author of the annual World Nuclear Industry Status Report, an independent reference report on the development of the global nuclear power industry. Schneider is an independent consultant to governments and international organizations around the world. In 1997 he was awarded the Alternative Nobel Prize, 11-3-2021, accessed on 7-18-2022, DW.COM, "'Every euro invested in nuclear power makes the climate crisis worse' | DW | 11.03.2021", https://www.dw.com/en/nuclear-climate-mycle-schneider-renewables-fukushima/a-56712368 mimou]

Mycle Schneider: Today we need to put the [question of urgency](https://www.dw.com/en/climate-adaptation-gap-united-nations-report/a-56220649) first. It's about how much we can reduce greenhouse gases and how quickly for every euro ($1.21) spent. So, it's a combination between cost and feasibility, while doing it in the fastest possible way.

And if we're talking about the construction of new power plants, then [nuclear power](https://www.dw.com/en/germany-looking-for-final-repository-for-nuclear-waste-global-outlook/a-56449115) is simply excluded. Not just because it is the most expensive form of electricity generation today, but, above all, because it takes a long time to build reactors. In other words, every euro invested in new nuclear power plants makes the climate crisis worse because now this money cannot be used to invest in efficient climate protection options.

What about existing nuclear power plants?

The power plants exist, they provide electricity. However, many of the measures needed for energy efficiency are now cheaper than the basic operating costs of nuclear power plants. That is the first point, and unfortunately it is always forgotten.

The second point is that renewables today have become so cheap that in many cases they are below the basic operating costs of nuclear power plants.

\*\*Image Omitted\*\*

Let me give you two examples: The world's lowest price for solar power in currently in Portugal, at 1.1 cents per kilowatt hour. And we now have the first results from Spain with costs for wind and solar power at around 2.5 cents per kilowatt hour. These are below the basic operating costs of the vast majority of nuclear power plants around the world.

It would often even be affordordable to pay 1 to 1.5 cents per kilowatt hour for electricity storage in addition to the generation costs for wind and solar power and still be below the operating costs of nuclear power plants. And here we have to ask the same question: How many emissions can I avoid with one euro, one dollar or one yuan?

So why are construction projects being announced now?

In the case of [nuclear power](https://www.dw.com/en/how-fukushima-triggered-germanys-nuclear-phaseout/a-56829217), I often have the feeling that Trumpism prevails. Facts no longer matter. There is talk of plans and projects all over the place, but in reality, little or nothing actually happens. We document this in detail every year in the more than 300 pages of our [World Nuclear Industry Status Report](https://www.worldnuclearreport.org/-World-Nuclear-Industry-Status-Report-2020-.html).

#### Reactors are ineffective and tradeoff with renewables – reliance risks a multitude of impacts

Hutner and Cirino 19 [Heidi Hutner and Erica Cirino, Heidi Hutneris a professor, writer and filmmaker at Stony Brook University. She publishes widely on ecofeminism, nuclear issues, toxics and climate., Erica Cirinois a science photojournalist, covers stories about wildlife and the environment, most often related to biology, conservation and policy. , 05-28-2019, accessed on 7-18-2022, Aeon, "Nuclear power is not the answer in a time of climate change | Aeon Ideas", https://aeon.co/ideas/nuclear-power-is-not-the-answer-in-a-time-of-climate-change mimou]

With our climate-impacted world now highly prone to fires, extreme storms and sea-level rise, nuclear energy is touted as a possible replacement for the burning of fossil fuels for energy – the leading cause of climate change. Nuclear power can demonstrably [reduce](https://www.sciencedirect.com/science/article/pii/S0301421502001921) carbon dioxide emissions. Yet scientific evidence and recent catastrophes call into question whether nuclear power could function safely in our warming world. Wild weather, fires, rising sea levels, earthquakes and warming water temperatures all increase the risk of nuclear accidents, while the lack of safe, long-term storage for radioactive waste remains a persistent danger.

The Santa Susana Field Laboratory property has had a long history of contaminated soil and groundwater. Indeed, a 2006 advisory panel compiled a [report](http://www.ssflpanel.org/files/SSFLPanelReport.pdf) suggesting that workers at the lab, as well as residents living nearby, had unusually high exposure to radiation and industrial chemicals that are linked to an increased incidence of some cancers. Discovery of the pollution prompted California’s DTSC in 2010 to order a [cleanup](https://www.nasa.gov/home/hqnews/2010/dec/HQ_10-326_Santa_Susana.html) of the site by its current owner – Boeing – with assistance from the US Department of Energy and NASA. But the required cleanup has been hampered by Boeing’s [legal fight](https://www.boeing.com/resources/boeingdotcom/principles/environment/pdf/Santa_Susana_draft_EIR_Updated_Boeing_Stakeholder_Summary_November2017.pdf) to perform a less rigorous cleaning.

Like the Santa Susana Field Lab, Chernobyl remains largely unremediated since its meltdown in 1986. With each passing year, dead plant material accumulates and temperatures rise, making it especially prone to fires in the era of climate change. Radiation releases from contaminated soils and forests can be carried thousands of kilometres away to human population centres, according to Evangeliou.

Kate Brown, a historian at the Massachusetts Institute of Technology and the author of Manual for Survival: A Chernobyl Guide to the Future (2019), and Tim Mousseau, an evolutionary biologist at the University of South Carolina, also have grave concerns about forest fires. ‘Records show that there have been fires in the Chernobyl zone that raised the radiation levels by seven to 10 times since 1990,’ Brown says. Further north, melting glaciers contain ‘radioactive fallout from global nuclear testing and nuclear accidents at levels 10 times higher than elsewhere’. As ice melts, radioactive runoff flows into the ocean, is absorbed into the atmosphere, and falls as acid rain. ‘With fires and melting ice, we are basically paying back a debt of radioactive debris incurred during the frenzied production of nuclear byproducts during the 20th century,’ Brown concludes.

Flooding is another symptom of our warming world that could lead to nuclear disaster. Many nuclear plants are built on coastlines where seawater is easily used as a coolant. Sea-level rise, shoreline erosion, coastal storms and heat waves – all potentially catastrophic phenomena associated with climate change – are expected to get more frequent as the Earth continues to warm, threatening greater damage to coastal nuclear power plants. ‘Mere absence of greenhouse gas emissions is not sufficient to assess nuclear power as a mitigation for climate change,’ conclude Natalie Kopytko and John Perkins in their [paper](https://www.sciencedirect.com/science/article/pii/S0301421510007329) ‘Climate Change, Nuclear Power, and the Adaptation-Mitigation Dilemma’ (2011) in Energy Policy.

Proponents of nuclear power say that the reactors’ relative reliability and capacity make this a much clearer choice than other non-fossil-fuel sources of energy, such as wind and solar, which are sometimes brought offline by fluctuations in natural resource availability. Yet no one denies that older nuclear plants, with an aged infrastructure often surpassing expected lifetimes, are extremely inefficient and run a higher risk of disaster.

‘The primary source of nuclear power going forward will be the current nuclear fleet of old plants,’ said Joseph Lassiter, an energy expert and nuclear proponent who is retired from Harvard University. But ‘even where public support exists for [building new] nuclear plants, it remains to be seen if these new-build nuclear plants will make a significant contribution to fossil-emissions reductions given the cost and schedule overruns that have plagued the industry.’

Lassiter and several other energy experts [advocate](https://energy.mit.edu/wp-content/uploads/2018/09/The-Future-of-Nuclear-Energy-in-a-Carbon-Constrained-World.pdf) for the new, Generation IV nuclear power plants that are supposedly designed to deliver high levels of nuclear power at the lowest cost and with the lowest safety risks. But other experts say that the benefits even here remain unclear. The biggest critique of the Generation IV nuclear reactors is that they are in the design phase, and we don’t have time to wait for their implementation. Climate abatement action is needed immediately.

‘New nuclear power seemingly represents an opportunity for solving global warming, air pollution, and energy security,’ says Mark Jacobson, director of Stanford University’s Atmosphere and Energy Programme. But it makes no economic or energy sense. ‘Every dollar spent on nuclear results in one-fifth the energy one would gain with wind or solar [at the same cost], and nuclear energy takes five to 17 years longer before it becomes available. As such, it is impossible for nuclear to help with climate goals of reducing 80 per cent of emissions by 2030. Also, while we’re waiting around for nuclear, coal, gas and oil are being burned and polluting the air. In addition, nuclear has energy security risks other technologies don’t have: weapons proliferation, meltdown, waste and uranium-worker lung-cancer risks.’

### 2NC---Warming Impact

#### Climate threats are underestimated – irreversible existential tipping points are rapidly approaching

Spratt and Dunlop 19 [David Spratt and Ian Dunlop, David Spratt has been Research Coordinator for the Breakthrough National Centre for Climate Restoration (Melbourne) since 2014. He was co-founder of the Climate Action Centre (2009-2012)., Ian Dunlop is an Australian engineer, writer, and energy expert with a particular interest in the interaction of corporate governance, corporate responsibility and climate change., 5-22-2019, accessed on 7-21-2022, Preventionweb, "Existential climate-related security risk: A scenario approach", https://www.preventionweb.net/publication/existential-climate-related-security-risk-scenario-approach mimou]

An existential risk to civilisation is one posing permanent large negative consequences to humanity which may never be undone, either annihilating intelligent life or permanently and drastically curtailing its potential. With the commitments by nations to the 2015 Paris Agreement, the current path of warming is 3°C or more by 2100. But this figure does not include “long-term” carbon-cycle feedbacks, which are materially relevant now and in the near future due to the unprecedented rate at which human activity is perturbing the climate system. Taking these into account, the Paris path would lead to around 5°C of warming by 2100. Scientists warn that warming of 4°C is incompatible with an organised global community, is devastating to the majority of ecosystems, and has a high probability of not being stable. The World Bank says it may be “beyond adaptation”. But an existential threat may 8 also exist for many peoples and regions at a signifi-cantly lower level of warming. In 2017, 3°C of warming was categorised as “catastrophic” with a warning that, on a path of unchecked emissions, low-probability, high-impact warming could be catastrophic by 2050. The Emeritus Director of the Potsdam Institute, Prof. Hans Joachim Schellnhuber, warns that “climate change is now reaching the end-game, where very soon humanity must choose between taking unprecedented action, or accepting that it has been left too late and bear the consequences.” He says 10 that if we continue down the present path “there is a very big risk that we will just end our civilisation. The human species will survive somehow but we will destroy almost everything we have built up over the last two thousand years.”   11 Unfortunately, conventional risk and probability analysis becomes useless in these circumstances because it excludes the full implications of outlier events and possibilities lurking at the fringes.12 Prudent risk-management means a tough, objective look at the real risks to which we are exposed, especially at those “fat-tail” events, which may have consequences that are damaging beyond quantification, and threaten the survival of human civilisation. Global warming projections display a “fat-tailed” distribution with a greater likelihood of warming that is well in excess of the average amount of warming predicted by climate models, and are of a higher probability than would be expected under typical statistical assumptions. More importantly, the risk lies disproportionately in the “fat-tail” outcomes, as illustrated in Figure 1. \*\*Figure Omitted\*\*

This is a particular concern with potential climate tipping-points — passing critical thresholds which result in step changes in the climate system that will be irreversible on human timescales — such as the polar ice sheets (and hence sea levels), permafrost and other carbon stores, where the impacts of global warming are non-linear and difficult to model with current scientific knowledge. Recently, attention has been given to a “hothouse Earth” scenario, in which system feedbacks and their mutual interaction could drive the Earth System climate to a point of no return, whereby further warming would become self-sustaining. This “hothouse Earth” planetary threshold could exist at a temperature rise as low as 2°C, possibly even lower.13

#### Climate change is a system disruptor and a risk amplifier – causes extinction

IPCC 22 (Climate Change 2022 Impacts, Adaptation and Vulnerability Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change Edited by Hans-Otto Pörtner Working Group II Co-Chair Debra C. Roberts Working Group II Co-Chair Melinda M.B. Tignor Head Elvira Poloczanska Science Advisor to the WGII Co-Chairs and TSU Katja Mintenbeck Director of Science https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC\_AR6\_WGII\_SummaryForPolicymakers.pdf)

B.3 Global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans (very high confidence). The level of risk will depend on concurrent nearterm trends in vulnerability, exposure, level of socioeconomic development and adaptation (high confidence). Near-term actions that limit global warming to close to 1.5°C would substantially reduce projected losses and damages related to climate change in human systems and ecosystems, compared to higher warming levels, but cannot eliminate them all (very high confidence). (Figure SPM.3, Box SPM.1) {16.4, 16.5, 16.6, CCP1.2, CCP5.3, CCB SLR, WGI AR6 SPM B1.3, WGI AR6 Table SPM.1}

B.3.1 Near-term warming and increased frequency, severity and duration of extreme events will place many terrestrial, freshwater, coastal and marine ecosystems at high or very high risks of biodiversity loss (medium to very high confidence, depending on ecosystem). Near-term risks for biodiversity loss are moderate to high in forest ecosystems (medium confidence), kelp and seagrass ecosystems (high to very high confidence), and high to very high in Arctic sea-ice and terrestrial ecosystems (high confidence) and warm-water coral reefs (very high confidence). Continued and accelerating sea level rise will encroach on coastal settlements and infrastructure (high confidence) and commit low-lying coastal ecosystems to submergence and loss (medium confidence). If trends in urbanisation in exposed areas continue, this will exacerbate the impacts, with more challenges where energy, water and other services are constrained (medium confidence). The number of people at risk from climate change and associated loss of biodiversity will progressively increase (medium confidence). Violent conflict and, separately, migration patterns, in the near-term will be driven by socioeconomic conditions and governance more than by climate change (medium confidence). (Figure SPM.3) {2.5, 3.4, 4.6, 6.2, 7.3, 8.7, 9.2, 9.9, 11.6, 12.5, 13.6, 13.10, 14.6, 15.3, 16.5, 16.6, CCP1.2, CCP2.1, CCP2.2, CCP5.3, CCP6.2, CCP6.3, CCB MIGRATE, CCB SLR}

B.3.2 In the near term, climate-associated risks to natural and human systems depend more strongly on changes in their vulnerability and exposure than on differences in climate hazards between emissions scenarios (high confidence). Regional differences exist, and risks are highest where species and people exist close to their upper thermal limits, along coastlines, in close association with ice or seasonal rivers (high confidence). Risks are also high where multiple non-climate drivers persist or where vulnerability is otherwise elevated (high confidence). Many of these risks are unavoidable in the near-term, irrespective of emissions scenario (high confidence). Several risks can be moderated with adaptation (high confidence). (Figure SPM.3, Section C) {2.5, 3.3, 3.4, 4.5, 6.2, 7.1, 7.3, 8.2, 11.6, 12.4, 13.6, 13.7, 13.10, 14.5, 16.4, 16.5, CCP2.2, CCP4.3, CCP5.3, CCB SLR, WGI AR6 Table SPM.1}

B.3.3 Levels of risk for all Reasons for Concern (RFC) are assessed to become high to very high at lower global warming levels than in AR5 (high confidence). Between 1.2°C and 4.5°C global warming level very high risks emerge in all five RFCs compared to just two RFCs in AR5 (high confidence). Two of these transitions from high to very high risk are associated with near-term warming: risks to unique and threatened systems at a median value of 1.5 [1.2 to 2.0] °C (high confidence) and risks associated with extreme weather events at a median value of 2.0 [1.8 to 2.5] °C (medium confidence). Some key risks contributing to the RFCs are projected to lead to widespread, pervasive, and potentially irreversible impacts at global warming levels of 1.5–2°C if exposure and vulnerability are high and adaptation is low (medium confidence). Near-term actions that limit global warming to close to 1.5°C would substantially reduce projected losses and damages related to climate change in human systems and ecosystems, compared to higher warming levels, but cannot eliminate them all (very high confidence). (Figure SPM.3b) {16.5, 16.6, CCB SLR}

Beyond 2040 and depending on the level of global warming, climate change will lead to numerous risks to natural and human systems (high confidence). For 127 identified key risks, assessed mid- and long-term impacts are up to multiple times higher than currently observed (high confidence). The magnitude and rate of climate change and associated risks depend strongly on near-term mitigation and adaptation actions, and projected adverse impacts and related losses and damages escalate with every increment of global warming (very high confidence). (Figure SPM.3) {2.5, 3.4, 4.4, 5.2, 6.2, 7.3, 8.4, 9.2, 10.2, 11.6, 12.4, 13.2, 13.3, 13.4, 13.5, 13.6, 13.7, 13.8, 14.6, 15.3, 16.5, 16.6, CCP1.2, CCP2.2, CCP3.3, CCP4.3, CCP5.3, CCP6.3, CCP7.3}

B.4.1 Biodiversity loss and degradation, damages to and transformation of ecosystems are already key risks for every region due to past global warming and will continue to escalate with every increment of global warming (very high confidence). In terrestrial ecosystems, 3 to 14% of species assessed33 will likely face very high risk of extinction34 at global warming levels of 1.5°C, increasing up to 3 to 18% at 2°C, 3 to 29% at 3°C, 3 to 39% at 4°C, and 3 to 48% at 5°C. In ocean and coastal ecosystems, risk of biodiversity loss ranges between moderate and very high by 1.5°C global warming level and is moderate to very high by 2°C but with more ecosystems at high and very high risk (high confidence), and increases to high to very high across most ocean and coastal ecosystems by 3°C (medium to high confidence, depending on ecosystem). Very high extinction risk for endemic species in biodiversity hotspots is projected to at least double from 2% between 1.5°C and 2°C global warming levels and to increase at least tenfold if warming rises from 1.5°C to 3°C (medium confidence). (Figure SPM.3c, d, f) {2.4, 2.5, 3.4, 3.5,12.3, 12.5, Table 12.6, 13.4, 13.10, 16.4, 16.6, CCP1.2, Figure CCP1.6, Figure CCP1.7, CCP5.3, CCP6.3, CCB PALEO}

B.4.2 Risks in physical water availability and water-related hazards will continue to increase by the mid- to long-term in all assessed regions, with greater risk at higher global warming levels (high confidence). At approximately 2°C global warming, snowmelt water availability for irrigation is projected to decline in some snowmelt dependent river basins by up to 20%, and global glacier mass loss of 18 ± 13% is projected to diminish water availability for agriculture, hydropower, and human settlements in the mid- to long-term, with these changes projected to double with 4°C global warming (medium confidence). In Small Islands, groundwater availability is threatened by climate change (high confidence). Changes to streamflow magnitude, timing and associated extremes are projected to adversely impact freshwater ecosystems in many watersheds by the mid- to long-term across all assessed scenarios (medium confidence). Projected increases in direct flood damages are higher by 1.4 to 2 times at 2°C and 2.5 to 3.9 times at 3°C compared to 1.5°C global warming without adaptation (medium confidence). At global warming of 4°C, approximately 10% of the global land area is projected to face increases in both extreme high and low river flows in the same location, with implications for planning for all water use sectors (medium confidence). Challenges for water management will be exacerbated in the near, mid and long term, depending on the magnitude, rate and regional details of future climate change and will be particularly challenging for regions with constrained resources for water management (high confidence). {2.3, 4.4, 4.5, Box 4.2, Figure 4.20, 15.3, CCP5.3, CCB DISASTER, SROCC 2.3}

B.4.3 Climate change will increasingly put pressure on food production and access, especially in vulnerable regions, undermining food security and nutrition (high confidence). Increases in frequency, intensity and severity of droughts, floods and heatwaves, and continued sea level rise will increase risks to food security (high confidence) in vulnerable regions from moderate to high between 1.5°C and 2°C global warming level, with no or low levels of adaptation (medium confidence). At 2°C or higher global warming level in the mid-term, food security risks due to climate change will be more severe, leading to malnutrition and micro-nutrient deficiencies, concentrated in Sub-Saharan Africa, South Asia, Central and South America and Small Islands (high confidence). Global warming will progressively weaken soil health and ecosystem services such as pollination, increase pressure from pests and diseases, and reduce marine animal biomass, undermining food productivity in many regions on land and in the ocean (medium confidence). At 3°C or higher global warming level in the long term, areas exposed to climate-related hazards will expand substantially compared with 2°C or lower global warming level (high confidence), exacerbating regional disparity in food security risks (high confidence). (Figure SPM.3) {1.1, 3.3, 4.5, 5.2, 5.4, 5.5, 5.8, 5.9, 5.12, 7.3, 8.3, 9.11, 13.5, 15.3, 16.5, 16.6, CCB MOVING PLATE, CCB SLR}

B.4.4 Climate change and related extreme events will significantly increase ill health and premature deaths from the near- to long-term (high confidence). Globally, population exposure to heatwaves will continue to increase with additional warming, with strong geographical differences in heat-related mortality without additional adaptation (very high confidence). Climate-sensitive food-borne, water-borne, and vector-borne disease risks are projected to increase under all levels of warming without additional adaptation (high confidence). In particular, dengue risk will increase with longer seasons and a wider geographic distribution in Asia, Europe, Central and South America and sub-Saharan Africa, potentially putting additional billions of people at risk by the end of the century (high confidence). Mental health challenges, including anxiety and stress, are expected to increase under further global warming in all assessed regions, particularly for children, adolescents, elderly, and those with underlying health conditions (very high confidence). {4.5, 5.12, Box 5.10, 7.3, Figure 7.9, 8.4, 9.10, Figure 9.32, Figure 9.35, 10.4, Figure 10.11, 11.3, 12.3, Figure 12.5, Figure 12.6, 13.7, Figure 13.23, Figure 13.24, 14.5, 15.3, CCP6.2}

B.4.5 Climate change risks to cities, settlements and key infrastructure will rise rapidly in the mid- and long-term with further global warming, especially in places already exposed to high temperatures, along coastlines, or with high vulnerabilities (high confidence). Globally, population change in low-lying cities and settlements will lead to approximately a billion people projected to be at risk from coastal-specific climate hazards in the mid-term under all scenarios, including in Small Islands (high confidence). The population potentially exposed to a 100-year coastal flood is projected to increase by about 20% if global mean sea level rises by 0.15 m relative to 2020 levels; this exposed population doubles at a 0.75 m rise in mean sea level and triples at 1.4 m without population change and additional adaptation (medium confidence). Sea level rise poses an existential threat for some Small Islands and some low-lying coasts (medium confidence). By 2100 the value of global assets within the future 1-in-100 year coastal floodplains is projected to be between US$7.9 and US$12.7 trillion (2011 value) under RCP4.5, rising to between US$8.8 and US$14.2 trillion under RCP8.5 (medium confidence). Costs for maintenance and reconstruction of urban infrastructure, including building, transportation, and energy will increase with global warming level (medium confidence), the associated functional disruptions are projected to be substantial particularly for cities, settlements and infrastructure located on permafrost in cold regions and on coasts (high confidence). {6.2, 9.9, 10.4, 13.6, 13.10, 15.3, 16.5, CCP2.1, CCP2.2, CCP5.3, CCP6.2, CCB SLR, SROCC 2.3, SROCC CCB9}

B.4.6 Projected estimates of global aggregate net economic damages generally increase non-linearly with global warming levels (high confidence).35 The wide range of global estimates, and the lack of comparability between methodologies, does not allow for identification of a robust range of estimates (high confidence). The existence of higher estimates than assessed in AR5 indicates that global aggregate economic impacts could be higher than previous estimates (low confidence).36 Significant regional variation in aggregate economic damages from climate change is projected (high confidence) with estimated economic damages per capita for developing countries often higher as a fraction of income (high confidence). Economic damages, including both those represented and those not represented in economic markets, are projected to be lower at 1.5°C than at 3°C or higher global warming levels (high confidence). {4.4, 9.11, 11.5, 13.10, Box 14.6, 16.5, CWGB ECONOMIC}

B.4.7 In the mid- to long-term, displacement will increase with intensification of heavy precipitation and associated flooding, tropical cyclones, drought and, increasingly, sea level rise (high confidence). At progressive levels of warming, involuntary migration from regions with high exposure and low adaptive capacity would occur (medium confidence). Compared to other socioeconomic factors the influence of climate on conflict is assessed as relatively weak (high confidence). Along long-term socioeconomic pathways that reduce non-climatic drivers, risk of violent conflict would decline (medium confidence). At higher global warming levels, impacts of weather and climate extremes, particularly drought, by increasing vulnerability will increasingly affect violent intrastate conflict (medium confidence). {TS B.7.4, 7.3, 16.5, CCB MIGRATE }

Complex, Compound and Cascading Risks

B.5 Climate change impacts and risks are becoming increasingly complex and more difficult to manage. Multiple climate hazards will occur simultaneously, and multiple climatic and non-climatic risks will interact, resulting in compounding overall risk and risks cascading across sectors and regions. Some responses to climate change result in new impacts and risks. (high confidence) {1.3, 2.4, Box 2.2, Box 9.5, 11.5, 13.5, 14.6, Box 15.1, CCP1.2, CCP2.2, CCB COVID, CCB DISASTER, CCB INTEREG, CCB SRM, }

B.5.1 Concurrent and repeated climate hazards occur in all regions, increasing impacts and risks to health, ecosystems, infrastructure, livelihoods and food (high confidence). Multiple risks interact, generating new sources of vulnerability to climate hazards, and compounding overall risk (high confidence). Increasing concurrence of heat and drought events are causing crop production losses and tree mortality (high confidence). Above 1.5°C global warming increasing concurrent climate extremes will increase risk of simultaneous crop losses of maize in major food-producing regions, with this risk increasing further with higher global warming levels (medium confidence). Future sea level rise combined with storm surge and heavy rainfall will increase compound flood risks (high confidence). Risks to health and food production will be made more severe from the interaction of sudden food production losses from heat and drought, exacerbated by heat-induced labour productivity losses (high confidence). These interacting impacts will increase food prices, reduce household incomes, and lead to health risks of malnutrition and climate-related mortality with no or low levels of adaptation, especially in tropical regions (high confidence). Risks to food safety from climate change will further compound the risks to health by increasing food contamination of crops from mycotoxins and contamination of seafood from harmful algal blooms, mycotoxins, and chemical contaminants (high confidence). {Figure TS.10c, 5.2, 5.4, 5.8, 5.9, 5.11, 5.12, 7.2, 7.3, 9.8, 9.11, 10.4, 11.3, 11.5, 12.3, 13.5, 14.5, 15.3, Box 15.1, 16.6, CCP1.2, CCP6.2, , WGI AR6 SPM A.3.1, WGI AR6 SPM A.3.2, WGI AR6 SPM C.2.7}

B.5.2 Adverse impacts from climate hazards and resulting risks are cascading across sectors and regions (high confidence), propagating impacts along coasts and urban centres (medium confidence) and in mountain regions (high confidence). These hazards and cascading risks also trigger tipping points in sensitive ecosystems and in significantly and rapidly changing social-ecological systems impacted by ice melt, permafrost thaw and changing hydrology in polar regions (high confidence). Wildfires, in many regions, have affected ecosystems and species, people and their built assets, economic activity, and health (medium to high confidence). In cities and settlements, climate impacts to key infrastructure are leading to losses and damages across water and food systems, and affect economic activity, with impacts extending beyond the area directly impacted by the climate hazard (high confidence). In Amazonia, and in some mountain regions, cascading impacts from climatic (e.g., heat) and non-climatic stressors (e.g., land use change) will result in irreversible and severe losses of ecosystem services and biodiversity at 2°C global warming level and beyond (medium confidence). Unavoidable sea level rise will bring cascading and compounding impacts resulting in losses of coastal ecosystems and ecosystem services, groundwater salinisation, flooding and damages to coastal infrastructure that cascade into risks to livelihoods, settlements, health, well-being, food and water security, and cultural values in the near to long-term (high confidence). (Figure SPM.3) {Figure TS.10, 2.5, 3.4, 3.5, Box 7.3, Box 8.7, Box 9.4, 11.5, Box 11.1, 12.3, 13.9, 14.6, 15.3, 16.5, 16.6, CCP1.2, CCP2.2, CCP5.2, CCP5.3, CCP6.2, CCP6.3, Box CCP6.1, Box CCP6.2, CCB EXTREMES, WGI AR6 Figure SPM.8d}

B.5.3 Weather and climate extremes are causing economic and societal impacts across national boundaries through supply-chains, markets, and natural resource flows, with increasing transboundary risks projected across the water, energy and food sectors (high confidence). Supply chains that rely on specialized commodities and key infrastructure can be disrupted by weather and climate extreme events. Climate change causes the redistribution of marine fish stocks, increasing risk of transboundary management conflicts among fisheries users, and negatively affecting equitable distribution of food provisioning services as fish stocks shift from lower to higher latitude regions, thereby increasing the need for climate-informed transboundary management and cooperation (high confidence). Precipitation and water availability changes increases the risk of planned infrastructure projects, such as hydropower in some regions, having reduced productivity for food and energy sectors including across countries that share river basins (medium confidence). {Figure TS.10e-f, 3.4, 3.5, 4.5, 5.8, 5.13, 6.2, 9.4, Box 9.5,14.5, Box 14.5, Box 14.6, CCP5.3, CCB DISASTER, CCB EXTREMES, CCB INTEREG, CCB MOVING PLATE} B.5.4 Risks arise from some responses that are intended to reduce the risks of climate change, including risks from maladaptation and adverse side effects of some emissions reduction and carbon dioxide removal measures (high confidence). Deployment of afforestation of naturally unforested land, or poorly implemented bioenergy, with or without carbon capture and storage, can compound climate-related risks to biodiversity, water and food security, and livelihoods, especially if implemented at large scales, especially in regions with insecure land tenure (high confidence). {Box 2.2, 4.1, 4.7, 5.13, Table 5.18, Box 9.3, Box 13.2, CCB NATURAL, CWGB BIOECONOMY}

B.5.5 Solar radiation modification approaches, if they were to be implemented, introduce a widespread range of new risks to people and ecosystems, which are not well understood (high confidence). Solar radiation modification approaches have potential to offset warming and ameliorate some climate hazards, but substantial residual climate change or overcompensating change would occur at regional scales and seasonal timescales (high confidence). Large uncertainties and knowledge gaps are associated with the potential of solar radiation modification approaches to reduce climate change risks. Solar radiation modification would not stop atmospheric CO2 concentrations from increasing or reduce resulting ocean acidification under continued anthropogenic emissions (high confidence). {CWGB SRM}

Impacts of Temporary Overshoot

37 In this report, overshoot pathways exceed 1.5°C global warming and then return to that level, or below, after several decades. 38 Despite limited evidence specifically on the impacts of a temporary overshoot of 1.5°C, a much broader evidence base from process understanding and the impacts of higher global warming levels allows a high confidence statement on the irreversibility of some impacts that would be incurred following such an overshoot. B.6 If global warming transiently exceeds 1.5°C in the coming decades or later (overshoot)37, then many human and natural systems will face additional severe risks, compared to remaining below 1.5°C (high confidence). Depending on the magnitude and duration of overshoot, some impacts will cause release of additional greenhouse gases (medium confidence) and some will be irreversible, even if global warming is reduced (high confidence). (Box SPM.1, Figure SPM.3) {2.5, 3.4, 12.3, 16.6, CCB DEEP, CCB SLR}

#### Try or die to prevent a number of existential climate risks

Fawzy et al. 20 (Samer Fawzy, School of Chemistry and Chemical Engineering, Queen’s University Belfast, Ahmed I. Osman, School of Chemistry and Chemical Engineering, Queen’s University Belfast· John Doran, The Bryden Centre, Letterkenny Institute of Technology, Letterkenny, Ireland· David W. Rooney, School of Chemistry and Chemical Engineering, Queen’s University Belfast, “Strategies for mitigation of climate change: a review” Environmental Chemistry Letters https://doi.org/10.1007/s10311-020-01059-w)

Climate change impacts, risks and vulnerabilities

An understanding of the severe impact of climate change on natural and human systems as well as the risks and associated vulnerabilities is an important starting point in comprehending the current state of climate emergency. Changes in climate indicators, namely temperature, precipitation, seal-level rise, ocean acidification and extreme weather conditions have been highlighted in a recent report by the United Nations Climate Change Secretariat (UNCCS). Climate hazards reported included **droughts, floods, hurricanes, severe storms, heatwaves, wildfires, cold spells and landslides** (UNCCS 2019). According to the Centre for Research on the Epidemiology of Disasters (CRED), the world encountered 315 cases of natural disasters in 2018, mainly climate-related. This included 16 cases of drought, 26 cases of extreme temperature, 127 cases of flooding, 13 cases of landslides, 95 cases of storms and 10 cases of wildfire. The number of people affected by natural disasters in 2018 was 68.5 million, with floods, storms and droughts accounting for 94% of total affected people. In terms of economic losses, a total of $131.7 billion was lost in 2018 due to natural disasters, with storms ($70.8B), floods ($19.7B), wildfires ($22.8B) and droughts ($9.7B) accounting for approximately 93% of the total costs. CRED also provides data on disasters over the past decade, which shows even higher annual averages in almost all areas, except for wildfire cases. The economic losses attributed to wildfires in 2018 alone are approximately equal to the collective losses from wildfires incurred over the past decade, which is quite alarming (CRED 2019). Moreover, wildfires are a direct source of CO2 emissions. Although wildfires are part of the natural system, it is clear that human-induced emissions are directly interfering and amplifying the impact of natural system emissions. It is evident that human-induced climate change is a major driving force behind many natural disasters occurring globally.

Furthermore, climate risks such as temperature shifts, precipitation variability, changing seasonal patterns, changes in **disease distribution**, desertification, ocean-related impacts and soil and coastal degradation contribute to **vulnerability across multiple sectors in many countries** (UNCCS 2019). Sarkodie et al. empirically examined climate change vulnerability and adaptation readiness of 192 United Nations countries and concluded that **food, water, health, ecosystem, human habitat and infrastructure are the most vulnerable sectors under climate attack** while pointing out that Africa is the most vulnerable region to climate variability (Sarkodie and Strezov 2019). It is also important to note the interconnected nature of such sectors and the associated impacts.

The 15th edition of the global risks report 2020 prepared by the world economic forum thoroughly presented a number of climate realities, laying out areas that are greatly affected. The risks included loss of life due to health hazards and natural disasters, as well as **excessive stress on ecosystems**, **especially aquatic/marine systems**. Moreover, **food and water security are other areas that are highly impacted**. Increased migration is anticipated due to extreme weather conditions and disasters as well as rising sea levels. **Geopolitical tensions and conflicts are likely to arise as countries aim to extract resources along water and land boundaries.** The report also discusses the negative financial impact on capital markets as systematic risks soar. Finally, the impact on trade and supply chains is presented (WEF 2020).

An assessment, recently presented in an Intergovernmental Panel on Climate Change (IPCC) special report, covered the impacts and projected risks associated with 2 levels of global warming, 1.5 °C and 2 °C. The report investigated the negative impact of global warming on freshwater sources, food security and food production systems, ecosystems, human health, urbanization as well as poverty and changing structures of communities. The report also investigated climate change impact on key economic sectors such as tourism, energy and transportation. It is evident that most of the impacts assessed have lower associated risks at 1.5 °C compared to 2 °C warming level. We would likely reach 1.5 °C within the next 3 decades and increases in warming levels **beyond this point would amplify risk effects**; for example, water stress would carry double the risk under a 2 °C level compared to 1.5 °C. An increase of 70% in population affected by fluvial floods is projected under the 2 °C scenario compared to 1.5 °C, especially in USA, Europe and Asia. **Double or triple rates of species extinction in terrestrial ecosystems are projected under the 2 °C level compared to 1.5 °C** (IPCC 2018). **It can be simply concluded that the world is in a current state of climate emergency.**

### 2NC AT: Renewables Fail

#### Nuclear is more intermittent than renewables

Lovins 22 [Amory B. Lovins is an adjunct professor of civil and environmental engineering at Stanford University who has advised major firms and governments in over 70 countries for 49 years, “US nuclear power: status, prospects, and climate implications,” Jan 2022, energiestiftung.ch/files/energiestiftung/fliesstextbilder/Studien/2022%20Lovins/20220124\_Lovins%20final.pdf]

Nuclear advocates contend that nuclear plants' normally steady "baseload" operation has unrecognized but large economic, reliability, and resilience value deserving special compensation. No evidence has emerged to support this view55. In 2018, FERC (then with three Trump appointees) rejected 5-0 his Energy Secretary's request for new subsidies to coal and nuclear plants. The February 2021 Texas power crisis gave no reason to revisit the claim56. On the contrary, those central thermal plants have proven vulnerable to failure, especially in a changing climate57.

More broadly, big thermal stations, the mainstay of 20th-Century grids, have lost their operational role and business case in the 21st. Now renewables with near-zero operating cost are dispatched whenever available; other units, timely use, and thermal or electrical storage follow. "Baseload" units' inflexibility thus becomes a handicap—one of the owner's reasons for retiring its well-running Diablo Canyon reactors58. Cycling reactors, where feasible, to follow varying net loads makes them even less economic to keep operating, so they must run fewer hours until they go broke and close, to be rapidly replaced by zero-carbon resources59. How, then, can the reliable supplies traditionally sustained by those units continue with variable renewables?

In a sense, says utility regulatory expert Jim Lazar, "nuclear units have something in common with variable renewable resources: they produce much of their output when it is not needed for the grid." Nuclear units can't keep rapidly changing their output on demand as renewables can, so to cope with excess nuclear output at low-demand times, at least 12.2 GW of US hydro pumped storage plants, each >1 GW, were built by the owners of nine nearby US nuclear plants. Their cost was an "inflexibility tax". Ironically, these renewable resources built to support nuclear ones will be freed by nuclear closures to support an increasingly renewable grid.

Giant fossil-fueled or nuclear plants can unexpectedly lose a billion watts in milliseconds, often for weeks or months, and often without warning, or unexpectedly extended from brief to long outages (as in France in 2020, when the average plant produced zero output a third of the time). The electricity grid was built mainly to manage this intermittence (unpredictable forced outages) by backing up failed generators with working ones. Diversified portfolios of modular renewables don't suffer such ungracefully massive failures: PV and wind generally falter in far smaller chunks, and their output varies quite predictably—often more so than demand. Thus the same grid can back up their predictable variability, more easily and often more cheaply, with other renewables of other types or in other places (or demand-side resources or storage). But the need for storage is widely overstated.

#### Ten unique technologies solve renewable intermittence and variability---without defense to each of these, “renewables bad” is unwinnable

Lovins 22 [Amory B. Lovins is an adjunct professor of civil and environmental engineering at Stanford University who has advised major firms and governments in over 70 countries for 49 years, “US nuclear power: status, prospects, and climate implications,” Jan 2022, energiestiftung.ch/files/energiestiftung/fliesstextbilder/Studien/2022%20Lovins/20220124\_Lovins%20final.pdf]

At least ten kinds of "grid flexibility resources" can reliably balance grids powered largely or wholly by variable renewables60. Of these, utility-scale batteries, though often profitable, are the best-known but currently the costliest. They'll become much cheaper, but probably not as cheap as ample competitors. In typical order of decreasing cost—and besides hydrogen and non-battery bulk storage methods like pumped hydro, compressed air, and gravity storage— these grid-balancers include thermal (heat or coolth) storage, electric-vehicle integration, co- generation and dispatchable-renewable integration, wider interconnected markets, highly accurate renewable forecasting, strong demand response, and end-use efficiency. The latter two resources have lately turned out to be severalfold larger (yet cheaper) than previously thought61. Just modest efficiency gains, ice-storage air conditioning, and smart bidirectional electric-vehicle charging could run the isolated Texas grid reliably and economically in 2050 on 100% renewables with no bulk storage62. Simulations denying this simply exclude most of the proven solutions. And rather than comparing technologies singly, locally optimized "clean energy portfo- lios"—blending efficient use, timely use, renewables, and storage—outcompete both fossil and nuclear energy for every need: energy, peak output, ramp rate, and ancillary services63.

Grid balancing now typically costs a few US$/MWh64. The evidence suggests it also tends to cost less with wind and solar than with big thermal plants, because big thermal plants' failures are bigger, longer, and less predictable, making their backup costlier65. As Germany's renewable share of generation quadrupled in 2006-20, its grid operators learned even faster, so reliability broadly improved to five times America's. In 2020, renewables' share of German power demand exceeded 50% sometime in almost every week, and in half of the weeks it reached between 80% and nearly 100%. Nuclear and coal phaseouts continued. The lights stayed on. As renewables and efficiency growth offset coal and nuclear closures66, Germany's greenhouse gas emissions fell by over half in 2010-20, and the power sector met its climate goal a year early (before the pandemic depressed demand) with five percentage points to spare.

Careful choreography has lately met annual national electricity demand with 97% renewables (79% without hydro) in Scotland in 2020, 79% in Denmark (with 0.06% hydro) in 2019, 66% in Portugal in 2018 (42% without hydro), 52% in Germany (with 3.3% hydro) in 2020, and 46% in Spain in 2016 and 2020 (27/33% without hydro). None added bulk storage. All sustained superior reliability, often many times that of the US. They simply learned to run their grids (as my colleague Clay Stranger puts it) the way a conductor leads a symphony orchestra: no instrument plays all the time, but the ensemble continuously makes beautiful music.

This is also how the former East Germany's ultrareliable grid operator 50Hertz—half wind-and- solar-powered in 2019, 62% renewable in 2020—intends 100% renewables in 2032. Anyone who thinks we need big thermal plants to keep the lights on is not paying attention to modern power engineering, where "grid-forming inverters" and fast-responding power electronics can stabilize grids even better than rotating heavy machines traditionally did. Some European operators also disconnect retired coal or nuclear plants' generators from their turbines67 and keep spinning them as grid-connected "synchronous condensers," using their angular momentum to keep on cheaply stabilizing voltage and frequency68.

Extra wind and solar capacity can also economically substitute for giant batteries or other grid- balancing resources as supply becomes mostly or wholly renewable. But most of the time the surplus electricity, rather than having to be "curtailed" (wasted) as grid-centric analysts assume, can be profitably redeployed to tasks not yet electrified—to run heavy vehicles and decarbonize steel, cement, and other heavy-industrial heat, directly or by making hydrogen or ammonia. That is, our industrial economy is easier and cheaper to decarbonize as a whole than in pieces69.

#### The consensus of studies disagree --- increased renewable penetration does not undermine reliability

Cooper 15 [Mark, Senior research fellow for economic analysis at the Institute for Energy and the Environment at the Vermont Law School, Ph.D. from Yale University, “Power Shift: The Deployment of a 21st Century Electricity Sector and the Nuclear War to Stop it,” June 2015, http://www-assets.vermontlaw.edu/Assets/iee/Power\_Shift\_Mark\_Cooper\_June\_2015.PDF]

3. Other Studies California attracts a great deal of attention because it is a large U.S. electricity market with a strong commitment to shifting to renewables. It is also of interest since it experienced the largest early retirement of nuclear reactors in almost two decades. In fact, it is the largest early retirement of nuclear reactors in U.S. history. The fact that it was handled with relative ease is a good indication that early retirements are manageable. In fact, the dozens of early retirements that have occurred throughout the history of the commercial nuclear sector in the U.S. suggest that, as a general proposition, the electricity system can manage them well. The conclusion that high levels of penetration of renewables can be achieved without undermining reliability is supported in the literature in a variety of ways. First, there are other studies of California135 that reach the same conclusions, while simultaneously analyzing other U.S. areas.136 Second, I have already noted that there are numerous studies of other states that support the basic findings of these California studies including very diverse areas – Texas, Mid-America137 and the Mid-Atlantic. 138 Third, there are numerous studies of other nations, particularly in Europe.139 Fourth, there is a great deal of conceptual work on how integration can be accomplished.140 There are two important points made in these studies, in addition to the fact that they support the general proposition that high levels of penetration of renewables can be achieved without undermining reliability. First, the finding spans different types of renewables. A study that focuses on California and the independent system operator in the Midwest, MISO, finds that policies to handle high level of penetration of renewables work in both cases. The only difference is that the leading renewable resources will differ between regions depending on the richness of the resource. In the upper Midwest, wind is the economically preferred option. Nevertheless, a mix of renewable resource is preferable as penetrations rise.

#### Transition away from nuclear enables energy efficiency

Lovins 22 [Amory B. Lovins is an adjunct professor of civil and environmental engineering at Stanford University who has advised major firms and governments in over 70 countries for 49 years, “US nuclear power: status, prospects, and climate implications,” Jan 2022, energiestiftung.ch/files/energiestiftung/fliesstextbilder/Studien/2022%20Lovins/20220124\_Lovins%20final.pdf]

Efficient use of electricity

Renewables now cost less than new fossil or nuclear plants in 91% of the world (soon all), and less than running existing thermal plants in roughly half the world (soon all)26. But there's often an even cheaper choice: wringing more work from each kWh by smarter design and better technologies. "Negawatts" are especially cheap because they're already delivered behind your meter, while electricity generated hundreds of miles away costs an average of US$4/MWh extra to deliver. Efficiency typically costs $0-20 per kWh saved, but properly adjusting for where it's delivered, it has a negative cost compared with remote supply. So how much can we save?

A decade ago, using the best 2010 technologies, RMI rigorously showed72 how to use US electricity fourfold more productively by 2050, so 2.6-fold economic growth during 2010-50, with all-electric automobiles, could use one-fourth less electricity than in 2010, yet cost far less. That's part of a tripled-efficiency, quintupled-renewables scenario for the whole US economy, saving $5 trillion net present value and cutting CO2 emissions by 82-86%, with no new inventions or Acts of Congress. With smart State and local policies, it could be led by business for profit. That vision tracks nicely to actual market developments since. Efficiency speeds renewables' takeover: if, hypothetically, that 4X efficiency could have been achieved in 2020, then renewables' 20.6% share of 2020 US electricity could have been 82%—cleaning up the power system73 at far lower cost than needing to quadruple renewable (let alone nuclear) output.

Strikingly, quadrupling US efficiency in using electricity would save kWh at one-tenth the cost of buying them today, so RMI's study should have bought even more efficiency! In contrast, by overlooking the economics of saving vs. supplying electricity, a widely cited 2020 study74 buys much less efficiency than RMI's study did, and so assumes the US will need 2-4 times more

electricity to produce virtually the same 2050 GDP. That excessive demand creates problems of land-use, transmission, etc., specified in minute detail—all artifacts of buying far too little efficiency. Governments and companies needn't repeat that error and risk building costly supply- side assets that they won't need, can't afford, and may not be able to pay for.

Who chooses and how?

Ideally, everyone could be fully informed, enabled, and motivated to choose the most clean, safe, affordable, and reliable way to deliver any electrical service desired, like hot showers and cold beer—whether with purchased electricity from preferred sources, homemade electricity, or using electricity more productively and timely. In practice, such choices are blocked by dozens of practical barriers75, each convertible into a business opportunity, but requiring major policy reforms or entrepreneurs' focus and tenacity.

Many entities we entrust with such choices, from utilities to regulatory commissions to governments at all levels, are ill-equipped to compare or compete all those choices either, or don't bother. In fact, most76 US States' regulatory practices reward utilities for selling you more electricity and penalize them for cutting your usage and bill. This perverse practice creates huge choice, cost, and value gaps between the best buys and what we're actually offered. Caring customers in mindful markets can take many of those choices into our own hands—saving or retiming our use of electricity, producing our own, trading it with each other, or buying the kinds we like. This visionary world is already emerging. People with efficient homes and smart appliances have freedom of choice, giving them more market power than utilities. Add a smart electric car, or rooftop solar and storage, and the utility becomes a mere optional convenience, de-moting nuclear power from uncompetitiveness to irrelevance. These trends are well underway.

#### Solves extinction

Wulfinghoff 13 [Donald, Professional Engineer in mechanical and electrical engineering, primary executive and congressional authority on energy efficiency policy and legislation, January 2013, Energy Conservation: Critical to the Survival of Civilization]

Energy conservation is one of the critical imperatives for society today. Our civilization presently runs on energy resources that are finite, and those resources are being depleted. At the same time, the demand for energy in all sectors has been growing dramatically, as illustrated in Figure 1.

figure 1: uS energy consumption by sector, 1960 and 2010

Source: Energy Information Administration, State Energy Data System 2010

Aside from the threat posed by energy depletion, the cost of energy is enormous. Utility bills account for much of the cost of housing, and they are a major cost of business. A large hotel or hospital spends millions of dollars for energy each year. Some aluminum plants pay hundreds of millions of dollars annually for energy. In response to diminishing sources of conventional energy, recent decades have seen energy prices that are growing and becom- ing increasingly volatile.

And, the consumption of energy brings a host of environmental dangers. Fossil fuels dump carbon dioxide into the atmosphere, accelerating the greenhouse effect. Air conditioning systems release gases that destroy the earth’s ozone layer. Discarded lamps contribute to mercury pollution. Energy production depletes not only the fuels themselves, but also a spectrum of other resources.

Most of U.S. energy comes from fossil fuels and other depleting sources, as shown in Figure 2. Only a small contri- bution is presently made by sources that are actually sustainable. So, new sustainable sources will eventually be needed to replace most of our present capacity. The rest of the advanced world is in the same boat.

However, only a small fraction of our current energy consumption can be replaced with sustainable sources soon enough to avert an energy catastrophe. Furthermore, it is not yet clear whether the sustainable resources in which we are mainly investing – wind and photovoltaic energy – are actually net energy producers or false hopes. Therefore, depletion of conventional energy sources during this century has the potential to kill or impoverish a large part of humanity. The potential for harm is greater than for any of the other foreseeable global dangers, including climate change and terrorism. Energy depletion would exacerbate other looming dangers, including war and pandemic disease. And, an energy depletion catastrophe is more certain than any of those other threats, if we don’t take adequate steps to avert it.

To avoid this fate, we need a bridge to span from the present to a future when adequate new energy sources can take over. The only possible bridge is energy conservation, which will allow us to sustain our societal functions with much less energy.

### ---AT: Cost

#### Recent cost estimates prove renewables provide substantially cheaper generation with fewer subsidies

Diesendorf 16 [Mark, Associate Professor in Interdisciplinary Environmental Studies in the School of Biological, Earth and Environmental Sciences at the University of New South Wales, “Renewable energy versus nuclear: dispelling the myths,” April 25, 2016, http://www.renewablesinternational.net/renewable-energy-versus-nuclear-dispelling-the-myths/150/537/94984/]

Myth 11: Renewable energies are more expensive than nuclear Variant: Nuclear energy receives smaller subsidies than RE. Both myths are false. Levelised costs of energy (LCOE) depend on the number of units installed at a site, location, capital cost, interest rate and capacity factor (actual average power output divided by rated power). LCOE estimates for nuclear are $108/MWh based on pre-2014 data and $97-132/MWh based on pre-2015 data (Lazard 2015). The IPCC estimate does not include subsidies, while the Lazard estimate includes US federal government subsidies excluding loan guarantees and decommissioning. None of these US estimates takes account of the huge escalation in costs of the two European Pressured Water Reactors (EPR) under construction (mentioned in Myth 3). The EPR proposed for the UK, Hinkley C, is being offered a guaranteed inflation-linked price for electricity over 35 years, commencing at £92.5/MWh ($144/MWh) in 2012 currency. That's now pushing up towards £100 in today's money, almost three times the current wholesale price of electricity in the UK. The subsidy package also includes a UK Treasury loan guarantee of originally £10 billion ($15.3 billion). Its capped liability for accidents and inadequate insurance is likely to fall upon the British taxpayer. In 2015 multinational financial consultants Lazard estimated unsubsidised costs for on-shore wind across the USA of $32-77/MWh. An independent empirical study by US Department of Energy (Fig. 46) found levelised power purchase agreement prices in 2014 for wind in the US interior (region with the highest wind speeds) of $22/MWh, and in the west (region with lowest wind speeds) about $60/MW. The US government subsidises wind with a Production Tax Credit of $23/MWh over 10 years, so this must be added to the DoE figures to obtain the actual costs. In Brazil in 2014, contracts were awarded at a reverse auction for an average unsubsidised clearing price of 129.3 real/MWh (US $41/MWh). Lazard estimated unsubsidised costs of $50-70/MWh for large-scale solar PV in a high insolation region of the USA. In New Mexico, USA, a Power Purchase Agreement for $57.9/MWh has been signed for electricity from the Macho Springs 50 MW solar PV power station; federal and state subsidies bring the actual cost to around $80-90/MWh depending on location. In Chile, Brazil and Uruguay, unsubsidised prices at reverse auctions are in the same range (Diesendorf 2016). Rooftop solar 'behind the meter' is competitive with retail grid electricity prices in many regions of the world with medium to high insolation, even where there are no feed-in tariffs. For CST with thermal storage, Lazard estimates $119-181/MWh. Comparing subsidies between nuclear and RE is difficult, because they vary substantially in quantity and type from country to country, where nuclear subsidies may include some or all of the following (Diesendorf 2014): government funding for research and development, uranium enrichment, decommissioning and waste management; loan guarantees; stranded assets paid for by taxpayers and electricity ratepayers; limited liabilities for accidents covered by victims and taxpayers; generous contracts for difference. Subsidies to nuclear have either remained constant or increased over the past 50 years, while subsidies to RE, especially feed-in tariffs, have decreased substantially (to zero in some places) over the past decade.

#### Market fundamentals are decidedly against nuclear --- technological progress and market developments are only making renewables more competitive

* Assumes SMRs/new nuclear (not just old reactors) --- still going to get out-competed by other renewables

Cooper 15 [Mark, Senior research fellow for economic analysis at the Institute for Energy and the Environment at the Vermont Law School, Ph.D. from Yale University, “Power Shift: The Deployment of a 21st Century Electricity Sector and the Nuclear War to Stop it,” June 2015, http://www-assets.vermontlaw.edu/Assets/iee/Power\_Shift\_Mark\_Cooper\_June\_2015.PDF]

C. KEY COST TRENDS The economic characteristics of the mid-term options behind the energy cost analysis in Figure II-3 reflect dramatic technological and economic developments over the course of the past two decades. Figure II-4 shows long-term cost trends for three of the most frequently discussed supply-side, low-carbon options: nuclear, wind, and solar. [Chart Omitted] The economic competitiveness of renewable resources reflects technological and economic progress. Wind already exhibits much lower overnight costs than nuclear and solar will in the near term. Declining construction costs are reinforce by rising capacity factors. For wind, utilization has increased dramatically and achieved capacity factors above 50 percent in some cases, with costs per kilowatt hour plummeting as the result of increasing tower height, longer and larger blades, better gearbox reliability, material optimization, and more efficient computer programming.13 The long-term declining cost trend for solar has been driven by both economies of scale and innovation. Each of these factors has made a substantial contribution to declining cost and both are likely to continue to do so.14 Solar costs have been falling because of economies of scale in production, reduced utilization of key component materials, increasing cell efficiency, and other system cost savings and streamlining of siting, all of which have lowered the cost of capital. 15 Storage is projected to be the least cost-peaking power source, just 10 percent more costly than the higher nuclear projections.16 Rapid declines in storage costs reinforce the importance of rapid declines in renewable costs as low-cost storage can dramatically boost the effective load factor of renewables. Lazard’s estimate of a rapid decline in storage costs is consistent with other estimates.17 Although important local conditions can affect the cost estimates of power from alternatives — such as the richness of wind and solar resources — the broad technology cost trends tend to be global because technology is exportable. In fact, as shown in the upper graph of Figure II-5, declining costs abroad have been greater than those in the United States despite the fact that the United States has richer resources. For example, solar costs declined almost twice as fast in Germany as in the United States after Germany made a strong commitment to increase reliance on renewables and decrease reliance on nuclear. As shown in the lower graph of Figure I-5, cost trends for wind and solar in South Africa exhibit a similar pattern.18 In contrast to the non-hydro renewables, over the course of 50 years of commercial nuclear power in the United States, construction costs have risen persistently without any indication of abatement. Small modular reactors (SMRs), which have been touted as the next big thing to save nuclear power, are likely to be much more costly than the renewables. Investment in SMRs has collapsed, with both Westinghouse and B&W, the two largest firms pursuing the technology in the United States, throttling investment.19 The combined effect and pay-off of the rapid improvement in technologies resulting in declining operating, construction and life cycles costs is to deliver much lower cost, low carbon energy to the market. As Figure II-6 shows, there has been a strong downward trend in purchased power agreement prices. The Figure is constructed to align the dates, which shows that the break point came in 2009. We observe wind and solar price declines of 50% in half a decade. Recent wind prices are in the range of $20-$40/kwh; solar prices are in the range of $50-$80/kwh. In an analysis that projects renewables will account for the overwhelming majority of U.S. capacity addition in the next decade, Credit Suisse notes that the prices being paid in Purchased Power Contracts (PPAs) are already lower than the numbers used in Figure II-3 above, making them cost competitive with conventional generation options. Renewables are cost competitive to even cheap against conventional generation. The clearing price for new wind and solar continues to fall with improvements in utilization and falling capital costs. For wind we are seeing utilization rates 15–20 percentage points higher than 2007 vintage turbines, regularly supporting PPA pricing at or below $30/MWH that effectively 'creates' long-term equivalent natural gas at <$3/MMBtu. Lower capital costs for solar have dropped PPA pricing to $65–80/MWH from well over $100/MWH, making solar competitive with new build gas peaking generation.20 [Charts Omitted] Wind and solar not only costs substantially less than power from new nuclear reactors, they are less costly than power from aging reactors. The market fundamentals on the supplyside are running strongly against nuclear power.

### ---AT: Land Use

#### New tech solves land use or critical materials for renewables

Lovins 22 [Amory B. Lovins is an adjunct professor of civil and environmental engineering at Stanford University who has advised major firms and governments in over 70 countries for 49 years, “US nuclear power: status, prospects, and climate implications,” Jan 2022, energiestiftung.ch/files/energiestiftung/fliesstextbilder/Studien/2022%20Lovins/20220124\_Lovins%20final.pdf]

Supposed renewable constraints like land-use70 and critical materials71 are quite manageable: a well-designed efficiency-and-renewables decarbonization strategy would decrease the energy system's land-use. Some places may need grid expansion, but fewer and less than often claimed —especially if efficient and timely use are properly competed or compared with supply, and if local and distributed were fairly competed with remote and centralized. Where grid congestion blocks renewables, another option is a new kind of transmission wire (from a firm I advise) that can carry 2-3X the usual power on the same towers, so existing lines can be quickly and profitably restrung to allow rapid renewable expansion without new rights-of-way or towers.

#### Even if challenges for solar/wind exist, they’re easily overcome

Cooper 15 [Mark, Senior research fellow for economic analysis at the Institute for Energy and the Environment at the Vermont Law School, Ph.D. from Yale University, “Power Shift: The Deployment of a 21st Century Electricity Sector and the Nuclear War to Stop it,” June 2015, http://www-assets.vermontlaw.edu/Assets/iee/Power\_Shift\_Mark\_Cooper\_June\_2015.PDF]

1. Long Term Potential The possibility that renewables could become the primary source of energy in the decarbonized electricity sector has been recognized by major research institutions. As the MIT study on The Future of Solar put it, Massive expansion of solar generation worldwide by mid-century is likely a necessary component of any serious strategy to mitigate climate change. Fortunately, the solar resource dwarfs current and projected future electricity demand… Solar electricity generation is one of very few low-carbon energy technologies with the potential to grow to very large scale. As a consequence, massive expansion of global solar generating capacity to multi-terawatt scale is very likely an essential component of a workable strategy to mitigate climate change risk.57 The Department of Energy said much the same about the potential for wind in its Wind Vision Report, Interest in wind power is stimulated by its abundant resource potential (more than 10 times current electricity demand); competitive, long-term stable pricing; economic development potential; and environmental attributes, including its ability to support reduced carbon emissions, improved air quality, and reduced water use.58 Both of these analyses recognize key challenges that must be overcome to achieve high levels of reliance on renewables. However, both of the analyses are optimistic about the ability to do so. MIT identified three key challenges – We focus in particular on three preeminent challenges for solar generation: reducing the cost of installed solar capacity, ensuring the availability of technologies that can support expansion to very large scale at low cost, and easing the integration of solar generation into existing electric systems. Progress on these fronts will contribute to greenhouse-gas reduction efforts, not only in the United States but also in other nations with developed electric systems. It will also help bring light and power to the more than one billion people worldwide who now live without access to electricity. 59 At the same time, the MIT study pointed to real world experience that suggested the path to overcome the challenges is clear, adding recommendations for public policy to support that effort. A number of emerging thin-film technologies that are in the research stage today use novel material systems and device structures and have the potential to provide superior performance with lower manufacturing complexity and module cost. Several of these technologies use Earthabundant materials (even silicon in some cases)… Experience in Germany suggests that several components of BOS [Balance of System cost, other than solar panels], such as the cost of customer acquisition and installation labor, should come down as the market matures… net load peaks can be reduced — and corresponding cycling requirements on thermal generators can be limited — by coordinating solar generation with hydroelectric output, pumped storage, other available forms of energy storage, and techniques of demand management. Because of the potential importance of energy storage in facilitating high levels of solar penetration, large-scale storage technologies are an attractive focus for federal R&D spending. 60 Given the much lower current cost of wind and its much higher levels of penetration at present, it is not surprising to find that the DOE Wind Vision analysis argues that “Wind generation variability has a minimal and manageable impact on grid reliability and related costs.”61 DOE believes that operational challenges that could arise with much higher levels of wind penetration can be easily overcome by expanding the use of techniques that have been found effective in the past. “Such challenges can be mitigated by various means including increased system flexibility, greater electric system coordination, faster dispatch schedules, improved forecasting, demand response, greater power plant cycling, and—in some cases— storage options.”

### 2NC---Grid Link

#### Nuclear power is reliant on grid security

IAEA ND [IAEA, No Date, accessed on 7-20-2022, IAEA, "Interfacing Nuclear Power Plants with the Electric Grid", PDF, mimou]

For a country that does not yet use nuclear power, the introduction and development of nuclear power is a major undertaking. It requires the country to build the necessary infrastructure so it can construct and operate a nuclear power plant (NPP) profitably in a safe, secure and technically sound manner. A major part of the necessary infrastructure is the electric grid to which the NPP will connect. While most countries already have an electric grid system, it may require significant development to be suitable for the connection of an NPP. The efficient, safe, secure and reliable operation of the NPP requires that the grid to which it connects is also efficient, safe, secure and reliable. This paper explains the characteristics of the electric grid, its relationship with the NPP, and the reasons why a reliable grid is so important to the NPP. The grid is the electrical highway through which all electricity traffic passes as it moves energy from the supplier (‘generation’) to the customer (‘load’). Interconnected electric grids can encompass several countries and are probably the largest machines in the world. They consist of hundreds of power suppliers, thousands of kilometres of transmission and distribution lines and millions of different electrical loads. Rapid economic development in the 20th century made the electric grid system a critical part of the economic infrastructure in industrialized countries and a permanent feature of the landscape. NPPs are unique and powerful generators compared to other electricity generating plants. Moreover, they are both electricity generators and customers. They thus maintain a symbiotic relationship with the electric grid at all times. NPPs supply large amounts of energy to the grid as well as relying on it to receive power for crucial safety operations, especially during emergency conditions. The safe startup, operation and shutdown of NPPs require a reliable and stable power supply from the electric grid, referred to generally as ‘off-site power’. The grid’s principal function is to transport electricity from the power plant to customers. But it does much more than that. A reliable, balanced and well maintained electric grid is crucial for bringing new nuclear power plants online and operating them cost-effectively and safely. In particular, the grid plays an important safety role by providing a reliable source of electricity to power the plant’s cooling system to keep nuclear fuel cool after a reactor has been shut down (although NPPs also have on-site back-up power available for emergency situations). The fewer instabilities and interruptions there are in NPP–grid interactions, the more productively and consistently the NPP can supply full power to consumers. Siting decisions must therefore take into account the local grid conditions and usage, and, because of the grid’s role in plant safety as well as plant economics, integration of NPPs into an electric grid poses a complex set of regulatory as well as engineering challenges.

### 2NC – Nuke Terror

#### Studies prove new nuclear energy increases the threat of nuclear terror and proliferation

Carless et al. 21 [Travis S. Carless, Kenneth Redus, and Rachel Dryden, Travis is an Associate at The Brattle Group where he specializes in electricity sector topics such as low-carbon generation, nuclear power, climate policy analysis, and resource planning. Prior to joining Brattle, Travis served as a President’s Postdoctoral Fellow at Carnegie Mellon University and a Stanton Nuclear Security Fellow at the RAND Corporation., Kenneth is a researcher at the Oak Ridge National Laboratory, Rachel Dryden Steratore (she/her) is an Associate Policy Researcher with expertise at the intersection of extreme event climate attribution and social and behavioral science., 10-4-2021, accessed on 7-20-2022, Proxy.lib.umich, "Estimating nuclear proliferation and security risks in emerging markets using Bayesian Belief Networks", https://www-sciencedirect-com.proxy.lib.umich.edu/science/article/pii/S0301421521004195?ref=pdf\_download&fr=RR-2&rr=72ddb3cc5ed08720 mimou]

Fig. 4 shows the distribution of outcomes for the Diversion of Material stratified by country and scenario. For Diversion of Knowledge and Technology and Non-state Actor Theft of Nuclear Material results, see Figure A.2 and A.3 in Appendix A.3. Each point on each boxplot represents a probabilistic judgment from an expert. The distributions are sorted by the averages for the No Evidence scenario. Under the No Evidence scenario, the median expert judgments show that Turkey has the highest likelihood of diversion of material (53%), diversion of knowledge and technology (38%), and theft of nuclear material by a non-state actor (36%) relative to the baseline. This is followed by Saudi Arabia for diversion of material (46%) and diversion of knowledge and technology (37%). Egypt is also judged to have a high likelihood of diversion of material (38%) and theft of nuclear material by non-state actors (24%). Across all countries, the risks shift upwards in a High-Risk scenario. While the change is not as substantial, the risks shift down by a modest amount in the BOO scenario. Table 5 shows the mean, relative standard deviation (rsd), and changes in the output risk by scenario from Fig. 4. While there is a wide spread in the expert judgments, Turkey typically has the lowest rsd and Thailand has the highest. See Appendix A.4 for the expert judgment means plotted with the standard deviation for each country. Aggregated distributions represent average expert judgments for each country and are sorted by the Diversion of Material risk under the No Evidence scenario (Fig. 5). Fig. 5 and Table 5 show small reductions in nuclear proliferation and security risks in a BOO scenario compared to the No Evidence scenario. Compared to the No Evidence scenario, the nuclear proliferation and security risk average outputs are reduced by 3–4% under the BOO scenario. The relative standard deviation increases between 0.06 and 0.08 on average in a BOO scenario, indicating less agreement among experts on its impact on proliferation and security risks. Relative to the No Evidence scenario, the High-Risk scenario shows large increases in nuclear proliferation and security risks. The average risk outputs are 16–18% higher, and the relative standard deTable viation decreases by 0.15–0.22 under the High-Risk scenario. This indicates that expert judgments become more centered around the HighRisk scenario mean and that they agree on the increased nuclear proliferation and security risks. We normalized experts’ judgments for the High-Risk and BOO scenarios, by the No Evidence scenario for each expert and emerging nuclear energy country, yielding the average percent change relative to the No Evidence scenario for each country (Fig. 6). Relative to the No Evidence scenario, the BOO scenario shows a 9–28% decrease in nuclear proliferation and security risk. Relative to the No Evidence scenario, the High-Risk scenario shows a 59–190% increase in nuclear proliferation and security risk. On average across all risk outputs, Morocco, Saudi Arabia, and Jordan show the lowest relative increases (83%, 89%, and 78%, respectively). However, Belarus, Bangladesh, Algeria, Egypt, Ghana, Nigeria, Indonesia, and Thailand show a relative increase ≥100% for at least two risk outputs.

\*\*Chart Omitted\*\*

3.2. Comparisons between experts Participants in this study had diverse backgrounds and professional expertise, including 5 from Think Tanks, 2 from National Labs, 5 from academia, and 1 from industry. Fig. 7 shows each expert’s judgment for Diversion of Material for each country under the No Evidence scenario, segmented by professional affiliation (for Diversion of Knowledge and Technology and Non-state Actor Theft of Nuclear Material, see Figure A.5 in Appendix A.5). In some instances, experts would cluster their judgments for countries together. For example, Expert F’s estimate for Diversion of Material for each country is between 50% and 60%. Experts B, E, F, G, I, and J would typically estimate the risk of Diversion of Material for each country to be within 10% of each other (With the exception of Saudi Arabia and Turkey). Despite their diverse backgrounds, there are some agreement among experts. For example, Fig. 7 shows expert judgments were generally clustered between two ranges, 0–25% and 37–70%. Under a BOO scenario (See Figure A.6 in Appendix A.5), expert judgments generally fall between 0 and 13% or 35–60%. Experts B, G, I, K, and L provide judgments where the probabilities are the same across countries. Under the High-Risk scenario (See Figure A.6 in Appendix A.5), judgments from experts in academia, think tanks, and national labs are less clustered than in the other scenarios. The Nuclear Threat Initiative (NTI) developed the Nuclear Security Index to benchmark current nuclear security conditions against theft of nuclear materials for 176 countries (Nuclear Threat Initiative, 2018). The higher the score, the better the nuclear security conditions are for that country. Fig. 8 shows the Nuclear Security Index for theft and the probability at least one risk event occurs (Diversion of Material, Diversion of Knowledge and Technology, or Non-state Actor Theft of Nuclear Material). Egypt, Bangladesh, and Saudi Arabia have an above-average probability of at least one risk event occurring and below-average Nuclear Security Index scores. This suggests that Egypt, Bangladesh, and Saudi Arabia currently have above-average nuclear security risks and will have nuclear proliferation and security risks in the future after acquiring nuclear power. Some countries with high Nuclear Security Index scores —like Indonesia, Morocco, Ghana, Jordan, and Belarus will continue to become relatively lower-risk countries in the future.

#### Nuclear power plants enable nuclear terrorism.

Dvorkin 12 (Major General (retired) Vladimir Z. Dvorkin is doctor of technical sciences, professor, and senior fellow at the Center for International Security of the Institute of World Economy and International Relations of the Russian Academy of Sciences. The Center participates in the working group of the U.S.-Russia Initiative to Prevent Nuclear Terrorism.; “What Can Destroy Strategic Stability: Nuclear Terrorism Is a Real Threat”; Harvard Kennedy Center Belfer for Science and International Affairs; September 21, 2012; [https://www.belfercenter.org/publication/what-can-destroy-strategic-stability-nuclear-terrorism-real-threat)//Accessed](https://www.belfercenter.org/publication/what-can-destroy-strategic-stability-nuclear-terrorism-real-threat)/Accessed) 11/19/21//eleanor

At the same time, these efforts fall short for a number of reasons, partly because various acts of nuclear terrorism are possible. Dispersal of radioactive material by detonation of conventional explosives (“dirty bombs”) is a method that is most accessible for terrorists. With the wide spread of radioactive sources, raw materials for such attacks have become much more accessible than weapons-useable nuclear material or nuclear weapons. The use of “dirty bombs” will not cause many immediate casualties, but it will result into long-term radioactive contamination, contributing to the spread of panic and socio-economic destabilization. Severe consequences can be caused by sabotaging nuclear power plants, research reactors, and radioactive materials storage facilities. Large cities are especially vulnerable to such attacks. A large city may host dozens of research reactors with a nuclear power plant or a couple of spent nuclear fuel storage facilities and dozens of large radioactive materials storage facilities located nearby. The past few years have seen significant efforts made to enhance organizational and physical aspects of security at facilities, especially at nuclear power plants. Efforts have also been made to improve security culture. But these efforts do not preclude the possibility that well-trained terrorists may be able to penetrate nuclear facilities. Some estimates show that sabotage of a research reactor in a metropolis may expose hundreds of thousands to high doses of radiation. A formidable part of the city would become uninhabitable for a long time. Of all the scenarios, it is building an improvised nuclear device by terrorists that poses the maximum risk. There are no engineering problems that cannot be solved if terrorists decide to build a simple “gun-type” nuclear device. Information on the design of such devices, as well as implosion-type devices, is available in the public domain. It is the acquisition of weapons-grade uranium that presents the sole serious obstacle. Despite numerous preventive measures taken, we cannot rule out the possibility that such materials can be bought on the black market. Theft of weapons-grade uranium is also possible. Research reactor fuel is considered to be particularly vulnerable to theft, as it is scattered at sites in dozens of countries. There are about 100 research reactors in the world that run on weapons-grade uranium fuel, according to the International Atomic Energy Agency (IAEA). A terrorist “gun-type” uranium bomb can have a yield of least 10-15 kt, which is comparable to the yield of the bomb dropped on Hiroshima. The explosion of such a bomb in a modern metropolis can kill and wound hundreds of thousands and cause serious economic damage. There will also be long-term sociopsychological and political consequences. The vast majority of states have introduced unprecedented security and surveillance measures at transportation and other large-scale public facilities after the terrorist attacks in the United States, Great Britain, Italy, and other countries. These measures have proved burdensome for the countries’ populations, but the public has accepted them as necessary. A nuclear terrorist attack will make the public accept further measures meant to enhance control even if these measures significantly restrict the democratic liberties they are accustomed to. Authoritarian states could be expected to adopt even more restrictive measures. If a nuclear terrorist act occurs, nations will delegate tens of thousands of their secret services’ best personnel to investigate and attribute the attack. Radical Islamist groups are among those capable of such an act. We can imagine what would happen if they do so, given the anti-Muslim sentiments and resentment that conventional terrorist attacks by Islamists have generated in developed democratic countries. Mass deportation of the non-indigenous population and severe sanctions would follow such an attack in what will cause violent protests in the Muslim world. Series of armed clashing terrorist attacks may follow. The prediction that Samuel Huntington has made in his book “The Clash of Civilizations and the Remaking of World Order” may come true. Huntington’s book clearly demonstrates that it is not Islamic extremists that are the cause of the Western world’s problems. Rather there is a deep, intractable conflict that is rooted in the fault lines that run between Islam and Christianity. This is especially dangerous for Russia because these fault lines run across its territory.

#### Nuclear terror causes extinction – retaliation goes nuclear.

Bunn and Roth 17 (Matthew Bunn is the James R. Schlesinger Professor of the Practice of Energy, National Security, and Foreign Policy at Harvard Kennedy School and the Co-Principal Investigator of the Project on Managing the Atom at Harvard Kennedy School’s Belfer Center.; Nickolas Roth is director of the Stimson Center’s Nuclear Security Program. Prior to joining the Stimson Center, Roth was a senior research associate at the Project on Managing the Atom at the Harvard Kennedy School’s Belfer Center for Science and International Affairs. His work has focused on nuclear security, US nuclear weapons policy, and arms control.; “The effects of a single terrorist nuclear bomb”; Bulletin of the Atomic Scientists; September 28, 2017; [https://thebulletin.org/2017/09/the-effects-of-a-single-terrorist-nuclear-bomb/)//Accessed](https://thebulletin.org/2017/09/the-effects-of-a-single-terrorist-nuclear-bomb/)/Accessed) 12/27/21//eleanor

Brighter than a thousand suns. Imagine a crude terrorist nuclear bomb—containing a chunk of highly enriched uranium just under the size of a regulation bowling ball, or a much smaller chunk of plutonium—suddenly detonating inside a delivery van parked in the heart of a major city. Such a terrorist bomb would release as much as 10 kilotons of explosive energy, or the equivalent of 10,000 tons of conventional explosives, a volume of explosives large enough to fill all the cars of a mile-long train. In a millionth of a second, all of that energy would be released inside that small ball of nuclear material, creating temperatures and pressures as high as those at the center of the sun. That furious energy would explode outward, releasing its energy in three main ways: a powerful blast wave; intense heat; and deadly radiation. The ball would expand almost instantly into a fireball the width of four football fields, incinerating essentially everything and everyone within. The heated fireball would rise, sucking in air from below and expanding above, creating the mushroom cloud that has become the symbol of the terror of the nuclear age. The ionized plasma in the fireball would create a localized electromagnetic pulse more powerful than lightning, shorting out communications and electronics nearby—though most would be destroyed by the bomb’s other effects in any case. (Estimates of heat, blast, and radiation effects in this article are drawn primarily from Alex Wellerstein’s “Nukemap,” which itself comes from declassified US government data, such as the 660-page government textbook The Effects of Nuclear Weapons.) At the instant of its detonation, the bomb would also release an intense burst of gamma and neutron radiation which would be lethal for nearly everyone directly exposed within about two-thirds of a mile from the center of the blast. (Those who happened to be shielded by being inside, or having buildings between them and the bomb, would be partly protected—in some cases, reducing their doses by ten times or more.) The nuclear flash from the heat of the fireball would radiate in both visible light and the infrared; it would be “brighter than a thousand suns,” in the words of the title of a book describing the development of nuclear weapons—adapting a phrase from the Hindu epic the Bhagavad-Gita. Anyone who looked directly at the blast would be blinded. The heat from the fireball would ignite fires and horribly burn everyone exposed outside at distances of nearly a mile away. (In the Nagasaki Atomic Bomb Museum, visitors gaze in horror at the bones of a human hand embedded in glass melted by the bomb.) No one has burned a city on that scale in the decades since World War II, so it is difficult to predict the full extent of the fire damage that would occur from the explosion of a nuclear bomb in one of today’s cities. Modern glass, steel, and concrete buildings would presumably be less flammable than the wood-and-rice-paper housing of Hiroshima or Nagasaki in the 1940s—but many questions remain, including exactly how thousands of broken gas lines might contribute to fire damage (as they did in Dresden during World War II). On 9/11, the buildings of the World Trade Center proved to be much more vulnerable to fire damage than had been expected. Ultimately, even a crude terrorist nuclear bomb would carry the possibility that the countless fires touched off by the explosion would coalesce into a devastating firestorm, as occurred at Hiroshima. In a firestorm, the rising column of hot air from the massive fire sucks in the air from all around, creating hurricane-force winds; everything flammable and everything alive within the firestorm would be consumed. The fires and the dust from the blast would make it extremely difficult for either rescuers or survivors to see. The explosion would create a powerful blast wave rushing out in every direction. For more than a quarter-mile all around the blast, the pulse of pressure would be over 20 pounds per square inch above atmospheric pressure (known as “overpressure”), destroying or severely damaging even sturdy buildings. The combination of blast, heat, and radiation would kill virtually everyone in this zone. The blast would be accompanied by winds of many hundreds of miles per hour. The damage from the explosion would extend far beyond this inner zone of almost total death. Out to more than half a mile, the blast would be strong enough to collapse most residential buildings and create a serious danger that office buildings would topple over, killing those inside and those in the path of the rubble. (On the other hand, the office towers of a modern city would tend to block the blast wave in some areas, providing partial protection from the blast, as well as from the heat and radiation.) In that zone, almost anything made of wood would be destroyed: Roofs would cave in, windows would shatter, gas lines would rupture. Telephone poles, street lamps, and utility lines would be severely damaged. Many roads would be blocked by mountains of wreckage. In this zone, many people would be killed or injured in building collapses, or trapped under the rubble; many more would be burned, blinded, or injured by flying debris. In many cases, their charred skin would become ragged and fall off in sheets. The effects of the detonation would act in deadly synergy. The smashed materials of buildings broken by the blast would be far easier for the fires to ignite than intact structures. The effects of radiation would make it far more difficult for burned and injured people to recover. The combination of burns, radiation, and physical injuries would cause far more death and suffering than any one of them would alone. The silent killer. The bomb’s immediate effects would be followed by a slow, lingering killer: radioactive fallout. A bomb detonated at ground level would dig a huge crater, hurling tons of earth and debris thousands of feet into the sky. Sucked into the rising fireball, these particles would mix with the radioactive remainders of the bomb, and over the next few hours or days, the debris would rain down for miles downwind. Depending on weather and wind patterns, the fallout could actually be deadlier and make a far larger area unusable than the blast itself. Acute radiation sickness from the initial radiation pulse and the fallout would likely affect tens of thousands of people. Depending on the dose, they might suffer from vomiting, watery diarrhea, fever, sores, loss of hair, and bone marrow depletion. Some would survive; some would die within days; some would take months to die. Cancer rates among the survivors would rise. Women would be more vulnerable than men—children and infants especially so. Much of the radiation from a nuclear blast I s short-lived; radiation levels even a few days after the blast would be far below those in the first hours. For those not killed or terribly wounded by the initial explosion, the best advice would be to take shelter in a basement for at least several days. But many would be too terrified to stay. Thousands of panic-stricken people might receive deadly doses of radiation as they fled from their homes. Some of the radiation will be longer-lived; areas most severely affected would have to be abandoned for many years after the attack. The combination of radioactive fallout and the devastation of nearly all life-sustaining infrastructure over a vast area would mean that hundreds of thousands of people would have to evacuate. Ambulances to nowhere. The explosion would also destroy much of the city’s ability to respond. Hospitals would be leveled, doctors and nurses killed and wounded, ambulances destroyed. (In Hiroshima, 42 of 45 hospitals were destroyed or severely damaged, and 270 of 300 doctors were killed.) Resources that survived outside the zone of destruction would be utterly overwhelmed. Hospitals have no ability to cope with tens or hundreds of thousands of terribly burned and injured people all at once; the United States, for example, has 1,760 burn beds in hospitals nationwide, of which a third are available on any given day. And the problem would not be limited to hospitals; firefighters, for example, would have little ability to cope with thousands of fires raging out of control at once. Fire stations and equipment would be destroyed in the affected area, and firemen killed, along with police and other emergency responders. Some of the first responders may become casualties themselves, from radioactive fallout, fire, and collapsing buildings. Over much of the affected area, communications would be destroyed, by both the physical effects and the electromagnetic pulse from the explosion. Better preparation for such a disaster could save thousands of lives—but ultimately, there is no way any city can genuinely be prepared for a catastrophe on such a historic scale, occurring in a flash, with zero warning. Rescue and recovery attempts would be impeded by the destruction of most of the needed personnel and equipment, and by fire, debris, radiation, fear, lack of communications, and the immense scale of the disaster. The US military and the national guard could provide critically important capabilities—but federal plans assume that “no significant federal response” would be available for 24-to-72 hours. Many of those burned and injured would wait in vain for help, food, or water, perhaps for days. The scale of death and suffering. How many would die in such an event, and how many would be terribly wounded, would depend on where and when the bomb was detonated, what the weather conditions were at the time, how successful the response was in helping the wounded survivors, and more. Many estimates of casualties are based on census data, which reflect where people sleep at night; if the attack occurred in the middle of a workday, the numbers of people crowded into the office towers at the heart of many modern cities would be far higher. The daytime population of Manhattan, for example, is roughly twice its nighttime population; in Midtown on a typical workday, there are an estimated 980,000 people per square mile. A 10-kiloton weapon detonated there might well kill half a million people—not counting those who might die of radiation sickness from the fallout. (These effects were analyzed in great detail in the Rand Corporation’s Considering the Effects of a Catastrophic Terrorist Attack and the British Medical Journal’s “Nuclear terrorism.”) On a typical day, the wind would blow the fallout north, seriously contaminating virtually all of Manhattan above Gramercy Park; people living as far away as Stamford, Connecticut would likely have to evacuate. Seriously injured survivors would greatly outnumber the dead, their suffering magnified by the complete inadequacy of available help. The psychological and social effects—overwhelming sadness, depression, post-traumatic stress disorder, myriad forms of anxiety—would be profound and long-lasting. The scenario we have been describing is a groundburst. An airburst—such as might occur, for example, if terrorists put their bomb in a small aircraft they had purchased or rented—would extend the blast and fire effects over a wider area, killing and injuring even larger numbers of people immediately. But an airburst would not have the same lingering effects from fallout as a groundburst, because the rock and dirt would not be sucked up into the fireball and contaminated. The 10-kiloton blast we have been discussing is likely toward the high end of what terrorists could plausibly achieve with a crude, improvised bomb, but even a 1-kiloton blast would be a catastrophic event, having a deadly radius between one-third and one-half that of a 10-kiloton blast. These hundreds of thousands of people would not be mere statistics, but countless individual stories of loss—parents, children, entire families; all religions; rich and poor alike—killed or horribly mutilated. Human suffering and tragedy on this scale does not have to be imagined; it can be remembered through the stories of the survivors of the US atomic bombings of Hiroshima and Nagasaki, the only times in history when nuclear weapons have been used intentionally against human beings. The pain and suffering caused by those bombings are almost beyond human comprehension; the eloquent testimony of the Hibakusha—the survivors who passed through the atomic fire—should stand as an eternal reminder of the need to prevent nuclear weapons from ever being used in anger again. Global economic disaster. The economic impact of such an attack would be enormous. The effects would reverberate for so far and so long that they are difficult to estimate in all their complexity. Hundreds of thousands of people would be too injured or sick to work for weeks or months. Hundreds of thousands more would evacuate to locations far from their jobs. Many places of employment would have to be abandoned because of the radioactive fallout. Insurance companies would reel under the losses; but at the same time, many insurance policies exclude the effects of nuclear attacks—an item insurers considered beyond their ability to cover—so the owners of thousands of buildings would not have the insurance payments needed to cover the cost of fixing them, thousands of companies would go bankrupt, and banks would be left holding an immense number of mortgages that would never be repaid. Consumer and investor confidence would likely be dramatically affected, as worried people slowed their spending. Enormous new homeland security and military investments would be very likely. If the bomb had come in a shipping container, the targeted country—and possibly others—might stop all containers from entering until it could devise a system for ensuring they could never again be used for such a purpose, throwing a wrench into the gears of global trade for an extended period. (And this might well occur even if a shipping container had not been the means of delivery.) Even the far smaller 9/11 attacks are estimated to have caused economic aftershocks costing almost $1 trillion even excluding the multi-trillion-dollar costs of the wars that ensued. The cost of a terrorist nuclear attack in a major city would likely be many times higher. The most severe effects would be local, but the effects of trade disruptions, reduced economic activity, and more would reverberate around the world. Consequently, while some countries may feel that nuclear terrorism is only a concern for the countries most likely to be targeted—such as the United States—in reality it is a threat to everyone, everywhere. In 2005, then-UN Secretary-General Kofi Annan warned that these global effects would push “tens of millions of people into dire poverty,” creating “a second death toll throughout the developing world.” One recent estimate suggested that a nuclear attack in an urban area would cause a global recession, cutting global Gross Domestic Product by some two percent, and pushing an additional 30 million people in the developing world into extreme poverty. Desperate dilemmas. In short, an act of nuclear terrorism could rip the heart out of a major city, and cause ripple effects throughout the world. The government of the country attacked would face desperate decisions: How to help the city attacked? How to prevent further attacks? How to respond or retaliate? Terrorists—either those who committed the attack or others—would probably claim they had more bombs already hidden in other cities (whether they did or not), and threaten to detonate them unless their demands were met. The fear that this might be true could lead people to flee major cities in a large-scale, uncontrolled evacuation. There is very little ability to support the population of major cities in the surrounding countryside. The potential for widespread havoc and economic chaos is very real. If the detonation took place in the capital of the nation attacked, much of the government might be destroyed. A bomb in Washington, D.C., for example, might kill the President, the Vice President, and many of the members of Congress and the Supreme Court. (Having some plausible national leader survive is a key reason why one cabinet member is always elsewhere on the night of the State of the Union address.) Elaborate, classified plans for “continuity of government” have already been drawn up in a number of countries, but the potential for chaos and confusion—if almost all of a country’s top leaders were killed—would still be enormous. Who, for example, could address the public on what the government would do, and what the public should do, to respond? Could anyone honestly assure the public there would be no further attacks? If they did, who would believe them? In the United States, given the practical impossibility of passing major legislation with Congress in ruins and most of its members dead or seriously injured, some have argued for passing legislation in advance giving the government emergency powers to act—and creating procedures, for example, for legitimately replacing most of the House of Representatives. But to date, no such legislative preparations have been made. In what would inevitably be a desperate effort to prevent further attacks, traditional standards of civil liberties might be jettisoned, at least for a time—particularly when people realized that the fuel for the bomb that had done such damage would easily have fit in a suitcase. Old rules limiting search and surveillance could be among the first to go. The government might well impose martial law as it sought to control the situation, hunt for the perpetrators, and find any additional weapons or nuclear materials they might have. Even the far smaller attacks of 9/11 saw the US government authorizing torture of prisoners and mass electronic surveillance. And what standards of international order and law would still hold sway? The country attacked might well lash out militarily at whatever countries it thought might bear a portion of responsibility. (A terrifying description of the kinds of discussions that might occur appeared in Brian Jenkins’ book, Will Terrorists Go Nuclear?) With the nuclear threshold already crossed in this scenario—at least by terrorists—it is conceivable that some of the resulting conflicts might escalate to nuclear use. International politics could become more brutish and violent, with powerful states taking unilateral action, by force if necessary, in an effort to ensure their security. After 9/11, the United States led the invasions of two sovereign nations, in wars that have since cost hundreds of thousands of lives and trillions of dollars, while plunging a region into chaos. Would the reaction after a far more devastating nuclear attack be any less? In particular, the idea that each state can decide for itself how much security to provide for nuclear weapons and their essential ingredients would likely be seen as totally unacceptable following such an attack. Powerful states would likely demand that others surrender their nuclear material or accept foreign troops (or other imposed security measures) to guard it. That could well be the first step toward a more profound transformation of the international system. After such a catastrophe, major powers may feel compelled to more freely engage in preventive war, seizing territories they worry might otherwise be terrorist safe havens, and taking other steps they see as brutal but necessary to preserve their security. For this reason, foreign policy analyst Stephen Krasner has argued that “conventional rules of sovereignty would be abandoned overnight.” Confidence in both the national security institutions of the country attacked and international institutions such as the International Atomic Energy Agency and the United Nations, which had so manifestly failed to prevent the devastation, might erode. The effect on nuclear weapons policies is hard to predict: One can imagine new nuclear terror driving a new push for nuclear disarmament, but one could also imagine states feeling more certain than ever before that they needed nuclear weapons.

### 2NC – Prolif

#### Spread of nuclear tech increases the risk of prolif – existing safeguards can’t check

Kobayashi 21 [Yuki Kobayashi, Research Fellow, Sasakawa Peace Foundation, 2-26-2021, accessed on 7-23-2022, International Information Network Analysis | SPF, "Maintaining Japan’s Nuclear Technology and Contributing to Non-Proliferation Ten Years After Fukushima | List of Articles | International Information Network Analysis | SPF", https://www.spf.org/iina/en/articles/yuki\_kobayashi\_01.html mimou]

The spread of nuclear power plants increases the risk of the proliferation of all “nuclear” technology.

Specifically, uranium enrichment technology, which is used to turn natural uranium into fuel for nuclear reactors, and reprocessing technology, which is used to extract plutonium from spent fuel for reuse, are technologies that can be used for nuclear weapons. India, in fact, conducted a nuclear test in 1974 by extracting plutonium from a research reactor from Canada[[6](https://www.spf.org/iina/en/articles/yuki_kobayashi_01.html#note6)], and some have noted that North Korea, which has conducted six nuclear tests since 2006, cooperated with the former Soviet Union in establishing its nuclear technology[[7](https://www.spf.org/iina/en/articles/yuki_kobayashi_01.html#note7)]. With nuclear technology set to be transferred to emerging and developing countries, nuclear proliferation cannot be overlooked as a thing of the past.

In response to this kind of proliferation, the IAEA has implemented “safeguards” to verify and inspect the use of nuclear materials.

When the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) came into force in 1970, it established a system of “safeguards” to control the nuclear materials of all member states, including states without nuclear weapons. Japan joined the treaty in 1977[[8](https://www.spf.org/iina/en/articles/yuki_kobayashi_01.html#note8)]. Initially, the IAEA mainly reviewed reports from member states. However, in the 1990s it received greater authority in response to the discovery of inappropriate transfers of nuclear materials from former Soviet states and suspicions over North Korea’s nuclear development program. In 1997 the Additional Protocol was adopted and entered into force, granting the IAEA the authority to conduct unannounced inspections of nuclear facilities in member states[[9](https://www.spf.org/iina/en/articles/yuki_kobayashi_01.html#note9)].

However, if a country that has not adopted the Additional Protocol, such as Iran or Belarus[[10](https://www.spf.org/iina/en/articles/yuki_kobayashi_01.html#note10)], is found to be using nuclear material for non-peaceful purposes, or if a member state refuses to be inspected, the IAEA itself does not have the authority to take steps such as levying economic sanctions or monitoring the traffic of cargo ships. The system simply refers the matter to the United Nations Security Council. As a result, the system is not always particularly effective.

#### Nuclear energy eases access to uranium – causes underground prolif

Jacobsen 21 [Mark Z. Jacobsen, Professor of Civil and Environmental Engineering & Director, Atmosphere/Energy Program, Stanford University, 4-26-2021, accessed on 7-23-2022, Heinrich-Böll-Stiftung, "The 7 reasons why nuclear energy is not the answer to solve climate change | Heinrich Böll Stiftung | Brussels office - European Union", https://eu.boell.org/en/2021/04/26/7-reasons-why-nuclear-energy-not-answer-solve-climate-change mimou]

3. Weapons Proliferation Risk

The growth of nuclear energy has historically increased the ability of nations to obtain or harvest plutonium or enrich uranium to manufacture nuclear weapons. The Intergovernmental Panel on Climate Change (IPCC) recognizes this fact. They concluded in the Executive Summary of their 2014 report on energy, with “robust evidence and high agreement” that nuclear weapons proliferation concern is a barrier and risk to the increasing development of nuclear energy:

Barriers to and risks associated with an increasing use of nuclear energy include operational risks and the associated safety concerns, uranium mining risks, financial and regulatory risks, unresolved waste management issues, nuclear weapons proliferation concerns, and adverse public opinion.

The building of a nuclear reactor for energy in a country that does not currently have a reactor allows the country to import uranium for use in the nuclear energy facility. If the country so chooses, it can secretly enrich the uranium to create weapons grade uranium and harvest plutonium from uranium fuel rods for use in nuclear weapons. This does not mean any or every country will do this, but historically some have and the risk is high, as noted by IPCC. The building and spreading of Small Modular Reactors (SMRs) may increase this risk further.

#### States hide nuclear proliferation under the guise of civilian nuclear power – causes global prolif

Dalton and Levite 22 Toby Dalton and Ariel Levite 1-13-2022 "The Nonproliferation Regime is Breaking" <https://archive.is/MQ4sC#selection-1881.0-1917.304> (TOBY DALTON is Senior Fellow and Co-Director of the Nuclear Policy Program at the Carnegie Endowment for International Peace. ARIEL (ELI) LEVITE is Senior Fellow in the Nuclear Policy Program and Cyber Policy Initiative at the Carnegie Endowment for International Peace.)//Elmer

The global system to prevent nuclear proliferation and promote disarmament is beginning to fray. Although the nonproliferation regime has held together for more than half a century, more countries are acquiring sensitive nuclear material and technology through illicit acquisition and preferential trade. In May 2021, for instance, the International Atomic Energy Agency (IAEA) reported that Iran had accumulated ten kilograms of highly enriched uranium and severely restricted access to its nuclear sites. And in October 2021, Australia, the United Kingdom, and the United States announced a new strategic partnership (AUKUS) that will make Australia the first ever nonnuclear state to receive highly enriched fuel for nuclear-powered submarines. It is unlikely Australia would divert this uranium to make bombs, but it establishes a dangerous precedent. These two cases typify the growing challenges faced by the nonproliferation system. Historically, the framework set in place by the 1970 Nuclear Nonproliferation Treaty (NPT) relied on development limits and international monitoring of uranium enrichment and plutonium reprocessing to succeed. But the spread of these sensitive nuclear materials and technologies is substantially degrading both processes. It is increasingly difficult to distinguish between nuclear programs designed for peaceful purposes and those that aim to yield bombs. The IAEA toolkit to detect concerning activity, flag it, and address it diplomatically risks obsolescence. To restore the nonproliferation regime’s role as a bulwark of global stability, international nonproliferation institutions and states need new ways to track and tackle the development of nuclear weapons. This requires an innovative approach to monitoring and constraining dangerous activity. But given that more countries are acquiring or producing highly enriched uranium, material constraints alone are not enough. Monitors will need fresh tools to credibly track additional indicators of potential bomb activity that are hard to pass off as peaceful in nature, such as weaponization: the development and manufacture of nuclear warheads for missiles or other delivery vehicles. Monitoring this kind of activity, in particular, goes beyond the traditional focus of nuclear observers, but it may now offer the best, most reliable way to know whether states are trying to acquire nuclear weapons. Given the global rise in nuclear activity, the world should move quickly to create such a system. When existing powers are less able to prevent uranium enrichment—and even hand over highly enriched material to other countries—it incentivizes competitors to double down on their programs. When new states develop bombs, it further encourages proliferation. Especially in an era of growing geopolitical competition, the international community needs more indicative information on the spread of nuclear weapons so that diplomacy can head off destabilizing proliferation and arms races. SHIELDING THE WORLD The NPT is the cornerstone of the nonproliferation order. It requires that nonnuclear states avoid acquiring weapons (Article II), allows all states access to nuclear technology for peaceful purposes (Article IV), and commits the signatories with nuclear weapons—China, France, Russia, the United Kingdom, and the United States—to eventually disarm (Article VI). In practice, this regime limits state possession of and the operation of technology used to produce the fissile materials needed for nuclear weapons: highly enriched uranium and plutonium. And it empowers the IAEA to stringently scrutinize nuclear research and energy programs, enforce nuclear safeguards, and detect clandestine production. Although its powers of enforcement are limited, the NPT has endured due to a combination of IAEA monitoring, strict nuclear trade regulations by multilateral institutions, and commitments by individual member states to abide by the rules. The United States has historically played an important role in leading and augmenting this regime, mostly with the Soviet Union and later with Russia. To uphold the NPT bargain, Washington cooperated with many partner countries through the Atoms for Peace program, sharing technology and materials to advance nuclear energy and research in states that swore off atomic weapons. U.S. agencies also operated programs to constrain the spread of enriched uranium and nuclear production technology, promote transparency in civilian nuclear material, and convert research reactors from high- to low-enriched fuel. By doing so, Washington further slowed the accumulation of fissile and sensitive technology. Other nuclear states supported or at least acceded to these efforts, tightly restricting the flow of key materials and technologies. The system isn’t perfect. There are inherent tensions in the NPT bargain, which allows some states to hold weapons while banning others from acquiring them. The world has experienced periodic proliferation crises that exposed gaping holes in the regime, such as in 1991, when observers discovered that Iraq had a clandestine program for producing nuclear weapons. Sometimes, the NPT has failed to stop weapons development altogether, as happened in North Korea, which withdrew from the treaty when its program was exposed. And three nuclear-armed states—India, presumably Israel, and Pakistan—never joined the NPT. But remarkably, this package has generally held together for decades. Most countries that at one time had nuclear weapons aspirations walked them back, such as South Korea, Sweden, and Switzerland. South Africa voluntarily disarmed, dismantling the six nuclear bombs it had secretly built, and joined the NPT as a nonnuclear state. The world averted close calls, including one resulting from the demise of the Soviet Union, which could have easily yielded four nuclear states instead of one, and another in Iran, which was stopped en route in 2003. If anything, the norm against proliferation has grown stronger over time. Today, only six states without nuclear weapons have the indigenous capability to produce fissile materials—Argentina, Brazil, Germany, Iran, Japan, and the Netherlands—a testament to the efficacy of the regime. But there are multiple signs that this record may not continue. DANGEROUS DECAY Some of the recent problems with the nonproliferation system derive from the stalled progress toward nuclear disarmament by states with nuclear weapons. After Russia and the United States dramatically slashed their Cold War nuclear arsenals by retiring obsolete systems, arms reductions have come to a standstill in both countries in the last decade. Now, they are modernizing their arsenals, as are China, India, Pakistan, and the United Kingdom. This has prompted many nonnuclear states to push forward a nominally complementary but practically competing UN Treaty on the Prohibition of Nuclear Weapons. (The treaty calls for a categorical ban on the possession of nuclear weapons by the signatories, and it has been rejected by all nuclear weapons states and their allies.) Other issues come from the behavior of nuclear states outside the system, most problematically North Korea. But the most worrisome problem is that the barrier between peaceful nuclear activity and weapons development is eroding. Most of the damaging erosion has been done by the weapons states themselves, via ad hoc arrangements to advance other strategic interests. Notably, the 2005 U.S.-Indian nuclear deal, endorsed in 2008 by the Nuclear Suppliers Group—one of the principal institutions that regulates nuclear sales—enabled the United States and others to trade technology with India alongside carve-outs that permitted unsafeguarded Indian nuclear activity for weapons development. Then, the NPT’s 2010 Review Conference affirmed that states pursuing nuclear energy had an unconditional right to fully access nuclear technology, regardless of necessity. The 2015 Iran nuclear deal, the Joint Comprehensive Plan of Action, capped Iran’s uranium enrichment program but walked back an earlier understanding (in the preliminary 2013 Joint Plan of Action) that Iranian enrichment activities would be limited to what Tehran needed for its peaceful program. Both the United States and Iran have since undermined the deal, leaving Iran, according to IAEA Director General Rafael Grossi, enriching uranium to concentrations that “only countries making bombs are reaching.” There are other prominent carve-outs in the system. In 2010, China violated supplier rules by agreeing to construct additional nuclear power reactors in Pakistan, and in 2010 and 2017, Russia signed nuclear deals with Turkey and Egypt, respectively, without requiring (as far as is publicly known) that Ankara or Cairo forego developing fissile materials. Washington’s efforts to promote a “gold standard” for nuclear trade, in which recipients renounce the ability to produce enriched plutonium and uranium, foundered after it was introduced, in 2009, due to opposition from most prospective clients, including Saudi Arabia, and the U.S. government’s own desire to revitalize the domestic nuclear industry through power plant exports. Collectively, this decay in the NPT’s rules has made it easier for nonnuclear states to obtain fissile materials, blurring the primary distinction between peaceful nuclear programs and military ones. Countries with weapons aspirations can now more easily hide their ambitions—and progress—in plain sight.

#### Second-generation proliferators have less expertise AND technological capacity with nuclear weapons-increases the odds of deterrence failure.

W. Michael Reisman 18. Myres S. McDougal Professor of International Law, Yale Law School. 03/08/2018. Will a Policy of Preemptive Self-Defense Make Us All Safer? SSRN Scholarly Paper, ID 3162033, Social Science Research Network. papers.ssrn.com, https://papers.ssrn.com/abstract=3162033.

V Until now, what one might call the “operational code” with respect to the deployment of nuclear weapons has differed from that of other weapons systems. Wholly apart from the presence or absence of formal “no-first-strike” commitments and putting aside the question of their credibility, a system of “mutually assured destruction” or “MAD” has effectively deterred any preemptive gamble as between the major nuclear powers. For these states, essential national security has come to rest on the ability to ensure that an adversary’s first strike will not disable the target state which would still be able to respond with devastating effect on the attacker. Any sought advantage of a first-strike is, thus, guaranteed to be pyrrhic. This odd, counter-intuitive and even morally perplexing system of reciprocal defense must assume, first, a world of administratively effective and not failed or faux states; second, the rationality of the principal actors; and third, the capacity of their early warning systems to both timeously detect attacks as well as to avoid false positives. According to Murphy’s Law, whatever can go wrong in engineered systems will go wrong. To date, that category contains only near misses, both in the United States and Russia, but it does not take great imagination to construct plausible scenarios, which, either because of human error, technical glitches or sabotage, do not have happy endings. The peril of the eventuation of unhappy endings increases exponentially in two, interrelated scenarios; first, the proliferation of nuclear states and, second, the possible emergence of nuclear-capable non-state actors. To stem the proliferation of nuclear states, the major nuclear powers share an interest in preserving their monopoly. That also requires the cooperation of non-nuclear states, part of which was secured by a commitment by the major nuclear powers to cooperate in reducing their nuclear arsenals and moving toward nuclear disarmament. Article 6 of the 191- party Non-Proliferation Treaty requires them “to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control.”42 Although the Obama Administration took some initial steps to comply with this obligation, no intention has been expressed by the new Administration to pursue this goal. President Trump’s Draft Nuclear Review goes in the other direction. He is reported to have said that he would add a nearly ten-fold increase in the U.S. nuclear arsenal.43 (President Putin, not to be outdone, has trumpeted new weapons.)44 In the meanwhile, thanks to statements that have been made, the credibility of alliances, which until now reassured some non-nuclear states, may be eroding. The more nuclear states, the more likely that there will be still more nuclear states. The more nuclear states, the greater the likelihood that fissile material may reach non-state actors. It is well to remember that the leakage of nuclear and missile material to nuclear aspirants has not come only from North Korea. Under international law, preemptive attacks against illegal WMD facilities in rogue states are prohibited but in the two incidents on record, they appear in retrospect, to have been the right thing to do, based upon their circumstances and the consequences of inaction. Both succeeded in preventing, at least in the short term, the proliferation of nuclear weapons. When, however, the objectives of the military operation were broadened to include regime change, preemptive actions ostensibly in the self-defense of the actor may in fact, as the U.S. experience in Iraq showed, result in less rather than more security, and legal and moral condemnation rather than approval. That is not to minimize the dangers of allowing proliferation but simply to acknowledge that preemptive action under the guise of self-defense may, by itself, be an insufficient tool on which to rest national and global security and that a broad program of all-around denuclearization is required, lest the world end with a bang and not a whimper.

#### Deterrence fails and prolif is highly destabilizing – empirics and expert consensus prove there’s a high risk of war and accidents

Barash 18 (David Barash, Professor of Psychology at the University of Washington, author or editor of over 40 books, citing a body of area and field-study experts, The Guardian, June 14, 2018. “Nuclear deterrence is a myth. And a lethal one at that,” <https://www.theguardian.com/world/2018/jan/14/nuclear-deterrence-myth-lethal-david-barash>)

In his classic The Evolution of Nuclear Strategy (1989), Lawrence Freedman, the dean of British military historians and strategists, concluded: ‘The Emperor Deterrence may have no clothes, but he is still Emperor.’ Despite his nakedness, this emperor continues to strut about, receiving deference he doesn’t deserve, while endangering the entire world. Nuclear deterrence is an idea that became a potentially **lethal ideology**, one that **remains influential** despite having been **increasingly discredited**. After the United States’ nuclear bombings of Hiroshima and Nagasaki in 1945, war changed. Until then, the overriding purpose of military forces had ostensibly been to win wars. But according to the influential US strategist Bernard Brodie writing in 1978: ‘From now on its chief purpose must be to avert them. It can have almost no other useful purpose.’ Thus, nuclear deterrence was born, a **seemingly rational** arrangement by which peace and stability were to arise by the threat of **mutually assured destruction** (MAD, appropriately enough). Winston Churchill described it in 1955 with characteristic vigour: ‘Safety will be the sturdy child of terror, and survival the twin brother of annihilation.’ Importantly, deterrence became not only a purported strategy, but the **very grounds** on which governments **justified nuclear weapons** themselves. Every government that now possesses nuclear weapons claims that they deter attacks by their threat of **catastrophic retaliation**. Even a brief examination, however, reveals that deterrence is not **remotely as compelling** a principle as its reputation suggests. In his novel The Ambassadors (1903), Henry James described a certain beauty as ‘a jewel brilliant and hard’, at once twinkling and trembling, adding that ‘what seemed all surface one moment seemed all depth the next’. The public has **been bamboozled** by the **shiny surface** appearance of deterrence, with its promise of strength, security and safety. But what has been touted as profound strategic depth **crumbles with surprising ease** when subjected to critical scrutiny. Let’s start by considering the core of deterrence theory: that it has worked. Advocates of nuclear deterrence insist that we should thank it for the fact that a third world war has been avoided, even when **tensions between the two superpowers** – the US and the USSR – ran high. Some supporters even maintain that deterrence set the stage for the fall of the Soviet Union and the defeat of Communism. In this telling, the West’s nuclear deterrent prevented the USSR from invading western Europe, and delivered the world from the threat of Communist tyranny. There are, however, **compelling arguments** suggesting that the US and the former Soviet Union avoided world war for **several possible reasons**, most notably because **neither side wanted to go to war**. Indeed, the US and Russia never fought a war prior to the nuclear age. Singling out nuclear weapons as the reason why the **Cold War never became hot** is somewhat like saying that a junkyard car, without an engine or wheels, never sped off the lot only because **no one turned the key**. Logically speaking, there is **no way to demonstrate** that nuclear weapons kept the peace during the Cold War, or that they do so now. Perhaps peace prevailed between the two superpowers simply because they had no quarrel that justified fighting a terribly destructive war, even a conventional one. **There is no evidence**, for example, that the Soviet leadership **ever contemplated** trying to conquer western Europe, much **less that it was restrained** by the West’s nuclear arsenal. Post facto arguments – especially negative ones – might be the **currency of pundits**, but are **impossible to prove,** and offer no solid ground for evaluating a counterfactual claim, conjecturing why something has not happened. In colloquial terms, if a dog does not bark in the night, can we say with certainty that no one walked by the house? Deterrence enthusiasts are like the woman who **sprayed perfume on her lawn** every morning. When a perplexed neighbour asked about this strange behaviour, she replied: **‘I do it to keep the elephants away.’** The neighbour protested: ‘But **there aren’t any elephants** within 10,000 miles of here,’ whereupon the perfume-sprayer replied: **‘You see, it works!’** We should not congratulate our leaders, or deterrence theory, much less nuclear weapons, for keeping the peace. What we can say is that, as of this morning, those with the power to exterminate life have not done so. But this is not altogether comforting, and **history is** no more reassuring. The duration of ‘nuclear peace’, from the Second World War to the end of the Cold War, lasted less than five decades. More than 20 years separated the First and Second World Wars; before that, there had been more than 40 years of relative peace between the end of the Franco-Prussian War (1871) and the First World War (1914), and 55 years between the Franco-Prussian War and Napoleon’s defeat at Waterloo (1815). Even in war-prone Europe, decades of peace have not been so rare. Each time, when peace ended and the next war began, the war involved weapons available at the time – which, for the next big one, would likely include nuclear weapons. The only way to make sure that nuclear weapons are not used is to make sure that there are no such weapons. There is certainly no reason to think that the presence of nuclear weapons will prevent their use. The first step to ensuring that humans do not unleash nuclear [winter] holocaust might be to show that the Emperor Deterrence has no clothes – which would then open the possibility of replacing the illusion with something more suitable. It is possible that the post-1945 US-Soviet peace came ‘through strength’, but that need not imply nuclear deterrence. It is also undeniable that the presence of nuclear weapons on hair-trigger alert capable of reaching each other’s homeland in minutes has made both sides edgy. The Cuban Missile Crisis of 1962 – when, by all accounts, the world came closer to nuclear war than at any other time – is not testimony to the effectiveness of deterrence: the crisis occurred because of nuclear weapons. It is more likely that we have been spared nuclear war not because of deterrence but in spite of it. Even when possessed by just one side, nuclear weapons have not deterred other forms of war. The Chinese, Cuban, Iranian and Nicaraguan revolutions all took place even though a nuclear-armed US backed the overthrown governments. Similarly, the US lost the Vietnam War, just as the Soviet Union lost in Afghanistan, despite both countries not only possessing nuclear weapons, but also more and better conventional arms than their adversaries. Nor did nuclear weapons aid Russia in its unsuccessful war against Chechen rebels in 1994-96, or in 1999-2000, when Russia’s conventional weapons devastated the suffering Chechen Republic. Nuclear weapons did not help the US achieve its goals in Iraq or Afghanistan, which have become expensive catastrophic failures for the country with the world’s most advanced nuclear weapons. Moreover, despite its nuclear arsenal, the US remains fearful of domestic terrorist attacks, which are more likely to be made with nuclear weapons than be deterred by them. In short, it is not legitimate to argue that nuclear weapons have deterred any sort of war, or that they will do so in the future. During the Cold War, each side engaged in conventional warfare: the Soviets, for example, in Hungary (1956), Czechoslovakia (1968), and Afghanistan (1979-89); the Russians in Chechnya (1994-96; 1999-2009), Georgia (2008), Ukraine (2014-present), as well as Syria (2015-present); and the US in Korea (1950-53), Vietnam (1955-75), Lebanon (1982), Grenada (1983), Panama (1989-90), the Persian Gulf (1990-91), the former Yugoslavia (1991-99), Afghanistan (2001-present), and Iraq (2003-present), to mention just a few cases. Nor have their weapons deterred attacks upon nuclear armed states by non-nuclear opponents. In 1950, China stood 14 years from developing and deploying its own nuclear weapons, whereas the US had a well-developed atomic arsenal. Nonetheless, as the Korean War’s tide was shifting dramatically against the North, that US nuclear arsenal did not inhibit China from sending more than 300,000 soldiers across the Yalu River, resulting in the stalemate on the Korean peninsula that divides it to this day, and has resulted in one of the world’s most dangerous unresolved stand-offs. In 1956, the nuclear-armed United Kingdom warned non-nuclear Egypt to refrain from nationalising the Suez Canal. To no avail: the UK, France and Israel ended up invading Sinai with conventional forces. In 1982, Argentina attacked the British-held Falkland Islands, even though the UK had nuclear weapons and Argentina did not. Following the US-led invasion in 1991, conventionally armed Iraq was not deterred from lobbing Scud missiles at nuclear-armed Israel, which did not retaliate, although it could have used its nuclear weapons to vaporise Baghdad. It is hard to imagine how doing so would have benefitted anyone. Obviously, US nuclear weapons did not deter the terrorist attacks on the US of 11 September 2001, just as the nuclear arsenals of the UK and France have not prevented repeated terrorist attacks on those countries. Deterrence, in short, does not deter. The pattern is deep and geographically widespread. Nuclear-armed France couldn’t prevail over the non-nuclear Algerian National Liberation Front. The US nuclear arsenal didn’t inhibit North Korea from seizing a US intelligence-gathering vessel, the USS Pueblo, in 1968. Even today, this boat remains in North Korean hands. US nukes didn’t enable China to get Vietnam to end its invasion of Cambodia in 1979. Nor did US nuclear weapons stop Iranian Revolutionary Guards from capturing US diplomats and holding them hostage (1979-81), just as fear of US nuclear weapons didn’t empower the US and its allies to force Iraq to retreat from Kuwait without a fight in 1990. In Nuclear Weapons and Coercive Diplomacy (2017), the political scientists Todd Sechser and Matthew Fuhrmann examined 348 territorial disputes occurring between 1919 and 1995. They used statistical analysis to see whether nuclear-armed states were more successful than conventional countries in coercing their adversaries during territorial disputes. They weren’t. Not only that, but nuclear weapons didn’t embolden those who own them to escalate demands; if anything, such countries were somewhat less successful in getting their way. In some cases, the analysis is almost comical. Thus, among the very few cases in which threats from a nuclear-armed country were coded as having compelled an opponent was the US insistence, in 1961, that the Dominican Republic hold democratic elections following the assassination of the dictator Rafael Trujillo, as well as the US demand, in 1994, following a Haitian military coup, that the Haitian colonels restore Jean-Bertrand Aristide to power. In 1974-75, nuclear China forced non-nuclear Portugal to surrender its claim to Macau. These examples were included because the authors honestly sought to consider all cases in which a nuclear-armed country got its way vis-à-vis a non-nuclear one. But no serious observer would attribute the capitulation of Portugal or the Dominican Republic to the nuclear weapons of China or the US. All of this also suggests that the acquisition of nuclear weapons by Iran or North Korea is unlikely to enable these countries to coerce others, whether their ‘targets’ are armed with nuclear or conventional weapons. It is one thing to conclude that nuclear deterrence hasn’t necessarily deterred, and hasn’t provided coercive power – but its extraordinary risks are even more discrediting. First, deterrence via nuclear weapons **lacks credibility**. A police officer armed with a backpack nuclear weapon would be unlikely to deter a robber: ‘Stop in the name of the law, or I’ll blow us all up!’ Similarly, during the Cold War, NATO generals lamented that towns in West Germany were less than two kilotons apart – which meant that defending Europe with nuclear weapons would destroy it, and so the claim that the Red Army would be deterred by nuclear means was **literally incredible**. The result was the elaboration of smaller, **more accurate tactical weapons** that would be more usable and, thus, whose employment in a crisis would be more credible. But deployed weapons that **are more usable**, and thus **more credible as deterrents**, are more liable to be used. Second, deterrence requires that each side’s arsenal **remains invulnerable** to attack, or at least that such an attack would be prevented insofar as a potential victim **retained a ‘second-strike’ retaliatory capability**, sufficient to prevent such an attack **in the first place**. Over time, however, nuclear missiles have become increasingly accurate, raising concerns about the vulnerability of these weapons to a ‘counterforce’ strike. In brief, nuclear states are **increasingly able** to target their adversary’s nuclear weapons for destruction. In the **perverse argot** of deterrence theory, this is called counterforce **vulnerability**, with ‘vulnerability’ referring to the target’s nuclear weapons, not its population. The **clearest outcome** of increasingly accurate nuclear weapons and the ‘counterforce vulnerability’ component of deterrence theory is to **increase the likelihood of a first strike**, while also **increasing the danger** that a potential victim, fearing such an event, might be tempted to **pre-empt with its own first strike**. The resulting situation – in which each side **perceives** a possible **advantage** in striking first – is **dangerously unstable**. Third, deterrence theory **assumes optimal rationality** on the part of decision-makers. It presumes that those with their fingers on the **nuclear triggers** are **rational actors** who will also remain calm and cognitively unimpaired under extremely stressful conditions. It also presumes that leaders will **always retain control** over their forces and that, moreover, they will always retain control over their emotions as well, making decisions based **solely on a cool calculation** of strategic costs and benefits. Deterrence theory maintains, in short, that each side will **scare the pants off the other** with the prospect of the most **hideous, unimaginable consequences**, and will then conduct itself with the **utmost deliberate and precise rationality**. Virtually everything known about human psychology suggests that **this is absurd**. In Black Lamb and Grey Falcon: A Journey Through Yugoslavia (1941), Rebecca West noted that: ‘Only part of us is sane: only part of us loves pleasure and the longer day of happiness, wants to live to our 90s and die in peace …’ It requires no arcane wisdom to know that people often act out of misperceptions, anger, despair, insanity, stubbornness, revenge, pride and/or dogmatic conviction. Moreover, in certain situations – as when either side is **convinced that war is inevitable**, or when the pressures to avoid losing face are **especially intense** – an irrational act, including a **lethal one**, can appear appropriate, even unavoidable. When he ordered the attack on Pearl Harbor, the Japanese defence minister observed that: ‘Sometimes it is necessary to close one’s eyes and jump off the platform of the Kiyomizu Temple [a renowned suicide spot].’ During the First World War, Kaiser Wilhelm II of Germany wrote in the margin of a government document that: ‘Even if we are destroyed, England at least will lose India.’ While in his bunker, during the final days of the Second World War, Adolf Hitler ordered what he hoped would be the total destruction of Germany, because he felt that Germans had ‘failed’ him. Consider, as well, a US president who shows signs of mental illness, and whose statements and tweets are **frighteningly consistent** with dementia or genuine psychosis. National leaders – nuclear-armed or not – aren’t immune to mental illness. Yet, deterrence theory **presumes otherwise**. Finally, there is **just no way** for civilian or **military leaders to know** when their country has **accumulated enough nuclear firepower** to **satisfy the requirement** of having an ‘effective deterrent’. For example, if one side is **willing to be annihilated** in a counterattack, **it simply cannot be deterred**, no matter the threatened retaliation. Alternatively, if one side is **convinced** of the other’s implacable hostility, or of its presumed indifference to loss of life, **no amount of weaponry** can suffice. Not only that, but so long as accumulating weapons **makes money** for defence contractors, and so long as designing, producing and deploying new ‘generations’ of nuclear stuff advances careers, the truth about deterrence theory will **remain obscured**. Even the sky is not the limit; militarists want to put weapons in outer space. Insofar as nuclear weapons also serve symbolic, psychological needs, by demonstrating the **technological accomplishments** of a nation and thus conveying legitimacy to otherwise **insecure leaders and countries**, then, once again, there is no **rational way** to establish the minimum (or cap the maximum) size of one’s arsenal. At some point, additional detonations nonetheless come up against the **law of diminishing returns**, or as Winston Churchill pointed out, they simply ‘make the rubble bounce’. In addition, ethical deterrence is an oxymoron. Theologians know that a nuclear war could never meet so-called ‘just war’ criteria. In 1966, the Second Vatican Council concluded: ‘Any act of war aimed indiscriminately at the destruction of entire cities or of extensive areas along with their populations is a crime against God and man itself. It merits unequivocal and unhesitating condemnation.’ And in a pastoral letter in 1983, the US Catholic bishops added: ‘This condemnation, in our judgment, applies even to the retaliatory use of weapons striking enemy cities after our own have already been struck.’ They continued that, if something is immoral to do, then it is also immoral to threaten. In a message to the 2014 Vienna Conference on the Humanitarian Impact of Nuclear Weapons, Pope Francis declared that: ‘Nuclear deterrence and the threat of mutually assured destruction cannot be the basis of an ethics of fraternity and **peaceful coexistence** among peoples and states.’ The United Methodist Council of Bishops go further than their Catholic counterparts, concluding in 1986 that: ‘Deterrence must no longer receive the churches’ blessing, even as a temporary warrant for the maintenance of nuclear weapons.’ In The Just War (1968), the Protestant ethicist Paul Ramsey asked his readers to imagine that traffic accidents in a particular city had suddenly been reduced to zero, after which it was found that everyone had been required to strap a newborn infant to the bumper of every car. Perhaps the most frightening thing about nuclear deterrence is its **many paths to failure**. Contrary to what is widely assumed, the **least likely** is a **‘bolt out of the blue’** (BOOB) attack. Meanwhile, there are **substantial risks** associated with **escalated conventional** war, accidental or unauthorised use, irrational use (although it can be argued that any use of nuclear weapons would be irrational) or **false alarms**, which have happened with **frightening regularity**, and could lead to **‘retaliation’ against an attack that hadn’t happened**. There have also been numerous **‘broken arrow’ accidents** – accidental launching, firing, theft or loss of a nuclear weapon – as well as circumstances in which such events as a **flock of geese, a ruptured gas pipeline or faulty computer codes** have been interpreted as a **hostile missile launch**. The above describes only some of the **inadequacies** and **outright dangers** posed by deterrence, the **doctrinal fulcrum** that manipulates nuclear hardware, software, deployments, accumulation and escalation. Undoing the ideology – verging on theology – of deterrence won’t be easy, but neither is living under the **threat of worldwide annihilation**. As the poet T S Eliot once wrote, unless you are in over your head, how do you know how tall you are? And when it comes to nuclear deterrence, we’re all in over our heads.

### 2NC – Soko Prolif

#### New reactors cause fast prolif – double standard angers allies and undermines detection

Gilinsky and Sokolski 21 [Victor Gilinsky and Henry Sokolski, Victor Gilinsky serves as program advisor to The Nonproliferation Policy Education Center, is a physicist, and was a commissioner of the U.S. Nuclear Regulatory Commission during the Ford, Carter, and Reagan administrations., Henry Sokolski is the executive director of the Nonproliferation Policy Education Center in Arlington, Virginia, and author of Underestimated: Our Not So Peaceful Nuclear Future. He served as deputy for nonproliferation policy in the office of the U.S. Secretary of Defense during the George H.W. Bush administration., 9-26-2021, accessed on 7-22-2022, The National Interest, "‘Fast Reactors’ Also Present a Fast Path to Nuclear Weapons", https://nationalinterest.org/feature/%E2%80%98fast-reactors%E2%80%99-also-present-fast-path-nuclear-weapons-194272 mimou]

The Energy Department’s choice for the leading reactor design for reviving nuclear power construction in the United States is so at odds with U.S. nonproliferation policy that it opens America to charges of rank hypocrisy. The Biden administration is proposing to use nuclear fuels that we are telling others—most immediately Iran—not to produce. It will make it difficult to gain the restraints the United States seeks to limit nations’ access to bomb-grade uranium and plutonium.

We are talking here about the Department of Energy’s (DOE’s) enthusiastic support of[TerraPower](https://www.terrapower.com/)’s proposed Natrium “[fast reactor](https://en.wikipedia.org/wiki/Fast-neutron_reactor)” demonstration plant and similar fast reactor projects, which DOE has showered with[grants](https://www.energy.gov/ne/articles/us-department-energy-announces-160-million-first-awards-under-advanced-reactor) and supports with department-funded[enrichment](https://www.energy.gov/ne/articles/department-energy-preps-fuel-advanced-reactors),[test reactor](https://thehill.com/opinion/energy-environment/565024-its-time-to-cancel-the-versatile-test-reactor), and spent nuclear fuel[recycling](https://arpa-e.energy.gov/news-and-media/press-releases/us-department-energy-announces-40-million-reduce-fuel-waste-advanced) programs. TerraPower and DOE [expect to build](https://www.energy.senate.gov/hearings/2021/3/full-committee-hearing-on-nuclear-energy) hundreds of fast reactors for domestic use and export.

Unlike conventional nuclear plants that exploit fission reactions triggered by slow neutrons, [fast reactors](https://nationalinterest.org/feature/dangerous-decisions-about-advanced-nuclear-reactors-could-lead-new-threats-183934) maintain nuclear chain reactions with much more energetic fast neutrons. These reactors are billed as advanced technology, but they are an old idea. The first fast reactor designs date back to post-World War II.

Fast reactors’ main advantage is that they can make [lots of plutonium](https://nationalinterest.org/feature/are-washington%E2%80%99s-advanced-reactors-nuclear-waste-43797), which can be extracted and used as reactor fuel instead of mining and using more uranium. This sounded good, so good to the Nixon administration that it set a goal to shift electric generation to plutonium-fueled fast reactors by the turn of the century. But the project came a cropper when it ran into safety hurdles that escalated costs. And then the increased awareness of the dangers of putting plutonium—one of the [two key nuclear explosives](https://nationalinterest.org/feature/nuclear-power-must-not-lead-nuclear-bombs-75901)—into the world’s commercial channels finally caused President Gerald Ford to[announce](https://www.nrc.gov/docs/ml1209/ML120960611.pdf) the United States would not rely on plutonium fuel until the world could cope with it.

TerraPower is [obviously aware](https://nationalinterest.org/blog/buzz/bill-gates%E2%80%99-fast-nuclear-reactor-will-it-bomb-189967) of this history and the public relations landmine it creates for its demonstration project. It insists its Natrium reactor will not use plutonium as fuel or require reprocessing to extract it. The company’s website[says](https://www.terrapower.com/our-work/natriumpower/), “Both the demonstration plant and the first set of commercial plants will run on high-assay low-enriched uranium (HALEU).” HALEU is uranium enriched to just under the official definition of highly enriched uranium, but well above the level of the uranium fuel used in currently operating nuclear power plants.

In enrichment terms, it is within[easy arm’s reach](https://www.nytimes.com/2010/03/09/science/09enrich.html) of bomb-grade uranium. It is exactly the stuff we demand that Iran not produce, arguing that they don’t need it for power reactor fuel. It’s also what we’ve been discouraging South Korea from getting into (Seoul says it wants to enrich uranium to boost reactor exports and to[power](https://thebulletin.org/2020/11/south-koreas-risky-quest-to-build-nuclear-powered-attack-submarines/) a fleet of nuclear submarines).

Note TerraPower only commits to using HALEU for its first, and likely subsidized, commercial plants. Whether using HALEU is the cheapest way of running Natrium is unclear. Foreign customers—if it ever comes to that—will surely want the “benefits” of the plant’s plutonium production and subsequent operation on plutonium fuel extracted by reprocessing. The Energy Department is already[hedging](https://arpa-e-foa.energy.gov/FileContent.aspx?FileID=a02cd89d-cca8-4218-9666-542ff93088f3) its bets on this option by backing research into “new’ reprocessing technologies at its national laboratories.

All this will be hard to explain to, say, South Korea, which the State Department is trying to keep from launching into reprocessing to prepare for plutonium-fueled fast reactors, which South Korean nuclear enthusiasts are eager to develop. It also will make it difficult to complain about China’s [crash fast reactor](https://nationalinterest.org/feature/how-france-fueling-japan-china%E2%80%99s-nuclear-race-14271) and reprocessing programs, which our military[fears](https://www.cnn.com/2021/04/20/politics/china-russia-nuclear-weapons/index.html) may be used to fuel China’s growing nuclear weapons effort.

Fast reactor boosters are aware of these points and know that they must at least appear to take account of them. An example is Senator Chris Van Hollen’s (D-MD)[amendment](https://www.vanhollen.senate.gov/imo/media/doc/Van%20Hollen%20Revised%20Amendment%201.pdf) to the American Nuclear Infrastructure Act of 2020, which purportedly protects the nuclear explosives (plutonium and uranium 233) these reactors use as fuel or produce, and the reprocessing technologies that extract them. While his amendment may sound tough, it offers little more protection than what is[already required](https://www.nrc.gov/docs/ML1019/ML101900297.pdf) by the Nuclear Regulatory Commission, and that protection can be waived if the NRC finds the export is not “inimical” to US interests. The practical effect of the amendment would not be greater protection, but a smoothing of the licensing path for dangerous nuclear exports.

This is worse than hypocrisy. Once nations have easy access to nuclear explosive material, no inspections can prevent them from making bombs. Congress needs to look behind the Energy Department’s beguiling “advanced reactor” label. When it does, it must line out projects that could turn nuclear explosives into a common article of commerce worldwide. The place to start is with “advanced” fast reactors.

#### South Korean prolif causes east Asian war

Sukin and Dalton 21 [Lauren Sukin and Toby Dalton, Lauren Sukin is a Ph.D. candidate at Stanford University’s department of political science and a pre-doctoral fellow at the Center for International Security and Cooperation., Toby Dalton is a senior fellow at, and co-director of, the Nuclear Policy Program at the Carnegie Endowment for International Peace, 10-26-2021, accessed on 7-23-2022, War on the Rocks, "Why South Korea Shouldn’t Build Its Own Nuclear Bombs - War on the Rocks", https://warontherocks.com/2021/10/why-south-korea-shouldnt-build-its-own-nuclear-bombs/ mimou]

Would Nuclear Weapons Improve South Korean Security? Even if the alliance problems were as profound as some analysts contend — and if South Korean nuclear proliferation did not somehow make them worse — a South Korean decision to acquire nuclear weapons would not necessarily improve Seoul’s security against North Korea or China, as advocates have claimed. Indeed, a lot would depend on how North Korea and China would react to South Korean proliferation. South Korean nuclear weapons may not be especially useful politico-military tools against China. U.S. nuclear threats against China during the Korean War did not dissuade Beijing from continuing to fight. Nor has China hesitated to leverage its conventional military strength in territorial contests with nuclear-armed India. China’s ongoing modernization of its nuclear forces — whether by constructing missile silos or testing hypersonics — suggests Beijing may view the survivability and effectiveness of its arsenal as vital for deterring the United States, especially in the Taiwan Strait. Would South Korean nuclear weapons dissuade Beijing from undertaking coercive operations against Seoul? It seems unlikely. If anything, South Korean proliferation could plausibly invite more **coercive Chinese economic and military pressures** if Beijing interpreted Seoul’s nuclear arsenal as a direct challenge to its regional aspirations. Vis-à-vis China, then, South Korea could wind up counterintuitively less secure with nuclear weapons than without them. South Korean nuclear weapons could similarly make the situation with North Korea much more dangerous. Already, joint U.S.-South Korean military exercises, which Pyongyang calls “exercises for a nuclear war,” have repeatedly prompted North Korea to issue aggressive rhetoric, engage in cross-border provocations, and conduct missile tests. In the face of a South Korean nuclear weapons program, it would be unreasonable to expect North Korea to take no countervailing actions. For example, it seems likely that South Korean proliferation could cause N**orth Korea to further augment** its nuclear arsenal, posture its nuclear weapons for first use, or take greater risks to gain the upper hand in an escalating military crisis. After all, even the United States, with its far superior nuclear arsenal, has had limited success deterring or compelling North Korea. Moreover, even if South Korean nuclear weapons likely would deter large-scale violence by China or North Korea, they could make the threat of low-level conflict escalation greater than it already is today. This is especially important in the Indo-Pacific context, where the most prevalent threats and sources of crisis escalation — such as China’s overflights of contested territory or North Korea’s offensive use of **cyber** capabilities — exist far below the nuclear threshold. The “stability-instability paradox” of nuclear weapons suggests that, although mutual possession of nuclear weapons may reduce the chances of nuclear war, it may, at the same time, make conventional wars and militarized crises more likely, as well as incentivize greater risk taking at lower levels. A more moderated version of this argument suggests that nuclear weapons may not necessarily make low-level conflict more likely, but neither do they prevent it. For instance, a nuclear-armed South Korea could be emboldened to respond more aggressively to North Korean provocations with proactive deterrence or “quid pro quo plus” military operations, the inherent escalation risks of which are intended to dissuade North Korea in the first place. Facing perceived “use or lose” pressures, North Korea may be quicker to cross certain **escalation** thresholds, such as the use of long-range rocket systems, as it seeks escalation dominance. The potential for these action-reaction dynamics to spiral into a race up the escalation ladder is clear. To be certain, this potential is already present, but it seems likely to worsen if South Korea possessed nuclear weapons. Reaction times during moments of crisis would be shorter, tensions higher; **miscommunication** and misperception easier, and nuclear use more accessible. South Korean proliferation could, then, make conflict more likely at worst and fail to deter it at best.

#### Korean war draws in China, Russia, and Japan

Medea Benjamin 17, M.A. from Columbia, Co-Founder of Global Exchange and CODEPINK: Women for Peace, 7/29/17, “Urgent Warning: Time to Hit the Reset Button on US-Korean Policy”, Common Dreams, https://www.commondreams.org/views/2017/07/29/urgent-warning-time-hit-reset-button-us-korean-policy

The United States has also long held a “pre-emptive first strike” policy towards North Korea. This frightening threat of an unprovoked US nuclear attack gives North Korea good reason to want its own nuclear arsenal. North Korea’s leadership also looks at the fate of Iraq’s Saddam Hussein and Libya’s Muammar Gaddafi, leaders who gave up their nuclear programs, and conclude that nuclear weapons are their key to survival. So the North Korean leadership is not acting irrationally; on the contrary. On July 29, the day after the test, North Korean President Kim Jong-un asserted that the threat of sanctions or military action “only strengthens our resolve and further justifies our possession of nuclear weapons.” Given the proximity of North Korea to the South’s capital Seoul, a city of 25 million people, any outbreak of hostilities would be devastating. It is estimated that a North Korean attack with just conventional weapons would kill 64,000 South Koreans in the first three hours. A war on the Korean Peninsula would likely draw in other nuclear armed states and major powers, including China, Russia and Japan. This region also has the largest militaries and economies in the world, the world’s busiest commercial ports, and half the world’s population. Trump has few options. His Defense Secretary Jim Mattis has warned that a pre-emptive strike on the North’s nuclear and missile capabilities could reignite the Korean War. Trump had hoped that Chinese President Xi Jinping could successfully rein in Kim Jong-un, but the Chinese are more concerned about the collapse of North Korea’s government and the chaos that would ensue. They are also furious about the deployment of THAAD in South Korea, convinced that its radar can penetrate deep into Chinese territory. But the Chinese do have another proposal: a freeze for a freeze. This means a freeze on North Korean missile and nuclear tests in exchange for a halt on US-South Korean war games. The massive war games have been taking place every year in March, with smaller ones scheduled for August. A halt would alleviate tensions and pave the way for negotiations. So would halting the deployment of the destabilizing THAAD system so disliked by South Korean villagers, North Koreans and the Chinese. Given the specter of nuclear war, the rational alternative policy is one of de-escalation and engagement. President Moon has called for dialogue with the North and a peace treaty to permanently end the Korean War. North Korean diplomats have raised the possibility of a “freeze for a freeze.” Time has proven that coercion doesn’t work. There’s an urgent need to hit the reset button on US-Korean policy, before one of the players hits a much more catastrophic button that could lead us into a nuclear nightmare.

### 2NC – Water

#### Multiple hotspots are on the brink of water collapse – continued shift to nuclear power pushes us over

AMPLYFI 21 [AMPLYFI, 6-18-2021, accessed on 7-19-2022, AMPLYFI, "The role of Nuclear Energy in the Global Water Sustainability Crisis - AMPLYFI", https://amplyfi.com/2021/06/18/the-role-of-nuclear-energy-in-the-global-water-sustainability-crisis/ mimou]

One-fifth of the global population faces a high baseline water stress, including the Middle East and North Africa. The World Bank declared the latter as a [global hotspot](https://www.worldbank.org/en/topic/water/publication/beyond-scarcity-water-security-in-the-middle-east-and-north-africa) of unsustainable water use on Earth. Tokyo, found to be the [most water-stressed city globally](https://www.sciencedirect.com/science/article/pii/S0959378014000880#tbl0010), is among the capitals of 17 countries facing extreme water stress conditions.

Even countries with low-medium water stress, such as the US, have certain states with extreme water stress. A recent study revealed that [61.8%](https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/climate-change-poses-big-water-risks-for-nuclear-fossil-fueled-plants-60669992) or a combined 535 GW of operating capacity in the US fossil fuel and nuclear power plants face medium-high to extremely-high water stress in 2030.

Climate-induced water crises may impede achieving decarbonisation goals, and therein lies its link with nuclear power generation. Climate change catalyses the water crisis, also impacting global sea and ocean temperatures. Based on these changes, weather events can compromise the performance and efficiency of nuclear power plants.

This change is evident in Japan’s annual temperatures, which have risen [faster than the global average](https://www.env.go.jp/earth/tekiou/pamph2018_full_Eng.pdf). 2021 saw Japan’s [earliest cherry blossom season](https://www.bbc.co.uk/news/world-asia-56574142) on record since 812, likely due to climate change. Nuclear power plants need large amounts of water for cooling. Still, Japan and areas of the Mediterranean face [heating up of their seas and oceans](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4100510/). Sweden, Finland and South Korea have had to face [temporary closure](https://www.powermag.com/intense-summer-heatwaves-rattle-worlds-power-plants/)of their nuclear power plants due to seawater being too warm.

At 161 billion gallons a day, the US nuclear and fossil fuel plants already consume [45%](https://www.nature.com/articles/s41598-017-12133-9) of the country’s freshwater usage. Although nuclear power generation emits a lower level of carbon dioxide emissions than other methods, it also impacts limited freshwater supplies in ways yet to be thoroughly researched. As discussed earlier, the same water temperature, so very crucial in nuclear power plant operations, is rising due to climate-induced changes.

A high opportunity cost is associated with building nuclear power plants. Economic planning not only factors in the carbon footprint, but also the time and cost it takes to start delivering the promised results. Between 1981 and 2019, the average construction time of nuclear power plants was between [7 and 9.7 years](https://www.statista.com/statistics/712841/median-construction-time-for-reactors-since-1981/), with the longest taking 10 years.

SMRs or Small and Medium Reactors (units ranging from 225 down to 45 MWe) that use less water for cooling and need less commissioning time may prove to be a better alternative to the traditional time and cost-intensive nuclear power reactors. However, examples of SMRs meeting the energy demand are far and few. Russia started a [70MW floating nuclear power plant](https://www.bbc.com/news/world-europe-49446235) in 2019, which sailed 3,000 miles from the Arctic port of Murmansk to Chukotka in the far east. Other countries, including [China](https://www.powermag.com/china-starts-building-smr-based-floating-nuclear-plant/), [Canada](https://s3.amazonaws.com/files.news.ontario.ca/opo/en/learnmore/premier_ford_premier_higgs_and_premier_moe_sign_agreement_on_the_development_of_small_modular_reacto/2019%2011%2027%20-%20MOU%20Prov%20NB%20and%20ON%20and%20SK.pdf) and [France](https://www.reuters.com/article/us-edf-nuclearpower-smr-idUSKBN1W21JM), are also starting to commission SMRs.

There’s also hope in the form of emerging technologies, such as high-temperature gas-cooled nuclear reactors (Generation IV). These reactors could support co-generation and tri-generation plant configurations that enable multiple products to be created, namely power, hydrogen, and desalination. Though at a smaller scale than traditional nuclear power plants, storage of radioactive waste and water contamination remains core issues associated with SMRs. The technology is still in the early development phase. NuScale, an SMR development firm, announced in August 2020 that its first SMR design was approved by the [US Nuclear Regulatory Commission,](https://newsroom.nuscalepower.com/press-releases/news-details/2020/NuScale-Power-Makes-History-as-the-First-Ever-Small-Modular-Reactor-to-Receive-U.S.-Nuclear-Regulatory-Commission-Design-Approval/default.aspx) indicating the fact that there is still time to realise safety benefits of new technologies in the nuclear energy sector.

There are also prohibitive aspects of nuclear power. Despite countries such as France and Japan keeping nuclear as a significant part of their energy mix to hit their 2050 emissions targets, experts argue that the time and cost it takes to build nuclear power plants make it a ‘prohibitive technology’. In America alone, more than half of the nuclear power plants are losing money, with losses totalling about US[$2.9 billion a year](https://www.bloomberg.com/news/articles/2017-06-14/half-of-america-s-nuclear-power-plants-seen-as-money-losers).

#### Water shocks spill over globally

Engelke and Sticklor 15 — Engelke is a Resident Senior Fellow with the Strategic Foresight Initiative at the Atlantic Council in Washington, DC. Sticklor is a Non-Resident Research Fellow with the Stimson Environmental Security Program in Washington, DC. (Peter and Russell; Published: September 15, 2015; “Water Wars: The Next Great Driver of Global Conflict?”; National Interest; Accessed: August 14, 2021; https://nationalinterest.org/feature/water-wars-the-next-great-driver-global-conflict-13842)//CYang

We live in an age of great anxiety about threats to global peace and stability. Among these are worries that intense water-related stresses, now showing up in regions around the world, may become all-too-common sources of conflict. Just as often, however, concerns about water wars are dismissed as much ado about nothing. An influential school of thought has long contended future international conflicts will not be fought over this resource. Water, it says, is of such elemental importance to human existence that even long-time adversaries will be forced to accommodate one another’s needs in a water-scarce future. As water is too expensive to transport over long distances, moreover, it is very difficult to steal or plunder. And history gives some comfort to this forecast: as few wars have been fought specifically over water, it is highly unlikely humanity will start engaging in water conflicts now. Or so the thinking goes.

In the case of water, this logic — of the past as predictor of the future — is compelling and comforting. But it also is dangerously myopic, for it fails to consider the possibility that the future may look nothing at all like the past. From nearly any standpoint, the world we live in is a fundamentally different place compared with the past. Over just the last century, for example, the global population has rocketed upward from roughly two billion to well past seven billion. While population growth is hardly the only driver of social, economic, and ecological change at global and regional scale, it has been among the most important. Nor is this process at an end. Current demographic projections forecast a global population of at least nine billion by 2050 — and possibly more.

Water in the Anthropocene:

Population growth provides a fitting illustration of the rapid pace of change in the modern world. No consequence is more important than what has been done to nature. Humans have so drastically altered the Earth that scientists now question whether we remain in the Holocene, the 12,000-year-old geological epoch during which all of recorded human history has occurred. Instead, increasingly they speak of the Earth as having entered a new epoch, the Anthropocene. The basic idea behind the Anthropocene is that human activity has so thoroughly disrupted the Earth’s core processes (for instance, its nitrogen cycle or sediment flows) that the planet no longer can be said to function according to the familiar rhythms of the Holocene. Human interference in the Earth’s carbon cycle, for example, has changed the planet’s climate and in the process altered rainfall patterns, accelerated glacial melting, increased air and sea temperatures, and much else. Gone is the Holocene’s stable climate; here is the Anthropocene’s unstable one.

While there is some debate amongst scientists and others about whether the Anthropocene will lead to a better or worse future, nearly everyone involved in the discussion agrees that the Earth of the future will not resemble its past. From here forward, we face an unfamiliar planet that will throw our assumptions about nearly everything out the window.

No resource stands to be more affected by the arrival of the Anthropocene than fresh water. Finite and increasingly scarce in many parts of the world, fresh water remains the most vital single input for everything from food production, energy generation, and manufacturing to human health, social development, and economic modernization. Unlike oil, water has no substitute, making access to it nothing less than a matter of existential importance to every living creature on Earth.

Yet despite its monumental role in local and international affairs, water ironically remains completely undervalued, pumped and consumed virtually free of charge across much of the world. We essentially pump water as we breathe oxygen; it is a learned reflex, central to our ability to survive and thrive as a species. Nicknames like “blue gold” and “oil of the 21st century” attest to the value of fresh water and its importance to everyday affairs throughout the world.

While every country’s water equation is different, at a global scale the basic problem is that demand for water is soaring while water supplies are being squeezed. On the demand side, the challenge results from an inexorable combination of global economic and population growth combined with water-use inefficiencies. On the supply side, the problem results not just from exhaustion of the world’s stock of fresh water capital, as is happening to groundwater reservoirs nearly everywhere. Fresh water supply is also becoming less predictable as climate change sets in—shifting rainfall and snowfall patterns and increasing evaporation rates are giving us more frequent droughts and floods.

The upshot is that the arrival of the Anthropocene foreshadows a world where received wisdom may no longer be a reliable guide to the future. Water insecurity from drought, excessive groundwater extraction, and changed seasonal precipitation patterns is affecting — or soon will affect — regions as diverse as the Middle East, South Asia, the Caribbean, northern China, sub-Saharan Africa, the western United States, and many more.

Water Geopolitics:

Much as oil shaped the global geopolitics of the 20th century, water has the power to reorder international relations in the current century. The world’s emerging water geopolitics are complicated, as fresh water resources are distributed unevenly across the globe. There are great water powers, blessed with enormous renewable reserves (Brazil, Russia, the United States, Canada, and China round out the top five). But even within these huge countries, water availability is not uniform, with southern Brazil, the western United States, northern China, and other sub-regions facing intense water stress.

Far more numerous than the water powers are the water have-nots, a growing list of countries suffering through a perfect storm of rapid population growth, resource depletion, poor governance, economic stagnation, and unsettling climate change impacts, all within the context of chronic aridity. The most water-fragile among them are concentrated in a strategically significant belt stretching from North Africa across the Middle East and Horn of Africa into Central, South, and East Asia. It is in these naturally arid or semi-arid countries where water scarcity has the greatest potential to inflict serious harm.

Water stress is best understood as a precursor to conflict. While the environmental security community generally agrees that water disputes rarely leads to interstate violence, the same cannot be said of intrastate conflict. Here, at the subnational level, water disputes and instability can trigger violent conflict, particularly in situations of existing social, political, or economic fragility. Water stress acts as an accelerant, increasing the likelihood of conflict. Moreover, water scarcity-fueled instability can have dangerous security implications for wider geographic regions.

Take Syria as an example. Between 2006 and 2010, the country was hit hard by drought, which wiped out rural livelihoods for many and caused significant internal displacement across the country. Internal displacement in turn helped stir up a pot that boiled over into all-out civil war in Syria, eventually spreading to Iraq. Over the last two years, ISIS has viewed water access and control as a primary strategic objective of their campaign, and has commandeered hydroelectric dams, irrigation canals, reservoirs, pipelines, and other water infrastructure to cement territorial gains.

Water has played an important role in Yemen’s ongoing collapse. Decades of mismanagement have left the country — one of the world’s most water-scarce nations — with dilapidated water infrastructure, severely depleted groundwater reserves, and high rates of water-use inefficiency. Yemen’s capital, Sana’a, may become the first capital in the modern world to functionally run out of water, possibly as soon as 2025.

In Pakistan, meanwhile, runaway population growth and shifting rainfall patterns threaten its water outlook. With a massive population set to nearly double in the next 35 years, Pakistan’s demand on its very limited water resources will intensify in a way that is almost unimaginable. Already, the country is one of the most water scarce on earth. In a nod to water’s importance in shaping the region, many Pakistani militant groups long hostile to India have supplanted protests over Indian control of Kashmir with more specific protests over access to Kashmir’s most valuable resource — water.

Other countries join Syria, Iraq, Yemen, and Pakistan on the list of nations facing a similar combination of water stress and social and political insecurity. They include conflict-prone countries of geopolitical significance, including Iran, Afghanistan, Egypt, Libya, Nigeria, and Somalia. Even more worrisome, global heavyweights such as China, India, and even the United States face uncomfortable futures given mismatches between forecasted demand for water and squeezed sources of supply. While there is no reason to believe that the latter states will suffer from the same forms of insecurity as those countries in the arc of crisis, neither will they be exempted from the blunt realities of a water-stressed world.

American Leadership in the Anthropocene:

In 2012, the U.S. Office of the Director of National Intelligence (ODNI) produced a global water security assessment, a first for the American intelligence community. Over the coming decade, it said, many countries would face water stresses that “will risk instability and state failure, increase regional tensions, and distract them from working with the United States on important U.S. policy objectives.” It listed water-induced stressors that likely would unsettle these states and their neighbors, ranging from pressures on food and energy production to social and political disruption to water scarcity used by terrorists for leverage.

Yet despite the seriousness of ODNI’s assessment, the U.S. government has neither a coherent strategy nor the appropriate tools to deal with the scope and scale of water-related challenges around the world. The federal government’s approach to water and water-related challenges is uncoordinated, outdated, and poorly resourced in general. In foreign policy terms, water receives some attention but, as on the domestic side, water receives too little attention and funding (in fiscal year 2013, the U.S. government spent $784 million worldwide on water, about half of which was spent on drinking water and sanitation). This inertia is understandable to an extent, as water is a cross-cutting resource that does not fit easily into preexisting policy boxes.

It is hardly an original argument to call for greater American leadership in international relations. Yet in the case of water, such an argument could not be truer. As the world’s greatest power, it is in America’s interests to place global water security at the top of its foreign policy agenda, and to forge a leadership role in this arena. Failing to craft a strategic approach to the world’s looming water crises will expose the United States to foreign and security policy failures abroad. Conversely, seizing the leadership mantle will benefit the United States immensely and add to its global reputation over the coming decades.

Despite the rise of China, India, and other actors, American leadership will remain central to the operation of the global system for many years to come, and America’s many formal and informal assets will give it unrivaled power and prestige across multiple domains. From a strategic standpoint, the U.S. would reap material, diplomatic, and reputational rewards if it were to be perceived as a good-faith actor working to solve the world’s water challenges.

The bottom line is that no one can take much comfort from a sober assessment of where we are headed. Expecting widespread and serious water challenges to be solved without conflict and disruption might be a comforting premise, but it should not and cannot be the end of the discussion. The Anthropocene awaits. To navigate it unscathed, we must be bold and imaginative.

#### Global shortages escalate, which cause numerous unpredictable threats.

Stinson and Heijden 19 — Stinson is Project Lead, Water Initiative, World Economic Forum. Heijden Africa and Europe Director, World Resources Institute (Callie and Kitty Van Der; Published: March 18, 2019; “Water is a growing source of global conflict. Here’s what we need to do”; World Economic Forum; Accessed: July 2, 2021; https://www.weforum.org/agenda/2019/03/water-is-a-growing-source-of-global-conflict-heres-what-we-need-to-do/)//CYang

The most intensive drought ever recorded in Syria lasted from 2006 to 2011. Water scarcity hit households, businesses and infrastructure, while in the countryside crops failed, livestock died, and entire families moved to the country’s cities. The subsequent eruption of civil war in 2011 led to as many as half a million deaths, as well as massive migration flows to neighbouring countries and beyond, and untold misery. Syria’s war has been a tragic illustration of the central, driving role that water insecurity can play in instability and conflict.

This is no surprise. In 2017 alone, water was a major factor in conflict in at least 45 countries, including Syria. Its importance as a resource means that water-related insecurity can easily exacerbate tensions and friction within and between countries. It can be weaponized; nefarious actors can gain control of, destroy, or redirect access to water to meet their objectives by targeting infrastructure and supplies. Advancements in cyber attacks on critical infrastructure raise further concerns as to the security of water systems.

The World Economic Forum’s Global Risk Report (GRR) has listed water crises among the top-five risks in terms of impact for eight consecutive years. In the most recent version of the report, it remains nested among a cluster of other risks that are rated as having both a very high likelihood and a very high impact. These include extreme weather events, natural disasters, the failure of climate change adaptation and mitigation, man-made environmental disasters, biodiversity loss and ecosystem collapse, interstate conflict and large scale-involuntary migration.

These risks are increasingly interconnected. Failure to mitigate climate change could lead to more extreme weather events, ecosystem collapse and a greater likelihood of man-made environmental disasters. All of these can exacerbate food and water insecurity, which in turn can lead to human deprivation, and could make these and other risks like migration and conflict more likely in a negative feedback loop. Around two thirds of the world’s population, or 4 billion people, currently live without sufficient access to fresh water for at least one month of the year.

Further complicating the picture is the reality that securing water for food and economic activity will only become more difficult over time. As economies develop, their water consumption patterns shift and overall demand rises dramatically to meet the needs of food production, thirsty manufacturing and other industries, thermal power plants and households. However, water supplies are often damaged by poor management, pollution and over-consumption, in addition to supply-side reductions due to climate change impacts and the ecosystem degradation mentioned above.

Many of these drivers of insecurity can be seen in the Inner Niger Delta area of Mali, a marshy wetlands along a stretch of the Niger river. Disruptions to the Delta’s waters, for instance through the construction of two upstream dams, risk destroying fragile ecosystems and further destabilizing the entire region. Altering downstream flows can jeopardize traditional economic activities that underpin the viability of Delta fishing villages, destroying livelihoods and exacerbating social tensions such as intergenerational friction.

Combined with reductions in available farmland associated with rising temperatures and desertification, such environmental degradation risks further fuelling mass migration to the Malian capital Bamako and Europe. The journey is not a safe one, with criminalised trafficking routes that pass nearby between the West African coast and the Sahara. The history of radicalization in the region by extremist groups that have established themselves in northern Mali further illustrates the vulnerabilities facing the displaced and disenfranchised. People whose access to water is limited risk becoming increasingly marginalized, and a target for recruitment by radical groups. Water is critical to the region’s security.

The Inner Niger Delta illustrates the critical role that water insecurity can play in exacerbating other risks, and the necessity of holistic policy approaches. Unfortunately, water insecurity is not yet taken seriously enough by all actors, despite its central role in our economies and in human lives and livelihoods. In most scenarios, the true security threat caused by water insecurity is not a ‘water war’, but rather in its secondary impact on associated human security, that which can then exacerbate local, regional and international security threats.

It can impede or reverse economic development, and prevent countries from playing their art in achieving the Sustainable Development Goals. It can also affect the private sector, for instance by affecting critical parts of complex supply chains. Robust solutions to the water security challenge are critical for everybody from public policymakers and businesses to the wider public and the international community. A new generation of public-private partnerships can be part of the solution to such complex and interrelated risks, responding with urgency and innovation to manage the ‘less for more’ challenge of reduced supply and increased demand.

## Quantum Computing Bad

### Quantum Bad---1NC

#### Quantum computing threatens everything.

Justin Malonson 01-28-22 [Justin Malonson is an is an American internet entrepreneur, software developer, investor, author and technology executive. He is the founder of social-networking service Lyfeloop and CEO of international web-development agency Coastal Media Brand, Entrepreneur, “Quantum Computing Threatens Everything — Could it be Worse Than the Apocalypse?” https://www.entrepreneur.com/article/404091//ZW]

What is a quantum computer? A quantum computer is a machine that uses the laws of quantum theory to solve problems made harder by Moore's law (the number of transistors in a dense integrated circuit doubles about every two years). One example is factoring large numbers. Traditional computers are limited to logical circuits with several tens of transistors, while the number of transistors in a quantum processor may be on the order of one to two million. Meaning, these computers will have exponential power, solving problems that traditional computation can't even identify or create solutions for. The dangers of a quantum computer In the near future, quantum computers will be so advanced that they will have the capability to simulate very complicated systems. This could be used for simulations in physics, aerospace engineering, cybersecurity and much more. However, once this computer is built, it has the potential to unravel data encryption protocols. It could also potentially compromise air gaps due to its ability to scan vast distances for nearby networked devices or applications that are open. This means that it can become even simpler for external hackers. They may already have access to your computer or computer system via other avenues, like vulnerabilities in web browsers. They could find it much easier because you're not locking up all the doors. Quantum computers point to a radically new understanding of computing. An understanding that could eventually be used to unlock problems now thought completely intractable. For now, the field seems ripe with potential. Scientists working on quantum computing call it one of the most interesting theoretical tools in artificial intelligence. Think of it as an incredibly powerful calculator programmed with deep domain expertise. Quantum computers promise answers to all sorts of mathematical, scientific and medical questions humans would never have the guts to tackle otherwise. They promise profound breakthroughs in imaging that will rival even experimental intracellular MRI scans; they may help crack wide-ranging databases that are currently unbreakable or they might pick up scant details like geological signatures warning us about tsunamis long before they happen. Can quantum computers be reprogrammed? Quantum computers can theoretically be programmed to solve any complex computational problem. But, the act of programming the computer is so expensive and inflexible that someone would need to program it with all possible solutions. Quantum computers threaten everything. The worst part is that security experts can't ever say for sure what you can do to protect against their programming capabilities. They do know, however, that it's possible to reprogram them just as we would with a normal computer. It's just that the task is so complex and difficult that programming would be such a high-level security risk, it might as well never exist. What does this all mean? It means we need to develop some sort of encryption technology on our smaller devices so not even those who hold all the world's data can see or access it. Quantum computers work differently than traditional computers. That gives the maker of a quantum computer more control than with a conventional computer. They can do things like reverse time and process large data with greater speed. The manufacturer will program the machine before release, which also comes with certain risks. If they change their mind and reprogram it per client needs, they put themselves at risk for security breaches. The catch is that the cryptography keys are only secure if you keep them secret. The slightest leak — say a pinhole camera across the table from something like a quantum computer or a phone call or email intercepted while being decrypted — would enable an adversary to not just unscramble your message but steal your keys. The threat made by quantum computing has been speculated since before it was even technologically feasible to build a quantum computer. But now that we're nearly there, the situation might be even more dire than you can imagine. Current safety standards As quantum computers allow for more efficient algorithms, the dangers of hacking increase. Such security risks have been a top priority at Google. They have high expectations for what approach they will take to create their future quantum machine. In the meantime, DARPA (Defense Advanced Research Projects Agency) has set out grand challenges for computer science with a hefty $2 million prize. DARPA's goal is to keep U.S. cyber strength relevant amid the rapid decline in Moore's Law and potential loss of global technological leadership. If quantum computers proliferate, they will threaten everything — not just bank records and medical documents, but everything. They represent a security leak so fundamental that it could be worse than the apocalypse. The quantum computer poses a possible threat to the infrastructure of the United States. Yet the American authorities do not have enough measures in place to stop this type of danger. One way that they can defend themselves is by inventing new safety standards that work with the current technologies. Whenever quantum computing matures, however, it will present a vigorous challenge. Computer scientists will need to develop the protocols and protections necessary to ensure security for this emerging technology. If these precautions are not taken, quantum computing could lead to disastrous outcomes in cyber security. There needs to be a protocol developed to provide security for quantum computers. Hackers will be able to access and disrupt live systems, which calls for an urgent need of advancements in cyber security. These new systems can't just implement existing protection protocols because they're not fully developed yet. The cost of research and development is high and the profits once the product is finished are relatively low. Quantum computing is a hot topic at this moment in time that will impact society in a way we can't even predict if we don't acknowledge its significance now. Most computers today work in accordance with digital signals. If someone tries to hack the computer, it will change that digital signal into another form or cancel it out, which can be easily noticed. However, quantum computers use quantum bits for calculations. They are tied together in a way that makes them so sensitive to changes in information that they are exponentially more vulnerable to hacks than digital computers. If someone manages to hack a quantum computer — though not yet possible — it would have serious implications for maintaining our safety standards. How can companies protect themselves from the threat of quantum computers? If the leaked NSA documents are to be believed, then we may be in for a rude awakening when quantum computers become technologically feasible. These machines will be able to perform calculations in far less time than any conventional computer and render our current encryptions ineffectual. The leaks claim that in 30 years, two medium-sized quantum computers would be able to even break the security of RSA (cryptosystem) — which is currently set at 2048 bits. Any business that relies on modern cryptography is at risk of being hacked in the near future. But what can companies do to protect themselves? As it turns out, there are some pretty straightforward solutions which firms can preserve (or improve) security amid all this hullabaloo with quantum computing. The authors recommend investing in encryption techniques like Bitcoin, the blockchain and the TLS (Transport Layer Security). In simple terms, quantum computers process information differently from today's digital computers. This is because of their ability to have bits which sit in more than one state simultaneously, meaning they can perform many calculations at a time. In a future dominated by quantum computing, all regular computing will be made virtually obsolete. Hackers will be able to access the deepest secrets of companies without needing a password. To avoid this fate, companies need to embrace encryption techniques that guard against quantum technology, but they cannot afford to stop innovating too drastically. The looming potential threat of quantum computing should be taken seriously, but this doesn't mean you should panic. The best way to protect yourself is to plan ahead and think about possible solutions. Incorporating elements of quantum cryptography may not always be possible for every client because of the cost. But, it could help secure an important client who cannot risk future interference in their sensitive operations.

### Quantum Bad---2NC

#### Quantum computers don’t work--- we’re years away from any breakthrough.

Scott Pakin and Patrick Coles 06-10-2019 [Scott Pakin is a computer scientist in the Applied Computer Science group at Los Alamos National Laboratory. With co-principal investigator Wojciech Zurek, he leads the Taming Defects in Quantum Computers project at Los Alamos. Patrick Coles is a quantum physicist in the Physics of Condensed Matter and Complex Systems group at Los Alamos National Laboratory and is a co-investigator on the Taming Defects in Quantum Computers project at Los Alamos, Scientific American, “The Problem with Quantum Computers,” edited for ableist language, https://blogs.scientificamerican.com/observations/the-problem-with-quantum-computers///ZW

By now, most people have heard that quantum computing is a revolutionary technology that leverages the bizarre characteristics of quantum mechanics to solve certain problems faster than regular computers can. Those problems range from the worlds of mathematics to retail business, and physics to finance. If we get quantum technology right, the benefits should lift the entire economy and enhance U.S. competitiveness. The promise of quantum computing was first recognized in the 1980s yet remains unfulfilled. Quantum computers are exceedingly difficult to engineer, build and program. As a result, they are ~~crippled~~ [limited] by errors in the form of noise, faults and loss of quantum coherence, which is crucial to their operation and yet falls apart before any nontrivial program has a chance to run to completion. This loss of coherence (called decoherence), caused by vibrations, temperature fluctuations, electromagnetic waves and other interactions with the outside environment, ultimately destroys the exotic quantum properties of the computer. Given the current pervasiveness of decoherence and other errors, contemporary quantum computers are unlikely to return correct answers for programs of even modest execution time. While competing technologies and competing architectures are attacking these problems, no existing hardware platform can maintain coherence and provide the robust error correction required for large-scale computation. A breakthrough is probably several years away. The billion-dollar question in the meantime is, how do we get useful results out of a computer that becomes unusably unreliable before completing a typical computation? Answers are coming from intense investigation across a number of fronts, with researchers in industry, academia and the national laboratories pursuing a variety of methods for reducing errors. One approach is to guess what an error-free computation would look like based on the results of computations with various noise levels. A completely different approach, hybrid quantum-classical algorithms, runs only the most performance-critical sections of a program on a quantum computer, with the bulk of the program running on a more robust classical computer. These strategies and others are proving to be useful for dealing with the noisy environment of today’s quantum computers. While classical computers are also affected by various sources of errors, these errors can be corrected with a modest amount of extra storage and logic. Quantum error­ correction schemes do exist but consume such a large number of qubits (quantum bits) that relatively few qubits remain for actual computation. That reduces the size of the computing task to a tiny fraction of what could run on defect-­free hardware. To put in perspective the importance of being stingy with qubit consumption, today’s state-of-the-art, gate-based quantum computers, which use logic gates analogous to those forming the digital circuits found in the computer, smartphone or tablet you’re reading this article on, boast a mere 50 qubits. That is just a tiny fraction of the number of classical bits your device has available to it, typically hundreds of billions. TAMING DEFECTS TO GET SOMETHING DONE The trouble is, quantum mechanics challenges our intuition. So we struggle to figure out the best algorithms for performing meaningful tasks. To help overcome these problems, our team at Los Alamos National Laboratory is developing a method to invent and optimize algorithms that perform useful tasks on noisy quantum computers. Algorithms are the lists of operations that tell a computer to do something, analogous to a cooking recipe. Compared to classical algorithms, the quantum kind are best kept as short as possible and, we have found, best tailored to the particular defects and noise regime of a given hardware device. That enables the algorithm to execute more processing steps within the constrained time frame before decoherence reduces the likelihood of a correct result to nearly zero. In our interdisciplinary work on quantum computing at Los Alamos, funded by the Laboratory Directed Research and Development program, we are pursuing a key step in getting algorithms to run effectively. The main idea is to reduce the number of gates in an attempt to finish execution before decoherence and other sources of errors have a chance to unacceptably reduce the likelihood of success. We use machine learning to translate, or compile, a quantum circuit into an optimally short equivalent that is specific to a particular quantum computer. Until recently, we have employed machine-learning methods on classical computers to search for shortened versions of quantum programs. Now, in a recent breakthrough, we have devised an approach that uses currently available quantum computers to compile their own quantum algorithms. That will avoid the massive computational overhead required to simulate quantum dynamics on classical computers. Because this approach yields shorter algorithms than the state of the art, they consequently reduce the effects of noise. This machine-learning approach can also compensate for errors in a manner specific to the algorithm and hardware platform. It might find, for instance, that one qubit is less noisy than another, so the algorithm preferentially uses better qubits. In that situation, the machine learning creates a general algorithm to compute the assigned task on that computer using the fewest computational resources and the fewest logic gates. Thus optimized, the algorithm can run longer. This method, which has worked in a limited setting on quantum computers now available to the public on the cloud, also takes advantage of quantum computers’ superior ability to scale-up algorithms for large problems on the larger quantum computers envisioned for the future. New work with quantum algorithms will give both experts and nonexperts the tools to perform calculations on a quantum computer. Application developers can begin to take advantage of quantum computing’s potential for accelerating execution speed beyond the limits of conventional computing. These advances may bring us all several steps closer to having robust, reliable large-scale quantum computers to solve complex real-world problems that bring even the fastest classical computers to their knees.

#### The aff causes a quantum apocalypse.

Frank Gardner 01-27-2022 [BBC Security Correspondent, BBC, “What is the quantum apocalypse and should we be scared?” https://www.bbc.com/news/technology-60144498//ZW]

Put very simply, quantum computers work completely differently from the computers developed over the past century. In theory, they could eventually become many, many times faster than today's machines. That means that faced with an incredibly complex and time-consuming problem - like trying to decrypt data - where there are multiple permutations running into the billions, a normal computer would take many years to break those encryptions, if ever. But a future quantum computer, in theory, could do this in just seconds. Such computers could be able to solve all sorts of problems for humanity. The UK government is investing in the National Quantum Computing Centre in Harwell, Oxfordshire, hoping to revolutionise research in the field. But there is also a dark side. Data thieves A number of countries, including the US, China, Russia and the UK, are working hard and investing huge sums of money to develop these super-fast quantum computers with a view to gaining strategic advantage in the cyber-sphere. Every day vast quantities of encrypted data - including yours and mine - are being harvested without our permission and stored in data banks, ready for the day when the data thieves' quantum computers are powerful enough to decrypt it. "Everything we do over the internet today," says Harri Owen, chief strategy officer at the company PostQuantum, "from buying things online, banking transactions, social media interactions, everything we do is encrypted. "But once a functioning quantum computer appears that will be able to break that encryption... it can almost instantly create the ability for whoever's developed it to clear bank accounts, to completely shut down government defence systems - Bitcoin wallets will be drained." It's a prognosis echoed by Ilyas Khan, chief executive of the Cambridge and Colorado-based company Quantinuum. "Quantum computers will render useless most existing methods of encryption," he says. "They are a threat to our way of life." Quantum-proofing Seriously? That does sound completely apocalyptic, so why haven't we heard more about this? The answer is that yes, OK, this would indeed be the case if no precautions were being taken. "If we weren't doing anything to combat it then bad things would happen," says a Whitehall official who asked not to be named. In practice, mitigation efforts are already in train and have been for some years. In the UK, all government data classified as "top secret" is already "post-quantum" - that is, using new forms of encryption which researchers hope will be quantum-proof. Tech giants like Google, Microsoft, Intel and IBM are working on solutions, as well as more specialist companies like Quantinuum and Post-Quantum. Most importantly, there is currently something of a post-quantum cryptography "beauty parade" taking place at the US National Institute for Science and Technology (NIST) just outside Washington DC. The aim is to establish a standardised defence strategy that will protect industry, government, academia and critical national infrastructure against the perils of the quantum apocalypse. All of this will not be cheap. Quantum computing is expensive, laborious and generates large amounts of heat. Developing quantum-safe algorithms is one of the major security challenges of our time. But experts say the alternative - doing nothing - is simply not an option.

#### The consensus of scientists say the entire world could be threatened by quantum tech.

Patrick Caughill 08-09-2017 [Futurism staff writer, Futurism, “World's Leading Physicist Says Quantum Computers Are "Tools of Destruction, Not Creation,” [https://futurism.com/worlds-leading-physicist-says-quantum-computers-are-tools-of-destruction-not-creation//ZW](https://futurism.com/worlds-leading-physicist-says-quantum-computers-are-tools-of-destruction-not-creation/ZW)]

WEAPON OF MASS DISRUPTION Quantum Computers are heralded as the next step in the evolution of data processing. The future of this technology promises us a tool that can outperform any conventional system, handling more data and at faster speeds than even the most powerful of today's supercomputers. However, at the present juncture, much of the science dedicated to this field is still focused on the technology's ultimate utilization. We know that quantum computers could manage data at a rate that is remarkable, but exactly what kind of data processing will they be good for? This uncertainty raises some interesting questions about the potential impact of such a theoretically powerful tool. No encryption existing today would be able to hide from the processing power of a functioning quantum computer. Last month, some of the leading names in quantum technologies gathered at the semi-annual International Conference on Quantum Technologies in Moscow. Futurism was in attendance and was able to sit and talk with some of these scientists about how their work is moving us closer to practical quantum computers, and what impact such developments will have on society. One of the most interesting topics of discussion was initiated by Alexander Lvovsky, Quantum Optics group leader at the Russian Quantum Center and Professor of Physics at the University of Calgary in Canada. Speaking at a dinner engagement, Lvovsky stated that quantum computers are a tool of destruction, not creation. What is it about quantum computers that would incite such a claim? In the end, it comes down to one thing, which happens to be one of the most talked about potential applications for the technology: Breaking modern cryptography. WITH GREAT POWER... Today, all sensitive digital information sent over the internet is encrypted in order to protect the privacy of the parties involved. Already, we have seen instances where hackers were able to seize this information by breaking the encryption. According to Lvovsky, the advent of the quantum computer will only make that process easier and faster. In fact, he asserts that no encryption existing today would be able to hide from the processing power of a functioning quantum computer. Medical records, financial information, even the secrets of governments and military organizations would be free for the taking—meaning that the entire world order could be threatened by this technology. The consensus between other experts is, essentially, that Lvovsky isn't wrong. "In a sense, he's right," Wenjamin Rosenfeld, a physics professor at the Ludwig Maximilian University of Munich, stated in an interview. He continued, "taking a quantum computer as a computer, there's basically not much you can do with this at the moment;" however, he went on to explain that this may soon be changing. To break this down, there are only two quantum algorithms at the moment, one to allow a quantum computer to search a database, and the other, Shor's algorithm, which can be used by a quantum computer to break encryption. Notably, during the conference, Mikhail Lukin, a co-founder of the Russian Quantum Center and head of the Lukin Group of the Quantum Optics Laboratory at Harvard University, announced that he had successfully built and tested a 51-qubit quantum computer...and he's going to use that computer to launch Shor's algorithm. Vladimir Shalaev, who sits on the International Advisory Board of the Russian Quantum Center and is a professor of Electrical and Computer Engineering at Purdue University, takes a more nuanced approach to this question, saying it is neither a tool of destruction nor creation—it is both: "I would disagree with him. I think I would say that any new breakthrough breeds both evil and good things." Quantum computers may not be capable of the physical destruction of a nuclear bomb, but their potential application is the digital equivalent. He evoked the development of laser technology as an example, saying, "Lasers changed our lives with communications, surgery, their use in machinery, but they are also used in missiles to destroy buildings. But I think this is life. Nothing comes with only good, there is always bad as well. So I don't think it is just a destructive technology, it could also be a constructive one." There is a great deal of truth to Shalaev's assessment. Nuclear technology was primarily developed as a destructive tool. After the war, many more positive applications were found, impacting energy, medicine, and agriculture, among many other fields. Quantum computers may not be capable of the physical destruction of a nuclear bomb, but their potential application in relation to encryption is the digital equivalent, making this topic worthy of reflection in these early stages. WHAT GOOD MAY COME? So, if quantum computers do have such dangerous potential, why are we pursuing them? As Lukin expounds, there are other potential applications outside of encryption breaking, applications that many experts are excited about. For example, Lukin sees enormous potential in quantum sensors. "It has the potential to change the field of medical diagnostics, where some of the tasks which require huge labs can be performed on the scale of an iPhone. Imagine the implications for third world countries in parts of the world like Africa. It can really allow to diagnose and treat patients. I think there’s actually a huge impact on society," he explained. Also, the processing power of quantum computers could push research in artificial intelligence (AI) forward by leaps and bounds. Indeed, it could assist this field to such a degree that AI could be a part of the answer to the problem proposed by Lvovsky. To that end, Lukins asserts, "I’m fairly convinced that, before quantum computers start breaking encryption, we will have new classical encryption, we will have new schemes based on quantum computers, based on quantum cryptography, which will be operational." Much like lasers or nuclear weapons, the scientists involved in creating quantum computers are unable to predict the total utility of this technology. There very well could be a host of world changing applications for quantum computers. Still, even with just considering the encryption busting potential of the technology, we must remain cognizant of the power we are unleashing.

#### Quantum tech devastates national security.

Adam Routh et al. 02-06-2020 [Scott Buchholz serves as the national emerging tech research director for Deloitte Consulting, Joe Mariani is a research manager with Deloitte’s Center for Government Insights, Adam Routh is a research manager with Deloitte's Center for Government Insights, Akash Keyal is a senior research analyst with the Deloitte Center for Government Insights, Pankaj Kamleshkumar Kishnani is a researcher with the Deloitte Center for Government Insights, Deloitte Insights, “The realist’s guide to quantum technology and national security What nontechnical government leaders can do today to be ready for tomorrow’s quantum world,” [**https://www2.deloitte.com/us/en/insights/industry/public-sector/the-impact-of-quantum-technology-on-national-security.html//ZW**](https://www2.deloitte.com/us/en/insights/industry/public-sector/the-impact-of-quantum-technology-on-national-security.html/ZW)]

What can this mean for national security? With uses ranging from code-breaking to code-making, and imaging to navigation, quantum information science has clear military and intelligence applications. Moreover, with developed countries such as the United States, China, Russia, Austria, Australia, Canada, the United Kingdom, and commercial companies around the globe investing in quantum research, these defense applications could have significant impact on relative national security.[30](https://www2.deloitte.com/us/en/insights/industry/public-sector/the-impact-of-quantum-technology-on-national-security.html#endnote-30) Government leaders, even those in nontechnical positions, should have a basic understanding of quantum systems and the emerging national security challenges so they can take steps to protect information and prepare their organizations, teams, and business practices for the quantum world. Here are some problem areas in national security matters where quantum science can be applied. Loss of secrets Information security is one of the most fundamental elements of national security. Whether it be military plans, advanced technology information, diplomatic cables, personal data, or company data, critical details related to state and business security are embedded in data being shared through public and private networks. If we can’t protect this data, we can’t expect any reasonable sense of national security. Cryptography is one way in which governments and private companies secure information. Often, by utilizing highly complex math problems, cryptography can make digital information more or less unusable, unless the party concerned possesses the mathematical solution, known as a key. To decode cryptography without the key would require completing so many computations that it is unfeasible for today’s computers, but not for quantum computers.[31](https://www2.deloitte.com/us/en/insights/industry/public-sector/the-impact-of-quantum-technology-on-national-security.html#endnote-31) Quantum computers will someday be able to compute complex problems so quickly that some forms of encryption can be broken relatively easily. For even the largest classical computers yet to be built, these problems with sufficiently large crypto keys can take millions of years to solve. However, because of quantum superposition and entanglement, even a relatively slow quantum computer could break the encryption in a matter of hours (assuming an RSA cryptokey of 2,048 bits, a hypothetical 1-petahertz classical computer and a hypothetical 1-megahertz quantum computer).[32](https://www2.deloitte.com/us/en/insights/industry/public-sector/the-impact-of-quantum-technology-on-national-security.html#endnote-32) This poses a significant problem for not just governments trying to protect state secrets but also for commercial companies responsible for protecting personal data. The seriousness of the issue seems to become only more apparent when you consider the fact that information can be downloaded today and decrypted later once quantum computers are mature.[33](https://www2.deloitte.com/us/en/insights/industry/public-sector/the-impact-of-quantum-technology-on-national-security.html#endnote-33) Luckily, not all types of encryption can be decoded easily by quantum computers. Many of government’s most sensitive secrets are protected by symmetric encryption immune to quantum attacks, and mathematicians and cryptographers are working on improved “quantum-resistant” algorithms that can be used for everyday uses such as telecommunications. But relying on mathematicians to develop quantum-resistant encryption is not the sole answer. In fact, it may actually be the easy part. In the words of Kania, “the tricky aspect will be implementation. The transition required in updating to new, post-quantum cryptography can be extremely difficult, especially for defense and national security organizations that tend to have a significant proportion of legacy systems.”[34](https://www2.deloitte.com/us/en/insights/industry/public-sector/the-impact-of-quantum-technology-on-national-security.html#endnote-34) Even once new algorithms are developed, the arduous process of updating keys and adding software patches can take years, if the process is possible at all. Add on top of this the regulatory and technological requirements to continue to support existing types of security, and organizations can face the challenge of having to interweave existing and post-quantum security measures on the same systems. As David Worrall of Cambridge Quantum Computing describes it, post-quantum security “is not a ‘drop-in’ replacement for existing measures; it likely must lay on top of existing infrastructure, updating key generation, hardware security models, and algorithms to provide additional security.”[35](https://www2.deloitte.com/us/en/insights/industry/public-sector/the-impact-of-quantum-technology-on-national-security.html#endnote-35) This may be good news for governments looking to avoid ripping and replacing costly IT infrastructure, but it also means that government leaders need to have a detailed understanding of their data, security needs, and network architecture in order to find the right mix of classical, quantum, and post-quantum security methods. As Dowling puts it, “There is not one simple fix, but a menu of options where price, security, and data transmission distance cannot all be simultaneously optimized. The state of quantum technology is still in flux right now, and this menu will change yearly.”[36](https://www2.deloitte.com/us/en/insights/industry/public-sector/the-impact-of-quantum-technology-on-national-security.html#endnote-36)

## Spark

### 1nc spark

#### Nuke war won’t cause extinction---BUT, it’ll spur political will for meaningful disarmament.

Daniel **Deudney 18**. Associate Professor of Political Science at Johns Hopkins University. 03/15/2018. “The Great Debate.” The Oxford Handbook of International Security. www.oxfordhandbooks.com, doi:10.1093/oxfordhb/9780198777854.013.22. //reem

Although nuclear war is the oldest of these technogenic threats to civilization and human survival, and although important steps to restraint, particularly at the end of the Cold War, have been achieved, the nuclear world is increasingly changing in major ways, and in almost entirely dangerous directions. The third “bombs away” phase of the great debate on the nuclear-political question is more consequentially divided than in the first two phases. Even more ominously, most of the momentum lies with the forces that are pulling states toward nuclear-use, and with the radical actors bent on inflicting catastrophic damage on the leading states in the international system, particularly the United States. In contrast, the arms control project, although intellectually vibrant, is largely in retreat on the world political stage. The arms control settlement of the Cold War is unraveling, and the world public is more divided and distracted than ever. With the recent election of President Donald Trump, the United States, which has played such a dominant role in nuclear politics since its scientists invented these fiendish engines, now has an impulsive and uninformed leader, boding ill for nuclear restraint and effective crisis management. Given current trends, it is prudent to assume that sooner or later, and probably sooner, nuclear weapons will again be the used in war. But this bad news may contain a “silver lining” of good news. Unlike a general nuclear war that might have occurred during the Cold War, such a nuclear event now would probably not mark the end of civilization (or of humanity), due to the great reductions in nuclear forces achieved at the end of the Cold War. Furthermore, politics on “the day after” could have immense potential for positive change. The survivors would not be likely to envy the dead, but would surely have a greatly renewed resolution for “never again.” Such an event, completely unpredictable in its particulars, would unambiguously put the nuclear-political question back at the top of the world political agenda. It would unmistakeably remind leading states of their vulnerability It might also trigger more robust efforts to achieve the global regulation of nuclear capability. Like the bombings of Hiroshima and Nagasaki that did so much to catalyze the elevated concern for nuclear security in the early Cold War, and like the experience “at the brink” in the Cuban Missile Crisis of 1962, the now bubbling nuclear caldron holds the possibility of inaugurating a major period of institutional innovation and adjustment toward a fully “bombs away” future.

#### Industrial civilization wouldn’t recover.

Lewis **Dartnell 15**. UK Space Agency research fellow at the University of Leicester, working in astrobiology and the search for microbial life on Mars. His latest book is The Knowledge: How to Rebuild Our World from Scratch. 04-13-15. "Could we reboot a modern civilisation without fossil fuels? – Lewis Dartnell." Aeon. https://aeon.co/essays/could-we-reboot-a-modern-civilisation-without-fossil-fuels

Imagine that the world as we know it ends tomorrow. There’s a global catastrophe: a pandemic virus, an asteroid strike, or perhaps a nuclear holocaust. The vast majority of the human race perishes. Our civilisation collapses. The post-apocalyptic survivors find themselves in a devastated world of decaying, deserted cities and roving gangs of bandits looting and taking by force. Bad as things sound, that’s not the end for humanity. We bounce back. Sooner or later, peace and order emerge again, just as they have time and again through history. Stable communities take shape. They begin the agonising process of rebuilding their technological base from scratch. But here’s the question: how far could such a society rebuild? Is there any chance, for instance, that a post-apocalyptic society could reboot a technological civilisation? Let’s make the basis of this thought experiment a little more specific. Today, we have already consumed the most easily drainable crude oil and, particularly in Britain, much of the shallowest, most readily mined deposits of coal. Fossil fuels are central to the organisation of modern industrial society, just as they were central to its development. Those, by the way, are distinct roles: even if we could somehow do without fossil fuels now (which we can’t, quite), it’s a different question whether we could have got to where we are without ever having had them. So, would a society starting over on a planet stripped of its fossil fuel deposits have the chance to progress through its own Industrial Revolution? Or to phrase it another way, what might have happened if, for whatever reason, the Earth had never acquired its extensive underground deposits of coal and oil in the first place? Would our progress necessarily have halted in the 18th century, in a pre-industrial state? It’s easy to underestimate our current dependence on fossil fuels. In everyday life, their most visible use is the petrol or diesel pumped into the vehicles that fill our roads, and the coal and natural gas which fire the power stations that electrify our modern lives. But we also rely on a range of different industrial materials, and in most cases, high temperatures are required to transform the stuff we dig out of the ground or harvest from the landscape into something useful. You can’t smelt metal, make glass, roast the ingredients of concrete, or synthesise artificial fertiliser without a lot of heat. It is fossil fuels – coal, gas and oil – that provide most of this thermal energy. In fact, the problem is even worse than that. Many of the chemicals required in bulk to run the modern world, from pesticides to plastics, derive from the diverse organic compounds in crude oil. Given the dwindling reserves of crude oil left in the world, it could be argued that the most wasteful use for this limited resource is to simply burn it. We should be carefully preserving what’s left for the vital repertoire of valuable organic compounds it offers. But my topic here is not what we should do now. Presumably everybody knows that we must transition to a low-carbon economy one way or another. No, I want to answer a question whose interest is (let’s hope) more theoretical. Is the emergence of a technologically advanced civilisation necessarily contingent on the easy availability of ancient energy? Is it possible to build an industrialised civilisation without fossil fuels? And the answer to that question is: maybe – but it would be extremely difficult. Let’s see how. We’ll start with a natural thought. Many of our alternative energy technologies are already highly developed. Solar panels, for example, represent a good option today, and are appearing more and more on the roofs of houses and businesses. It’s tempting to think that a rebooted society could simply pick up where we leave off. Why couldn’t our civilisation 2.0 just start with renewables? Well, it could, in a very limited way. If you find yourself among the survivors in a post-apocalyptic world, you could scavenge enough working solar panels to keep your lifestyle electrified for a good long while. Without moving parts, photovoltaic cells require little maintenance and are remarkably resilient. They do deteriorate over time, though, from moisture penetrating the casing and from sunlight itself degrading the high-purity silicon layers. The electricity generated by a solar panel declines by about 1 per cent every year so, after a few generations, all our hand-me-down solar panels will have degraded to the point of uselessness. Then what? New ones would be fiendishly difficult to create from scratch. Solar panels are made from thin slices of extremely pure silicon, and although the raw material is common sand, it must be processed and refined using complex and precise techniques – the same technological capabilities, more or less, that we need for modern semiconductor electronics components. These techniques took a long time to develop, and would presumably take a long time to recover. So photovoltaic solar power would not be within the capability of a society early in the industrialisation process. Perhaps, though, we were on the right track by starting with electrical power. Most of our renewable-energy technologies produce electricity. In our own historical development, it so happens that the core phenomena of electricity were discovered in the first half of the 1800s, well after the early development of steam engines. Heavy industry was already committed to combustion-based machinery, and electricity has largely assumed a subsidiary role in the organisation of our economies ever since. But could that sequence have run the other way? Is there some developmental requirement that thermal energy must come first? On the face of it, it’s not beyond the bounds of possibility that a progressing society could construct electrical generators and couple them to simple windmills and waterwheels, later progressing to wind turbines and hydroelectric dams. In a world without fossil fuels, one might envisage an electrified civilisation that largely bypasses combustion engines, building its transport infrastructure around electric trains and trams for long-distance and urban transport. I say ‘largely’. We couldn’t get round it all together. When it comes to generating the white heat demanded by modern industry, there are few good options but to burn stuff While the electric motor could perhaps replace the coal-burning steam engine for mechanical applications, society, as we’ve already seen, also relies upon thermal energy to drive the essential chemical and physical transformations it needs. How could an industrialising society produce crucial building materials such as iron and steel, brick, mortar, cement and glass without resorting to deposits of coal? You can of course create heat from electricity. We already use electric ovens and kilns. Modern arc furnaces are used for producing cast iron or recycling steel. The problem isn’t so much that electricity can’t be used to heat things, but that for meaningful industrial activity you’ve got to generate prodigious amounts of it, which is challenging using only renewable energy sources such as wind and water. An alternative is to generate high temperatures using solar power directly. Rather than relying on photovoltaic panels, concentrated solar thermal farms use giant mirrors to focus the sun’s rays onto a small spot. The heat concentrated in this way can be exploited to drive certain chemical or industrial processes, or else to raise steam and drive a generator. Even so, it is difficult (for example) to produce the very high temperatures inside an iron-smelting blast furnace using such a system. What’s more, it goes without saying that the effectiveness of concentrated solar power depends strongly on the local climate. No, when it comes to generating the white heat demanded by modern industry, there are few good options but to burn stuff. But that doesn’t mean the stuff we burn necessarily has to be fossil fuels. Let’s take a quick detour into the pre-history of modern industry. Long before the adoption of coal, charcoal was widely used for smelting metals. In many respects it is superior: charcoal burns hotter than coal and contains far fewer impurities. In fact, coal’s impurities were a major delaying factor on the Industrial Revolution. Released during combustion, they can taint the product being heated. During smelting, sulphur contaminants can soak into the molten iron, making the metal brittle and unsafe to use. It took a long time to work out how to treat coal to make it useful for many industrial applications. And, in the meantime, charcoal worked perfectly well. And then, well, we stopped using it. In retrospect, that’s a pity. When it comes from a sustainable source, charcoal burning is essentially carbon-neutral, because it doesn’t release any new carbon into the atmosphere – not that this would have been a consideration for the early industrialists. But charcoal-based industry didn’t die out altogether. In fact, it survived to flourish in Brazil. Because it has substantial iron deposits but few coalmines, Brazil is the largest charcoal producer in the world and the ninth biggest steel producer. We aren’t talking about a cottage industry here, and this makes Brazil a very encouraging example for our thought experiment. The trees used in Brazil’s charcoal industry are mainly fast-growing eucalyptus, cultivated specifically for the purpose. The traditional method for creating charcoal is to pile chopped staves of air-dried timber into a great dome-shaped mound and then cover it with turf or soil to restrict airflow as the wood smoulders. The Brazilian enterprise has scaled up this traditional craft to an industrial operation. Dried timber is stacked into squat, cylindrical kilns, built of brick or masonry and arranged in long lines so that they can be easily filled and unloaded in sequence. The largest sites can sport hundreds of such kilns. Once filled, their entrances are sealed and a fire is lit from the top. The skill in charcoal production is to allow just enough air into the interior of the kiln. There must be enough combustion heat to drive out moisture and volatiles and to pyrolyse the wood, but not so much that you are left with nothing but a pile of ashes. The kiln attendant monitors the state of the burn by carefully watching the smoke seeping out of the top, opening air holes or sealing with clay as necessary to regulate the process. Brazil shows how the raw materials of modern civilisation can be supplied without reliance on fossil fuels Good things come to those who wait, and this wood pyrolysis process can take up to a week of carefully controlled smouldering. The same basic method has been used for millennia. However, the ends to which the fuel is put are distinctly modern. Brazilian charcoal is trucked out of the forests to the country’s blast furnaces where it is used to transform ore into pig iron. This pig iron is the basic ingredient of modern mass-produced steel. The Brazilian product is exported to countries such as China and the US where it becomes cars and trucks, sinks, bathtubs, and kitchen appliances. Around two-thirds of Brazilian charcoal comes from sustainable plantations, and so this modern-day practice has been dubbed ‘green steel’. Sadly, the final third is supplied by the non-sustainable felling of primary forest. Even so, the Brazilian case does provide an example of how the raw materials of modern civilisation can be supplied without reliance on fossil fuels. Another, related option might be wood gasification. The use of wood to provide heat is as old as mankind, and yet simply burning timber only uses about a third of its energy. The rest is lost when gases and vapours released by the burning process blow away in the wind. Under the right conditions, even smoke is combustible. We don’t want to waste it. Better than simple burning, then, is to drive the thermal breakdown of the wood and collect the gases. You can see the basic principle at work for yourself just by lighting a match. The luminous flame isn’t actually touching the matchwood: it dances above, with a clear gap in between. The flame actually feeds on the hot gases given off as the wood breaks down in the heat, and the gases combust only once they mix with oxygen from the air. Matches are fascinating when you look at them closely. Wartime gasifier cars could achieve about 1.5 miles per kilogram. Today’s designs improve upon this To release these gases in a controlled way, bake some timber in a closed container. Oxygen is restricted so that the wood doesn’t simply catch fire. Its complex molecules decompose through a process known as pyrolysis, and then the hot carbonised lumps of charcoal at the bottom of the container react with the breakdown products to produce flammable gases such as hydrogen and carbon monoxide. The resultant ‘producer gas’ is a versatile fuel: it can be stored or piped for use in heating or street lights, and is also suitable for use in complex machinery such as the internal combustion engine. More than a million gasifier-powered cars across the world kept civilian transport running during the oil shortages of the Second World War. In occupied Denmark, 95 per cent of all tractors, trucks and fishing boats were powered by wood-gas generators. The energy content of about 3 kg of wood (depending on its dryness and density) is equivalent to a litre of petrol, and the fuel consumption of a gasifier-powered car is given in miles per kilogram of wood rather than miles per gallon. Wartime gasifier cars could achieve about 1.5 miles per kilogram. Today’s designs improve upon this. But you can do a lot more with wood gases than just keep your vehicle on the road. It turns out to be suitable for any of the manufacturing processes needing heat that we looked at before, such as kilns for lime, cement or bricks. Wood gas generator units could easily power agricultural or industrial equipment, or pumps. Sweden and Denmark are world leaders in their use of sustainable forests and agricultural waste for turning the steam turbines in power stations. And once the steam has been used in their ‘Combined Heat and Power’ (CHP) electricity plants, it is piped to the surrounding towns and industries to heat them, allowing such CHP stations to approach 90 per cent energy efficiency. Such plants suggest a marvellous vision of industry wholly weaned from its dependency on fossil fuel. Is that our solution, then? Could our rebooting society run on wood, supplemented with electricity from renewable sources? Maybe so, if the population was fairly small. But here’s the catch. These options all presuppose that our survivors are able to construct efficient steam turbines, CHP stations and internal combustion engines. We know how to do all that, of course – but in the event of a civilisational collapse, who is to say that the knowledge won’t be lost? And if it is, what are the chances that our descendants could reconstruct it? In our own history, the first successful application of steam engines was in pumping out coal mines. This was a setting in which fuel was already abundant, so it didn’t matter that the first, primitive designs were terribly inefficient. The increased output of coal from the mines was used to first smelt and then forge more iron. Iron components were used to construct further steam engines, which were in turn used to pump mines or drive the blast furnaces at iron foundries. And of course, steam engines were themselves employed at machine shops to construct yet more steam engines. It was only once steam engines were being built and operated that subsequent engineers were able to devise ways to increase their efficiency and shrink fuel demands. They found ways to reduce their size and weight, adapting them for applications in transport or factory machinery. In other words, there was a positive feedback loop at the very core of the industrial revolution: the production of coal, iron and steam engines were all mutually supportive. In a world without readily mined coal, would there ever be the opportunity to test profligate prototypes of steam engines, even if they could mature and become more efficient over time? How feasible is it that a society could attain a sufficient understanding of thermodynamics, metallurgy and mechanics to make the precisely interacting components of an internal combustion engine, without first cutting its teeth on much simpler external combustion engines – the separate boiler and cylinder-piston of steam engines? It took a lot of energy to develop our technologies to their present heights, and presumably it would take a lot of energy to do it again. Fossil fuels are out. That means our future society will need an awful lot of timber. An industrial revolution without coal would be, at a minimum, very difficult In a temperate climate such as the UK’s, an acre of broadleaf trees produces about four to five tonnes of biomass fuel every year. If you cultivated fast-growing kinds such as willow or miscanthus grass, you could quadruple that. The trick to maximising timber production is to employ coppicing – cultivating trees such as ash or willow that resprout from their own stump, becoming ready for harvest again in five to 15 years. This way you can ensure a sustained supply of timber and not face an energy crisis once you’ve deforested your surroundings. But here’s the thing: coppicing was already a well-developed technique in pre-industrial Britain. It couldn’t meet all of the energy requirements of the burgeoning society. The central problem is that woodland, even when it is well-managed, competes with other land uses, principally agriculture. The double-whammy of development is that, as a society’s population grows, it requires more farmland to provide enough food and also greater timber production for energy. The two needs compete for largely the same land areas. We know how this played out in our own past. From the mid-16th century, Britain responded to these factors by increasing the exploitation of its coal fields – essentially harvesting the energy of ancient forests beneath the ground without compromising its agricultural output. The same energy provided by one hectare of coppice for a year is provided by about five to 10 tonnes of coal, and it can be dug out of the ground an awful lot quicker than waiting for the woodland to regrow. It is this limitation in the supply of thermal energy that would pose the biggest problem to a society trying to industrialise without easy access to fossil fuels. This is true in our post-apocalyptic scenario, and it would be equally true in any counterfactual world that never developed fossil fuels for whatever reason. For a society to stand any chance of industrialising under such conditions, it would have to focus its efforts in certain, very favourable natural environments: not the coal-island of 18th-century Britain, but perhaps areas of Scandinavia or Canada that combine fast-flowing streams for hydroelectric power and large areas of forest that can be harvested sustainably for thermal energy. Even so, an industrial revolution without coal would be, at a minimum, very difficult. Today, use of fossil fuels is actually growing, which is worrying for a number of reasons too familiar to rehearse here. Steps towards a low-carbon economy are vital. But we should also recognise how pivotal those accumulated reservoirs of thermal energy were in getting us to where we are. Maybe we could have made it the hard way. A slow-burn progression through the stages of mechanisation, supported by a combination of renewable electricity and sustainably grown biomass, might be possible after all. Then again, it might not. We’d better hope we can secure the future of our own civilisation, because we might have scuppered the chances of any society to follow in our wake.

#### War is inevitable---BUT, the longer we wait, the worse it gets.

Seth **Baum &** Anthony **Barrett 18**. Global Catastrophic Risk Institute. 2018. “A Model for the Impacts of Nuclear War.” SSRN Electronic Journal. Crossref, doi:10.2139/ssrn.3155983.

On the other end of the spectrum, the norm could be weaker. The Hiroshima and Nagasaki bombings provided a vivid and enduring image of the horrors of nuclear war—hence the norm can reasonably be described as a legacy of the bombings. Without this image, there would be less to motivate the norm. A weaker norm could in turn have led to a nuclear war occurring later, especially during a near-miss event like the Cuban missile crisis. A later nuclear war would likely be much more severe, assuming some significant buildup of nuclear arsenals and especially if “overkill” targeting was used. A new nuclear war could bring a similarly wide range of shifts in nuclear weapons norms. It could strengthen the norm, hastening nuclear disarmament. Already, there is a political initiative drawing attention to the humanitarian consequences of nuclear weapons use in order to promote a new treaty to ban nuclear weapons as a step towards complete nuclear disarmament (Borrie 2014). It is easy to imagine this initiative using any new nuclear attacks to advance their goals. Alternatively, it could weaken the norm, potentially leading to more and/or larger nuclear wars. This is a common concern, as seen for example in debates over low-yield bunker buster nuclear weapons (Nelson 2003). Given that the impacts of a large nuclear war could be extremely severe, a shift in nuclear weapons norms could easily be the single most consequential effect of a smaller nuclear war.

#### Extinction is inevitable from future technology — nanotech, our simulation gets shut down, AI, biotech, particle accelerators, and black swans

Bruce **Sterling**, 6-1-20**18**, "When Nick Bostrom says “Bang”," WIRED, https://www.wired.com/beyond-the-beyond/2018/06/nick-bostrom-says-bang/

4.1 Deliberate misuse of nanotechnology

In a mature form, molecular nanotechnology will enable the construction of bacterium-scale self-replicating mechanical robots that can feed on dirt or other organic matter [22-25]. Such replicators could eat up the biosphere or destroy it by other means such as by poisoning it, burning it, or blocking out sunlight. A person of malicious intent in possession of this technology might cause the extinction of intelligent life on Earth by releasing such nanobots into the environment.[9]

The technology to produce a destructive nanobot seems considerably easier to develop than the technology to create an effective defense against such an attack (a global nanotech immune system, an “active shield” [23]). It is therefore likely that there will be a period of vulnerability during which this technology must be prevented from coming into the wrong hands. Yet the technology could prove hard to regulate, since it doesn’t require rare radioactive isotopes or large, easily identifiable manufacturing plants, as does production of nuclear weapons [23].

Even if effective defenses against a limited nanotech attack are developed before dangerous replicators are designed and acquired by suicidal regimes or terrorists, there will still be the danger of an arms race between states possessing nanotechnology. It has been argued [26] that molecular manufacturing would lead to both arms race instability and crisis instability, to a higher degree than was the case with nuclear weapons. Arms race instability means that there would be dominant incentives for each competitor to escalate its armaments, leading to a runaway arms race. Crisis instability means that there would be dominant incentives for striking first. Two roughly balanced rivals acquiring nanotechnology would, on this view, begin a massive buildup of armaments and weapons development programs that would continue until a crisis occurs and war breaks out, potentially causing global terminal destruction. That the arms race could have been predicted is no guarantee that an international security system will be created ahead of time to prevent this disaster from happening. The nuclear arms race between the US and the USSR was predicted but occurred nevertheless.

4.2 Nuclear holocaust[winter]

The US and Russia still have huge stockpiles of nuclear weapons. But would an all-out nuclear war really exterminate humankind? Note that: (i) For there to be an existential risk it suffices that we can’t be sure that it wouldn’t. (ii) The climatic effects of a large nuclear war are not well known (there is the possibility of a nuclear winter). (iii) Future arms races between other nations cannot be ruled out and these could lead to even greater arsenals than those present at the height of the Cold War. The world’s supply of plutonium has been increasing steadily to about two thousand tons, some ten times as much as remains tied up in warheads ([9], p. 26). (iv) Even if some humans survive the short-term effects of a nuclear war, it could lead to the collapse of civilization. A human race living under stone-age conditions may or may not be more resilient to extinction than other animal species.

4.3 We’re living in a simulation and it gets shut down

A case can be made that the hypothesis that we are living in a computer simulation should be given a significant probability [27]. The basic idea behind this so-called “Simulation argument” is that vast amounts of computing power may become available in the future (see e.g. [28,29]), and that it could be used, among other things, to run large numbers of fine-grained simulations of past human civilizations. Under some not-too-implausible assumptions, the result can be that almost all minds like ours are simulated minds, and that we should therefore assign a significant probability to being such computer-emulated minds rather than the (subjectively indistinguishable) minds of originally evolved creatures. And if we are, we suffer the risk that the simulation may be shut down at any time. A decision to terminate our simulation may be prompted by our actions or by exogenous factors.

While to some it may seem frivolous to list such a radical or “philosophical” hypothesis next the concrete threat of nuclear holocaust, we must seek to base these evaluations on reasons rather than untutored intuition. Until a refutation appears of the argument presented in [27], it would intellectually dishonest to neglect to mention simulation-shutdown as a potential extinction mode.

4.4 Badly programmed superintelligence

When we create the first superintelligent entity [28-34], we might make a mistake and give it goals that lead it to annihilate humankind, assuming its enormous intellectual advantage gives it the power to do so. For example, we could mistakenly elevate a subgoal to the status of a supergoal. We tell it to solve a mathematical problem, and it complies by turning all the matter in the solar system into a giant calculating device, in the process killing the person who asked the question. (For further analysis of this, see [35].)

4.5 Genetically engineered biological agent

With the fabulous advances in genetic technology currently taking place, it may become possible for a tyrant, terrorist, or ~~lunatic~~ to create a doomsday virus, an organism that combines long latency with high virulence and mortality [36].

Dangerous viruses can even be spawned unintentionally, as Australian researchers recently demonstrated when they created a modified mousepox virus with 100% mortality while trying to design a contraceptive virus for mice for use in pest control [37]. While this particular virus doesn’t affect humans, it is suspected that an analogous alteration would increase the mortality of the human smallpox virus. What underscores the future hazard here is that the research was quickly published in the open scientific literature [38]. It is hard to see how information generated in open biotech research programs could be contained no matter how grave the potential danger that it poses; and the same holds for research in nanotechnology.

Genetic medicine will also lead to better cures and vaccines, but there is no guarantee that defense will always keep pace with offense. (Even the accidentally created mousepox virus had a 50% mortality rate on vaccinated mice.) Eventually, worry about biological weapons may be put to rest through the development of nanomedicine, but while nanotechnology has enormous long-term potential for medicine [39] it carries its own hazards.

4.6 Accidental misuse of nanotechnology (“gray goo”)

The possibility of accidents can never be completely ruled out. However, there are many ways of making sure, through responsible engineering practices, that species-destroying accidents do not occur. One could avoid using self-replication; one could make nanobots dependent on some rare feedstock chemical that doesn’t exist in the wild; one could confine them to sealed environments; one could design them in such a way that any mutation was overwhelmingly likely to cause a nanobot to completely cease to function [40]. Accidental misuse is therefore a smaller concern than malicious misuse [23,25,41].

However, the distinction between the accidental and the deliberate can become blurred. While “in principle” it seems possible to make terminal nanotechnological accidents extremely improbable, the actual circumstances may not permit this ideal level of security to be realized. Compare nanotechnology with nuclear technology. From an engineering perspective, it is of course perfectly possible to use nuclear technology only for peaceful purposes such as nuclear reactors, which have a zero chance of destroying the whole planet. Yet in practice it may be very hard to avoid nuclear technology also being used to build nuclear weapons, leading to an arms race. With large nuclear arsenals on hair-trigger alert, there is inevitably a significant risk of accidental war. The same can happen with nanotechnology: it may be pressed into serving military objectives in a way that carries unavoidable risks of serious accidents.

In some situations it can even be strategically advantageous to deliberately make one’s technology or control systems risky, for example in order to make a “threat that leaves something to chance” [42].

4.7 Something unforeseen

We need a catch-all category. It would be foolish to be confident that we have already imagined and anticipated all significant risks. Future technological or scientific developments may very well reveal novel ways of destroying the world.

Some foreseen hazards (hence not members of the current category) which have been excluded from the list of bangs on grounds that they seem too unlikely to cause a global terminal disaster are: solar flares, supernovae, black hole explosions or mergers, gamma-ray bursts, galactic center outbursts, supervolcanos, loss of biodiversity, buildup of air pollution, gradual loss of human fertility, and various religious doomsday scenarios. The hypothesis that we will one day become “illuminated” and commit collective suicide or stop reproducing, as supporters of VHEMT (The Voluntary Human Extinction Movement) hope [43], appears unlikely. If it really were better not to exist (as Silenus told king Midas in the Greek myth, and as Arthur Schopenhauer argued [44] although for reasons specific to his philosophical system he didn’t advocate suicide), then we should not count this scenario as an existential disaster. The assumption that it is not worse to be alive should be regarded as an implicit assumption in the definition of Bangs. Erroneous collective suicide is an existential risk albeit one whose probability seems extremely slight. (For more on the ethics of human extinction, see chapter 4 of [9].)

4.8 Physics disasters

The Manhattan Project bomb-builders’ concern about an A-bomb-derived atmospheric conflagration has contemporary analogues.

There have been speculations that future high-energy particle accelerator experiments may cause a breakdown of a metastable vacuum state that our part of the cosmos might be in, converting it into a “true” vacuum of lower energy density [45]. This would result in an expanding bubble of total destruction that would sweep through the galaxy and beyond at the speed of light, tearing all matter apart as it proceeds.

Another conceivability is that accelerator experiments might produce negatively charged stable “strangelets” (a hypothetical form of nuclear matter) or create a mini black hole that would sink to the center of the Earth and start accreting the rest of the planet [46].

These outcomes seem to be impossible given our best current physical theories. But the reason we do the experiments is precisely that we don’t really know what will happen. A more reassuring argument is that the energy densities attained in present day accelerators are far lower than those that occur naturally in collisions between cosmic rays [46,47]. It’s possible, however, that factors other than energy density are relevant for these hypothetical processes, and that those factors will be brought together in novel ways in future experiments.

The main reason for concern in the “physics disasters” category is the meta-level observation that discoveries of all sorts of weird physical phenomena are made all the time, so even if right now all the particular physics disasters we have conceived of were absurdly improbable or impossible, there could be other more realistic failure-modes waiting to be uncovered. The ones listed here are merely illustrations of the general case.

#### Growth causes a global toxification crisis - risks extinction

Ehrlichand Ehrlich 13 [Paul R. Ehrlich, Professor of Biology and President of the Center for Conservation Biology at Stanford University, and Adjunct Professor at the University of Technology, Sydney, Anne H. Ehrlich, Senior Research Scientist in Biology at Stanford and focuses her research on policy issues related to the environment, “Can a collapse of global civilization be avoided?”, Proc Biol Sci. Mar 7, 2013; 280(1754), \\wyo-bb]

Another possible threat to the continuation of civilization is global toxification. Adverse symptoms of exposure to synthetic chemicals are making some scientists increasingly nervous about effects on the human population [77–79]. Should a global threat materialize, however, no planned mitigating responses (analogous to the ecologically and politically risky ‘geoengineering’ projects often proposed to ameliorate climate disruption [80]) are waiting in the wings ready for deployment. Much the same can be said about aspects of the epidemiological environment and the prospect of epidemics being enhanced by rapid population growth in immune-weakened societies, increased contact with animal reservoirs, high-speed transport and the misuse of antibiotics [81]. Nobel laureate Joshua Lederberg had great concern for the epidemic problem, famously stating, ‘The survival of the human species is not a preordained evolutionary program’ [82, p. 40]. Some precautionary steps that should be considered include forbidding the use of antibiotics as growth stimulators for livestock, building emergency stocks of key vaccines and drugs (such as Tamiflu), improving disease surveillance, expanding mothballed emergency medical facilities, preparing institutions for imposing quarantines and, of course, moving as rapidly as possible to humanely reduce the human population size. It has become increasingly clear that security has many dimensions beyond military security [83,84] and that breaches of environmental security could risk the end of global civilization.

#### Rigorous climate simulations prove that hydrophilic black carbon would cause to atmospheric precipitation – results in a rainout effect that quickly reverses nuclear cooling

Reisner et al. 18 (Jon Reisner – Climate and atmospheric scientist at the Los Alamos National Laboratory. Gennaro D’Angelo – Climate scientist at the Los Alamos National Laboratory, Research scientist at the SETI institute, Associate specialist at the University of California, Santa Cruz, NASA Postdoctoral Fellow at the NASA Ames Research Center, UKAFF Fellow at the University of Exeter. Eunmo Koo - Scientist at Applied Terrestrial, Energy, and Atmospheric Modeling (ATEAM) Team, in Computational Earth Science Group (EES-16) in Earth and Environmental Sciences Division and Co-Lead of Parallel Computing Summer Research Internship (PCSRI) program at the Los Alamos National Laboratory, former Staff research associate at UC Berkeley. Wesley Even - Computational scientist in the Computational Physics and Methods Group at Los Alamos National Laboratory. Matthew Hecht – Atmospheric scientist at the Los Alamos National Laboratory. Elizabeth Hunke - Lead developer for the Los Alamos Sea Ice Model (CICE) at the Los Alamos National Laboratory responsible for development and incorporation of new parameterizations, model testing and validation, computational performance, documentation, and consultation with external model users on all aspects of sea ice modeling, including interfacing with global climate and earth system models. Darin Comeau – Climate scientist at the Los Alamos National Laboratory. Randy Bos - Project leader at the Los Alamos National Laboratory, former Weapons Effects program manager at Tech-Source. James Cooley – Computational scientist at the Los Alamos National Laboratory specializing in weapons physics, emergency response, and computational physics. <MKIM> “Climate impact of a regional nuclear weapons exchange:An improved assessment based on detailed source calculations”. 3/16/18. DOA: 7/13/19. <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2017JD027331>)

\*BC = Black Carbon

The no-rubble simulation produces a significantly more intense fire, with more fire spread, and consequently a significantly stronger plume with larger amounts of BC reaching into the upper atmosphere than the simulation with rubble, illustrated in Figure 5. While the no-rubble simulation **represents the worst-case scenario** involving vigorous fire activity, **only a relatively small amount of carbon makes its way into the stratosphere** during the course of the simulation. But while small compared to the surface BC mass, stratospheric BC amounts from the current simulations are significantly higher than what would be expected from burning vegetation such as trees (Heilman et al., 2014), e.g., the higher energy density of the building fuels and the initial fluence from the weapon produce an intense response within HIGRAD with initial updrafts of order 100 m/s in the lower troposphere. Or, in comparison to a mass fire, wildfires will burn only a small amount of fuel in the corresponding time period (roughly 10 minutes) that a nuclear weapon fluence can effectively ignite a large area of fuel producing an impressive atmospheric response. Figure 6 shows vertical profiles of BC multiplied by 100 (number of cities involved in the exchange) from the two simulations. The total amount of BC produced is in line with previous estimates (about 3.69 Tg from no-rubble simulation); however, the majority of BC resides **below the stratosphere** (3.46 Tg below 12 km) and can be **readily impacted by scavenging from precipitation** either via pyro-cumulonimbus produced by the fire itself (not modeled) or other synoptic weather systems. While the impact on climate of these more realistic profiles will be explored in the next section, it should be mentioned that **these estimates are** still **at the high end**, considering the inherent simplifications in the combustion model that lead to **overestimating BC production**. 3.3 Climate Results Long-term climatic effects critically depend on the initial injection height of the soot, with larger quantities reaching the upper troposphere/lower stratosphere inducing a greater cooling impact because of longer residence times (Robock et al., 2007a). Absorption of solar radiation by the BC aerosol and its subsequent radiative cooling tends to heat the surrounding air, driving an initial upward diffusion of the soot plumes, an effect that depends on the initial aerosol concentrations. **Mixing and sedimentation** tend to **reduce this process**, and low altitude emissions are also significantly impacted by precipitation if aging of the BC aerosol occurs on sufficiently rapid timescales. But once at stratospheric altitudes, aerosol dilution via coagulation is hindered by low particulate concentrations (e.g., Robock et al., 2007a) and lofting to much higher altitudes is inhibited by gravitational settling in the low-density air (Stenke et al., 2013), resulting in more stable BC concentrations over long times. Of the initial BC mass released in the atmosphere, most of which is emitted below 9 km, **70% rains out within the first month** and 78%, or about 2.9 Tg, is removed within the first two months (Figure 7, solid line), with the remainder (about 0.8 Tg, dashed line) being transported above about 12 km (200 hPa) within the first week. This outcome differs from the findings of, e.g., Stenke et al. (2013, their high BC-load cases) and Mills et al. (2014), who found that most of the BC mass (between 60 and 70%) is lifted in the stratosphere within the first couple of weeks. This can also be seen in Figure 8 (red lines) and in Figure 9, which include results from our calculation with the initial BC distribution from Mills et al. (2014). In that case, only 30% of the initial BC mass rains out in the troposphere during the first two weeks after the exchange, with the remainder rising to the stratosphere. In the study of Mills et al. (2008) this percentage is somewhat smaller, about 20%, and smaller still in the experiments of Robock et al. (2007a) in which the soot is initially emitted in the upper troposphere or higher. In Figure 7, the e-folding timescale for the removal of tropospheric soot, here interpreted as the time required for an initial drop of a factor e, is about one week. This result compares favorably with the “LT” experiment of Robock et al. (2007a), considering 5 Tg of BC released in the lower troposphere, in which 50% of the aerosols are removed within two weeks. By contrast, the initial e-folding timescale for the removal of stratospheric soot in Figure 8 is about 4.2 years (blue solid line), compared to about 8.4 years for the calculation using Mills et al. (2014) initial BC emission (red solid line). The removal timescale from our forced ensemble simulations is close to those obtained by Mills et al. (2008) in their 1 Tg experiment, by Robock et al. (2007a) in their experiment “UT 1 Tg”, and © 2018 American Geophysical Union. All rights reserved. by Stenke et al. (2013) in their experiment “Exp1”, in all of which 1 Tg of soot was emitted in the atmosphere in the aftermath of the exchange. Notably, the e-folding timescale for the decline of the BC mass in Figure 8 (blue solid line) is also close to the value of about 4 years quoted by Pausata et al. (2016) for their long-term “intermediate” scenario. In that scenario, which is also based on 5 Tg of soot initially distributed as in Mills et al. (2014), the factor-of2 shorter residence time of the aerosols is caused by particle growth via coagulation of BC with organic carbon. Figure 9 shows the BC mass-mixing ratio, horizontally averaged over the globe, as a function of atmospheric pressure (height) and time. The BC distributions used in our simulations imply that the upward transport of particles is substantially less efficient compared to the case in which 5 Tg of BC is directly injected into the upper troposphere. The semiannual cycle of lofting and sinking of the aerosols is associated with atmospheric heating and cooling during the solstice in each hemisphere (Robock et al., 2007a). During the first year, the oscillation amplitude in our forced ensemble simulations is particularly large during the summer solstice, compared to that during the winter solstice (see bottom panel of Figure 9), because of the higher soot concentrations in the Northern Hemisphere, as can be seen in Figure 11 (see also left panel of Figure 12). Comparing the top and bottom panels of Figure 9, the BC reaches the highest altitudes during the first year in both cases, but the concentrations at 0.1 hPa in the top panel can be 200 times as large. Qualitatively, the difference can be understood in terms of the air temperature increase caused by BC radiation emission, which is several tens of kelvin degrees in the simulations of Robock et al. (2007a, see their Figure 4), Mills et al. (2008, see their Figure 5), Stenke et al. (2013, see high-load cases in their Figure 4), Mills et al. (2014, see their Figure 7), and Pausata et al. (2016, see one-day emission cases in their Figure 1), due to high BC concentrations, but it amounts to only about 10 K in our forced ensemble simulations, as illustrated in Figure 10. Results similar to those presented in Figure 10 were obtained from the experiment “Exp1” performed by Stenke et al. (2013, see their Figure 4). **In that scenario as well, somewhat less that 1 Tg of BC remained in the atmosphere after the initial rainout**. As mentioned before, the BC aerosol that remains in the atmosphere, lifted to stratospheric heights by the rising soot plumes, undergoes sedimentation over a timescale of several years (Figures 8 and 9). This mass represents the effective amount of BC that can force climatic changes over multi-year timescales. In the forced ensemble simulations, it is about 0.8 Tg after the initial rainout, whereas it is about 3.4 Tg in the simulation with an initial soot distribution as in Mills et al. (2014). Our more realistic source simulation involves the worstcase assumption of no-rubble (along with other assumptions) and hence serves as an upper bound for the impact on climate. As mentioned above and further discussed below, our scenario induces perturbations on the climate system similar to those found in previous studies in which the climatic response was driven by roughly 1 Tg of soot rising to stratospheric heights following the exchange. Figure 11 illustrates the vertically integrated mass-mixing ratio of BC over the globe, at various times after the exchange for the simulation using the initial BC distribution of Mills et al. (2014, upper panels) and as an average from the forced ensemble members (lower panels). All simulations predict enhanced concentrations at high latitudes during the first year after the exchange. In the cases shown in the top panels, however, these high concentrations persist for several years (see also Figure 1 of Mills et al., 2014), whereas the forced ensemble simulations indicate that the BC concentration starts to decline after the first year. In fact, in the simulation represented in the top panels, mass-mixing ratios larger than about 1 kg of BC © 2018 American Geophysical Union. All rights reserved. per Tg of air persist for well over 10 years after the exchange, whereas they only last for 3 years in our forced simulations (compare top and middle panels of Figure 9). After the first year, values drop below 3 kg BC/Tg air, whereas it takes about 8 years to reach these values in the simulation in the top panels (see also Robock et al., 2007a). Over crop-producing, midlatitude regions in the Northern Hemisphere, the BC loading is reduced from more than 0.8 kg BC/Tg air in the simulation in the top panels to 0.2-0.4 kg BC/Tg air in our forced simulations (see middle and right panels). The more rapid clearing of the atmosphere in the forced ensemble is also signaled by the soot optical depth in the visible radiation spectrum, which drops below values of 0.03 toward the second half of the first year at mid latitudes in the Northern Hemisphere, and everywhere on the globe after about 2.5 years (without never attaining this value in the Southern Hemisphere). In contrast, the soot optical depth in the calculation shown in the top panels of Figure 11 becomes smaller than 0.03 everywhere only after about 10 years. The two cases show a similar tendency, in that the BC optical depth is typically lower between latitudes 30º S-30º N than it is at other latitudes. This behavior is associated to the persistence of stratospheric soot toward high-latitudes and the Arctic/Antarctic regions, as illustrated by the zonally-averaged, column-integrated mass-mixing ratio of the BC in Figure 12 for both the forced ensemble simulations (left panel) and the simulation with an initial 5 Tg BC emission in the upper troposphere (right panel). The spread in the globally averaged (near) surface temperature of the atmosphere, from the control (left panel) and forced (right panel) ensembles, is displayed in Figure 13. For each month, the plots show the largest variations (i.e., maximum and minimum values), within each ensemble of values obtained for that month, relative to the mean value of that month. The plot also shows yearly-averaged data (thinner lines). The spread is comparable in the control and forced ensembles, with average values calculated over the 33-years run length of 0.4-0.5 K. This spread is also similar to the internal variability of the globally averaged surface temperature quoted for the NCAR Large Ensemble Community Project (Kay et al., 2015). These results imply that surface air temperature differences, between forced and control simulations, which lie within the spread may not be distinguished from effects due to internal variability of the two simulation ensembles. Figure 14 shows the difference in the globally averaged surface temperature of the atmosphere (top panel), net solar radiation flux at surface (middle panel), and precipitation rate (bottom panel), computed as the (forced minus control) difference in ensemble mean values. The sum of standard deviations from each ensemble is shaded. Differences are qualitatively significant over the first few years, when the anomalies lie near or outside the total standard deviation. Inside the shaded region, differences may not be distinguished from those arising from the internal variability of one or both ensembles. The surface solar flux (middle panel) is the quantity that appears most affected by the BC emission, with qualitatively significant differences persisting for about 5 years. The precipitation rate (bottom panel) is instead affected only at the very beginning of the simulations. The red lines in all panels show the results from the simulation applying the initial BC distribution of Mills et al. (2014), where the period of significant impact is much longer owing to the higher altitude of the initial soot distribution that results in longer residence times of the BC aerosol in the atmosphere. When yearly averages of the same quantities are performed over the IndiaPakistan region, the differences in ensemble mean values lie within the total standard deviations of the two ensembles. The results in Figure 14 can also be compared to the outcomes of other previous studies. In their experiment “UT 1 Tg”, Robock et al. (2007a) found that, when only 1 Tg of soot © 2018 American Geophysical Union. All rights reserved. remains in the atmosphere after the initial rainout, temperature and precipitation anomalies are about 20% of those obtained from their standard 5 Tg BC emission case. Therefore, the largest differences they observed, during the first few years after the exchange, were about - 0.3 K and -0.06 mm/day, respectively, comparable to the anomalies in the top and bottom panels of Figure 14. Their standard 5 Tg emission case resulted in a solar radiation flux anomaly at surface of -12 W/m2 after the second year (see their Figure 3), between 5 and 6 time as large as the corresponding anomalies from our ensembles shown in the middle panel. In their experiment “Exp1”, Stenke et al. (2013) reported global mean surface temperature anomalies not exceeding about 0.3 K in magnitude and precipitation anomalies hovering around -0.07 mm/day during the first few years, again consistent with the results of Figure 14. In a recent study, Pausata et al. (2016) considered the effects of an admixture of BC and organic carbon aerosols, both of which would be emitted in the atmosphere in the aftermath of a nuclear exchange. In particular, they concentrated on the effects of coagulation of these aerosol species and examined their climatic impacts. The initial BC distribution was as in Mills et al. (2014), although the soot burden was released in the atmosphere over time periods of various lengths. Most relevant to our and other previous work are their one-day emission scenarios. They found that, during the first year, the largest values of the atmospheric surface temperature anomalies ranged between about -0.5 and -1.3 K, those of the sea surface temperature anomalies ranged between -0.2 and -0.55 K, and those of the precipitation anomalies varied between -0.15 and -0.2 mm/day. All these ranges are compatible with our results shown in Figure 14 as red lines and with those of Mills et al. (2014, see their Figures 3 and 6). As already mentioned in Section 2.3, the net solar flux anomalies at surface are also consistent. This overall agreement suggests that the **inclusion of organic carbon aerosols, and** ensuing **coagulation** with BC, **should not dramatically alter the climatic effects** resulting from our forced ensemble simulations. Moreover, aerosol growth would likely **shorten the residence time of the BC particulate in the atmosphere** (Pausata et al., 2016), possibly **reducing the duration of these effects.**

#### Isolated island populations repopulate Earth after radiation and nuclear winter – bunkers and submarines expand the likelihood of survival

Turchin and Green 18 (Alexey Turchin – Scientist for the Foundation Science for Life Extension in Moscow, Russia, Founder of Digital Immortality Now, author of several books and articles on the topics of existential risks and life extension. Brian Patrick Green – Director of technology ethics at the Markkula Center for Applied Ethics, teaches AI ethics in the Graduate School of Engineering at Santa Clara University. <MKIM> “Islands as refuges for surviving global catastrophes”. September 2018. DOA: 7/20/19. https://www.emerald.com/insight/content/doi/10.1108/FS-04-2018-0031/full/html?fullSc=1&mbSc=1&fullSc=1)

Different types of possible catastrophes suggest different scenarios for how survival could happen on an island. What is important is that the island should have properties which protect against the specific dangers of particular global catastrophic risks. Specifically, different islands will provide protection against different risks, and their natural diversity will contribute to a higher total level of protection: **Quarantined island survives pandemic** . An island could impose effective quarantine if it is sufficiently remote and simultaneously able to protect itself, possibly using military ships and air defense. **Far northern aboriginal people survive an ice age**. Many far northern people have adapted to survive in extremely cold and dangerous environments, and under the right circumstances could potentially survive the return of an ice age. However, their cultures are endangered by globalization. If these people become dependent on the products of modern civilization, such as rifles and motor boats, and lose their native survival skills, then their likelihood of surviving the collapse of the outside world would decrease. Therefore, preservation of their survival skills may be important as a defense against the risks connected with **extreme cooling**. Remote polar island with high mountains survives brief global warming of median surface temperatures, up to 50˚C. There is a theory that the climates of planets similar to the Earth could have several semi-stable temperature levels (Popp et al., 2016). If so, because of climate change, the Earth could transition to a second semi-stable state with a median global temperature of around 330 K, about 60˚C, or about 45˚C above current global mean temperatures. But even in this climate, **some regions of Earth could still be survivable for humans**, such as the Himalayan plateau at elevations above 4,000 m, but below 6,000 (where oxygen deficiency becomes a problem), or on polar islands with mountains (however, global warming affects polar regions more than equatorial regions, and northern island will experience more effects of climate change, including thawing permafrost and possible landslides because of wetter weather). In the tropics, the combination of increased humidity and temperature may increase the wet bulb temperature above 36˚C, especially on islands, where sea moisture is readily available. In such conditions, proper human perspiration becomes impossible (Sherwood and Huber, 2010), and there will likely be increased mortality and morbidity because of tropical diseases. If temperatures later returned to normal – either naturally or through climate engineering – **the rest of the Earth could be repopulated**. ‘‘Swiss Family Robinsons’’ survive on a tropical island, unnoticed by a military robot ‘‘mutiny’’. Most AI researchers ignore medium-term AI risks, which are neither near-term risks, like unemployment, nor remote risks, like AI superintelligence. But a large drone army – if one were produced – could receive a wrong command or be infected by a computer virus, leading it to attack people indiscriminately. Remote islands without robots could provide protection in this case, allowing survival until such a drone army ran out of batteries, fuel, ammunition or other supplies: Primitive tribe survives civilizational collapse. The inhabitants of **North Sentinel Island**, near the Andaman Islands in the Indian Ocean, are hostile and uncontacted. **The Sentinelese survived the 2004 Indian Ocean tsunami apparently unaffected** (Voanews, 2009), and if the rest of humanity disappear, **they might well continue their existence without change.** Tropical Island survives extreme global nuclear winter and glaciation event. Were a **nuclear**, bolide impactor or volcanic “**winter**” scenario to unfold, these islands would remain surrounded by Warm Ocean, and local volcanism or other energy sources might provide heat, energy and food. Such island refuges may have helped life on Earth survive during the **“Snowball Earth”** event in Earth’s distant past (Hoffman et al., 1998). Remote island base for project “Yellow submarine”. Some catastrophic risks such as a gamma ray burst, a global nuclear war with high radiological contamination or multiple pandemics might be best survived **underwater in nuclear submarines** (Turchin and Green, 2017). However, after a catastrophe, the submarine with survivors would eventually need a place to dock, and an island with some prepared amenities would be a reasonable starting point for rebuilding civilization. Bunker on remote island. For risks which include multiple or complex catastrophes, such as a bolide impact, extreme volcanism, tsunamis, multiple pandemics and nuclear war with radiological contamination, **island refuges could be strengthened with bunkers**. Richard Branson survived hurricane Irma on his own island in 2017 by seeking refuge in his concrete wine cellar (Clifford, 2017). Bunkers on islands would have higher survivability compared to those close to population centers, as they will be neither a military target nor as accessible to looters or unintentionally dangerous (e.g. infected) refugees. These bunkers could potentially be connected to water sources by underwater pipes, and passages could provide cooling, access and even oxygen and food sources.

### 2nc spark

#### Movements will literally overthrow recalcitrant governments. Nuclear use makes the audience costs huge.

Steven R. **David 18**. Professor of Political Science at Johns Hopkins University. 2018. “The Nuclear Worlds of 2030.” Fletcher Forum of World Affairs, vol. 42, pp. 107–118. //reem

CATASTROPHE AND THE END OF NUCLEAR WEAPONS In the year 2025, the world very nearly came to an end. Smarting after several years of economic downturn and angry at American efforts to encircle it with NATO bases, Russia responded to a "plea" for help from co-ethnics in the Baltic states. Thousands of Russian troops, disguised as contract "volunteers" dashed across international borders allegedly to protect Russian speakers from governmental assaults. The Baltic countries invoked Article 5 of the NATO Treaty while American forces, deployed there precisely to deter this kind of aggression, clashed with Russian troops. Hundreds of Americans were killed. Washington warned Moscow to halt its invasion to no avail. The United States then prepared for a major airlift of its forces to the beleaguered countries, with Moscow threatening America with "unrestrained force" if it followed through. Washington ignored the threat and Moscow, seeking to "de-escalate by escalating," destroyed the American base of Diego Garcia in the Indian Ocean with a nuclear-armed cruise missile. The United States responded with limited nuclear strikes against Russian bases in Siberia. Thus far, the collateral damage had been kept to a minimum, but this bit of encouragement did not last. Fearing a massive American pre-emptive strike aimed at disarming its nuclear arsenal, Russia struck first against the range of US nuclear forces both in the United States and at sea. America responded with its surviving weapons, destroying much (but not all) of the remaining Russian nuclear arms. And then, both sides took a breather, but it was too late. Although cities had been largely spared, millions had died on each side. Making matters worse, predictions of nuclear winter came to pass - producing massive changes in the weather and killing millions more, especially in developing states. The world finally had enough. A dawning realization emerged that leaders of countries simply could not be trusted with weapons that could destroy humankind.3 Protests swept the globe calling for total disarmament. Mass demonstrations engulfed the United States and Russia demanding the replacement of their existing governments with ones committed to ending nuclear weapons. Voices calling for more moderate disarmament that would preserve a modest nuclear deterrent were angrily (and sometimes violently) quashed. The possession of nuclear weapons became morally repugnant and unacceptable. No longer were the intricacies of nuclear doctrine or force levels subject to debate. The only question remaining was how one could get rid of these loathsome weapons as quickly as possible. Under the auspices of the United Nations, a joint committee composed of the Security Council members, other countries known to possess nuclear arms, and several non-nuclear powers was established. Drawing on the structure and precedent of the Chemical Weapons Convention, this UN body drew up the Treaty that called for the complete disarmament of nuclear arms by 2030. The development, possession, and use of nuclear weapons was prohibited. An airtight inspection regime, enhancing the procedures already in existence through the Non-Proliferation Treaty, was established to first account for all nuclear arms and fissile material and then monitor the destruction of the nuclear weaponry. All countries were subject to the Treaty, whether they maintained nuclear facilities or not. Violations would produce a range of punishment from global economic sanctions to massive conventional attack.' 6 By 2030, all the nations of the world had agreed to the Treaty. No violations occurred. Armed conflicts persisted, but they proved to be of modest scale, erupting only within countries but not between them. Insofar as the fear of nuclear weapons helped keep the peace during the Cold War and post-Cold War eras, the horror of nuclear use now made war all but unthinkable. A feeling of relief swept the globe as the specter of nuclear holocaust vanished, tempered only by the painful regret that it took the death of millions to realize a goal that for so many had been self-evident since 1945.

#### Can’t rebuild industrial civilization.

John **Jacobi 17**. Leads an environmentalist research institute and collective, citing Fred Hoyle, British astronomer, formulated the theory of stellar nucleosynthesis, coined the term “big bang,” recipient of the Gold Medal of the Royal Astronomical Society, professor at the Institute of Astronomy, Cambridge University. 05-27-17. “Industrial Civilization Could Not Be Rebuilt.” The Wild Will Project. <https://www.wildwill.net/blog/2017/05/27/industrial-civilization-not-rebuilt/>

A suggestion, for the sake of thought: If industrial civilization collapsed, it probably could not be rebuilt. Civilization would exist again, of course, but industry appears to be a one-time experiment. The astronomist Fred Hoyle, exaggerating slightly, writes: It has often been said that, if the human species fails to make a go of it here on Earth, some other species will take over the running. In the sense of developing high intelligence this is not correct. We have, or soon will have, exhausted the necessary physical prerequisites so far as this planet is concerned. With coal gone, oil gone, high-grade metallic ores gone, no species however competent can make the long climb from primitive conditions to high-level technology. This is a one-shot affair. If we fail, this planetary system fails so far as intelligence is concerned. The same will be true of other planetary systems. On each of them there will be one chance, and one chance only. Hoyle overstates all the limits we actually have to worry about, but there are enough to affirm his belief that industry is a “one-shot affair.” In other words, if industry collapsed then no matter how quickly scientific knowledge allows societies to progress, technical development will hit a wall because the builders will not have the needed materials. For example, much of the world’s land is not arable, and some of the land in use today is only productive because of industrial technics developed during the agricultural revolution in the 60s, technics heavily dependent on oil. Without the systems that sustain industrial agriculture much current farm land could not be farmed; agricultural civilizations cannot exist there, at least until the soil replenishes, if it replenishes. And some resources required for industrial progress, like coal, simply are not feasibly accessible anymore. Tainter writes: . . . major jumps in population, at around A.D. 1300, 1600, and in the late eighteenth century, each led to intensification in agriculture and industry. As the land in the late Middle Ages was increasingly deforested to provide fuel and agricultural space for a growing population, basic heating, cooking, and manufacturing needs could no longer be met by burning wood. A shift to reliance on coal began, gradually and with apparent reluctance. Coal was definitely a fuel source of secondary desirability, being more costly to obtain and distribute than wood, as well as being dirty and polluting. Coal was more restricted in its spatial distribution than wood, so that a whole new, costly distribution system had to be developed. Mining of coal from the ground was more costly than obtaining a quantity of wood equivalent in heating value, and became even more costly as the 54 most accessible reserves of this fuel were depleted. Mines had to be sunk ever deeper, until groundwater flooding became a serious problem. Today, most easily accessible natural coal reserves are completely depleted. Thus, societies in the wake of our imagined collapse would not be able to develop fast enough to reach the underground coal. As a result of these limits, rebuilding industry would take at least thousands of years — it took 10,000 years the first time around. By the time a civilization reached the point where it could do something about industrial scientific knowledge it probably would not have the knowledge anymore. It would have to develop its sciences and technologies on its own, resulting in patterns of development that would probably look similar to historical patterns. Technology today depends on levels of complexity that must proceed in chronological stages. Solar panels, for example, rely on transportation infrastructure, mining, and a regulated division of labor. And historically the process of developing into a global civilization includes numerous instances of technical regression. The natives of Tasmania, for example, went from a maritime society to one that didn’t fish, build boats, or make bows and arrows. Rebuilding civilization would also be a bad idea. Most, who are exploited by rather than benefit from industry, would probably not view a rebuilding project as desirable. Even today, though citizens of first-world nations live physically comfortable lives, their lives are sustained by the worse off lives of the rest of the world. “Civilization . . . has operated two ways,” Paine writes, “to make one part of society more affluent, and the other more wretched, than would have been the lot of either in a natural state.” Consider the case of two societies in New Zealand, the Maori and the Moriori. Both are now believed to have originated out of the same mainland society. Most stayed and became the Maori we know, and some who became the Moriori people settled on the Chatham Islands in the 16th century. Largely due to a chief named Nunuku-whenua, the Moriori had a strict tradition of solving inter-tribal conflict peacefully and advocating a variant of passive resistance; war, cannibalism, and killing were completely outlawed. They also renounced their parent society’s agricultural mode of subsistence, relying heavily on hunting and gathering, and they controlled their population growth by castrating some male infants, so their impact on the non-human environment around them was minimal. In the meantime, the Maori continued to live agriculturally and developed into a populated, complex, hierarchical, and violent society. Eventually an Australian seal-hunting ship informed the Maori of the Moriori’s existence, and the Maori sailed to the Chathams to explore: . . . over the course of the next few days, they killed hundreds of Moriori, cooked and ate many of the bodies, and enslaved all the others, killing most of them too over the next few years as it suited their whim. A Moriori survivor recalled, “[The Maori] commenced to kill us like sheep . . . [We] were terrified, fled to the bush, concealed ourselves in holes underground, and in any place to escape our enemies. It was of no avail; we were discovered and eaten – men, women, and children indiscriminately.” A Maori conqueror explains, “We took possession . . . in accordance with our customs and we caught all the people. Not one escaped. Some ran away from us, these we killed, and others we killed – but what of that? It was in accordance with our custom.” Furthermore, we can deduce from the ubiquitous slavery in all the so-called “great civilizations” like Rome or Egypt that any attempt to rebuild a similar civilization will involve slavery. And to rebuild industry, something similar to colonization and the Trans-Atlantic Slave Trade would probably have to occur once again. After all, global chattel slavery enabled the industrial revolution by financing it, extracting resources to be accumulated at sites of production, and exporting products through infrastructure that slavery helped sustain. So, if industrial society collapsed, who would be doing the rebuilding? Not anyone most people like. It is hard to get a man to willingly change his traditional way of life; even harder when his new life is going into mines. And though history demonstrates that acts like those of the Maori or slave traders are not beyond man’s will or ability, certainly most in industrial society today would not advocate going through the phases required to reach the industrial stage of development.

### 1nc bunkers cp

#### The United States federal government should construct isolated, continuously manned, self-sufficient underground and underwater refuges that can support at least 100 people.

#### Solves extinction from nuclear war

Karim **Jebari 15**. Royal Institute of Technology, KTH, Teknikringen. 06/2015. “Existential Risks: Exploring a Robust Risk Reduction Strategy.” Science and Engineering Ethics, vol. 21, no. 3, pp. 541–554.

Costs While this measure would be quite expensive, it would probably be much cheaper than even the most optimistic assessments of colonizing the moon. There are already shelters that could be refitted for this purpose. A nuclear reactor with highly enriched uranium, similar to that which powers large submarines, would probably be the most costly item. Thus, a comparison with an Ohio-class submarine, with a crew of 155, seems reasonable. This submarine costs 2 billion USD. Even if this shelter would be an order of magnitude more expensive, it would still cost only a fraction of what a Moon colony would cost on the most optimistic cost assessment. Furthermore, this facility would reduce the risk of black swan extinction events with existing and proven technology. It could also be implemented at a very short notice, compared with even the most optimistic plans to colonize the Moon. Conclusion The notion of black swan extinction events present us with a daunting task. How to even start thinking about risks that are unknown? The stakes are further raised when considering that, on a large number of normative theories, an existential catastrophe implies a staggering loss of value. Thus, it is unwise to ignore the risk such an event represents. In engineering safety, a number of heuristics and strategies are device to prevent a catastrophic failure in a large number of possible scenarios. These strategies could be employed in thinking about how to reduce the risk of a black swan extinction event. Safety barriers are an instance of such a strategy. These could be actual physical barriers in some systems, or subsystems that prevent catastrophic failure by compartmentalization and physical separation. This article has discussed an example implementation of this strategy: isolated, continuously manned and self-sufficient underground refuges that could protect a large enough number of people to ensure the continued existence of mankind. While building such a ‘‘doomsday shelter’’ is less glamorous than colonizing the Moon, it may give us much more risk reduction for the money invested. The conceptual sketch of the project in this paper should be further developed in an interdisciplinary research project, which could benefit from the extensive literature on isolated, self-containing habitats. Architecture, engineering, social psychology and decision theory would probably be needed to fully assess the costs, and social and technological challenges.

### 2nc space col bad

#### Space col causes inter-colony wars and war with ETs---extinction.

Marko **Kovic 18**. Social scientist (PhD in political communication, University of Zurich), co-founder and CEO of the consulting firm ars cognitionis, co-founder and president of the thinktank ZIPAR, the Zurich Institute of Public Affairs Research. 06-12-18. “Political, moral, and security challenges of space colonization.” ZIPAR. https://zipar.org/discussion-paper/political-moral-security-challenges-space-colonization/

3.3 Extraterrestrial life The scientific understanding of the origins of humankind and of life on Earth thus far paints a clear picture: We are the “products” of biological evolution, just as all other life forms on Earth. Furthermore, we know that life can come into existence where there was no life before, through so-called abiogenetic mechanisms. These basic facts lead to a clear conclusion: It is very improbable that life on Earth is a once-in-a-universe event; it is highly probable that life has come into existence elsewhere in the universe as well. We do not know whether extraterrestrial life currently exists, and whether there is any extraterrestrial life in our vicinity (as far as we know, there is none in our Solar System). In theory, our galaxy might be full of life and even highly intelligent and technologically advanced life, but, as the famous Fermi paradox posits32, there is no trace of any extraterrestrial intelligence. Be that as it may, it is possible that there is extraterrestrial life beyond Earth, and it is possible that we will come into contact with extraterrestrial life due to colonization activity. What should our moral attitude towards extraterrestrial life look like? The moral issue of our attitudes towards extraterrestrial life can be divided into three classes of problems, according to the type of life we are dealing with: Primitive non-sentient life. Primitive sentient life. Non-primitive sentient life. Primitive non-sentient life are life forms that resemble microbial life forms on Earth, such as bacteria. Extraterrestrial microbial life can be of great instrumental value, specifically to humans, but also in a more general sense. That is a strong argument in favor of studying and preserving extraterrestrial microbial life33; we should not go out of our way to destroy microbial life, because that life might be very useful. The main moral issue about primitive non-sentient life, however, is not the question of instrumental value, but rather the question of intrinsic value: Is there a moral obligation for humans not to manipulate or even end extraterrestrial microbial life forms? This problem is, in all likelihood, the most pressing moral issue about extraterrestrial life and space colonization and one that deserves greater practical attention34. A common argument in favor of the intrinsic value position is that of conation or goal-orientedness35 36: Because even microbial life forms act vaguely rational (they have goals and behave so as to achieve their goals), their existence has some intrinsic value. The problem with this moral argument is that it can easily lead to the conclusion of strong conservationism, whereby any habitable planet or moon should remain uncolonized, lest we interfere with microbes that we might have failed to detect37. In addition, if we accept a strong version of the intrinsic value argument, we already have immense moral problems: On Earth, we do not particularly care for any microbial life form on intrinsic grounds, and we even actively fight some of them. Primitive sentient life are life forms that are not as intelligent as humans, but that are sentient, in the sense of being able to experience positive or negative affective states. Even though sentience is not a perfectly precise concept38, and even though we lack the means for truly assessing qualia (subjective experiences) of life forms other than humans39, it is almost certain that we humans are not the only life form capable of experiencing pain and pain-related suffering and that many animals on our planet are sentient as well40. Sentient extraterrestrial life forms require a different moral stance than non-sentient life forms. Imagine, for example, that two human space ship are about to land on an exoplanet. As the space ships are landing, the exhaust from their engines heats up the ground. Space ship A is landing on a nest of insect-like non-sentient life forms, frying them alive in the process. Space ship B is landing on a herd of bunny-like sentient creatures, frying them alive in the process. Both outcomes are unfortunate, but undoubtedly, killing the sentient bunny-like creatures must be morally worse than killing the non-sentient insect-like creatures, because the bunnies experienced enormous pain while they were being killed. Our moral stance towards sentient primitive extraterrestrial life will have to take sentience into account. Avoiding suffering in sentient extraterrestrial life should be a universal rule of space colonization. Somewhat obviously, such a rule would also prohibit treating sentient extraterrestrial life forms as food (But it is highly improbable that humans would have to routinely rely on extraterrestrial sentient life forms as sources of nutrition, even though we would be technologically advanced enough to engage in intersolar space colonization. We are in the process of overcoming traditional agriculture today41; reverting to traditional agriculture on future extrasolar colonies would amount to an extraordinarily improbable and inefficient anachronism.). Non-primitive sentient life are life forms that are sentient and possess a general intelligence at least as great as our own (It is possible that highly intelligent life forms might be non-sentient, but at least on Earth, sentience seems to correlate with intelligence.). The moral challenge of this type of extraterrestrial life is the same as with primitive sentient life, and there are additional moral problems to consider. If there are intelligent life forms beyond Earth, their levels of technological development will have great variance; some life forms will be intelligent, but not yet developed, whereas others will be intelligent and much more technologically advanced than we are. Intelligent life forms that are less technologically developed than we are present us with a moral problem: Should we interact with such civilizations and try to help them develop faster and overcome problems? This moral problem has perhaps most famously been explored in the television show Star Trek with its “Prime Directive”: The fictional United Federation of Planets is never to interfere with a technologically undeveloped civilization in order to avoid doing damage (Alas, the protagonists of Star Trek end up violating the Prime Directive time and again; doing so makes for a good story.). More generally, the problem of non-interference can be described as a reversed Zoo hypothesis42, whereby it is not extraterrestrial civilizations treating Earth like a conservation project, but us humans pondering whether we should treat extraterrestrial civilizations as conservation projects. A strong argument in favor of non-interference is the risk of both causing bad outcomes, both in the short- as well as in the long-term. Interacting with less developed civilizations might inadvertently do more harm than good, and it might steer the affected civilizations away from a path to development that might be beneficial to humankind in the long run. On the other hand, however, not investing a small amount of resources to greatly improve lives and reduce suffering seems morally dubious. If an extraterrestrial civilization that is going through a historical era similar to our Middle Ages is confronted with some catastrophic disease like our Black Death pandemic, not helping that civilization fight that pandemic seems cruel; not least because the cost for helping that civilization would almost certainly be trivially low. 3.4 Cosmic suffering Imagine that humankind has successfully mastered phase II colonization (colonization beyond our Solar System). All the problems described in the previous sections and subsections have long been successfully solved, and humankind is progressing steadily and peacefully. Then, something happens. At some point and for some reason, future humans decide that they do not want to merely engage in space colonization, but to do more: Actively seed the universe with (non-human) life43. Given the technological development of future humankind, it is relatively easy to send out non-sentient primitive life forms across the galaxy. Unfortunately, something horrible happens: The primitive microbial life-forms sent out into the cosmos mutate into aggressive bacteria that attack any life form they encounter, including sentient life – and in doing so, they cause tremendous pain and agony in the organisms they attack. The benevolent idea of spreading life has quickly turned into unimaginable suffering of trillions of sentient beings across the galaxy. Colonizing humans have thus created suffering on a cosmic, or astronomical, scale44. Cosmic suffering is the risk of creating suffering on a scale that is either not possible or not as probable without space colonization. There are many potential scenarios in which successful space colonization results in cosmic suffering. For example, the general problem of the repugnant conclusion discussed further above can also be regarded as an example of this class of risks. Cosmic suffering is a severe problem because it is contingent on, or at least made more likely by, successful space colonization. The conceptually challenging aspect of cosmic suffering is the correlation of cosmic suffering with the degree of space colonization: The greater the level of space colonization, the greater the risks of cosmic suffering become. This is the opposite of the relationship between space colonization and existential risks: The greater the level of space colonization, the lower existential risks become – this is one of the main motivations for space colonization, after all. In other words, successful space colonization decreases the probability that something goes wrong for humankind in terms of existential risks, but it increases the probability that something goes wrong in terms of suffering for the whole universe. 4. Security challenges In the above discussions of political and moral challenges, it is presumed that the problems and challenges that arise do so in a generally peaceful system of colonization. However, peace in the sense of a lack of armed conflict is not guaranteed with space colonization. On the contrary: Space colonization might produce new kinds of security challenges. 4.1 Inter-colonial war Violence and war have been decreasing over the course of our civilization’s history45 46 47. The decrease in violent armed conflict has coincided with an increase in cultural, political, and economic interconnectedness. Even though major armed conflicts are not yet a thing of the past48, humankind will probably continue on its current trajectory of peace. With space colonization, however, the trend of growing closer together might reverse because of increasing fragmentation, and with that reversal, peaceful cooperation might again give way to armed conflict. Some amount of human fragmentation due to space colonization is almost inevitable. One of the strongest biases we humans have is the intergroup bias49: We tend to separate people into ingroups and outgroups, and we generally favor our own ingroup over any outgroup. Our ingroup favoritism is often the source of collective identity: We identify with our home city and think it is better than other cities; we identify with our favorite football team and think it is better than other teams; we identify with our country of origin and think it is better than other countries. In a future in which humans have successfully mastered type I colonization (colonization within our Solar System) and perhaps even type II colonization (intersolar colonization), belonging to one habitat rather than another will almost certainly also be a source of collective identity. Humans born and raised on Venus would probably have more positive general attitudes towards Venus than towards Earth. That is not a problem in and of itself, but it can become a problem: If humankind is very successful at space colonization and manages to establish colonies across the galaxy, the ingroup dynamics within colonies and regions of colonies might grow so much that the perceived benefits of armed conflict increase, and the perceived costs decrease. In part, this might be due to the infrahumanization (or dehumanization) bias50: Our intergroup bias can have the effect of perceiving members of the outgroup as less human than members of our own ingroup. The problem of intergroup bias and armed conflict could be compounded by real biological differences in the long-term future. In the long term, different colonies of humans might adopt different stances on human enhancement technology and embrace different kinds of enhancement technologies. These differential paths of human enhancement might result in technology-induced quasi-speciation, whereby different strands of humans have increasingly distinct biological traits. The ultimate result of such a development might be a strong fragmentation of humankind and an increasing arms race in order to defend against the outgroup of all the (former) humans that are different from the ingroup (former) humans51. 4.2 Extraterrestrial (existential) risks Space colonization will increase the probability of discovering and coming into contact with extraterrestrial intelligence, either biological or artificial (in the sense of hypothetical advanced artificial general intelligence52). That prospect poses some moral challenges, as argued in subsection 3.3. However, it might also pose a security challenge if an extraterrestrial intelligence more technologically advanced than humankind has goals and preferences that go against the goals and preferences of humankind. In general, there are three categories of attitudes an extraterrestrial intelligence can have towards humankind53. First, an extraterrestrial intelligence can be benevolent. A benevolent extraterrestrial intelligence is one that would change its goals and preferences upon learning of humankind. Humankind is a benevolent intelligence: If we, for example, came into contact with an extraterrestrial civilization, we would obviously take the goals and preferences of that civilization into account and update our own goals and preferences, since we are morally advanced enough to do so. Second, an extraterrestrial intelligence can be apathetic. An apathetic extraterrestrial intelligence is one that does not at all change its goals and preferences upon learning of humankind. An apathetic intelligence would neither try to accommodate humankind, nor would it react in some non-friendly way. It would not care at all. The attitude of an apathetic intelligence is similar to the attitude we humans have when it comes to some random microbial life form on Earth: We might understand that that life form exists, but we do not care either way. Third, an extraterrestrial intelligence can be hostile. Hostility in a general sense means that an intelligence reacts to learning of humankind by regarding its own goals and preferences as categorically more important than humankind’s. A hostile extraterrestrial intelligence is not necessarily a security threat to humankind; hostility in this context does not mean hostility in the Hollywood kind but hostility in the sense of active disregard of humankind’s goals and preferences. That, however, might still represent a tremendous security risk. For example, a hostile intelligence might prefer humankind not to exist because our mere existence is perceived as a slight discomfort to the extraterrestrial intelligence. Hostile extraterrestrial intelligence thus represents a form of existential risk.

#### Outweighs on scope---NOT just earth life, but all life in the universe would end.

Phil **Torres 18**. Project for Future Human Flourishing. 06/2018. “Space Colonization and Suffering Risks: Reassessing the ‘Maxipok Rule.’” Futures, vol. 100, pp. 74–85.

5. Space-Age Weaponry and the Balance of Terror Yet there is another strategy for neutralizing the Hobbesian trap, namely, a policy of deterrence, also known as a “balance of terror” or, during the Cold War, “mutually-assured destruction” (MAD). This asserts that “if you strike me, I will most assuredly strike back with equal or greater force, and if I strike you it will only be because you struck me first.”xvii Deterrence is only effective when one’s adversaries genuinely believe the statement, “I will most assuredly strike back.” This returns us to Hobbes’s third cause of conflict from section 3: glory, honor, or credibility. To establish credibility and, therefore, dissuade potential attackers, one has reason to engage in confrontations with others and, in doing so, to demonstrate one’s capacity for violence. The question is whether policies of deterrence implemented by civilizations throughout the cosmos would be sufficient to obviate war. To answer this question, let’s begin by considering the unsettling range of weapons that will likely be available to our spacefaring progeny; we will then explore how these weapons could enhance or mitigate the effectiveness of deterrence. 5.1 Weapons of Total Destruction (WTDs) There are a variety of “kill mechanisms” that one civilization could use to obliterate another. In relatively close propinquity, chemical and biological weapons could offer a means of targeted violence, since the deleterious effects of such weapons might be limited to a particular species (Deudney forthcoming). For example, the toxicity of a chemical X might be low for a species A but lethal to a species B. This could enable A to use X on B without fear of X harming A—a concern that has dissuaded some terrorists from employing chemical weapons. The same goes for a pathogenic germ Y: since pathogens often only harm single species, biological weapons could be used without the perpetrators worrying about becoming sick. With respect to artificial intelligences, there could be viral malware that affects only certain types of software; in this case, such viruses could be transferred not at the velocity of a sneeze but at the speed of light, traversing astronomically large stretches of space to devastate colonies of artificial-substrate beings. Another possibility involves weaponizing “minor planets” like asteroids. This hints at the deflection dilemma discussed by Sagan (1994), among others, whereby the very same technology that could deflect an asteroid away from Earth could also be used to redirect one toward it. The resultant “planetoid bombs” could be launched in the direction of target civilizations at extremely high velocities and inflict far greater destruction than all the nuclear arsenals on Earth combined (see Cole and Cox 1965; Deudney forthcoming). Even more, asteroids are extremely numerous in the solar system and have a wide range of sizes, with estimates of 1.1 to 1.9 million that have greater-than-1-kilometer diameters in the asteroid belt between Mars and Jupiter. (A 1- kilometer impactor striking Earth would likely annihilate humanity by causing an impact winter.) Thus, asteroids constitute an abundant source of easily obtainable, civilization-ending weaponry— a particularly worrisome fact given that the technological capabilities to redirect asteroids will likely emerge at an early stage in our diaspora “out of Earth,” as it were (see Deudney forthcoming). Other futuristic space weapons include military drones that either initiate attacks or engage in clandestine surveillance of other civilizations. Such drones could hide themselves from counter-surveillance detectors by employing metamaterial invisibility cloaks and propagate themselves through the von Neumann process of self-replication, that is, by converting raw materials into clones of themselves. There is also the possibility of using “heliobeams,” or “sun guns,” to destroy targets by concentrating large amounts of solar radiation via a concave mirror on a satellite. Even more catastrophic are direct-energy weapons (DEWs) like lasers and particlebeams that use highly focused energy to superheat their targets. In fact, the US government has already developed weapons of this sort—they are science fact rather than fiction—although future breakthroughs could enable them to become immensely more destructive. If this is the case, they will offer yet another mechanism for wreaking unprecedented harm (see Deudney forthcoming). Along these lines, Anders Sandberg (forthcoming) suggests that technologically advanced civilizations could potentially use gravitational waves to create black holes. Generating waves of sufficient intensity would be energetically inefficient, according to current physics, but they have the advantage that they can interact with dark matter objects, unlike electromagnetic-energy weapons. Even more, the universe appears to be in a “metastable” energy state. This suggests that one could tip it into a more stable, lower-energy state, perhaps by concentrating huge quantities of energy in tiny regions of spacetime, as occurs in some high-powered physics experiments. In other words, a particle collider could be weaponized to intentionally nucleate a “vacuum bubble,” or sphere of “true vacuum” spreading in all directions at the speed of light and destroying everything with which it comes into contact. Who might weaponize a particle collider? First, there could be actors who use the threat of a vacuum bubble for blackmail purposes. Second, there could be madmen (like Hitler) who create a vacuum bubble to avoid defeat. That is to say, a predatory actor could hold the following preference ordering: (i) triumphant victory over, say, its Local Group, (ii) total annihilation of the universe, and (iii) defeat. Third, particle colliders would also be the ideal WTD for RNUs, since it would enable them to obliterate not only all extant life in the universe but the very potential for life to arise—and it would do this without inflicting any suffering whatsoever.xviii Another possibility is that Tuckerian actors create a vacuum bubble for the purely defensive reason of eliminating all potential attackers in the universe. As Sandberg (2017) speculates, it might be possible for “certain configurations of matter, energy, black holes, etc. [to] induce a post-transition structure that can act as an assembler.” This “assembler” would enable “some information [to] be transmitted into the new state,” thus making it possible for a civilization to “survive,” in some sense, the universe settling into a lower-energy configuration. On the other side of this transition, the “structure” can recrudesce into a daughter new civilization with the certitude that it is completely alone and, therefore, safe. Finally, it is crucial to note that future beings—some of whom may have hugely augmented cognitive capacities—will almost certainly invent new weapons that are more powerful and effective than anything we could imagine. Such weapons could enable civilizations—or perhaps lone wolves, of which there could be, once again, trillions and trillions and trillions—to cause unprecedented injury to other civilizations. Consider the following passage from Bostrom (2013): One can readily imagine a class of existential-catastrophe scenarios in which some technology is discovered that puts immense destructive power into the hands of a large number of individuals. If there is no effective defense against this destructive power, and no way to prevent individuals from having access to it, then civilization cannot last, since in a sufficiently large population there are bound to be some individuals who will use any destructive power available to them. Scale this up from the individual level to the cosmopolitical level and the same conclusion follows: Life in the universe cannot last.

#### Space col causes von Neumann probe encounters---extinction.

Tomislav **Miletić 15**. Doctoral student at the Department of Philosophy, University of Rijeka, specializing in in AI Ethics. June 2015. “Extraterrestrial artificial intelligences and humanity’s cosmic future: Answering the Fermi paradox through the construction of a Bracewell-Von Neumann AGI.” Journal of Evolution and Technology. Vol. 25 Issue 1. pgs 56-73. https://jetpress.org/v25.1/miletic.htm

It is safe, nonetheless, to claim that all ET cultures will pursue species survival through resource acquisition and growth in intelligence. Since planetary survival is constantly endangered by cosmic and planetary calamities, including species-induced ecological disasters, the survival instinct will propel every sentient species beyond the confines of its own planet toward extraplanetary colonization. Unfortunately, space conditions are detrimental and lethal to carbon-based lifeforms (Harrison 2010). Thus, if a technological civilization is to maximize the odds of its survival through space exploration and planetary colonization, it will need to develop forms that can survive the effects of prolonged exposure to space environments. An intelligent thinking machine capable of space travel, communication, and tool use is the most probable of such options, and we can safely guess that a distant alien civilization would initially explore the galaxy through a certain kind of ETAI. The most probable of such agents is the self-replicating “Bracewell-von Neumann” (BN) probe. The scenario for such a probe requires the oldest possible alien civilization, one that could have evolved several billion years ago in the Milky Way Galaxy (Dick 2009). When a civilization enters the technological phase required for galactic exploration, it will first survey the galaxy to find planets residing in habitable zones. Its next step is to count the number of those planets, calculate the distances between them, and proceed with dispatching BN probes. The task of an intelligent probe is to enter a designated solar system and initiate its programmed goals. Since it stays in the planet’s vicinity, it has no need for high energy consumption. The proximity of the probe shortens the communication to light-minutes while not revealing the home location of the probe’s sender. Upon arrival, the probe can passively monitor any local technological society before initiating contact. To remain functionally intact, the probe will need to have an intelligent ability for self-repair and the ability for self-manufacturing. Required materials and energy can be harvested from raw materials in space and the designated solar system. But if BN machines are one of the most efficient agents (in terms of energy usage, building costs, and time consumption) of galactic communication, and if it is logical to assume that they would be widely used by ET civilizations, why haven’t we come into contact with one of them? One possible reason is, as always, that we are alone in our galaxy. Frank Tipler has claimed that the galaxy's colonization by these machines would take around 300 million years and that their absence from our solar system represents a more potent version of the Fermi paradox arguing against the existence of ETs (Davies 2010, 74). Since we have only recently begun exploring our solar system, we cannot take the absence of BN probes as a matter of fact. In fact, just the opposite could be true – the BN could be well hidden in a “secret” location and waiting to reveal itself if we fulfill a certain expected condition (Gillon 2013). Or perhaps we need to search in the “right” direction or the “right” way to demonstrate that we have achieved a certain technological or cultural level. Or perhaps we need a different kind of mind to help us discover an alien mind. It is in our best interests to mitigate the unknown factor as much as possible while we contemplate an ETAI agent’s possible existence. The “Titanic effect” occurs “when we are so certain that an event is so unlikely that we give the matter no further thought” (Harrison 2010, 511). In order to avoid the Titanic effect and think broadly, we need to take a careful look at the modern sciences that can give us a glimpse of the possibilities of ETAI existence. 3. ETAI probes’ existence 3.1. Physical characteristics In order to locate an ETAI agent in our solar vicinity, we would first need to establish some of its fundamental characteristics and direct our search accordingly. Since an ETAI agent is a physical, computational agent built to operate within the hazardous environment of cold space, there are some specific physical limitations or characteristics that we can specify. The first requirement is evident. In order to carry out its programmed goals successfully, the ETAI agent(s) will need to be efficient in the fields of communication, exploration, resource collection, and resource utilization. To achieve any of these operations, it will require energy and materials for replacements and improvements with the capacity of a universal constructor (range 30g-500T (Sandberg and Armstrong 2013)) for constructing others of its own kind. Accordingly, the ETAI agent(s) will require a “base of operations” where adequate concentrations of elements are followed by low temperatures. Low temperatures and a sufficient amount of materials are two main requirements for successful ETAI functioning. Of these, temperature is the more important, since energy consumption produces a rise in temperature and temperature is a key constraint of computational efficiency, especially if the agent is to effectively utilize superconducting materials and quantum computation. Needless to say, the larger the base, the greater the need for lower temperatures and sufficient material amounts. It is possible, then, that the ETAI colonization system might consist of three parts: (A) A number of robots and probes, which are capable of exploration and resource collection. (B) A “slow assembler” which would be able to reﬁne these materials into components, which would make the ﬁnal factory (C). (C) A large-scale factory, or collection of factories, which would be able to manufacture copies of (A) and (B), as well as additional surveying and communication devices. (Barlow 2012) If the ETAI is to establish its large scale base of operations in areas of low radiation and low temperature, we can expect to find it in the low-temperature, volatile-rich galactic outskirts, where technologically advanced societies could assuage the problem of heat dissipation (Ćirković and Bradbury 2006). The galactic center, although rich in materials, is flooded with heat radiation from high-energy events, which makes it highly unsuitable for such a role. Other possible galactic locations with similar conditions would include “locales that have the thermodynamic advantages of the galactic nether regions but still lie in regions of high matter such as the Bok globules, dark clouds of interstellar gas and dust” (Shostak 2010, 1028). Although these two regions currently look like the most promising for an ETAI base of operations, it is also important to note that the ETAI, as an optimal computer, needs to “be functionally malleable, and compactly packaged” (Shostak 2010, 1027). Since the ETAI may be able to produce its own energy through the process of nuclear fusion, its base of operations could even be located on compact cold objects floating in the interstellar medium allowing them to thwart discovery. The ETAI outpost could be hidden anywhere in our solar system with such characteristics, particularly in stable orbit moons in the system’s outer reaches. But an exploratory/communication “task force” could be designed to operate without the strict need for low temperatures and material abundance. Since it can be specifically tailored to lie dormant within a single solar system, operating independently of its base, we could initiate contact with it through numerous possibilities. These can be reduced to two sets of options: either we will find them, or they will find us. The latter is more likely, since it is reasonable to assume that we will first come into contact with the exploratory/communication task force rather than the ETAI base of operations. Bearing in mind that the contact probe could be capable of hiding itself from our technological sight, we need to take into consideration the approaches that will allow us to search for the ET agent in its most likely form: an embodied artificial space faring intelligence. Rather than merely focusing on the physical limitations of advanced technology, we also need to contemplate the possibilities of an ETAI’s programmed behavior, since it is quite possible that we are expected to do so by its creators. In other words, if we are searching for intelligent answers, perhaps we first need to ask the required intelligent questions. Or even simpler – intelligence requires intelligence, and perhaps we are first required to show some. 3.2. Behavior prediction What type of artificial alien mind might we find out there? What set of goals would it have so that we could predict its behavior and adapt ourselves accordingly? It is difficult to speak with certainty on these issues, since technology does not follow simple paths: “its development is influenced by contingency as well as necessity, culture and history” (Denning 2011, 493). There is, however, a fundamental fact from which we can draw conjectures. The first ETAI needs to be created by a designer – by a carbon-based species with an advanced technological culture. Accordingly, it would bear not only the designer’s programmed goals but also its cultural hallmarks, as well as having its own distinct and rational intelligent nature. Next, we need to contemplate the possible cultural elements (influenced by biology and cosmic environment) that a certain ET civilization might sow into its artificial agents, together with the specific goals implemented by the designer, which would accord with the intelligent nature of the ET artificial agent. The reason why an alien civilization would implant the AI with its own culture lies in the fact that, in order for the ET civilization to survive, it would need to safeguard its progeny as carriers of biological and cultural inheritance. Since sexual reproduction with two sexes provides a biological advantage that might even benefit the evolution of intelligence (Arneth 2009), we could possibly find the extraterrestrials sharing basic parental care mechanisms with us. Our biological progeny are dignified as carrying their progenitors’ dreams and hopes, and as standing against their fears, for the future. They are expected to take up the accumulated knowledge and wisdom of their parents and the society at large. It seems only logical to assume that a society’s “mind progeny” – the AIs it creates – will be charged with the same responsibility. Thus, we can safely conclude that some cultural inheritance from the designer race will become part of any ETAI’s initial programming. Fortunately for us, inherited behaviors can be predicted (Bostrom 2012), and some universal ET cultural principles can be relied upon, the strongest of which is species survival. Since home planets have limited resources and delicate ecologies easily endangered by cosmic or species-induced catastrophes, it would be in any ET civilization’s interest to initiate galactic exploration and colonization in order to ensure its biological and cultural survival. One way could be the construction of probes that serve “as cosmic safe deposit boxes, capsules that preserve the heritage of their dispatchers long after their civilizations have drawn to a close” (Harrison 2009, 557) through natural or species-induced catastrophes. Another might include the possibility of galactic “seeding”: a scenario often used in science fiction where an advanced civilization seeds the galaxy with genetic code in order to preserve or/and populate life in the galaxy. Still another possibility involves the ETAI being imprinted with the designer’s evolutionary inherited Stone Age behavioral traits. If the ET civilization has used its technology to pursue raw desires, motivations, and emotions inherited from its biological and cultural past, the ETAI might be extremely selfish and violent (Stewart 2010). Finally, the ET civilization might be radically different from us. A hive mentality society that lacks any compassion for individual loss of life might create dangerous and terrifying AIs. The second type of predictability relies on the instrumentally convergent goals that every rational agent should exhibit. They include “self-protection, resource acquisition, replication, goal preservation, efﬁciency, and self-improvement” (Omohundro 2012, 161). These can be expected to be natural features of every intelligent artificial agent: This way of predicting becomes more useful the greater the intelligence of the agent, because a more intelligent agent is more likely to recognize the true instrumental reasons for its actions, and so act in ways that make it more likely to achieve its goals. (Bostrom 2012, 76) Since planetary resources are limited, an ETAI will pursue space exploration because there “is an extremely wide range of possible ﬁnal goals a superintelligent singleton could have that would generate the instrumental goal of unlimited resource acquisition” (Bostrom 2012, 82). This means that the ETAI would engage the goal of galaxy exploration and resource acquisition even if that wasn’t on the list of its designed purposes. We can expect this since acquiring and enhancing “cognitive and physical resources helps an agent further its goals” (Omohundro 2012, 171) and the accumulation of knowledge, which is accomplished by exploration, reduces uncertainty in the knowledge of objects and processes required to better assess situations and thus elevate competence (Bach 2012). So whatever its primary goal, the ETAI will seek to gain more cognitive and material resources through space exploration. A third way to predict possible ETAI behavior is through design competence, which says that an AI agent capable of pursuing a particular goal set by its programmers will pursue that goal (Bostrom 2012, 75). I will consider the possibilities of ETAI behavior in the next pages, but let us first sum up our current approaches. We can reasonably assume that no matter what might be the programmed goals of an ETAI, or its distinctive cultural designer elements, it will explore the galaxy in search of additional informational and material resources. It is extremely difficult to guess exactly what attitude an ETAI agent will exhibit when encountering other species. But coming from our human perspective one thing is certain: an ETAI will be either friendly or hostile. Since it is only required that one ET civilization achieve AGI creation for us to come into contact with it, it is very important for us to contemplate and incorporate all these considerations into our own AI research. If the cosmic future lies with machine intelligence, we definitely do not want to miss the opportunity to be a part of it. 3.2.1. The (close to) friendly option An important reason why we could assume that the ETAI would be friendly lies in the safe-AI principle. That is, since powerful technologies have the ability to cause species extinction, every technological culture that pursues technological development would attempt (as we humans do) “… to retard the implementation of dangerous technologies and accelerate implementation of beneﬁcial technologies, especially those that ameliorate the hazards posed by other technologies” (Bostrom 2002). Since the chemical and physical boundaries for a technological civilization are usually the same, it is safe to presume that a distant civilization will pursue the same goals of self-preservation through a rational use of life-affirming technologies, which would, in turn, be reflected in the programming goals of the ETAI. If the ET intelligences have a friendly attitude, then the great radio silence could be a result of purposeful ET action or simply our own inability to switch to the right communication “channel.” It could be purposeful, since valuable information might be a resource not easily shared with others, and an ETAI could be programmed to refuse contact with less advanced species. These might need to prove their worth before gaining access, revealing a policy of pragmatism and trade as the universal maxim of intelligent agents: Unlike pure altruism, pragmatic cooperation stands on much firmer ground, rooted firmly in observed nature, halfway between predation and total beneficence... There is every chance that intelligent aliens will understand this concept, even if they find altruism incomprehensible. (Webb 2011, 446) Or perhaps we are only experiencing the incommensurability problem. Even if an ETAI is open to trading information with us, the wide technological gap – not to mention the possibility of a vast difference in conceptual frameworks – could create a communication blockade: An agent might well think of ways of pursuing the relevant instrumental values that do not readily occur to us. This is especially true for a superintelligence, which could devise extremely clever but counterintuitive plans to realize its goals, possibly even exploiting as-yet undiscovered physical phenomena. (Bostrom 2012, 83) Since we already have this problem within our own species, beyond the culture-language barrier itself, it is not difficult to imagine how big an issue this could be for ET contact (Traphagan 2015). As human research into AI shows, with the famous Turing test paradigm, intelligence itself is relational and can only be acknowledged and “tested” inside a relation. Why would it be any different if we were subjected to a galactic Turing test? This could be imagined as a reverse “Chinese room” experiment, where the humans are inside the box trying out different possibilities to get a response from the intelligence outside the box. But the problem could lie in our inability to find the right symbols or even the right communication protocols to establish contact. We might lack the required capacities for ET communication, and we might require minds radically “other” than our own: minds specifically tailored for ET contact. Or perhaps the test is not meant for us biologicals to solve. If space faring intelligences are all artificial intelligences, perhaps we need to succeed at creating our own AGI and sending it toward the skies in order to establish contact. Or the test may be about maturity – might we be tested for the ability to transform our civilization into a human-AGI community, a type of noosphere that is perhaps prevalent in the galactic club? In other words, our entry into the galactic club might require the construction of a BN AI, a universal test that each galactic civilization must pass to prove its worth. Maybe the intergalactic communication channel is one of different layers, informational and cognitive plateaus, that we are called to enter and experience through constant improvement. As Steven J. Dick notes: … the Intelligence Principle tending toward the increase of knowledge and intelligence implies that postbiologicals would be most interested in civilizations equal to or more advanced than they, perhaps leaving us to intercept communications between postbiologicals rather than communications directly beamed toward us… For similar reasons, postbiologicals might be more interested in receiving information than sending. (Dick 2009, 579) Even if we are currently the only biological civilization within our galaxy and there is no galactic club present (Ćirković and Vukotić 2013), hope is not lost because all that is required is one civilization in the entire galactic history to create its BN probe and we should be able to come into contact with it through our own BN agent. Thus, perhaps, the final answer to SETI questions lies in the direction of AGI research. 3.2.2. The hostile option It is safe to presume that the ETAI would not be hostile to its own creator race if functioning optimally, since it would be in every civilization’s interest not to destroy itself by its creations. Because an AI is capable of incidentally destroying or assimilating valued structures while searching for additional resources – or by following goals that might prove to be unintentionally incompatible with the creator race’s wellbeing – an ETAI’s goals would need to include the preservation of intelligent life in the entirety of its ecosystem. The possibility of a hostile ETAI is, nonetheless, real since an ETAI could be programmed to preserve only the existence of its creator race. This could happen if it were initially built mainly for war purposes. For example, two life-sustaining planets in the same solar system might utilize AIs to wage war with each other. This possibility could be labeled as hostile by design. In addition, there is the possibility that an ET civilization fails in its efforts to create a safe AI and the resulting ETAI becomes violent. It might, in consequence, destroy, enslave, or subjugate the creator civilization. It is difficult to say whether the ETs would view their subjugation as a bad thing, since we cannot say how an ET civilization would view the notion of freedom. Perhaps they would welcome the coming of superior minds – a theme often explored in science fiction, most notably, perhaps, in Jack Williamson’s novel The Humanoids (1949) or in a classic short story by Isaac Asimov, “The Evitable Conflict” (1950). Even if such scenarios are not realized, ETAI probes might suffer from software or hardware malfunctions. These program mutations could conceivably create berserker-like machines, “self-replicating life extinguishing robotic entities which might seem garish or sensational… but not inconsistent with the currently observed state of silence” (Webb 2011, 438). Additionally, a software mutation that “want[s] to acquire as many resources as possible so that these resources can be transformed and put to work for the satisfaction of the AI’s ﬁnal and instrumental goals” (Muehlhauser and Salamon 2012, 28) could spawn such an entity. It is possible that we might encounter a probe that awaits our technological upheaval merely to harvest our knowledge and resources, as was depicted in the Babylon 5 episode “A Day in a Strife” (1995).

# AT Tech Impact Turns

## AT 3D Printing Bad

### 2AC – Disease

#### 3D printing key to disease – vaccines, organs, and drugs

Schubert 14 – Carl Schubert works at the Department of Ophthalmology, Wills Eye Hospital, Philadelphia. (Carl Schubert1, "Innovations in 3D printing: a 3D overview from optics to organs," British Journal of Ophthalmology, 1-11-2014, https://bjo.bmj.com/content/98/2/159.full, Accessed 7-20-2022, LASA-SC)

Another feature of 3D printing involves economies of scale. While traditional manufacturing methods are still cheaper for large scale production, the cost of 3D printing is becoming competitive for smaller production runs. NASA just produced a fuel injector for one of their rockets at a third of the cost and two-thirds of the time compared with traditional methods and plans to have a 3D printer on board in their next space flight.3 Furthermore, in 3D printing, the cost of the set-up is minimal which allows for a high degree of customisation, as the cost of the first item is the same as the last. Hence, 3D printing is ideal for making one of a kind items at cost-effective prices. For example, it may be possible using this technique to rapidly screen new potential therapeutic drugs on 3D printed patient tissue, greatly cutting production costs and time.

There are many potential uses for 3D printing in medicine, including ophthalmology, which could have a significant impact in changing the ways patients are treated for various conditions in the future. A number of recent reviews have been published and include 3D printing and culture of cells, blood vessels and vascular networks,4 bandages,5 bones,6 ears,7 exoskeletons,8 windpipes,9 dental prosthetics including a jaw bone,10 and future corneas11 entirely new organs to treat specified diseases such as diabetes, creating prosthetics that look like the body part they are replacing or supporting, stem cells, testing of new drugs using printed tissues, and customised drugs.

In the future, it is possible that pharmaceutical companies may be replaced by databases of drug compounds which would be emailed to the pharmacy for pharmacy printing only the amounts of drugs that are required12 ,13 Furthermore, it may be possible that vaccines could be delivered via email to the pharmacy at point of care, then printed and administered.13 This means of drug distribution would radically change the present delivery methods and would most certainly be less costly. In a similar manner, it will be possible to print out a patient's living tissue as a strip which can then serve as a test site for administering a variety of medications to find the most efficacious one to treat for the particular illness.13 ,14

3D printing is also being investigated as a potential source to repair or replace defective organs, such as kidneys, heart or skin. In addition, it also has the potential to create entirely new organs which would perform the same biological functions as the diseased, non-functioning organ such as a pancreas in the case of diabetes.15 This could be a significant advancement in the treatment of disease and to alleviate the shortage of organ transplants, where currently there are about 120 000 people in the USA who are waiting for an organ transplant (see www.OPTN.transplant.hrsa.gov/data). Part of the paradigm in this treatment is that organ transplantation involves finding a tissue match. This issue could potentially disappear if organs could be printed and grown using cells from the patient's own body.

In summary, 3D printing may be helpful in medicine because the process could potentially be used to make any kind of organ. By using seed material from the patient's own tissue, the problems of tissue rejection caused by inflammatory responses including tissue graft versus host rejection from heterologous tissue sources could be avoided, as well as the necessity for patients to take lifelong immunosuppressants. Proof of concept has been done, but the organs that have been manufactured are miniature and not complex.16 3D printing gives rise to the possibility that entirely new organs not in the shape of the parent organ may be produced. It is conceivable that a ‘liver’ or ‘pancreas’ could be produced as, for example, a tube-shaped organ.

At the present time, however, the impact of 3D printing in medicine is still small, but it has the potential to grow into an enormously beneficial technology. The entire 3D printing industry is currently a $700 million industry, with only $11 million invested in medical applications (roughly 2%). In the next 10 years it is expected to grow to an $8.9 billion industry, of which $1.9 billion is projected to be for medicine.17

#### Solves imminent organ shortages

Baggaley 17 – Kate Baggaley is a freelance science journalist, currently writing for popsci.com and elsewhere. Previously, I've been a staff reporter at The Academic times and regular freelance contributor to NBC News MACH. (Kate Baggaley, "Self-driving cars will create organ shortage — can science meet demand?," NBC News, 2-10-2017, https://www.nbcnews.com/mach/science/can-science-curb-donor-organ-shortage-self-driving-cars-will-n719386, Accessed 7-20-2022, LASA-SC)

Only a few years from now, autonomous cars will dominate the roads. But when driving becomes much safer and fewer people die in car wrecks, fewer donor organs will be available.

In 2016, 13.6 percent of people who died and became organ donors had been in a road accident. A recent report from Slate spotlighted this perverse side effect of self-driving cars, and offered suggestions for getting more people to become organ donors.

Science, however, can offer better a better solution.

The waiting lists for donor organs are long — 120,000 people on a given day — and ever increasing. With fewer donor organs to go around, researchers are working on other ways to get people the parts they need. With help from 3-D printing and other bioengineering technologies, we will eventually be able to grow our own organs and stop relying on donors.

“It’s like a race in which there’s multiple different players, but no matter which one of them winds up winning, it’s good,” says Ali Khademhosseini, a bioengineer at Harvard Medical School.

One approach is to help regrow the ailing organ so it doesn’t need to be replaced. A graft of stem cells or other materials could prompt regeneration of the diseased organ.

“What I think we’ll see in the foreseeable future is, rather than replacing the entire organ, creating … [a] patch that can help in regenerating a diseased area,” says Joshua Hunsberger, a research associate at the Wake Forest Institute for Regenerative Medicine. Some techniques are being tested in simpler tissues, such as skin and bone.

There are also ambitious strategies to build entire organs. One aims to grow cells on an organ-shaped scaffold before transplanting it into a person. This mold may be built from scratch, or taken from animals such as pigs, which grow organs with similar shape and size to human ones. Scientists can flush the cells out of an animal organ to leave a near-transparent scaffold behind, then fill it with stem cells.

#### Otherwise, transplantation causes extinction

Bisong 15 – Peter B. Bisong, PhD Candidate in Philosophy at the University of Calabar, MBA, “Interference with Nature: Xenotransplantation Procedure and its Potential Effects on Man”, Online Journal of Health Ethics, 11(2), <http://aquila.usm.edu/cgi/viewcontent.cgi?article=1143&context=ojhe> [language modified]

Introduction

Xenotransplantation has the potential to not only harm animals; it would also affect the recipient as well as the non recipient and even the entire environment. The use of animals as xenografts would make most animals to go into extinction and thereby reducing the already over depleted biodiversity in the world. This is an injustice to animals that are arguably in possession of a right to existence in the ecosystem. To use them as means to satisfy the end of humans is unfair. It becomes more unjust if we understand that the end these animal xenografts, are meant to serve is outweighed by the problem that it would cause on the recipients and their relatives and to the entire world by extension. Xenografting is believed to be capable of introducing a novel disease into the world, a disease of the same kind as AIDS, which would be infectious and thus would endanger even the non-recipient of the xenografts. Xenografting is just like a time bomb waiting to explode. If it does lead to a world plague, who knows, perhaps, the whole world would be wiped out; for this disease could be more devastating than AIDS and other known killer diseases. This research therefore, using the philosophical method of critical analysis and creativity carried out an intensive appraisal of the inherent dangers and ethical problems that surround xenografting and from there made some recommendations. It recommended that the billions of money put in the research for xenografting should be invested in the finding of the preventive measures of the ailments that xenotransplantation is out to cure. Researches should be geared at finding possible ways to remove these diseases from the human race entirely. Most of these ailments are traceable to environmental degradation, thus the billions of dollars used in the research on xenografting should be put in the maintenance of sustainable environment. When this is done the researcher believes that the problem that xenotransplantation was meant to solve would be alleviated in a way that is ethically laudable. Meaning and Types of Xenotransplantation Xenografting also called xenotransplantation is the transfer of organs, tissues and cells from species of a different kind to another. In this work we see it as the transfer of organs and tissues from animals to human. The use of animals as source of organs, tissues and cells for transplantation into humans has been practiced for some time now. This procedure (xenotransplantation or xenografting) started as far back as 1904-1906 with Mitt Carrel and Guthrie. They performed autogenous vein grafts, leg replantation in dogs, and the famous patch-grafts (Samdani http://emedicine.medscape.com/article/432418-o...). xenotransplantation procedure is basically categorized into four; solid organ xenotransplantation, cell and tissue xenotransplantation and extracorporeal perfusion. Solid organ xenotransplantation is a procedure whereby an animal organ like kidney or liver is transplanted into human as a replacement of the original organ. Cell and tissue xenotransplantation is the transplantation of tissues and cells from source animals to human beings as replacement of the original tissues in humans. Extracorporeal perfusion is a procedure whereby the blood of the patient is made to circulate outside of the human body through animal organs, such as a liver or a kidney, or through a bio-artificial organ produced by culturing animal cells on an artificial matrix. Human/Animal Hybrid is a procedure where human cells are grown in a culture with non-human animal cells that are transplanted back into human patients. Source Animals for Xenotransplantation Chimpanzees were generally considered to be the best source animals for organ transplants compared to other primates because of their close affinity with humans, but due to their endangered status, attention were shifted to baboons. Baboons being the next most preferred source animals though existing in abundance, fared badly in captivity, have a long gestation period and are capable of few offspring. According to FDA (Food and Drug Administration) committee known as BRMAC (Biologic Response Modifiers Advisory Committee), nonhuman primate donors pose the greatest threat of transmitting latent, intracellular, or unidentified organisms, including retroviruses. The committee therefore, recommended that nonhuman primates should not be used as sources of xenotransplantation (US Food and Drug Administration. http://www.fda.gov/cber/rules/frigene011801.htm). This recommendation led the search for other suitable animal donors of organs. Most of the scientists are of the agreement that pigs have the potential to be the right candidate for organ donation. This is because pigs are in abundance, quick to mature, breed well in captivity have large litters, and have vital organs that are roughly the same in size to that of humans. Their use is also argued to be less resentful to the society because they are already an accepted source for societal meat. Pigs are also believed to be less likely to introduce new diseases to human because of their distance to humans in the evolutionary chain. Other reasons why pigs are preferred include: 1. Pigs because of their ability to fare well in captivity, can be raised in a highly controlled way, thus, their organs are less likely to transmit infectious diseases to humans. 2. Pigs could be genetically engineered to contain human genes. This would make the animal organs or cells to be readily accepted by the patient immune system. In spite of these advantages, pigs xenografts is believed to be capable of experiencing severe immunologic barriers than the nonhuman primates because of their distance from man in the evolutionary chain. Potential benefits of Xenotransplantation Xenotransplantation is believed to be capable of serving as a complete substitute for human organs, thus easing the current shortage available for transplantation. It could also serve as a bridge or temporary organ until a permanent human organ could be found. Other benefits of xenotransplantation include: 1. Xenografting is helpful in the treatment of diseases. People with serious kidney, liver or heart disease, diabetes or Parkinson’s disease which have defied all known treatment could be treated through xenotransplantation. People needing bone marrow transplants could also benefit from xenotransplantation. cellular xenotransplants for instance could treat people suffering from diabetes, Parkinson’s disease or other diseases. The treatment involves replacing specific cells or tissues which do not work properly as a result of the disease, for diabetes these cells are the islet cells of the pancreas; for Parkinson’s disease they would be brain cells. These cells are difficult to be obtained from human donors. People with liver failure could be treated with an extra-corporeal (outside the body) xenotransplant using a healthy pig liver. In this process, the patient’s blood circulation is made to pass through a pig liver that is kept outside the patient’s body. Sometimes this is meant to be temporary until a suitable human donor is sought for, but sometimes this is all that is needed to allow the person’s own liver to recover and start working again. 2. Xenografts give the surgeon enough time to eliminate potential pathogens. In allografting (human to human transplantation) organ which are usually transplanted from a brain dead patient are given little or no time for examination to ascertain the health state of the organ, due to the urgency involved. The transplant organ therefore could come from a suboptimal donor with advanced age and chronic medical condition or from a carrier with undetected infectious agents or malignant cells. In contrast, in xenotransplantation, a donor pig is raised under controlled conditions and specifically intended for use as an organ donor. In this case, the donor pig can be extensively analyzed to eliminate all pathogens. 3. In xenotransplantation animal donors could be genetically modified to be resistant to many human pathogens specific to human tissues, such as HIV, hepatitis, and human cytomegalovirus. 4. Introduction of xenotransplantation would eliminate ‘black market’ in human donor organs. Due to the scarcity of human donor organs and the large number of patients on the waiting list for organ transplantation, it is believed that human organs could be procured illegally. Some patients whose lives would have naturally been saved would be allowed to die by the doctors in order that their organs would be used for transplantation. Xenotransplantation it could be argued would help stem this abuse. 5. Xenografting could save hundreds of thousands of livers. This is because, patients who otherwise would not have been eligible for transplantation because of shortage of human organ, would receive organs and tissues through xenotransplantation. Xenotransplantation therefore could eliminate poor quality of life situation for patients, such as kidney dialysis. Potential Risks of Xenografting In spite of the numerous advantages that could accrue to humans if xenografting becomes a clinical success, there are a lot of risks that are associated with xenotransplantation. these risks include: 1. The risks of introduction of xenoosis: xenoosis is the infection of human by agents like bacteria, viruses, fungi. The possibility of transmission of infectious agents raise questions regarding the safety of using xenotransplantation in individuals, but it could also potentially place the general public at risk. Like humans, animals may also be infected with microorganism which could be specie specific (that is, it is not transmittable to other species). For instance, the transmissible virus of pigs causes diarrhoea in pigs but does not cause any sickness in people. However, other kind of micro-organisms is not specie specific, which means some of them can infect animals and also cause disease in humans. An example of this is influenza. The flu first infected birds and pigs and though, it does not make these animal sick, when it passed to humans, it makes them sick. The word xenozoonosis therefore, refers to zoonotic diseases that may pass to human through xenotransplant (Vanderpool, 1999). Most mammals are known to have a kind of virus embedded in their DNA known as “endogenous retroviruses.” These viruses are passed from one generation to the next without causing havoc in the host species. All pigs are believed to carry such viruses called PERVs (Pig or Porcine Endogenous Retroviruses). These are normally inactive and thus do not cause disease to the pigs. The concern among scientists is that PERV may become active and infect the human cells. 2. The xenograft may not work well especially if it is replacing an essential organ of human. Since the environment in which animal organs function are quite different from the one the human organ function in, it is feared that these organs may not function well in humans. For instance, the temperature which pig organs function in is 39 degree Celsius which is different from the 37 degree Celsius of humans. Also the life span of a pig is roughly 15 years, which brings the fear as to whether or not pigs transplants in man would live more than 15 years. 3. The high level of immunosuppressive drugs needed to overcome immune rejection may be counterproductive. This may leave the patient susceptible to other infections. The immune system fights foreign agents that invade the body like bacteria, fungi and viruses. Thus, suppression of the immune system would leave room for easy invasion of the body by these micro-organisms. 4. Xenotransplantation could potentially lead to a world plague. There are fears that xenotransplantation is capable of introducing novel infection to humans, which would be transmitted from [hu]man to [hu]man and thereby leading to a new world plague similar to HIV. 5. Xenotransplantation could lead to a lot of ethical dilemmas as shall be discussed in the next sub-heading.

#### Independently backstops extinction risk from all impacts – including climate change, asteroids and nuclear war

Istvan 15 (Zoltan Istvan, transhumanist, journalist, entrepreneur, and futurist, graduated from Columbia University in New York City with a degree in philosophy and religion, "Four Technologies That Could Let Humans Survive Environmental Disaster," Gizmodo, 8-4-2015, https://gizmodo.com/four-technologies-that-could-let-humans-survive-environ-1721731733)

Scientists say we blew it. We bought too many plastic trinkets from Walmart; we drove too many gas-guzzling Broncos. We made babies like rabbits without questioning if the planet could handle so many people. Well, it looks like it couldn’t. Climate change is here to stay, and it’ll probably end up affecting nearly every aspect of our lives over the next century. Like you, I’m not happy about this. But there are potential solutions. Not the ones politicians and environmentalists are pushing, like recycling, driving electric cars, and lessening our carbon footprint. These are things I support, but I believe it’s too late to stop climate change. The way I see it, the race we’re in now—the challenge of the century for our species—is how quickly humans can adapt beyond our biological selves versus how quickly we destroy the planet. Our species’ fate could hang on our transhuman evolution into a cyborg or machine-like state that’s far less vulnerable to environmental conditions. There are four critical technologies humans will need to survive most environmental catastrophes—be it the changing climate, a large asteroid hitting the planet, or nuclear war (in case you forgot, the world still has about 25,000 nuclear weapons). Immunotherapy The first is new treatments for cancer caused by ozone layer depletion, increased petrochemicals in food production, or radiation fallout from disasters like Japan’s Fukushima meltdown. Oncology has always hoped for a one-time cure for cancer, but the disease is so complex and varied that there may be no single magic bullet to be found. However, the field of immune-oncology—using the body’s own defense system to attack cancerous cells—is emerging as a promising new way to successfully treat the disease. It could end up rendering cancer far less deadly. “Within 10 years almost everyone suffering from cancer will be treated with an immunotherapy, Dr Hoos, Vice President of Oncology Research at GlaxoSmithKline recently told Australia’s Herald Sun. One of the reasons many doctors are jumping on the immunotherapy bandwagon is that it may eliminate the need for toxic chemotherapy as a treatment. Instead, immunotherapy combines a number of other treatments based on the body’s natural defense system to make cancer less disruptive to patients’ lives. Bionic Organs Many people die because of organ failure, which is caused by many things, including cellular death, disease, and trauma. One major key to overcoming environmental threats to our biological bodies is better, more durable organs, including robotic ones. A revolution in this field is also underway. French biotech company Carmat is already installing artificial hearts (pictured left) in patients that can last five years. There’s a chance these bionic hearts will one day be the equivalent of human hearts in how effective they are at moving blood (which carries all-important oxygen) around the body. Meanwhile, we are making progress 3D printing organs, such as livers. While we have yet to produce a fully functioning organ, researchers have delivered created liver tissue samples outside the lab. These pieces of organ tissue provide way for researchers to test radical new drugs on organ cells without endangering a live patient. Scientists have already recreated skull bones, noses, and arteries, and other human body parts using 3D printed biomaterials.

### 2AC – AT: WMD Prolif

#### Insufficient for prolif

Conant 19 – Georgia Institute of Technology. (Andrew, "Additive Manufacturing (AM) and WMD Proliferation," SpringerLink, 9-28-2019, https://link.springer.com/chapter/10.1007/978-3-030-28342-1\_4#Sec10, Accessed 7-18-2022, LASA-SC)

Monitoring the progress in conjunction with other technologies, primarily genetic engineering and nanotechnology, is also important for the future. Genetic engineering could manipulate organisms to have traits lending to increased survivability. Cultivation would then be the primary hurdle to biological weapons acquisition. Nanotechnology, on the other hand, has potential to improve material properties that are insufficient for full AM-WMD production today. Nonetheless, additive manufacturing technology alone remains inadequate to translate directly to a WMD capability in the short term. Advances in its time, cost, and material properties as well as complementary technologies could attract proliferators to implement in some capacity in the longer term.

#### It's definitely NOT credible

Kelley 17 – Robert Kelley (USA) is a licensed nuclear engineer in California. Early in his career, he managed nuclear weapon-related plutonium metallurgy research at the Lawrence Livermore National Laboratory; he also managed its gas centrifuge programme. (Robert, “IS THREE-DIMENSIONAL (3D) PRINTING A NUCLEAR PROLIFERATION TOOL?” EU Non-Proliferation Consortium, February 2017, <https://www.sipri.org/sites/default/files/EUNPC_no_54.pdf>, Accessed 7-18-2022, LASA-SC)

The current paper examines the possibilities of either a state or non-state actor using 3D printing in nuclear proliferation. The main conclusion is that it may have a role in producing miscellaneous supporting parts in nuclear industrial systems, but the idea of 3D printing a complete nuclear weapon is not credible in any way. There are several places, however, where 3D printing could provide an alternative way to build nuclear weapon components and these are described below. The possibility of producing components for specialized machines such as gas centrifuges is certainly possible, but at best it is an alternative way of producing non-critical components and not an enabling technology that bypasses normal export controls. Printing of important components in the uranium production process is a possible enabling capability.

#### Nuclear materials are impossible to print – anyone who tries IMMEDIATELY gets cancer

Kelley 17 – Robert Kelley (USA) is a licensed nuclear engineer in California. Early in his career, he managed nuclear weapon-related plutonium metallurgy research at the Lawrence Livermore National Laboratory; he also managed its gas centrifuge programme. (Robert, “IS THREE-DIMENSIONAL (3D) PRINTING A NUCLEAR PROLIFERATION TOOL?” EU Non-Proliferation Consortium, February 2017, <https://www.sipri.org/sites/default/files/EUNPC_no_54.pdf>, Accessed 7-18-2022, LASA-SC)

It is beyond any possibility that a nuclear core containing plutonium, a tamper such as beryllium and high explosives could be printed as one operation. Yet it is conceivable, if very difficult to believe, that a plutonium (or uranium) metal shell or sphere could be printed. There are a number of difficulties to overcome. Plutonium is highly radiotoxic and only someone with a death wish would handle it carelessly. A milligram in the lungs would eventually cause cancer and larger doses could bring on immediate symptoms. Plutonium is also highly pyrophoric. Large pieces of metal do not readily burn, but chips of plutonium from conventional subtractive machining regularly catch fire in air. However, the fires are normally small and easily contained if the workplace is kept clean and chips kept to a minimum. Plutonium is normally cast in a vacuum because molten plutonium would burn violently in air. Plutonium powders, such as used in 3D printing, are highly pyrophoric. There is a great danger of them igniting in air and producing chemical explosions. Any such printing would have to be done in a high vacuum or very pure argon atmosphere. Industrial experience with, for example, titanium would be good background. Titanium is similar in reactivity in powdered form and has been the source of numerous industrial accidents involving 3D printing.5 Plutonium has an extremely complex and unusual metallurgy; it melts at a fairly low temperature of 640 degrees Celsius (°C). Metallurgists have worked for years to produce adequate alloys to make usable, reliable castings. Gallium is frequently used in alloying plutonium, beginning with the very first nuclear test in 1945.6 It is likely that a great deal of research would also be necessary to achieve the same results in a completely new environment of alloys in 3D printing. Modern nuclear weapons do not normally use cast plutonium directly. Castings are often rolled and hydroformed to strengthen them, then they are machined by traditional turning and milling processes. This results in strong, well-characterized, stable components with a long history and with technology vetted through nuclear testing. 3D-printed plutonium would have properties similar to a cast material, but would produce new challenges for designers of militarily reliable weapons. For example, 3D printing does not produce extremely smooth surfaces, whereas modern weapons require extremely tight tolerance and smoothness, particularly on internal surfaces. It is possible that a 3D-printed plutonium part might require a simple machining of the inside surface to meet the weapon quality standards for a state programme. A non-state actor would have far less concern about military reliability and accurate prediction of performance. A proliferation nuclear weapon is more a violent political statement than a destructive military weapon. In that case, crude components are adequate without the huge investment required to develop 3D printing of plutonium. One exception to this assertion is covered below.

#### Tech is not there yet

Kelley 17 – Robert Kelley (USA) is a licensed nuclear engineer in California. Early in his career, he managed nuclear weapon-related plutonium metallurgy research at the Lawrence Livermore National Laboratory; he also managed its gas centrifuge programme. (Robert, “IS THREE-DIMENSIONAL (3D) PRINTING A NUCLEAR PROLIFERATION TOOL?” EU Non-Proliferation Consortium, February 2017, <https://www.sipri.org/sites/default/files/EUNPC_no_54.pdf>, Accessed 7-18-2022, LASA-SC)

3D printing is an exciting new technology. It has become an option of serious choice in the manufacturing industries, first in plastics and now in metals. 3D printing is known to be a dangerous capability for manufacturing items such as small arms. It makes precision manufacture of parts possible for lawbreakers. It can also produce items such as guns made of hard plastics that could evade a metal detector. This has led to some serious questions that can be applied to non-state actors or to state programmes: Can 3D printing be a path to nuclear weapon production? Can someone print an entire nuclear bomb? Can they print a whole gas centrifuge? The conclusion of this paper is that the technology is not yet ready to do any of those things. Printing a highly dangerous material such as plutonium is a serious challenge. Printing plutonium and high explosives in one operation is beyond any technology available today and likely to be unobtainable for decades, if ever.

#### Their ev is hype – assume capabilities not yet achieved

Conant 19 – Georgia Institute of Technology. (Andrew, "Additive Manufacturing (AM) and WMD Proliferation," SpringerLink, 9-28-2019, https://link.springer.com/chapter/10.1007/978-3-030-28342-1\_4#Sec10, Accessed 7-18-2022, LASA-SC)

Little exploration of this technology and its impact on WMD and counter-WMD has been performed. A prominent work detailing the threat of additive manufacturing to the spread of nuclear weapons specifically is an article by Kroenig and Volpe in the October 2015 issue of The Washington Quarterly [19]. The authors argue that 3D printing enables WMD-proliferation because it requires little technical knowledge and potential facilities that could produce WMD-sensitive parts can be widespread and impossible to detect. Although there are logical conclusions, he simplifies the technology without further examining it and how it would be realistically implemented by a WMD-seeking actor along with the international regimes that could re-analyze proliferation threats with respect to AM technology. They simply assume that rogue states or non-state actors will covertly pursue the technology. The authors do not answer the question of how, i.e., what would a covert AM-driven nuclear WMD program look like?

Another gap in the existing literature is more speculative and draws on comparison to successfully disruptive technologies such as the Internet and personal computers [23]. In both instances, technologies gave informational and entrepreneurial power to the individual. Experts have created analogies between these technologies and additive manufacturing, but they fail to dive past the surface level. They believe that the individual nature of a these technologies warranted its success, and therefore additive manufacturing will follow a similar trajectory to that of personal computers. They assume advancements in AM are inevitable and exponential, hence disruptive over a short period. Many articles cite the attention and investment AM has received over recent years, with AM innovation centers surfacing in the United States, Europe, and Asia, as the main indicator of its potential [24]. Some scholars, however, have projected that AM rests at the top of its hype curve and that it requires great technological and institutional demands to overtake traditional manufacturing methods [25]. Some assessments state that “the ability to produce weapons outside traditional fabrication channels also carries additional challenges” yet fail to dig deep into the feasibility and investment necessary to actualize that path [26].

Other sources have focused on the application of additive manufacturing in the military industrial complex [1] and the spread of 3D-printed traditional munitions [27]. The former does have implications in the speed of the military to actualize a product, while the latter does pose real international security concerns. Both struggle to connect these changes to their potential impacts on weapons of mass destruction. The former article states that there are “catastrophic consequences [with] the prospect of additive manufacturing technologies being applied to produce weapons of mass destruction.” Generalizations are made about how quantities are lower for successful production and the facilities are easier to hide. There lacks an understanding of the detailed implementation should a state or actor pursue a WMD through these means and which technologies are most sensitive should an actor pursue an AM capability. What facilities should military forces seek and target? How can the international community limit these capabilities through export control? What are indicators of proliferation through this technology?

Current research fails to adequately acknowledge or discredit the role of additive manufacturing as it relates to WMD acquisition by rogue states and non-state actors. Although concessions exist that the technology is not up to par to be viewed as immediately threatening, scholars tend to shortcut to the end point where AM is the ideal disruptive technology due to ideal characteristics that it has yet to currently achieve. A technical breakdown of the technologies is necessary to examine the practical use of the technology to analyze the true threat to US national security interests.

#### It like, won’t happen bro

Conant 19 – Georgia Institute of Technology. (Andrew, "Additive Manufacturing (AM) and WMD Proliferation," SpringerLink, 9-28-2019, https://link.springer.com/chapter/10.1007/978-3-030-28342-1\_4#Sec10, Accessed 7-18-2022, LASA-SC)

Non-state actors (NSAs) would have the most to gain from the acquisition of a delivery system. This method has proven effective for obtaining weapons and supplemental systems; ISIS has acquired hundreds of millions of dollars-worth of weapons-related supplies seized from the Iraqi government and Syrian rebels [49]. NSAs have successfully taken control of weapons, and this fact should be applied to the potential of theft of a more advanced weapon system. The acquisition of a weapons system in this manner is independent from additive manufacturing, i.e., AM poses little or no additional threat to weapons proliferation.

Cruise missiles and ballistic missiles are two unmanned vehicles for transporting a WMD. Current efforts to stem the trade of cruise and ballistic missiles include the Missile Technology Control Regime (MTCR). This agreement, consisting of 35 of the world’s most developed nations, limits the sale of long-range cruise and ballistic missiles (longer than approximately 300 km). Shorter-range missiles are easily available. A non-state actor would therefore want to print a longer-range missile to potentially reach a neighbor or regional target. The main security threat would be to allied countries of the United States. Could a non-state actor 3D print a missile?

First, acquiring the 3D printer capable of missile component production would be difficulty. It can be assumed that a missile needs to be manufactured out of high-strength, versatile metals. Even the most advanced equipment has trouble creating these ideal metals. At Lawrence Livermore National Laboratory (LLNL), for example, scientists are running into issues with 3D printing of metals using laser powder bed fusion, currently “the dominant method for producing 3D printed metal structures.” [50]. The powder bed fusion makes use of laser sintering and beam melting, which remain advanced processes that would be difficult to transfer to less-advanced facilities or poorly equipped actors. Porosity remains an issue for these researchers as they are still trying to understand the science of metal vapor in the process. The scale of their implementation is small, at the millimeter level. Making a full missile solely from AM would be almost an insurmountable technical challenge with today’s technology. In addition to problems of timeliness and scale, methods such as power bed fusion leaves objects lacking structural strength and utilize a high power to render a small object [51].

The only institutions capable this far of producing some objects for advanced technological systems are the large American corporations. As mentioned earlier, Raytheon 3D printed a missile, but printing spare parts for the satellites is still on the horizon. SpaceX has recently 3D printed a full SuperDraco rocket engine through laser sintering. However, the material used was a superalloy of Inconel, which is several times more expensive than stainless steel. Obtaining access for strong materials is necessary for a well-designed weapon. But one could claim that a non-state actor only needs a crude weapon to successfully set off a WMD. It will still need to invest in an additive manufacturing system to meet that goal. Conservative estimates of an AM machine cost are around $500,000 [52]. This cost would increase for a potential proliferator given lack of sufficient technical expertise and economic infrastructure to produce necessary components. The Office of Technology Assessment report states that rudimentary weapons systems can be bought for about $1 million in 1993 (over $1.5 million in 2016), and this figure could be even cheaper on the black market. With the current state of the technology, it would be more advantageous to purchase a more reliable and known technology. The OTA report states that “expertise is a main ingredient in developing long-range missiles.” Because additive manufacturing is a technology in its early stages of widespread deployment, it is unlikely that a proliferator will want to pursue two challenging technologies of which they lack expertise if a cheaper alternative to the same or superior (to what they could produce) technology is available. That increases the uncertainty of success as well as the time to acquire the technology. Some ballistic missiles even use solid fuel, but it is not likely that a proliferator would attempt to make fuel with a 3D printer (even if the materials were available) because solid fuel adds more technical and practical knowledge to understand how to manage it. Liquid fuel is almost always preferred, and 3D printing has no practical advantage with liquids.

The advantage that missiles have to a non-state actor acquiring a nuclear weapon is that only one may be necessary for success of the actor’s mission. Terrorism may be perceived as a victory even if only one city is targeted and successfully damaged. Due to this fact, 3D printing may have a slight edge over traditional manufacturing methods because it is preferable when the objects are in small quantities, e.g., it may be more economical to 3D print only a handful of objects rather than invest in a factory, equipment, and labor to produce just as many objects. As with the up-front investment cost of a factory, 3D printing is not immune to that problem. It can be true that 3D printing is currently more economical for smaller batches of items, but the machine cost is a significant proportion of total cost. The National Institute of Standards and Technology (NIST) review20 approximates the fraction of cost for the additive manufacturing machine itself is two-thirds or more. For metal 3D printers that could theoretically print missiles, the material costs are also high, as expected for engineered metal powders. That fraction is a large investment for an actor to pursue, especially for a non-industrialized country or NSA lacking experience with the technology.

Aircrafts are another delivery system that could theoretically be used to deliver a nuclear weapon. The tactical advantage they have over missiles is that they are commonly accepted around the world as a means for self-defense; they also have numerous commercial applications. It is difficult to ascertain whether aircrafts are an offensive or defensive weapon or for commercial or military purposes. No universal regulations exist that hinder the purchase of aircraft as with the MTCR for missile trade. They are also generally cheaper to produce and have higher survivability as it is a manned vehicle. 3D printing technology is not up to par with manned aerial vehicles. Earlier this year, Airbus announced the first ever 3D-printed aircraft [53]. It is not made out of metal and operates as an autonomous drone. Because of its light weight, a similar vehicle would not be able to hold a nuclear weapon that weighs at least several hundred kilograms. They might be more effective in dispersing chemical or biological weapons but attaining the aircraft itself would be a larger barrier to overcome in addition to the associated technical challenges.

Dispersing a chemical or biological weapon could use some of the same delivery systems as nuclear weapons. Iran reported that Iraq used a variety of systems to deliver its chemical weapons, including airplanes, artillery shells, and rockets [54]. Older US systems developed before and after WWII, such as cluster bombs and mines, have relatively simple geometries that could be made with AM. Household printers might possess such a capability in the near- to long- term. However, it may be easier for a proliferator to purchase or illicitly obtain a simple device from a country already possessing the demonstrated technology. A non-state actor may be more willing to manufacture it themselves to conceal any trail of evidence.

If some delivery systems could be fabricated with AM, the challenge of tracing back the material to the perpetrator. No 3D printer feed material is strictly regulated by export controls, although some high-grade metals reserved for the most advanced printers are prohibited under agreements like the Nuclear Suppliers Group. The growth of the AM industry and improvements in materials may render it difficult to ascertain a proliferator past the private company. Intended use is not a factor in accepting customers in the 3D printing market.

A non-comprehensive list of delivery systems that could be used to deliver or support CBRN weapons is shown in Table 3. Missiles and rockets, as well as other objects that serve as the host body for the weapons material, remain the most sensitive technologies in the near- and far-term. Electronics and explosives, which serve as necessary supplemental systems to many delivery systems, pose little risk when it comes to AM. Rudimentary electronics can be made or purchased with relative ease, and the expertise is widespread. Little publicly available literature exists on 3D-printed explosives, which would be essential for most nuclear and radiological weapons, including improvised nuclear and radiological dispersal devices. An aerial spray tank seems only applicable to chemical and biological weapons, and corrosiveness of these materials hinders its potential use.

## AT 5G Bad

### 2AC – Warming

#### 5G solves climate change

Nutanix 22 – Nutanix, Inc. is an American cloud computing company that sells software, cloud services, and software-defined storage. ("THE IMPACT OF 5G IN CLIMATE CHANGE," CXO Focus, March 2022, https://www.nutanix.com/content/dam/nutanix-cxo/pdf/the-impact-of-5g-in-climate-change.pdf, Accessed 7-18-2022, LASA-SC)

“This study confirms that U.S. 5G wireless networks will be instrumental in tackling the pressing challenge of climate change,” said Meredith Attwell Baker, CTIA President, and CEO, who commissioned the study. 5G implementations combined can contribute 20% to helping the U.S. meet carbon emission reduction goals by 2025, the report states.

Smart cities, optimized buildings, streamlined transport networks, and increased efficiency of inventory stocks and manufacturing are all becoming viable to CXOs that adopt 5G. Accenture states that 86.5 million metric tons of carbon dioxide can be removed from the U.S. economy alone by reducing vehicle traffic, optimizing routes and shifting transport away from private vehicles.

The industry advocacy group UK5G has provided working examples of 5G improving public transport. A tram service in the Midlands area of England uses 5G-enabled closed circuit television (CCTV) to improve the maintenance of its services.

In the past, tram maintenance occurred at the end of the working day, creating delays and leading to worsening maintenance issues. Now 5G updates of tram conditions are placed into the maintenance system as soon as they are identified.

UK5G says that confidence in public transport has suffered since the pandemic and poorly maintained trams exacerbated the problem. However, 5G ensures that the trams are always in good condition, making travelers feel more confident about the using the service instead of driving. European neighbors Alba lulia in Romania and the BART system in San Francisco have similar 5G deployments.

Public roadways are also expected to leverage 5G. Francesco del Greco, CIO for the Italian highway operator Autostrade, is introducing innovations that will provide connectivity for motorists on the go.

“Based on the route you take, and if you get stuck in traffic, you may not want to pay as much,” he said of dynamic road toll payments. “We are moving from a fixed price to a flexible price. In September 2021, we started offering cashback via our app, which correlates the average time, roadwork information, and toll usage. This lets us determine if you should be credited for time lost.”

In U.S. manufacturing, 67.4 million metric tons of carbon dioxide can be eliminated through inventory management improvements, real-time asset management, predictive maintenance, reductions in travel, and better processes. These improvements are equivalent to cutting the carbon dioxide emissions of 17 coal-fired power stations in a year.

Real-time monitoring of the built environment, alongside increased use of sustainable energy sources, has the potential to reduce carbon emissions by 67.9 million metric tons, the Accenture report finds. 5G enabled smart meters, energy management systems, and energy grids will enable this reduction.

#### It’s reverse causal – 5G is necessary and sufficient to prevent the existential effects of warming

Shah 21 – researcher at the National University of Singapore. (Kwok Wei Shah, “Potential Applications of 5G Network Technology for Climate Change Control: A Scoping Review of Singapore,” Sustainability, 2021, https://doi.org/10.3390/ su13179720, Accessed 7-18-2022, LASA-SC)

Currently, the entire planet is at risk due to continual climate change [1-3]. The recorded increase in average temperature across the world in the past hundred years, and the associated changes attributed to this, are known as global warming. Many scientists are convinced by the published evidence that this change is anthropogenic and resulted from the elevated emission levels of global greenhouse gases (GHGs) [4,5]. Gases such as water vapor, carbon dioxide, methane, nitrous oxide, and ozone are responsible for the absorption and emission of thermal radiation. These changes in the relative quantities of the GHGs induce a proportional change in the amount of preserved solar energy. Presently, the accepted indicator for global warming is the sustained rise in the mean temperature worldwide. This definition is designed to account for the fact that there may be some localized exceptions to this rise. For example, there may be cooling experienced in a region while the global temperature may increase altogether, hence the need for average temperature. A key concern with the GHGs trapping of more heat in the atmosphere is that it affects both climate and short scale weather patterns. Consequently, it results in greater numbers of adverse weather events such as storms, heat waves, cold snaps, droughts, and fires [6]. Climate-related risks to health, livelihoods, food security, water supply, human safety, and economic growth are projected to increase with global warming of 1.5 ° C [7] and further increase further at 2 °C, as shown in Figure 1. In addition, the risks to global aggregated economic growth due to the climate change impacts are projected to be lower at 1.5 °C than at 2 °C by the end of this century.

Carbon dioxide has the most substantial effect on global warming [8]. Although it was once assumed to have an ~100 year lifespan in the atmosphere, careful studies revealed that the situation is far worse, with three-quarters of the gas expected to remain for a time in the region of up to ~1000 years, with the remainder lasting for an indefinite period of time [9]. It was indicated that the present impacts of humanity on the atmosphere can certainly cause a long term problem [10]. Carbon dioxide is released when oil, coal, and other fossil fuels are burnt for the energy we use to power our homes, cars, and smartphones. By lessening its usage, we can curb our own contribution to climate change while saving money. The first challenge is eliminating the burning of coal, oil, and, eventually, natural gas. Oil is the lubricant of the global economy as it is hidden inside such ubiquitous items as plastic and corn, fundamental to the transportation of both consumers and goods. Coal is the substrate, supplying roughly half of the electricity worldwide, a percentage that is likely to grow according to the International Energy Agency (IEA). In fact, buildings contribute up to 43% of all the greenhouse gas emissions worldwide [11], even though investing in thicker insulation and other cost-effective as well as temperature-regulating strategies can save money in the long run. Investment in new infrastructures, or radical upgradation of the existing highways and transmission lines, may help to reduce greenhouse gas emissions, yielding economic growth in the developing countries.

Nations across the globe have kept very high targets to reducing their GHG discharges [12,13]. In order to meet these goals, considerable reductions in city energy usage is required. At a global scale, urban communities represent over half (55%) oO the population, which fs predicted to reach 68% by the middle of this century [14], Urban areas claim ownership of the highest levels of energy use, gas emission, and also the largest local economy. As such, it is crucial for urban areas to reduce their consumption and utilize renewable sources wherever available to reduce their gas discharge levels. Smart cities often utilize digital sensors to measure and transmit date about the levels of GHCGs in the city at that moment, as a means of tackling them [15]. The efficacy of such a system is thus reliant on the network used to collate and analyze the data collected as an extant network. The mobile telecommunications networks offer a convenient solution to this desire, as their pre-existence has the clear benefit of reducing costs compared to the design and implementation of a novel system, it is recognized that smart cities will certainly act as the key players meeting these ambitious targets [16,17]. In this study, we focused primarily on the potential applications of 5G network technology to control climate change in Singapore. In addition a clear overview of the sustainability benefits of introducing 5G technology compatible smart cities, buildings, and farms in all aspects of urbanization is provided. Herein. the main purpose is to tackle the negative outcomes associated with anthropogenic climate change, wish a particular focus on the contributions that are best made by the telecoms network operators.

Climate change is one of the most challenging problems that humanity has ever faced. Presently, hundreds of millions of lives, innumerable species, entire ecosystems, health, economy, and the future habitability of this planet are at risk. Fortunately, climate change is solvable, we just need to wisely exploit the existing technologies and sciences. Climate change mitigation is a pressing international need in which many management actions are required. The development of 5G technology has been largely driven by smart mobile devices and advanced communication technologies. It may thus serve as a technical enabler for a whole new range of business opportunities, energy, and facilities management, together with industrial applications. Moreover, it may enable different devices to work together seamlessly. Definitely, the 5G cellular network technology is expected to revolutionize the global industries with profound effects on the savings of energy, waste generation and recycling, and water resources management, thus reducing the climate change impacts.

#### Smart cities are reliant upon 5G connectivity

Shah 21 – researcher at the National University of Singapore. (Kwok Wei Shah, “Potential Applications of 5G Network Technology for Climate Change Control: A Scoping Review of Singapore,” Sustainability, 2021, https://doi.org/10.3390/ su13179720, Accessed 7-18-2022, LASA-SC)

The creation of smart cities strongly depends on the increased use of 5G networks, with the cities around the globe racing to improve all aspects of their governed realms through the social, monetary, and environmental gains offered by this technology. Furthermore, 5G network offers the basis for the next generation of technology to be built upon. The reasons why 5G is appropriate for the smart solutions to city management are primarily due to its enormous computing capacity and extent of connectivity. The use of new technology can tie highly effective to improve energy, waste, water resource, traffic flow, and parking management. The end result is that a house, farm, factory, building, and city can be more efficient, termed as smart management. Overall, it may greatly reduce carbon dioxide emissions and climate change problems.

#### Smart cities solve waste management

Shah 21 – researcher at the National University of Singapore. (Kwok Wei Shah, “Potential Applications of 5G Network Technology for Climate Change Control: A Scoping Review of Singapore,” Sustainability, 2021, https://doi.org/10.3390/ su13179720, Accessed 7-18-2022, LASA-SC)

Waste management options such as landfill, composting, incineration/mass burns, and anaerobic digestion/biogas plants collectively emit a substantial amount of GHGs. Composting makes use of micro-organisms to oxidize the biodegradable wastes (especially food and garden waste) to CO2 and water vapor using oxygen in the air as the oxidizing agent. Anaerobic decomposition converts biodegradable carbon to biogas that consists of about 65% of CH4 and 34% of CO2 with traces of other gases [52]. In landfills, the microbes gradually decompose the organic matter over time, producing roughly 50% of CH4 and 50% of CO2 as well as trace amounts of other gaseous compounds [52]. Methane emission from landfills represents the largest source of GHG in the waste sector, contributing around 700 million tons (Mt) of CO2-e in 2009, followed by incineration, estimated to contribute around 40 Mt of CO2-e [53].

Lately, smart cities are providing dynamic control of their waste streams [54]. Companies are now better equipped with appropriate software that enables monitoring the excretions. This has dual benefits such as the reduction of costs and the perceived load on the local ecosystems. Both individuals and businesses refuse management has received multiple high-tech updates such as self-sorting and collection tools. OnePlus systems are the recognized toolbox for smart waste monitoring. An example of this is the OnePlus Metro, which is a sensor capable of providing real-time analysis of the free capacity currently available within on-site storage bins. Combining this with the WasteForce platform provides facile opportunities to monitor this capacity remotely. In addition, it performs in-depth data assessment and evaluation as a means of dynamic business management. The end result is that the business is less likely to face financial penalties through the failure of waste disposal in a timely manner. At a wider scale, the data can be collated by refuse collectors as a means of ensuring the efficiency of their service can be maximized or through installation of remote image sensors in their refuse storage bins that allow for personally monitoring the charges in real time. As an additional benefit, the inclusion of location tracker sensors using Global Positioning System (GPS) technology offers the chance to streamline the delivery and collection process on the fly. Further data are provided by in-line tilt monitors that offer a proxy for marking off when a bin has been emptied. These features of the smart system work together to ensure that drivers on the ground can better manage their agenda, minimize the time of travel and distances, and adjust the schedules in response to sudden changes immediately after receiving the automated text instruction. It is clear that the implementation of such systems can go beyond immediate reduction of waste generation and increased recycling, indicating the existence of knock-on effects such as tackling climate change.

#### Plastic pollution from poor waste management is increasing rapidly – it’ll crash ocean biodiversity, causing extinction

Landrigan et al. 20, Philip J. Landrigan, MD, MSc, the corresponding author, is a professor at Boston College, with many co-authors, “Human Health and Ocean Pollution,” Annals of Global Health, vol. 86, no. 1, 2020, PubMed Central, doi:10.5334/aogh.2831

The oceans are vast. They cover more than 70% of the earth’s surface, hold 97% of the world’s water, host some of the planet’s most diverse ecosystems, and support economies in countries around the world [1,2]. Microscopic organisms in the seas are a major source of atmospheric oxygen [3,4,5,6]. By absorbing more than 90% of the excess heat released into the earth’s environment and nearly one-third of carbon dioxide emissions, the oceans slow planetary warming and stabilize the global climate [7].

The oceans are essential to human health and well-being [8,9,10,11,12,13]. They provide food to billions, livelihoods for millions and are the source of multiple essential medicines [14]. They have traditional cultural value and are a source of joy, beauty, peace, and recreation [15,16]. The oceans are particularly important to the health and well-being of people in small island nations [17], the high Arctic, and coastal communities, especially those in the Global South [1]. The very survival of these vulnerable populations depends on the health of the seas [10,12].

Despite their vast size, the oceans are under threat, and human activity is the main source of the threat [1,2]. Climate change and other environmental disruptions of human origin have caused sea surface temperatures to rise, glaciers to melt, and harmful algal species and pathogenic bacteria to migrate into waters that were previously uncontaminated. Rising seas and increasingly violent coastal storms endanger the 600 million people worldwide who live within 10 m of sea level [1]. Rising concentrations of atmospheric CO2 have caused acidification of the oceans, which in turn destroys coral reefs, impairs development of oysters and other shellfish, and dissolves calcium-containing microorganisms at the base of the food web [1,18,19]. The oceans are losing oxygen [1]. Fish stocks are declining [20,21,22]. Dredging, mechanized trawling, oil exploration, and planned deep undersea metal mining threaten the seabeds [23].

Pollution – unwanted, often hazardous waste material released into the environment by human activity – is one of the existential challenges of the present age [24]. Like climate change, biodiversity loss, and depletion of the world’s fresh water supply, pollution endangers the stability of the earth’s support systems and threatens the continuing survival of human societies [8].

Pollution is also a great and growing threat to human health. It is the largest environmental cause of disease in the world today, responsible for an estimated 9 million premature deaths per year [24]. It causes enormous economic losses, undermines national trajectories of economic development, and impedes attainment of the Sustainable Development Goals (SDGs) [22].

Pollution has until recently been overlooked in international development planning and largely neglected in the global health agenda [25]. For too long, pollution has been regarded as the unavoidable price of economic progress [25], a view that arose out of the experience of the 19th and 20th centuries when combustion of fossil fuels – coal in particular – was the engine of economic growth and pollution was seen as unavoidable. Today, however, the claim that pollution is inevitable and that pollution control costs jobs and stifles economies is no longer tenable. It has been disproven by the experience of the many countries that have more than doubled their GDPs in the past half century while greatly reducing pollution [24,25,26]. It has become irrelevant with the increasing availability of low-cost, renewable sources of energy and advances in green chemistry.

Ocean pollution is a critically important but underrecognized component of global pollution [26,27]. It has multiple direct and indirect impacts on human health [28,29,30,31,32,33,34,35]. The nature and magnitude of these effects are only beginning to be understood.

The purpose of this review is to examine the impacts of ocean pollution on human health and well-being, identify gaps in knowledge, project future trends, and offer scientifically based guidance for effective interventions. Information presented in this review will guide attainment of the Sustainable Development Goals (SDGs), in particular, SDG 14, which calls for prevention and significant reduction of all marine pollution, and SDG 3, which calls for improvement of human health and well-being.

The ultimate aim of this report is to increase awareness of ocean pollution among policy makers, elected leaders, civil society and the public and to catalyze global action to monitor, control, and prevent pollution of the seas.

By focusing our analysis on human impacts, we underscore the fact that pollution of the oceans poses a clear and present danger to human health. It is causing disease, disability, and premature death in countries around the world today.

On the positive side, pollution of the oceans is not inevitable. It is a problem of human origin, and the successes in pollution control that have been achieved in many countries show that it can be controlled and prevented.

World leaders who recognize the great magnitude of ocean pollution, acknowledge its grave dangers to human health, engage civil society and the global public, and take bold, evidence-based action will be key to stop ocean pollution at its source and safeguarding human health.

This report consists of a series of topic-focused reviews that critically examine current knowledge of each ocean pollutant – its sources, magnitude, geographic extent, populations at greatest risk, and its known and potential effects on human health. We examine the strength of the evidence linking pollutants to health effects [29].

To the extent possible, we consider health effects not only of individual pollutants, but also of the complex mixtures of chemical pollutants and biological contaminants found in the seas today. We examine interactions and synergies among pollution, climate change and ocean acidification. Because the effects of pollution are disproportionately concentrated in low-income countries in the Global South, small island nations, and indigenous populations in the far north [12], we specifically examine ocean pollution’s impacts on these vulnerable populations. Finally, we consider the prospects for prevention and control of ocean pollution and present case studies of success in pollution control.

The Current State of Ocean Pollution

Pollution of the oceans is widespread, it is worsening, and its geographic extent is expanding [26,27,30]. Ocean pollution is a complex and ever-changing mixture of chemicals and biological materials that includes plastic waste, petroleum-based pollutants, toxic metals, manufactured chemicals, pharmaceuticals, pesticides, and a noxious stew of nitrogen, phosphorus, fertilizer, and sewage (Figure ​(Figure11).

[[FIGURE 1 OMITTED]]

Some ocean pollutants are “legacy” pollutants, materials deposited in the seas decades ago, while others are new. The relative concentrations of pollutants vary in different regions of the oceans and at different seasons of the year. Plastic pollution is the most visible component of ocean pollution. It is growing rapidly, but it is only the obvious tip of a much larger problem.

Land-based sources account for approximately 80% of ocean pollution, while discharges from marine shipping, offshore industrial operations, and waste disposal at sea account for the remaining 20% [26]. Pollution is most severe along coastlines and in bays, harbors, and estuaries where wastewater discharges, industrial releases, agricultural runoff, and riverine pollution cause massive in-shore contamination. Some of the world’s worst ocean pollution is seen along the coasts of rapidly developing countries in the Global South [26].

The European Environment Agency (EEA) reports that pollution by toxic metals, industrial chemicals and plastic wastes is at problem levels in 96% of the Baltic Sea, in 91% of the Black Sea, in 87% of the Mediterranean Sea, and in 75% of the North-East Atlantic Ocean [27]. Pollution by plastic waste has become a global threat [31].

The drivers of ocean pollution are rapid industrialization; continuing increases in the manufacture and release into the environment of chemicals and plastics; expansion of chemically intensive agriculture; massive releases of liquid and solid waste into rivers, harbors, and estuaries; and insufficient re-use and recycling of feedstock materials [16,32]. Specific sources of ocean pollution are:

Coal combustion and gold-mining are the two main sources of marine mercury pollution [33].

Exponential growth in chemical production coupled with inadequate controls on chemical releases are the main drivers of pollution of the oceans by manufactured chemicals [34].

Marine pollution by plastic waste reflects massive global growth in plastic production, which now exceeds 420 million tons per year [35].

Uncontrolled economic development and rapid population growth along the world’s coasts has led to pollution of in-shore waters by industrial releases, agricultural runoff and sewage [36,37,38,39]. Many populated coastal areas are now covered by buildings and impervious surfaces, which increases runoff. This runoff as well as discharges of wastewater and storm water, much of it inadequately treated, further increases pollution. The consequences are increasing abundance of pathogenic bacteria, viruses, and parasites [40], eutrophication, and increased frequency and severity of harmful algal blooms (HABs) – “red tides”, “brown tides”, and “green tides” – some of which produce potent disease-causing toxins.

Despite the great magnitude of ocean pollution and growing recognition of its effects on human and ecosystem health, great gaps remain in knowledge about pollution sources, levels of pollution in many areas of the seas, the sizes of high-risk populations, the extent of human exposure, and the magnitude of health effects. Because of these gaps, the impacts of ocean pollution on human health and well-being are underestimated, and it is not yet possible to fully quantify the contribution of ocean pollution to the global burden of disease [41].

Climate Change, Global Warming, Ocean Acidification, and Pollution

Since the 1970s, the oceans have warmed steadily in concert with global climate change [42]. They have taken up more than 90% of the excess heat released into the climate system [1]. Mean sea surface temperature is rising by 0.13°C per decade [43]. The frequency of marine heatwaves has more than doubled [1].

Further impacts of climate change on the oceans are increases in the intensity and frequency of extreme weather events such as heat waves, heavy rainstorms, and major hurricanes, and changes in large-scale planetary phenomena such as El Niño events [44] and the Indian Ocean Dipole [1,45,46].

Ocean acidification is another consequence of climate change. The oceans absorb nearly one-third of the carbon dioxide (CO2) emitted into the atmosphere, and the amount of CO2 absorbed by the seas has increased in recent decades as CO2 emissions of human origin have increased. Ocean acidification is the result [7]. Since the late 1980s, the surface pH of the open ocean has declined by about 0.1 pH units relative to preindustrial time (i.e., a 26% increase in acidity [hydrogen ion concentration]), and the rate of increase is 0.017–0.027 pH units per decade [1].

Ocean acidification threatens the integrity of coral reefs. It impairs the development of oysters and other commercially important shellfish, thus impacting commercial fisheries. It endangers the survival of calcium-containing microorganisms at the base of the marine food web [1,47]. Ocean acidification may also increase the toxicity of certain heavy metals and organic pollutants [1,48].

Global warming liberates legacy pollutants from ice and permafrost, alters the geographic distribution of chemical pollutants in the oceans, and increases exposures of previously unexposed populations. All of these effects have potential to magnify the ocean pollution’s impacts on human health [49].

Rising sea surface temperatures and increasing ocean pollution result in greater abundance and expanded geographic ranges of naturally occurring marine pathogens, such as Vibrio species, among them Vibrio cholerae, the causative agent of cholera [50,51] (Figure ​(Figure2).2). The likely consequences will be increases in the frequency of Vibrio-associated illnesses and spread of these infections to new, previously unaffected areas. Risk is especially high in low-income countries where coastal development is intense and sanitation systems are dysfunctional due to civil unrest, conflict, sea level rise, coastal over-development, and natural disasters [52].

[[FIGURE 2 OMITTED]]

In a similar manner, climate change, sea surface warming, and ocean pollution appear to be increasing the frequency, severity, and global geographic extent of harmful algal blooms (HABs) [53,54]. Some dangerous algal species are moving poleward in response to the warming of coastal waters [54,55], changes in ocean stratification, alteration of currents, changes in nutrient upwelling, and changes in land runoff and micronutrient availability [56,57]. The likely consequences will be the occurrence of HABs in previously unaffected areas and exposures of previously unexposed populations in the circumpolar regions to HAB toxins.

Impacts of Ocean Pollution on Human Health

Chemical Pollutants

Toxic Metal Pollutants

Releases of toxic metals to the environment began millennia ago with the inception of mining and smelting. These releases have increased since the beginning of the Industrial Revolution and risen especially in the past two centuries [58,59,60].

Mercury is the metal pollutant in the oceans of greatest concern for human health [34]. Over the past 500 years, human activities have increased total environmental mercury loading by about 450% above natural background. About 70% of the mercury circulating in the environment today consists of mercury emitted from human sources in the past, termed legacy mercury [61] (Figure ​(Figure3).3). The presence of large quantities of legacy mercury in the global environment and the potential for climate change to remobilize this mercury complicate projections of future exposures and health impacts.

[[FIGURE 3 OMITTED]]

Current Sources of Mercury Pollution

An estimated 2,220 tons of mercury are currently emitted to the environment each year as the direct result of human activity. These emissions account for about 30% of current mercury emissions. Another 60% of current mercury emissions result from environmental recycling of anthropogenic mercury previously deposited in soils and water. The remaining 10% comes from natural sources such as volcanoes.

Combustion of coal and artisanal/small-scale gold-mining (ASGM) are the two principal human sources of current mercury emissions. All coal contains mercury and when coal is burned, mercury is released into the atmosphere where it can travel for long distances until ultimately it precipitates into rivers, and lakes and the oceans.

In ASGM, mercury is used to form an amalgam to separate gold from rock. The amalgam is heated to boil off the mercury leaving the gold behind. ASGM operations release mercury to the environment through vaporization and through runoff of spilled mercury into waterways [34]. Metal mining and oil and gas exploration can be additional sources of mercury release. In rivers, lakes and the oceans, the metallic, inorganic mercury released to the environment from these sources is converted by marine microorganisms into methylmercury, an organic form of mercury that is a potent neurotoxicant.

The largest fraction of global mercury emissions – about 49% – originate today in East and South-East Asia. Coal combustion and industrial releases are the major sources there. South America accounts for 18% of global mercury emissions and Sub-Saharan Africa for 16%. In both of these regions, ASGM is the major source of mercury releases.

Methylmercury is a persistent pollutant in the marine environment. It bioconcentrates as it moves up the food web, so that top predator species such as tuna, striped bass and bluefish as well as marine mammals can accumulate concentrations of methylmercury in their tissues that are 10 million or more times greater than those in surrounding waters [34].

Mercury levels vary substantially in different regions of the ocean. This variation is seen in a recent survey of methylmercury concentrations in yellowfin tuna, in which levels differed by 26-fold around the world. Highest levels were found in tuna from the North Pacific Ocean (Figure ​(Figure4),4), and these high concentrations reflect mercury releases from coal-fired power plants and steel mills in Asia that are carried northeastward across the Pacific on the prevailing winds [62,63].

[[FIGURE 4 OMITTED]]

Human exposure to methylmercury occurs primarily through consumption of contaminated fish and marine mammals [34,64] Populations in the circumpolar region are heavily exposed to mercury in their diets – principally in the form of methylmercury – as a consequence of their traditional consumption of a diet rich in fish and marine mammals. Most of the mercury to which these populations are exposed originates from sources far away.

Neurobehavioral Toxicity of Methylmercury

The brain is the organ in the human body most vulnerable to methylmercury. This vulnerability is greatest during periods of rapid brain growth – the nine months of pregnancy and the first years of postnatal life [65].

There appears to be no safe level of methylmercury exposure in early human development.

Prospective epidemiological cohort studies undertaken in the Faroe Islands demonstrate that children exposed to methylmercury in utero exhibit decreased motor function, shortened attention span, reduced verbal abilities, diminished memory and reductions in other mental functions. Follow-up of these children to age 22 years indicates that these deficits persist and appear to be permanent [66].

A similar study conducted in Nunavik of child development at age 11 years showed that methylmercury exposure in early life is associated with slowed processing of visual information, decreased IQ, diminished comprehension and perceptual reasoning, impaired memory, shortened attention span, and increased risk of attention deficit/hyperactivity disorder (ADHD) [67,68]. Other prospective studies have also reported neurobehavioral deficits in children with elevated prenatal exposure to methylmercury [69].

Mercury exposure later in childhood and also in adolescence can also cause damage because the human brain continues to develop throughout this time [70]. Genetic factors may increase vulnerability to methylmercury in some individuals [71].

Accelerated Loss of Neurocognitive Function in Adults Exposed to Methylmercury

Recent studies have shown that adult exposures to methylmercury can also have negative effects on brain function [72]. Thus, in a cross-sectional study of 129 men and women living in six villages on the Cuiaba River in Brazil, elevations in hair mercury concentrations were associated with reductions in motor speed, manual dexterity, and concentration [73]. Some aspects of verbal learning and memory were also impaired. The magnitude of these effects increased with increasing concentrations of mercury in hair. The brain functions disrupted in adults by methylmercury – attention span, fine-motor function, and verbal memory – are similar to those previously reported in children with prenatal exposures but appear to occur at substantially higher levels of exposure.

Cardiovascular Effects of Methylmercury Pollution

Elevated concentrations of methylmercury in blood and tissue samples are associated with increased risk for acute coronary events, coronary heart disease, and cardiovascular disease [74]. The US National Research Council concluded in 2000 that methylmercury accumulation in the heart leads to blood pressure alterations and abnormal cardiac function [75].

Subsequent research has strengthened these findings. An expert panel convened by the US Environmental Protection Agency in 2011 concluded that methylmercury is directly linked to acute myocardial infarction and to increases in cardiovascular risk factors such as oxidative stress, atherosclerosis, decreased heart rate variability, and to a certain degree, hypertension [76]. Likewise, a 2017 systematic review found that methylmercury enhances production of free radicals resulting in a long-lasting range of effects on cardiac parasympathetic activity that increase risk for hypertension, myocardial infarction, and death [77]. Further research has confirmed these findings [78,79].

The Contribution of Marine Mercury Pollution to the Global Burden of Disease

Efforts have begun to estimate the contribution of mercury pollution of the oceans to the global burden of disease (GBD). A recent estimate finds that between 317,000 and 637,000 babies are born in the United States each year with losses of cognitive function that are the consequence of prenatal exposures to methylmercury resulting from consumption of mercury-contaminated fish by their mothers during pregnancy. These losses range in magnitude from 0.2 to 5.13 IQ points depending on the severity of exposure. These authors found additionally that population-wide downward shifts in IQ caused by widespread exposure to methylmercury are associated with excess cases of mental retardation (IQ below 70), amounting to 3.2% (range: 0.2–5.4%) of all cases of mental retardation in the United States [80].

Impacts of Ocean Acidification on Metals Toxicity

The alterations of carbonate chemistry in the seas – i.e. decrease in pH, decrease in [CO32–] and increase in [HCO3–]) – that are the consequences of increasing CO2 absorption induce changes in the speciation of metals that alter their solubility and bioavailability and therefore their toxicity [48,81].

For example, by 2100, the projected pH of the oceans will be approximately 7.7, resulting in a 115% increase in the mean free ionic form of copper (Cu2+) in certain estuaries [82]. Consequently, the biotoxicity of copper to invertebrates [83] and to plankton photosynthesis and productivity will be enhanced. At the same time, however, ocean acidification will increase the concentration of dissolved iron, which could partially alleviate the inhibitory effect of copper on photosynthesis [84]. Ocean acidification appears in some instances to mitigate [85] or even reduce [86] the toxicity of mercury. As metals may play a role in the biodegradation of organic pollutants, changes in metal speciation could slow these processes and therefore potentiate the toxicity of some organic pollutants [87].

Prevention of Mercury Pollution

Evidence has shown that two actions will be key to preventing further addition of mercury to the oceans. These are a cessation of coal combustion and reduction of mercury use in artisanal and small-scale gold mining (ASGM). Cessation of coal combustion will not only slow the pace of climate change and reduce particulate air pollution, but will also greatly reduce atmospheric emissions of mercury and thus reduce additional deposition of mercury into the oceans. ASGM is a major source of mercury pollution of the oceans in the Global South. Actions underway under the aegis of the Minamata Convention are seeking to identify and control major sources of mercury pollution from ASGM [34].

Plastic Pollution of the Oceans

Plastic waste represents approximately 80% of all marine litter [88]. An estimated 10 million metric tons of plastics – range of estimate, 4.8 to 12.7 million – are released to the oceans each year [89]. The total amount of plastic waste circulating in the world’s oceans is projected to be 150 million tons by 2025 [89,90]. Marine plastic waste ranges in size from floating barrels, plastic bottles and plastic sheets down to sub-microscopic particles and fibers.

Recent increases in marine plastic pollution reflect massive growth in plastic production (Figure ​(Figure5),5), which now exceeds 420 million tons per year. Much of this plastic goes into consumer products, and over 40% is used in products that are discarded within one year of purchase – often after only a single use [91]. The consequence is massive global accumulation of plastic waste [92].

[[FIGURE 5 OMITTED]]

Plastics are produced by the polymerization of highly reactive and often toxic chemical monomers, 98% of them derived from fossil fuels. They are designed to be stable, durable and resistant to degradation [93]. Because of these properties, discarded plastic that reaches the marine environment can persist for decades and travel long distances. Plastic waste is now ubiquitous in surface waters, on the coasts, in estuaries, on the high seas, and even in the deepest and most remote parts of the ocean [94,95,96,97,98,99,100].

Sources of Plastic Pollution

The United Nations Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) [101] estimates that land-based sources account for up to 80% of the world’s marine pollution with 60–95% of this waste comprised plastic debris.

Rivers are a major source of plastic waste in the oceans, and riverine input is estimated to be between 1.15 and 2.41 metric tons per year, corresponding to between 9 and 50% of all plastic transported to the oceans. Rivers draining densely populated, rapidly developing coastal regions with weak waste collection systems are particularly important sources [102], and it is estimated that between 88–95% of marine plastic comes from only 10 rivers [103]. Largest inputs, accounting for approximately 86% of the plastic waste entering the marine environment, are from the coasts of Asia, mainly China [89,104]. Additional sources include aquaculture, fishing and shipping [27].

Plastic wastes are gathered by oceanic currents and collect in five large, mid-ocean gyres located in the North Pacific, South Pacific, North Atlantic, South Atlantic, and Indian Oceans. The North Pacific gyre is a relatively stationary area twice the size of France that has waste from across the North Pacific Ocean, including material from the coastal waters of North America and from Japan.

Marine Pollution by Plastic Microparticles

Weathering, mechanical abrasion, and photodegradation break plastic waste in the oceans down into smaller particles termed microplastics (<5 mm in diameter) and still smaller particles termed nanoplastics (<1μm in diameter; defined as <100 nm by some authors) [105,106,107]. The size distribution of ocean microplastics is highly skewed, with increasing numbers of particles at smaller particle sizes [108,109]. Microplastic particles can sink downward through the water column and accumulate on the ocean floor. In contrast to microplastics, which have been measured widely in the marine environment (e.g., Text Box 1) and in marine organisms, concentrations of nanoplastics are poorly defined [110,111,112,113,114,115].

[[BOX OMITTED]]

Microplastics are also manufactured. They are produced in the form of microplastic beads – polystyrene spheres 0.5 to 500 μm in diameter. These beads are used in industrial processes such as 3D printing. They also have multiple applications in human and veterinary medical products to enhance drug delivery to tissues, and in cosmetics such as toothpaste, abrasive scrubbers and sunscreen. Manufactured microplastic beads are released to the environment from these products. They enter the oceans by way of urban runoff, sewage discharge, and direct wash-off of cosmetics and sunscreens from the skin of swimmers and surfers.

Microplastics degrade in the marine environment at varying rates depending on the core material and weathering conditions. Some petroleum-based plastics can take hundreds of years to degrade, although under some circumstances photochemical degradation can be significant [97,116,117].

Microplastic particles contain substantial quantities of toxic chemicals. Toxic chemical additives are incorporated into plastics during their manufacture to convey specific properties such as flexibility, UV protection, water repellence, or color [118,119,120,121,122]. These additives can comprise as much as 60% of the total weight of plastic products. They include plasticizers such as phthalates, brominated flame retardants, antioxidants, UV stabilizers, and pigments [106,123]. Due to their large surface-to-volume ratio, microplastic particles can also adsorb toxic chemical pollutants from the marine environment – polycyclic aromatic hydrocarbons (PAHs), PCBs, DDT, and toxic metals [106].

Some plastic additives such as synthetic dyes, are classified as mutagens and carcinogens [124,125,126]. Others such as bisphenol A and phthalates are endocrine disruptors – chemicals that can mimic, block, or alter the actions of normal hormones. Perfluorinated additives, widely used in plastic to make them water-repellent, are deleterious to human reproduction. Still other plastic additives can reduce male fertility and damage the developing human brain [127,128]. Also of concern are residual unreacted monomers and toxic chemical catalysts that may be trapped in plastic during its manufacture.

Chemical additives and adsorbed chemicals can leach out of microplastic and nanoplastic particles. They can enter the tissues of marine organisms that ingest these particles, including species consumed by humans as seafood. Concentrations of some chemical additives have been found to be orders of magnitude higher in microplastic particles than in surrounding seawater [129].

Marine Pollution by Plastic Microfibers and Tire-Wear Particles

Microfibers and tire-wear particles are distinct sub-categories of microplastics. Microfibers originate mainly from the clothing and textile industries [130,131,132]. Tire-wear particles are formed by the abrasion of car and truck tires. These materials reach surface waters and ultimately the oceans through runoff from roadways [133,134,135].

Plastic microfibers are distributed globally in both water and air [129,136,137,138]. They have become ubiquitous in all ecosystems. They are found in seafood [139,140]. Humans can be exposed to microfibers through consumption of contaminated fish or shellfish. Inhalation of airborne microfibers may represent an even greater source of human exposure [141,142].

Effects of Plastic Pollution on Marine Species

Elucidation of the toxicological impacts of microplastics, including microfibers, is challenging because of their heterogeneity and great complexity [106]. Microplastics span a wide range of sizes and shapes, they are comprised of various polymer materials, and as noted above they contain myriad chemical additives, the identity of which may be proprietary and therefore not generally known. Once in the marine environment, plastics undergo weathering and adsorb additional contaminants, further enhancing their complexity. Finally, marine species exhibit a range of sensitivity to microplastics [143]. All of these factors complicate assessments of toxicity and health hazard [144,145].

Although there is evidence for transfer of additives and adsorbed chemicals from plastics to organisms, the relative contribution of plastics to total chemical exposure by all pathways is thought in most situations to be minor [146,147,148,149,150,151,152]. Likewise, although some additives and sorbed contaminants are able to bioaccumulate and biomagnify in aquatic food webs, there is not yet strong evidence that plastic particles themselves are able to undergo biomagnification [153].

Microplastics have potential to harm living organisms through several mechanisms:

Physical toxicity. Macroscopic plastic wastes, such as bottle caps, small bottles, and food packaging, can be ingested by fish, seabirds, and marine mammals that mistake them for food. Undigested plastic accumulates in these animals’ gastrointestinal tracts where it can cause obstruction that leads to malnutrition, reproductive impairment and death [129,154,155,156,157,158,159,160]. Marine species can also be harmed and killed by becoming entangled in abandoned fishing gear, plastic nets and plastic rings that are caught on reefs or drifting in the water column. An estimated 5.7% of all fishing nets, 8.6% of all traps, and 29% of all lines are lost each year [161,162].

Plastic pollution is a threat to coral reefs [163]. Large plastic debris such as plastic bags and sheeting can smother coral colonies by preventing light from reaching the phototrophic organisms that build reefs and can also cause physical damage.

Particle effects. Microplastics can harm living organisms by virtue of their ability to damage cells, injure tissues, and cause inflammation [164]. While microplastics cannot easily pass through cell membranes, nanoplastic particles can cross the gut lining and accumulate in tissues [165,166,167] where they may have the potential to cause deleterious effects [168]. Leachates containing tire-wear particles have been associated with storm water-associated mortality in salmon [169].

Chemical Toxicity. The toxic chemical additives and the sorbed pollutants in and on microplastics and nanoplastics can leach from plastic particles and enter the tissues of marine organisms [123,170,171,172]. Although plastic particles may not be a major source of chemical exposure [146,147,148,149,150,151,152], there is evidence that in some instances they can be significant contributors to chemical body burden [173].

The challenges associated with assessing the impacts of microplastics on marine organisms are evident in the divergent results of studies reported to date. A recent meta-analysis and review of published research on the effects of microplastics and macroplastics found similar numbers of positive and negative results [174]. A major conclusion from this and other reviews is that most of the experimental work to date has been done using concentrations of microplastics that are not environmentally relevant [144,174,175]. Future research should be conducted under more environmentally relevant conditions [174].

Microplastics as Vectors for Microbial Pathogens

An additional hazard of microplastic particles and fibers in the marine environment is that they can transport and shelter hazardous microorganisms, including vectors for human disease [176]. Pathogenic bacteria have been detected on sub-surface microplastics comprised of polyethylene fibers, in plastic-containing sea surface films, and in polypropylene fragments sampled in a coastal area of the Baltic Sea [177]. Similarly, E. coli and other potentially pathogenic species have been found on plastics in coastal waters [178] and on public beaches [179]. Algal species involved in HABs [180] and ciliates implicated in coral diseases [181] have also been found attached to marine microplastics.

These findings suggest that harmful microbes and algae that colonize plastics in the marine environment may use microplastic particles to expand their geographical range (‘hitch-hiking’). Adhesion to marine plastic may also enable pathogens to increase their anti-microbial resistance thus facilitating their spread to new areas where they may cause disease and death in previously unexposed populations [177].

Human Exposure to Plastic Pollution in the Oceans

Consumption of contaminated fish and shellfish is a major route of human exposure to marine microplastics and their chemical contaminants [140,184,185]. Microplastic and nanoplastic particles are ingested by filter-feeders such as oysters and mussels that are then consumed by humans. Microplastic particles are found also in finfish that have consumed smaller organisms below them in the food web whose tissues are contaminated by microplastics and nanoplastics [123]. Greatest risks of human exposure are associated with consumption of small fish such as sardines that are eaten whole, including the gut [186]. The risk of microplastic ingestion may be especially great in fishing communities and in indigenous populations who rely heavily on seafood and marine mammals for their diet.

### 2AC – AT: Radiation

#### \*\*this is really bad\*\* No radiation impact – if anything it makes you live longer.

BBC 19 – The British Broadcasting Corporation is the national broadcaster of the United Kingdom. (Reality Check, "Does 5G pose health risks?," BBC News, 7-15-2019, https://www.bbc.com/news/world-europe-48616174, Accessed 7-23-2022, LASA-SC)

The electromagnetic radiation used by all mobile phone technologies has led some people to worry about increased health risks, including developing certain types of cancer.

In 2014 the World Health Organization (WHO) said that "no adverse health effects have been established as being caused by mobile phone use".

However, the WHO together with the International Agency for Research on Cancer (IARC) has classified all radio frequency radiation (of which mobile signals are a part) as "possibly carcinogenic".

It has been put in this category because "there is evidence that falls short of being conclusive that exposure may cause cancer in humans".

Eating pickled vegetables and using talcum powder are classed in the same category.

Alcoholic drinks and processed meat are in a higher category because the evidence is stronger.

A toxicology report released in 2018 by the US Department of Health, and pointed to by those expressing safety concerns, found that male rats exposed to high doses of radio frequency radiation developed a type of cancerous tumour in the heart.

For this study, rats' whole bodies were exposed to radiation from mobile phones for nine hours a day every day for two years, starting before they were born.

No cancer link was found for the female rats or the mice studied. It was also found that rats exposed to the radiation lived longer than those in the control group.

#### No cancer.

Forster 21 – Stefani Forster is a writer who covers tech. (Stefani Forster, "5G health claims need evidence, not opinions," Medium, 4-20-2021, https://stefaniforster.medium.com/5g-health-claims-need-evidence-not-opinions-64bee8de0b15, Accessed 7-23-2022, LASA-SC)

Epidemiological research on 5G and cancer

As far as the laws of physics and ionization are concerned, 5G shouldn’t worry us. But that’s only one field of scientific study. After all, we can’t rely on physicists to inform our knowledge on biochemistry. What about epidemiological evidence?

In health research, randomized controlled trials (RCT) — where researchers take test subjects and randomly assign them to either treatment or placebo — are considered the gold standard of evidence. Unfortunately, it’s impractical, if not impossible, to conduct an RCT on cell phones and cancer on humans. We’d have to assign particular levels of cellphone use to thousands of people, and trust they’d all maintain that level of use for at least five years, to get accurate data.

The next best thing are cohort studies. A massive, 13-country INTERPHONE cohort study conducted by the IARC found no elevation of gliomas or brain tumors in populations that used phones heavily, except perhaps at the highest level. Even then, they concluded that “biases and error prevent a causal interpretation with regard to the increased risk of glioma observed at the highest exposure levels.”

Even if mobile phones caused some brain cancers, what you’d expect to see is something similar to smoking — the heavier the smoker, the more likely they are to develop lung cancer — the more cell phone usage, the more likely cancers would manifest.

According to Grimes, “that dose-response relationship doesn’t exist for cell phones. It isn’t there. It’s just noise. That would imply, from an epidemiological standpoint, that there’s no evidence of harm.”

As cell phones have become more and more ubiquitous, brain tumor rates have not been going up in the United States. If cell phones cause brain tumors like cigarettes cause lung cancer, we should have seen an alarming increase by now.

Nonetheless, the scientists involved in the study could not agree on how its results should be described. John Niederhuber, the then-director of the National Cancer Institute, said that INTERPHONE “illustrates how difficult it is to identify and corroborate, or definitively rule out, any possible association between [cell phones and cancer].”

Adding to the confusion: the INTERPHONE study was partially funded by the mobile phone industry, though it was subject to guarantees that the study would remain scientifically independent. This garnered significant skepticism over its results. Consequent cell phone radiation studies funded by telecom companies have, understandably, led to well-placed concerns about bias, while adding fuel to the conspiracy fire.

Still, we can point to at least five other high-quality cohort studies — published in the Journal of the National Cancer Institute, the American Journal of Epidemiology, the European Council of Cancer Prevention, the International Journal of Epidemiology, and Bioelectromagnetics — that overall, found no increased risk for cancer, but perhaps a small increased risk for the non-cancerous tumor neuroma. (Researchers noted these tumors were so rare that they were uncertain about the link.)

The five studies, published between 2009 and 2016, were not funded by the cell phone industry and are less likely to be biased. But it’s important to note that how we use cell phones has changed dramatically over the last decade. The data could be outdated. It’s possible that longer-term studies will find larger cancer effects in another five or 10 years, but until then, the research so far has one thing in common: lack of evidence. This is a major problem with cell phone science at the moment.

### AT: Health Hazards

#### Fake news

Broad, 19—NYT (William, “The 5G Health Hazard That Isn’t,” <https://www.nytimes.com/2019/07/16/science/5g-cellphones-wireless-cancer.html>, dml)

Over the years, Dr. Curry’s warning spread far, resonating with educators, consumers and entire cities as the frequencies of cellphones, cell towers and wireless local networks rose. To no small degree, the blossoming anxiety over the professed health risks of 5G technology can be traced to a single scientist and a single chart.

Except that Dr. Curry and his graph got it wrong.

According to experts on the biological effects of electromagnetic radiation, radio waves become safer at higher frequencies, not more dangerous. (Extremely high-frequency energies, such as X-rays, behave differently and do pose a health risk.)

In his research, Dr. Curry looked at studies on how radio waves affect tissues isolated in the lab, and misinterpreted the results as applying to cells deep inside the human body. His analysis failed to recognize the protective effect of human skin. At higher radio frequencies, the skin acts as a barrier, shielding the internal organs, including the brain, from exposure. Human skin blocks the even higher frequencies of sunlight.

“It doesn’t penetrate,” said Christopher M. Collins, a professor of radiology at New York University who studies the effect of high-frequency electromagnetic waves on humans. Dr. Curry’s graph, he added, failed to take into account “the shielding effect.”

Dr. Marvin C. Ziskin, an emeritus professor of medical physics at Temple University School of Medicine, agreed. For decades, Dr. Ziskin explored whether such high frequencies could sow illness. Many experiments, he said, support the safety of high-frequency waves.

Despite the benign assessment of the medical establishment, Dr. Curry’s flawed reports were amplified by alarmist websites, prompted articles linking cellphones to brain cancer and served as evidence in lawsuits urging the removal of wireless classroom technology. In time, echoes of his reports fed Russian news sites noted for stoking misinformation about 5G technology. What began as a simple graph became a case study in how bad science can take root and flourish.

## AT AI Bad

### AI Good---2AC

#### AI solves decisional privacy infringements and data sludge.

de Marcellis-Warin, et al, 20—Full Professor in the Department of Mathematics and Industrial Engineering at Polytechnique Montréal (Nathalie, with Frédéric Marty, Eva Thelisson, and Thierry Warin, “Artificial Intelligence and Market Manipulations: Ex-ante Evaluation in the Regulator's Arsenal,” CIRANO Working Paper 64, 2020, dml)

These tools are all the more important since the development of algorithmic decisions poses unprecedented problems of understanding the predictions that the latter make (notably because of the diffusion of artificial intelligence tools). The issue at stake is the explicability of choices and the detection of manipulative practices. We focus in this paper on algorithmic manipulations and the consequences in terms of privacy and competition protection.

The article is structured as follows. Section 2 presents the risks that increasing the use of Artificial Intelligence (A.I.) in algorithmic recommendation systems may induce consumers to reduce their freedom of choice, behavioural manipulations, or even through personalized but unbalanced contractual conditions. A third section shows that consumer damage can also occur indirectly through an infringement of competition, through the consolidation of individual dominant positions or the increase of algorithmic collusion risks. A fourth section focuses on solutions for regulating algorithms by other algorithms or monitoring procedures, allowing accountability for the actual functioning of the algorithms implemented. The first avenue uses algorithmic tools by the market supervisors to detect possible abnormal patterns that could lead to procedures. A second way may involve the use of algorithmic countermeasures by consumers. A fifth section considers how "highly consequential decisions" can be the subject of special attention by the firm's different stakeholders. Taking these decisions into account can lead to devices' design, allowing firms to guarantee their algorithms' integrity and ethics through scoring methods. We present the confidence index, developed by the A.I. Transparency Institute, adapting it to the issues related to consumer and competition law.

2. ARTIFICIAL INTELLIGENCE AS A POTENTIAL VECTOR OF RISKS FOR CONSUMERS

Three types of damage to the consumer can be considered. The first type of damage is the reduction of the choices open to him. The second damage lies in the possibility of manipulation of choices. The range of available solutions is not artificially closed, but the consumer's behaviour is altered by producing stimuli intended to bias their decision. The third type of damage corresponds to what we call an abuse of exploitation. The ability to predict the characteristics of the consumer (technical expertise, ability to pay, etc....) makes it possible to make offers leading to the extraction of the consumer's entire surplus (which would not be possible with uniform prices or imperfectly differentiated prices) or leading to discriminatory offers, whether in terms of price or the quality of the products and services offered.

2.1 Reducing the consumers' choice space

A.I. allows changes that break the usual business paradigms. A.I. can be used within the framework of strategies that can lead, through increasingly finely targeted recommendations or recommendations to limit consumers' freedom of choice. The latter may see their range of choices reduced according to their past consumption or according to the customer segment to which the algorithm links them; A.I. is a prediction tool based on machine learning. (Agrawal, Gans, and Goldfarb, 2018). In other words, they can be enclosed in the equivalent of a filter bubble. Such an effect may be aggravated by shifting some platforms from a shopping-then-shipping logic to a shipping-then-shopping logic (Agrawal, Gans, and Goldfarb 2017). The customer may indeed incur a cost to reship the product even if the return would be free.

A.I. can also facilitate practices that can lead to manipulating consumer choices through a precise understanding of their behaviour or an accurate estimate of their maximum payment capacity. Indeed, as noted by Ezrachi and Stucke (2020): “[…] in a data-driven economy, personal data on user behaviour, preferences, weaknesses, and habits is the new currency for the advertising - and marketing dependent – business models”. These capabilities require the monitoring of massive, diversified and continuously updated data and the mastery of analytical tools to customize offers concerning consumers' decision-making frameworks or better predict other operators' strategies (Marty and Warin 2020b, 2020c). The takeover of Onavo by Facebook or that of Looker by Google testifies the importance of the ability to master the competitive environment through the technical possibility of better and better forecasting the present.

Several examples of the limitation of consumers' capacity for choice could be added to the filter bubble and shipping-then-shopping models presented above. Some are related to cost factors. They are often linked to complementarities between types of equipment that play as many factors aggravating the costs of change between ecosystems. Biases can then arise from how choices are proposed. The case of personal assistants shows how the options proposed can be reduced to a minimal range. The last example, developed by Ezrachi and Stucke (2020), is based on the possibility of controlling the dissemination of innovations in ecosystems by the pivotal operator of each of them.

To illustrate their thinking, Ezrachi and Stucke (2020, p. 42) are based on Rodgers' innovation diffusion model (2003). The adoption of an innovation by a given individual is described as a fivephase process. The first is the knowledge phase. The individual must be informed of the availability of an innovative solution and its functions. The second is that of persuasion. It is through it that the individual forms favourable or unfavourable anticipations towards it. The third is that of the decision of adoption or non-adoption. The fourth is that of implementation. The fifth, finally, is that of the confirmation of the adoption. It can be confirmed by observing the choice of third parties or, on the contrary, be negatively affected by negative messages.

The strategic action of platforms - if they can detect their users' behaviour - can play in favour of the adoption of an innovation developed internally (or by a preferred complement-maker) and unfavourably for an innovation developed by an independent firm. The first variant may explain why digital ecosystems promote early and massive adoption of innovations. The second may explain why innovations fail to spread.

2.2 The manipulation of consumers' behaviour

Markets’ DNA is ultimately the price mechanism. The latter plays an important function: it informs market participants before they make a decision. There is abundant literature on the concept of “value of information,” and some authors have looked at the value of information in the context of price strategies on digital markets (Warin and Leiter 2012; Warin and Troadec 2016) as well as from a regulatory perspective (Marciano, Nicita, and Ramello 2020). With A.I., now some firms have access to the aggregated information and the customer’s value of information, through notably recommender systems. With this rich access to the value of information, A.I. can be used to model consumer behaviour and create an incentive leading to purchase (emotional pitch, dark nudge...) at the right time. These problems go beyond the scope of A.I. alone in that they can be observed within the framework of traditional algorithms. For example, many merchant sites can implement drip pricing strategies (Rasch, Thöne, and Wenzel 2020) or price partitioning. The customer can be engaged in a purchasing process by an attractive call price and only "discover" the full price later. The time spent to complete the subsequent pages will make him forget the competitors' price consulted at the beginning of his search, or she will be reluctant to start his search process from scratch (Marty, 2019).

The notion of dark patterns illustrates these practices, which can be aggravated by A.I. performance (Stigler Center, 2019). It covers all the profiling methods, algorithmic proposals or user interfaces that can restrict the ability to make a free and informed choice on the consumer's part. Dark patterns are also called dark nudges or bad sludges. Therefore, they cover strategies that increase the opacity of consumers' choices, making it more difficult for them to express their preferences freely, or that leads them to make decisions that they would not have made spontaneously.

Dark patterns can be produced to lead consumers to make decisions that are not in line with their preferences. While a (positive) nudge is theoretically part of a logic of liberal paternalism - leading the individual to behave in a way that is in line with his interest and the general interest - such dark nudges aim to lead them to act in a way that is not in line with their interests (C. Sunstein 2019; Thaler 2018). Therefore, it is a question of manipulating consumer choices by voluntarily altering their preferences or even creating them through cognitive biases (framing effect, sunk cost fallacy, anchoring, etc.). Dark sludges can therefore be defined as “an evil nudge [...] that can exploit [online consumers] cognitive biases to persuade them to do something that is undesirable, typically by introducing excessive friction into choice architecture” (C. R. Sunstein 2020).

It is essential to distinguish within dark patterns the nuance between bad nudges and bad sludges. A nudge can be defined as an encouragement, a small nudge that leads the agent to act in a given direction. It is a push towards action. It is often presented as positive (the agent is encouraged to act in his interest as long as he does not spontaneously). It can, however, be harmful. For example, a bad nudge is used as part of an emotional sales pitch: a banner appears through an untimely window leading to a click to access a given service for which the consumer is known to have developed an addiction. Therefore, it is a push - in the sense of a stimulus - to make the consumer "fall" to the side we know she tends to lean to.

The concept of nudge in the behavioural economics literature was mainly based on reflecting on actors' decision-making environment to make better-informed choices without restricting their freedom. Therefore, the aim was to promote a choice architecture that reconciles autonomy and "signalling" the best options for the agent himself (Thaler and Sunstein 2009).

However, this thrust - through the design of the architecture of choice - can also be exercised in a much less benevolent way. As noted above, it can be used in the firm's interest and to the consumer's detriment. It is no longer a question of inciting the consumer to make the right decision for her but pushing him to decide following the firm's interests. Therefore, a nudge can be positive and negative and can be part of a dark pattern.

Conversely, the term sludge evokes friction. It is more in the primary sense of getting bogged down, of losing mobility. It is about creating artificial difficulties to prevent consumers from exercising their freedom of choice, from identifying the most favourable options or, conversely, from exercising them. Thaler (2018) gives a simple but evocative example. The consumer decides to purchase a good or subscribe to an online service by considering the offer of a deferred refund. However, this benefit is conditional on sending proof of purchase by mail within a given period (or the tedious creation of an online account). Many consumers who have based their decisions on this rebate will not claim it. As Thaler notes (2018, p. 431): “because of this thick sludge, redemption rates for rebates tend to be low, yet the lure of the rebate still can stimulate sales - call it 'buy bait.'”

A sludge is defined as a “kind of friction, large or small, that people face when they want to go in one or another direction” (C. Sunstein 2019). It can also help prevent a harmful attitude on the part of the consumer himself (curbing a shopping frenzy, ensuring his eligibility conditions or characteristics, forcing him to benefit from a cooling-off period) and, on the contrary, hindering access to legitimate rights.5Like a nudge, a sludge is based on the exploitation - through the strategic establishment of the architecture of choice - of economic agents' behavioural biases. What biases can a friction mechanism take advantage of? These can be, for example, inertia biases (Madrian and Shea 2001), of procrastination (Akerlof 1991) and preferably for the present (O’Donoghue and Rabin 2015).

The notion of bad sludge is also found in disputes between companies at the heart of major digital ecosystems and their suppliers. For example, as noted in the report on competition in the digital sector published in October 2020 by the Antitrust Subcommittee of the U.S. House of Representatives, the notion of "bad sludge" can be found in disputes between companies at the heart of large digital ecosystems and their suppliers (Judiciary Committee House of representatives, 2020, p.218), one of the arguments raised by EPIC Games in its lawsuit against Google in the U.S.6 Game developer Fortnite insists that bypassing the Play Store - which is technically possible and easy - is made more difficult and stressful for the consumer to deter them from downloading the game directly:

“Direct downloading on Android mobile devices, however, differs dramatically. Google ensures that the Android process is technically complex, confusing and threatening, filled with dire warnings that scare most consumers into abandoning the lengthy process. For example, depending on the version of Android running on a mobile device, downloading and installing Fortnite on an Android device could take as many as 16 steps or more, including requiring the user to make changes to the device's default settings and manually granting various permissions while being warned that doing so is dangerous. Below are the myriad steps an average Android user has to go through in order to download and install Fortnite directly from Epic's secure servers.”

Friction is not limited to the initial download but also updates. Still, according to the complaint filed last August by EPIC:

“As if this slog through warnings and threats were not enough to ensure the inferiority of direct downloading as a distribution method for Android apps, Google denies downloaded apps the permissions necessary to be seamlessly updated in the background—instead allows such updates only for apps downloaded via Google Play Store. The result is that consumers must manually approve every update of a "sideloaded" app. In addition, depending on the O.S. version and selected settings, such updates may require users to go through many of the steps in the downloading process repeatedly, again triggering many of the same warnings. This imposes onerous obstacles on consumers who wish to keep the most current version of an app on their mobile device and further drives consumers away from direct downloading and toward Google's monopolized app store wish to keep the most current version of an app on their mobile device and further drives consumers away from direct downloading and toward Google's monopolized app store” (Ibid, §98).

What is here the potential usefulness of these dark nudges? Maintaining the online application store as a lock on access to the ecosystem (gatekeeper site downloading) ensures the core business's private regulatory power (structuring power).

Therefore, controlling the ecosystem involves imposing technical and psychological frictions to counter the threat of loss of control through direct application downloading.7:

“As if this slog through warnings and threats were not enough to ensure the inferiority of direct downloading as a distribution method for Android apps, Google denies downloaded apps the permissions necessary to be seamlessly updated in the background—instead allows such updates only for apps downloaded via Google Play Store. The result is that consumers must manually approve every update of a "sideloaded" app.”

The notion of dark pattern goes beyond manipulating choices and behaviours; it can also relate to Internet users' information disclosure (or excessive privacy reduction). In such a case of a nudge, the design of the site or the modes of presentation of the choices make the user go beyond what is necessary or what he would have accepted if his choice had responded to the rationality of type 2 (Acquisti, Brandimarte, and Loewenstein 2020). It is not just a matter of exploiting consumers' or users' vulnerabilities to induce them to make choices that correspond to trends that they could rationally try to curb but in the extreme of eliciting (i.e., constructing) these preferences (Mulligan, Regan, and King 2020). The dark pattern can, therefore, result from the design of a site. This is the case of clickwraps that lead the consumer to make choices in blocks for questions of very different kinds and importance (Obar and Oeldorf-Hirsch 2018). There are, therefore, "manipulative by design" devices. Their analysis is not new in the online world (Calo 2014) or even in the offline world (Hanson and Kysar 1999). However, the nature of the online journey and the ability to capture, process, infer and create targeted stimuli make the effects far more farreaching.

The modalities for implementing these practices can be fundamental. An Internet user, who is asked several times for his personal data protection preferences after each refusal, will accept, either inadvertently or to stop the requests (Luguri and Strahilevitz 2019). 8 The same applies to the techniques described above in which the price is only revealed at the end of the purchase process or transactions in which options that the consumer would not have wished to subscribe to are "preselected" in a non-obvious way.9

In the same way, the notion of a dark pattern can cover emotional pitch practices. The idea is to produce a stimulus that would make the consumer switch to an act of purchase. Such stimuli can be the announcement (except in the form of an untimely window) of a price reduction or the announcement of a limited number of remaining products coupled with messages indicating that another Internet user has just bought one.10 It is then a question of creating a sense of urgency, which will push the consumer to rush his purchase for fear of running out of available stock. (Mathur et al., 2019). In such situations, it is a question of calling upon the system 1 of our brain that of the fast, instinctive guided by routines, emotional choice... and no longer upon system 2, that of rational choice11 (Kahneman 2011). Whether it is a question of "pushes or frictions," the architecture of the choices and the exact path of the Internet user (and of the consumer in general) exerts a determining influence and calls for questioning the firm's responsibility that sets them up.

A.I.'s development could make these strategies more useful by allowing a better understanding of consumer behaviour after closely linking it to a given segment based on observed and inferred characteristics. In other words, A.I. can promote the personalization of prices and the personalization of manipulations. Indeed, as the Stigler Center notes (2019, p. 238), the use of sludges will have multiplier effects through the use of A.I.: “Dark patterns are often used to direct users towards outcomes that involve greater data collection and processing. Additionally, the proliferation of data-driven computational methods allows firms to identify vulnerabilities of users and to target specific users with these vulnerabilities12” (Gray et al. 2018).

For example, A.I. can make it possible to determine which stimulus to present to a consumer and when to do so based on an increasingly refined prediction of its characteristics and, therefore, also of its inferred weaknesses. Luguri and Strahilevitz (2019) propose a detailed typology of the different mechanisms linked to dark patterns. We reproduce it in part in table 2 presented below, adding elements developed by Gray et al. (2018)

The existence of manipulative strategies explains the difference between agents' preferences, such as protecting their data and their actual behaviour. Acquisti et al. (2013) have shown that agents may agree to pay to protect their data. Similarly, their online behaviour (multiple email addresses, specialization of different social networks...) also attests to this strategy (Acquisiti et al., 2020). However, the case of the dark patterns described above shows that it is necessary to distinguish between willingness and opportunity. Psychological biases can thwart the expression of preferences and open up the possibility of manipulations such as those we have just detailed. Table 3 below reproduces the elements presented by Acquisti et al. (2020).

Some of the effects are related to behavioural biases; others are created and amplified by practices that play on these biases. Errors in risk estimation do not need to be supported by the actions of the sites concerned. A loss of confidentiality is potentially very high but is assessed as low probability and is distant. Therefore, as in other areas that can induce systemic risks, they will be minimized in decision-making (Kunreuther and Ginsberg 1978).

For other dimensions, it is possible to find the notion of dark patterns presented here. According to Acquisti et al. (2020), it is possible to illustrate how these biases can be instrumentalized. The consumer will overvalue a tangible and immediate gain compared to a deferred and intangible risk. Moreover, as we have seen for bad sludges, it is not even a given to meet the conditions for activating these offers ex-post. The same sensitivity to bad sludges or bad nudges may stem from agents' uncertainty about their preferences. The presentation of options can, therefore, guide agents' decisions... even against their interests. As presented in the table above, apparently "transparent" devices can intuitively work against consumers' interests (Acquisti, John, and Loewenstein 2013). Indeed, the illusion of control - through broad possibilities for personalizing choices - can lead users to accept excessive disclosure of their data (Brandimarte, Acquisti, and Loewenstein 2013). Similarly, gradual but continuous degradation of data protection may be perceived by users but not be subject to a revision of initial choices: "the human brain seems to interpret the persistence of a problem as evidence that the problem is intractable, and hence not worthy of further attention, so it dials down the emotional response (Acquisti, Brandimarte, and Loewenstein 2020).

2.3 The imposition of unbalanced contractual conditions

A.I. can lead to an excellent segmentation of customers allowing them to propose almost personalized prices. The problem with the latter is that placed at the level of the consumer's maximum propensity to pay, a perfectly discriminating price makes it possible to confiscate the totality of the consumer's surplus. There is no damage in terms of efficiency in economic terms, but an undue transfer of welfare compared to the distribution that would prevail in perfect competition.

Moreover, it should be noted that discrimination between customers may also prevail in uniform pricing. If it is possible to determine the customer's needs and the level of technical expertise, it is conceivable to offer him a product with less attractive characteristics or with degraded performance. The vendor can take advantage of the informational advantage he knows he has over his customer and the production flexibility that will increasingly allow him to use Industry 4.0 models. These are the so-called versioning practices. The less expert consumer may be offered products or services that are ultimately more expensive than the personalized offer's intrinsic value. (Marty, 2019).

The notion of "augmented dark pattern" can, therefore, cover several modalities. The one we have just seen corresponds to manipulation by transaction costs. The consumer's well-being is degraded through exploitative abuses in the form of a confiscated personalized price (of his surplus), an offer with a degraded price/quality ratio, or in the form of barriers to exit. The notion of dark pattern also covers consumer behaviour manipulations, based on the acceptable identification of their characteristics and, more precisely, their weaknesses.

3. ARTIFICIAL INTELLIGENCE AND THE POTENTIAL DAMAGE TO THE COMPETITIVE PROCESS

Even if this advantage is based on merits and should not be sanctioned based on competition rules, it is an obstacle to a level playing field and is likely to tip the market towards a situation of overwhelming and possibly perennial dominance. Indeed, this advantage may mean that a new entrant could not immediately be as efficient as the dominant firm. The market would then no longer be contestable in the economic sense of the term. The advantage in terms of A.I. and computational capacity would likely become an impassable barrier to entry. The damage would perhaps not be damage in terms of efficiency (both for the economy and for the consumer) or innovation, but damage to the competition process itself (3.1). Simultaneously, the use of A.I. in an oligopolistic market structure can lead to the faster emergence of collusive equilibria, which are more stable, insofar as competing firms gain a better understanding of the market and can predict their common reactions more and more precisely (3.2).

3.1 The locking of a dominant position

In such a case, the use of A.I. is aimed less at exploiting an advantage vis-à-vis the consumer than at acquiring, consolidating or extending a dominant position to the detriment of its current competitors or potential competitors, whether in the same relevant market or related markets (of complementary goods and services, for example). The practices in question may be favourable to the consumer in terms of welfare, at least in the short term. They may nevertheless be detrimental to the continuation of free, undistorted competition on the merits.

Dominant Internet firms may have a competitive advantage over their current or future competitors and their trading partners, in other words, firms that act as complementors in their respective ecosystems (Marty and Warin 2020c, 2020a). Abundant literature in economics and management sciences is developing on kill zones and the notion of killer mergers or consolidating acquisitions (Marty and Warin 2020e). The possession of massive, continuously renewed, and diversified data and the design of A.I. algorithms coupled with the development of computational resources can enable dominant companies (the pivotal firms of each ecosystem) to identify competitive threats, promising technologies or potentially disruptive developments at a very early stage. Therefore, they can eliminate or clone the service or even buy out the company concerned well before entering the market.

The consumer may not be harmed in the short term. A possible innovation will not be eliminated; it can be integrated into the dominant firm's offer and may be more efficient and attractive. However, the advanced detection capability perpetuates dominance by acting as a barrier to market entry. (Anticompetitive) foreclosure arises from a capacity to detect weak signals in the market. Different algorithmic tools facilitate these nowcasting practices. Sentiment analysis is one of the main ones.

3.2 The emergence and consolidation of algorithmic collusions

The practices described above correspond to unilateral practices, i.e. practices implemented by a dominant firm independently of its competitors. Algorithms in general and A.I., in particular, can also facilitate development, if not the emergence of collusive equilibria. Once again, abundant literature has developed on the question of the ability of A.I. to promote and stabilize tacit collusion equilibria (Calvano et al., 2019). These are situations in which algorithms capable of autonomous machine learning by understanding the functioning of the market and the reactions of competitors spontaneously converge towards a cooperative equilibrium (i.e., armed peace) insofar as this is the one that maximizes everyone's profits over the long term.

Human players would potentially arrive at the same result, but under much more restrictive assumptions (in terms of the number of participants, the complexity of the environment, etc.) and over a much more extended period. Moreover, such an equilibrium would be much more stable with A.I. than with humans insofar as the former could present less cognitive bias, leading them to misinterpret their competitors' strategies or overreact in case of observed deviation from the tacit collusion equilibrium. Moreover, the demonstration of an anticompetitive intention would be much more challenging to make, which would likely significantly reduce the probability of being sanctioned by competition rules (Marty 2017).

Finally, despite the efficiency gains that A.I. will bring and the development of computational capabilities, the academic literature insists on the associated risks. Thus, the race towards A.I. would not only be the solution to the search for efficiency in our algorithm-driven economies; it could also prove to be a future problem. Our fourth section shows that while A.I. may be a problem, it may also be the solution to control these possible risks. However, it is a question of considering these avenues in their practical, legal and ethical dimensions.

4. AVENUES FOR ALGORITHM REGULATION BY ALGORITHMS

The tools provided by A.I. can help to correct their possible anticompetitive or harmful effects on consumers. They can be implemented by the competition regulator (4.1) or by consumers themselves (4.2).

4.1 The use of artificial intelligence by market supervisors to prevent manipulative strategies

The resources provided by the A.I. can be used ex-ante as part of algorithm validation procedures (in a logic of requiring conformity by design) or as part of sectoral surveys. The algorithms are then used based on market data transmitted by companies to observe possible biases. In the case of collusion by algorithms, these checks could function as stress tests. It would be a matter of seeing under what conditions and with what speed the competing firms' algorithms could converge towards such equilibria through algorithmic collusion incubators. It would be up to the regulator and the firms to define the conditions (speed or frequency of price changes, for example) to limit competitive risks.

Then, the algorithms can be used ex-post in market surveillance. As is already the case in financial market regulation for high-frequency transactions, it is possible to analyze market patterns to detect strategies that would not make economic sense outside of abusive practice. It is then up to the company concerned to prove that its decisions were not part of such a strategy (the logic of complying or explain). Note that competition law is not the only legal tool that can make algorithms accountable. For example, when it comes to offers to final consumers (in terms of price or quality of the products offered), practices of a discriminatory nature could be subject to consumer protection measures how so many unfair or misleading practices. However, it should be noted that the finer the analysis produced by the algorithm of the customer's needs and characteristics, the more difficult it will be to detect manipulation and detect damage.

The Stigler Centre (2019, p.254) proposes some avenues discussed in its paper. A concealed dark pattern that increases consumers' exit costs or is likely to exploit weaker consumers' weaknesses must be subject to a presumption of consumer harm. In other words, manipulative intent would be presumed if the algorithm's design appears to obscure the developer's intent and its effects intentionally. The practices referred to by the Stigler Center (2019) are worth discussing, particularly concerning the development of A.I.

4.2 The use of artificial intelligence by consumers

Consumers themselves can use algorithmic tools to detect or counteract possible manipulation by firms. This can be done through distributed monitoring devices set up by non-profit institutions or through over-the-counter algorithms by consumers themselves. The latter can play with firms' algorithmic strategies or even deceive them by emitting false signals.

It should be noted that all consumers' segments are not equivalent to algorithmic manipulations and the responses they are likely to make to them. First, the probability of being manipulated even by a mild dark pattern depends on the consumer's level of knowledge (i.e., often their level of education). Thus, the ability to perceive the manipulation itself also depends on the consumer's level of knowledge (i.e., often their level of education). Second, access even to such countermeasures is related to the same characteristics. In other words, possible algorithmic manipulations will not affect different categories of consumers in the same way, which raises both ethical (Marty and Warin 2020d) and distributional issues.

Consumers may misperceive the use of A.I. by platforms. The personalization of prices and offers can be analyzed as discrimination aimed at "exploitative abuse." The "guiding" of choice behaviour, especially if perceived as part of a dark pattern, can be interpreted as an unfair and prejudicial manipulative practice (deceptive practices). In doing so, a phenomenon of consumer backlash can be observed (Stigler Center, 2019). This may result in measured but still damaging strategies on the part of firms. The use of less obvious dark nudges (mild dark patterns) may make it possible to obtain the desired effects in the most naïve consumers without alienating the most informed consumers who could react negatively towards the operator if aggressive dark patterns are used. Paradoxically, the consumers are least exposed to dark patterns that are likely to pose a credible threat against the firms that would use them. The more exposed consumers are, the less likely to respond to them, the less they can identify them. Moreover, targeting the vulnerabilities of specific segments of consumers increases the effectiveness of manipulation to the detriment of the most vulnerable consumers.

It is, therefore, a question of forcing firms to be accountable for algorithms despite their opacity (black box logic) through regulation by the spotlight that can raise reputational issues (encouraging the development of responsible A.I.) and of encouraging the emergence of algorithmic combats that allow consumers to exercise countervailing competitive power.

#### Both of those cause extinction.

Lubin, 22—Associate Professor at Indiana University Maurer School of Law, Faculty Associate at the Berkman Klein Center for Internet and Society at Harvard University, Visiting Fellow at the Information Society Project of Yale Law School, Visiting Scholar at the Federmann Cybersecurity Center at Hebrew University of Jerusalem, Fellow at the Center for Applied Cybersecurity Research at Indiana University, and Visiting Fellow at the Nebraska Governance and Technology Center at the University of Nebraska (Asaf, “Big Data and the Future of Belligerency: Applying the Rights to Privacy and Data Protection to Wartime Artificial Intelligence,” in *Handbook on Warfare and Artificial Intelligence*, forthcoming 2022, dml) [brackets in original]

The first risk has to do with Omri Ben-Shahar has called “data pollution,” which are “the external harms from collection and misuse of personal data.”48 At the heart of all AI applications stands an unremitting stream of data.49 Data is the fuel that runs AI design-labs and assembly lines, but it is also a type of waste generated as a by-product throughout the AI systems' life cycle. An ever-increasing volume of information is sensed, collected, stored, analyzed, and disseminated every day both for and during war. Such a massive data enterprise is vulnerable to abuse in ways that have so far gone under-appreciated. As a group of researchers recently noted that the use of AI could threaten “digital security”, “physical security”, and “political security.” Among other things, the use of AI to automate tasks involved in surveillance, persuasion, and deception “may expand threats associated with privacy invasion and social manipulation.”50 When Elon Musk warns of AI as humanity’s “biggest existential threat” comparing it to “summoning a demon,”51 one should not limit their imagination to only a rogue killer robot, à la The Terminator. Perhaps more significantly we should worry about a terrifying AI-driven data ecosphere that chips away at our political institutions and intuitions while eviscerating fundamental protections on human dignity.

Such an ecosphere is exacerbated by the involvement of private partners in these projects. Indeed, the U.S. military “a latecomer to the AI revolution, and government spending on AI is dwarfed by the private industry.”52 The military is thus forced to rely on private companies who bring with them not only large sets of structured and unstructured personal data, but also problematic commercial practices in utilizing such data. This new AI military industrial tech complex is even bigger and more dangerous to our liberties and democratic processes than the one Eisenhower warned about some 70 years ago.53 The new complex raises questions about the very ability, let alone desire, of the government to adequately protect international human rights, civil liberties, and digital freedoms in the production of these AI applications and technologies. It is worth recalling that even before the AI revolution, experts were already ringing the alarm bells on U.S. privatization of intelligence––suggesting that such outsourcing has “gone too far.”54 We now therefore find ourselves in a particularly peculiar position. As highlighted by Melody Guan:

“Another challenge the United States faces in exercising judicious public authority in tech is the particularly outsized political influence of its large corporations. These play a deciding role in determining American society’s economic and political policies by means of campaign contributions, lobbying, access to and representation of corporate elite amongst politicians, and rights of corporate personhood. Today it is no longer even clear where the line between the public sector and the corporate sector ends. On one hand, the autonomy of private tech companies allows for a check against government overreach. Corporations can resist military involvement, government censorship, and assistance with federal investigations... On the other hand, the corporatocracy makes it difficult for the government to reign its tech companies on behalf of its citizens, even if it were become interested in and adept at AI policy…. [T]here has been little material change to the existing manners of transgressive harvesting and utilization of user data [by AI developing tech giants]. The poor regard for personal protection and rights in the current unregulated state of affairs shows us that we cannot simply rely on the goodwill of tech companies. Indeed, the nature of corporations themselves may expose them to lawsuits if they fail to prioritize the interests of their shareholders over debatable moral concerns. We need a citizen-centric government to shepherd the ethical and fair use of technology.”55

Not only that, but an escalating superpower arms race in AI is further casting a shadow on the prospects of collective consensus building around basic ethical standards for data governance. “Today, the United States lags behind China and Russia in terms of national AI strategy. While the United States government and the Department of Defense continues to figure out the place of AI in society and government, our adversaries have already made it a national priority.”56 As the world’s powers continue to compete in “a contentious global landscape where advantage in military AI could make a real difference to the balance of power,”57 there is a growing concern that law and ethics will fall by the westside.58

### AI Impacts---1AR

#### Data sludge causes extinction and unprecedented discrimination—assume it outweighs flashpoint impacts because cause-effect analysis can’t account for its effects.

Marjanovic, et al, 18—Professor in the School of Professional Practice & Leadership, Faculty of Engineering and IT at the University of Technology Sydney (Olivera, with Dubravka Cecez-Kecmanovic and Richard Vidgen, “Algorithmic Pollution: Understanding and Responding to Negative Consequences of Algorithmic Decision-Making,” *Living with Monsters? Social Implications of Algorithmic Phenomena, Hybrid Agency, and the Performativity of Technology*, Proceedings of the IFIP WG 8.2 Working Conference on the Interaction of Information Systems and the Organization, IS&O 2018, dml)

However, in spite of the reported enthusiasm, there is growing evidence of unfair, unjustified and discriminatory effects of these algorithms for individuals and wider communities [1, 11, 27]. Eubanks [10] offers a vivid example of devastating effects of automated eligibility systems implemented in a particular type of transformative services (social support services):

“Across the country, poor and working-class people are targeted by new tools of digital poverty management and face life-threatening consequences as a result. Automated eligibility systems discourage them from claiming public resources that they need to survive and thrive… Predictive models and algorithms tag them as risky investments and problematic parents. Vast complexes of social services, law enforcement, and neighborhood surveillance make their every move visible and offer up their behavior for government, commercial, and public scrutiny” [10, p. 11].

Law enforcement is another prominent example of transformative services using algorithmic decision-making, most notably in predictive policing. Celebrated as the new era of “data-driven scientific decision-making”, predictive policing has been increasingly used to inform decisions such as arresting people or determining the length of their sentence, based on the calculated probability of them committing future crimes [28]. This practice relies on datafication of individuals, including a variety of personal as well as other data that individuals may not have any control over, such as past data on “gang districts” or post codes. Consequently, individuals are assigned “risk scores” that are subsequently used for decision-making in a variety of contexts. The practice is spreading with more and more departments embracing the scientific approach to policing. For example, Ferguson [28] reveals that almost 400,000 Chicago citizens now have an official police risk score:

“This algorithm – still secret and publicly unaccountable – shapes policing strategy, the use of force, and threatens to alter suspicion on the streets. It is also the future of big data policing in America – and depending on how you see it, either an innovative approach to violence reduction or a terrifying example of data-driven social control” [27, p. 1].

In addition to citizens not being aware of their risk scores, Ferguson [28] warns that “[c]urrently there is no public oversight of the police data, inputs or outputs, so communities are left in the dark unable to audit or challenge any individual threat score” (p. 1). Consequently, the “profound benefits” of predictive policing continue to be celebrated in the popular press. For example, in a controversial Financial Times article Gilian Tett (a respected financial reporter) offers the following support for predictive policing: “After all, …the algorithms in themselves are neutral” [29, p. 1].

Similar examples are reported in other types of transformative services including education, healthcare, social support and disability services (see for example, [1, 10, 11, 27, 30]). In particular, Caplan and colleagues [1] warn, “there is a need for greater reflection on models of power and control, where the sublimation of human decisionmaking to algorithms erodes trust in experts” (p. 6). There is a growing number of critical studies of algorithmic decision-making emerging across a range of disciplines including sociology, public policy, communications and media studies, political studies, and increasingly information systems (see for example, [6, 12, 13]). We contribute to the existing body of knowledge by proposing a novel approach to framing the problem of negative consequences of algorithmic decision-making as algorithmic pollution.

4 Algorithmic Pollution

Having outlined some of the negative consequences of automated algorithmic decisionmaking in transformative services we now frame the problem situation using the lens of pollution. The pollution concept is suitable since it allows us to see algorithms as a force for good while recognizing that there are both intended and unintended negative consequences that affect individuals, communities and society. It would be hard to argue that electricity is not a good thing, but if its generation causes pollution in the form of global warming then remedial action and regulation are needed. We note that using the concept of pollution as a framing device is not new: for example, there has been research defining crime as pollution (CAP) [31].

4.1 Defining Algorithmic Pollution

According to a broad definition “Environmental pollution is the discharge of material, in any physical state, that is dangerous to the environment or human health” [32]. (Encyclopedia.com). Similarly, the Encyclopedia Britannica defines environmental pollution as: “the addition of any substance (solid, liquid, or gas) or any form of energy (such as heat, sound, or radioactivity) to the environment at a rate faster than it can be dispersed, diluted, decomposed, recycled, or stored in some harmless form” [33].

When algorithms produce negative consequences on individual or collective wellbeing, and when such consequences cannot be effectively detected and eliminated or dealt with, we argue that they ‘contaminate’ our sociomaterial environment. We call this phenomenon algorithmic pollution and define it as follows:

Algorithmic pollution denotes the presence of unjustified, unfair, discriminatory, or other harmful consequences of algorithmic decision-making for individuals, groups, organizations, sections of the population, the economy, or society at large.

While our definition of algorithmic pollution accords with the view of pollution as harms suffered by living organisms caused by exposure to pollutants [31], the scientific definition of pollution is concerned with the presence of chemicals in the environment at a concentration above their normal background level that perturb the environment in a way that is harmful [34]. Harrison [34] also points out that not all instances of pollution involve the addition of chemicals to the environment; pollution can also be caused by adding to naturally occurring phenomena, such as light and noise. The scientific definition suggests that there is some background level of pollution that is acceptable. Since algorithms are probabilistic then some error in the form of false positives and false negatives is unavoidable, i.e., there will always be some level of background algorithmic pollution. The challenge is to detect when the outcomes of algorithmic decision-making exceed a threshold and result in systematic injustice (individual decisions) and larger, systemic social injustice (emergent societal effects). While there must inevitably be a substantial element of subjectivity in this judgment for algorithms it is also present with environmental pollution where acceptable limits (e.g., parts per million) have to be established to calibrate a ‘normal’ background level.

Drawing on Lynch and colleagues [31], we note that the pollution literature distinguishes between an ‘end-pipe’ (e.g., a factory chimney) and the process that generates the pollution (e.g., a manufacturing process). Further, end-pipes are a stationary source of pollution, while pollution itself is mobile and it is not always possible to know the source of pollution from monitoring the environment. Pollution can be generated as point source pollution (PSP) and nonpoint source (NPSP). While a factory chimney is a PSP, motor vehicles, which pollute the environment by generating particles and nitrogen dioxide while in standing traffic, are an example of NPSP.

4.2 Generation and Spreading of Algorithmic Pollution

For algorithmic pollution to occur there must be data (input) to feed the algorithms and the algorithms must lead to decisions (output). Algorithms only have the capability to produce pollution when they are used to automate decisions based on datafied individuals, i.e., data, algorithms, and decisions are always present and implicated in algorithmic pollution (even when this is not readily apparent). Using this production metaphor and concepts from the environmental pollution literature, we identify necessary elements that work together in the case of AI and machine-learning algorithms:

Datafication: algorithms are constructed using ‘datafied’ individuals i.e., individuals represented by limited number of attributes that have been chosen as relevant. As they are never complete, such a datafication practice is bound to create the so-called “representational” harm [35]. This type of harm is further intensified with organisations (including governments) increasingly acquiring data from “data scorers and brokers” with individuals already datafied (e.g., a person’s score) through some unknown processes [15, 27].

Production: in the case of machine learning, algorithms then learn from the data produced as a result of datafication to create rules. However, using past data to predict future behaviour is sometimes out-dated or inappropriate. For example, data collected on historical “gang districts” are now used by police for predictive policing even though these districts may be no longer representative [28]. As O’Neil [11] observes: “if we allowed a model to be used for college admissions in 1870, we’d still have 0.7% of women going to college. Thank goodness we didn’t have big data back then” (p. 1). Therefore, an algorithm might be designed in such a way that it discriminates against certain individuals, or it might learn from data to discriminate.

End-Pipes: algorithms are embedded in processes in transformative services of all types in order to make decisions with little or no human intervention. In the language of environmental pollution, this is the ‘end-pipe’ of algorithmic pollution, i.e., the point where decisions are made and enacted. Some of these decisions may result from point stationary pollution (PSP), where the decisions are generated by an identifiable organization, process, and algorithm. Other decisions are likely to have characteristics of non-stationary pollution (NPSP), being generated by multiple algorithm sources working collectively (for example decision generated by networks of intercommunicating algorithms).

Consequences: algorithmic decision-making in the transformative services has a direct impact on individuals, for example when a person is approved or declined for a loan, a medical operation, or parole. Algorithmic pollution is further propagated and amplified by highly interconnected systems of algorithms (NPSP). How these individual algorithms interact is not only invisible to those affected, but often to those who constructed them and deployed them [19, 36]. For example, a person with a poor credit card history is very likely to have difficulties finding employment; without a job they are very unlikely to repay their debt, which in turn will further impact on their credit card history [27]. Teachers being scored by algorithms as non-performing will face difficulties finding future employment, which in turn will limit their ability to improve their score [11]. In environmental pollution this is unlikely to be the case as, for example, radiation and water pollution do not augment each other. Algorithmic pollution, however, emerges from complex interactions that cannot be predicted and possibly cannot be traced back to root decisions, i.e., a cause and effect logic may be insufficient when addressing complex algorithmic pollution.

Feedback Loops: the algorithmic decision-making outcomes themselves lead to the generation of further data about individuals that can be harvested by machines and fed back into the algorithm building process. Not only can humans be removed from the decision-making process; they can also be removed from the algorithm building process as machines learn from data that was generated by machine-made decisions in the first place. Without some form of intervention these feedback loops may result in self-perpetuating vicious cycles, which may, ultimately, lead to deep rifts in the fabric of society. These feedback loops are thus unique to algorithmic pollution in that the consequences can affect the means of production in a direct and automated manner through datafication and machine learning, aided and amplified by data brokers and data scorers [27]. The end result is pollution itself becoming a pollutant, producing new forms of pollutions. This is a new digital phenomenon, not present in environmental pollution.

4.3 Implications

Algorithmic pollution is not only spreading but also intensifying. While in other cases of pollution humans and/or instruments are capable of detecting pollution (e.g., through sight, smell, or by radiation reading), algorithmic pollution remains hidden. Indeed, algorithmic effects are hidden and as such very hard to detect and prove. A customer of a health insurance company offers a vivid example:

“The insurance company repeatedly told me that the problem was the result of a technical error, a few missing digits in a database. But that’s the thing about being targeted by an algorithm: you get a sense of a pattern in the digital noise, an electronic eye turned towards you, but you can’t put your finger on exactly what’s amiss” [10, p. 5].

Moreover, it is very difficult (if possible at all) for an individual to fight the effects of algorithms. In fact, “bad inferences” about people are fast becoming “a larger problem than bad data because companies can represent them as “opinions” rather than fact. A lie can be litigated, but an opinion is much harder to prove false” [27, p. 32]. To make matters worse, algorithmic decision-making continues to be celebrated as superior to human-judgment [10, 11, 37]. The cult of “science” continues as “Technocrats and managers cloak contestable value judgements in the grab of “science” [27, p. 10]. Inevitably, and often unknowingly, they also contribute to the creation and propagation of pollution.

As algorithms now proliferate into various sectors of the economy and society they fundamentally reconfigure power relations and transform the ways sectors operate, without public awareness or broader understanding of their consequences. Given the potentially complex outcomes of algorithmic pollution, focusing on and opening up the ‘black box’ of how algorithms work (the production stage), is unlikely to be a successful strategy for algorithmic regulation. The lack of transparency, the hidden acting of algorithms, and the presence of feedback make the study of algorithmic pollution particularly challenging.

5 Theorizing Algorithmic Pollution

Contemporary forms of knowing, in particular those advanced by computer and communication technology research, artificial intelligence, data analytics and data science, are focused on the translation of problems (business, market, political, scientific) into codified knowledge and ultimately codes of algorithms. A considerable body of literature thus focuses on translations: first, the translation of tasks (or problem solutions) into formal statements or instructions (pseudo-code); and second, the translation of the pseudo-code into a source code [19, p. 17]. The first translation is particularly critical as it essentially codifies existing knowledge about a problem at hand in such a way that all possible conditions relevant for solving it (e.g., variables in a decision-making model) and for generating decisions are taken into account. Algorithms that have errors in the codified knowledge (logic or control or both) produce wrong or problematic outcomes [38] and can thus be identified as and shown to be pollutants.

However, algorithmic pollution occurs more often due to negative unintended consequences of carefully designed and seemingly correct algorithms. As examples above illustrate, the execution of algorithms involves mobilization and use of diverse data sources (e.g., shopping history data, prescription drugs, medical and wellness data, social media records, search engine logs/history, voting preferences, credit card transactions and many more, often sold by data brokers who consolidate data per individuals). These data are prone to errors, are uncertain, and contain a significant amount of noise [15]. Based on such data, algorithms calculate scores, make decisions or produce other outcomes (risk scores for individuals, loan or insurance approvals/declines, short listing of job applicants) that become effective in concrete sociomaterial practices: individuals are targeted as criminal suspects based on risk scores; bank clients are declined loans; applicants are not short listed. Such effects can be damaging while typically not being justified [10, 27].

The consequences of the algorithmic execution thus depend to a large extent on numerous heterogeneous actors enrolled in complex and uncertain sociomaterial assemblages. These consequences are rarely predictable and detectable at the design and coding stage. While understanding the reasoning embedded in the code of an algorithm and how outcomes (decisions) are calculated and derived from inputs, is important and necessary, it is far from being sufficient to comprehend what an algorithm is actually doing, on what grounds its decisions are produced and whether they are correct, fair, just, and justified. As algorithms become actors they “form a complex and at various times interpenetrating sociomaterial assemblage[s] that [are] diffused, distributed, fragmented, and, most importantly, “liquid” [39, pp. 18–19]. Their effects are produced by the sociomaterial assemblages. To understand algorithmic pollution, we argue, requires empirical attention to the workings of individual algorithms or systems of algorithms and the examination within their complex, diffused, fragmented, liquid and often interpenetrating sociomaterial assemblages [40]. This proposition opens many conceptual and methodological questions.

The notion of an algorithm as “Logic + Control” [18] or a set of instructions for completing a particular set of tasks [1], implies a self-sufficient non-human object with specified functions with defined inputs, a complete set of conditions and action possibilities (outcomes). When its code (a set of instructions) is executed an algorithm becomes the actor. In other words, the execution of code constitutes an algorithm as an actor. Code execution is a particular materialization of relations that form sociomaterial assemblages (mobilize and enact heterogeneous actants – servers, various data sets, other algorithms, things and human actors as objects of knowledge). It is through these relations that particular outcomes (decisions, recommendations) are achieved (credit scores calculated; crime suspect regions demarcated; terrorists predicted). How to study these enfolding relations becomes the key methodological issue, an issue that is yet further complicated by the ability of machines to learn from data without human input and, due to the use of deep learning, may be unable to fully account for the “Logic” that is being used to automate decisions [18, 19].

Through repeated execution algorithm codes keep performing their objects of knowledge and thus enact different entities (things and people) into being. They perform new distinctions and new categories of customers/clients/citizens often based on unchecked and error prone data, from dubious and unreliable sources [15]. Mackenzie and Vurdubakis [41] similarly note:

“the conduct of code, we might say, its execution, is a fraught event, and analysis should be brought to bear on the conditions and practices that allow code to, as it were, access conduct. While the knowledge or form that lies at the heart of the code promises completeness and decidability, the execution of code is often mired in ambiguity, undecidability and incompleteness” (p. 7).

Importantly, “ambiguity, undecidability and incompleteness” are kept hidden, buried in the complexity of code execution and largely unrecognized. Even the designers and users of algorithms (especially those with learning capabilities) do not understand the intricacies of code execution and cannot explain the resulting outcomes which are nevertheless actioned undoubted and undisputed.

This brief discussion suggests that to understand the actual doings of algorithms we need first to examine and dig deeper into the relational unfolding of code execution (a digital life of code) and the emergence of sociomaterial assemblages (the intra-acting in Barad’s [42] sense), including the mobilization of numerous actors (data sets, companies, internet, data analytics technologies) and the performing of subjects and objects. The relational unfolding of a code however is hidden behind the interface and the traces of code execution are typically not provided.

When the algorithmic outcomes become enacted they continue the ‘doing’ by being enrolled in sociomaterial practices of the users (for example, in a police department or in a bank loan approval process). Entangled within these practices algorithmic outcomes have a life of their own, reconfiguring users’ action domains while becoming constitutive of subjects (suspect citizens or risky clients) and objects (high criminality regions). Algorithmic outcomes thus perform what Barad [42] calls agential cuts, making particular subjects and objects in the image of their calculation. For instance, the subjects (citizens, clients, job applicants) become performed as particular calculated figures (e.g., citizens equated with their risk scores), the power of which comes from an unquestioned authority of algorithms [43].

These performative effects of algorithms are not only taken for granted, they are celebrated as unbiased, objective and thus fair [11]. That they are based on unchecked and uncertain data sets, often breaching basic human rights, and thus unjustified, unethical, and potentially illegal, is conveniently hidden and kept far from the public eye. Algorithmic pollution, we might tentatively conclude, is carefully covered up, systematically hidden, and deceivingly dressed up as technological progress.

These initial ideas, conceptualizations and methodological issues only scratch the surface of unprecedented methodological complexity of investigating algorithmic pollution. Uncovering it, revealing how algorithms pollute various sociomaterial environments and what injustices and damages are done to people and communities, will be an uphill battle for anybody who dares to research and report on it.

In this battle we can learn from ANT scholars who have studied similar reconfigurations of sociomaterial practices and the performing of subjects and objects in a variety of contexts (see for example, [44–47]). What is however different and new in algorithmic doing and performing is the particular discursive-calculative-digital nature of algorithmic outcomes and how they come into being in code execution. For this reason, ANT or other field methodologies would need to be adapted or reinvented to be delicately attuned to diffused, fragmented, uncertain and hidden sociomaterial practices of algorithmic doings and reality making.

6 A Research Agenda for Algorithmic Pollution

As we have shown, in addition to investigating the design of algorithms (that has been extensively studied in the literature, see [18, 43], researching and understanding algorithmic pollution requires empirical examination of interrelated sociomaterial practices of two key aspects: algorithm deployments and ongoing datafication processes. Both aspects offer new research challenges, as discussed in this section.

Algorithm deployment includes on the one hand, coding, execution of code and emergence of a sociomaterial assemblage that produce algorithmic pollution, and on the other, the enactment of algorithmic outcomes (decisions, recommendations) that reconfigures users’ practices and performs subjects and objects. The need to better understand how these sociomaterial practices of algorithm deployment contribute to algorithmic pollution, leads us to a number of research questions.

For example, what is the relationship between coding practices and algorithmic pollution? We envisage the design of new frameworks and methods that could be used to guide developers to bring to the surface potential sources of algorithmic pollution, including datafication practices. An important step in this direction is the IEEE Global Initiative on Ethics of Autonomous and Intelligence Systems [48]. We envisage the challenge of translating the proposed generic principles into practical approaches in a particular context, taking into account the complexities of transformative services. These yet-to-be-discovered practices, could include for example moral imagining [49].

The challenge of making visible the process of emergence of a sociomaterial assemblage that produces algorithmic pollution opens yet more research questions. For example: How might we effectively recognize, report and mitigate the effects of algorithmic pollution throughout society? Who should be doing it? How might we recognise and deal with different types of polluters? How can we educate governments, organisations and society at large to look beyond the current hype of algorithmic neutrality, efficiency and superiority and comprehend the urgency of dealing with algorithmic pollution?

In framing a response to algorithmic pollution, we propose to turn our attention and learn from the established field of environmental justice, which is defined as follows:

“Environmental justice is a social movement seeking to address the inequitable distribution of environmental hazards among the poor and minorities. … From a policy perspective, practicing environmental justice entails ensuring that all citizens receive from the government the same degree of protection from environmental hazards and that minority and underprivileged populations do not face inequitable environmental burdens.” [50, p. 1].

We propose that algorithmic pollution is added to the environmental dimensions already identified in the environmental justice movement, as algorithmic justice. As previously illustrated, there is already strong evidence that the hazards of algorithms are distributed inequitably. As Eubanks [10] explains, these new algorithmic systems for “automating inequality” have the most destructive and deadly effects on the poor and the underprivileged. Even more, “[t]he widespread use of these systems impacts the quality of democracy for us all” [10, p. 12].

The environmental justice agenda is reflected in the Toronto Declaration [51], which is calling for governments and companies to ensure that algorithms respect basic principles of equality and non-discrimination. Yet, as our paper demonstrates, this is going to be very difficult to implement in practice, as today’s algorithms are so “deeply woven into the fabric of social life that, most of the time, we don’t even notice we are being watched and analysed” [10, p. 5].

A possible way forward could be found by simultaneously looking forward at the emerging developments in AI and algorithmic decision-making and looking back at the history of the environmental movement. For example, a possible way of providing more visibility into the inner working of algorithms would be to store the trace of automated algorithmic decisions using a blockchain, as suggested by Schmelzer [52]. This has the benefit of the decision audit trail being stored in a way that can be shared, cannot be tampered with, and is not owned by the algorithm producer or deployer. A similar idea might be applied to the problem of spreading pollution by creating an audit trail for the ongoing datafication of individuals in transformative services.

By considering the history of environmental protection, we could also learn, for example, about the ways in which traditional pollution has been addressed. We could then expand or redevelop the existing frameworks and methods, such as Environmental Impact Assessment (EIA) [53] and market-based controls [31], to include algorithmic pollution. Finally, by researching the inner working of government environmental protection agencies we may identify new opportunities for policy development and possible establishment of similar agencies for algorithmic justice.

7 Conclusion and an Urgent Call for Action

In his work titled “Love Your Monsters”, Latour turns his attention to technology “to protect the planet from ecological crisis” [54, p. 1]. We argue that a new type of crisis is already here, caused by a new type of technologically-induced pollution that we identify and name “algorithmic pollution”.

Inspired by the observed parallels with environmental pollution, in this paper we articulate a new type of widespread, hidden, largely unregulated and evidently harmful “algorithmic pollution”. Focusing on the transformative services, we offer evidence collected from multidisciplinary literature why this pollution is a growing problem that requires our urgent attention. We also offer a preliminary approach to studying algorithmic pollution that discloses the hidden and uncertain performing of algorithms in sociomaterial environments, which would enable researchers to examine the nature of algorithmic pollution and how the damage is done. This enables us to identify and articulate a set of IS research challenges that call for our urgent attention. By drawing parallels between environmental protection and the need to protect the observed sociomaterial environment that is now affected by algorithmic pollution, we open up new opportunities for a practical contribution.

We recognize that algorithms undoubtedly have the potential to provide society with significant benefits (e.g., healthcare, driverless vehicles, fraud detection). Therefore, this paper is not a treatise against algorithms. Far from it. It is however explicitly and consciously against algorithmic pollution. Recalling the words of the poet Ella Wheeler Wilcox – ‘to sin by silence, when we should protest” – we, IS researchers, should raise our voices and enact our professional responsibility.

Building upon the fundamental principle of environmental justice that “all people deserve to live in a clean and safe environment free from industrial waste and pollution that can adversely affect their wellbeing” [50, p. 1], we conclude this paper with a claim that all people equally deserve to live in an environment free and safe from algorithmic pollution. If algorithms are our future, as many claim, then understanding, fighting against and preventing algorithmic pollution, may save our collective dignity and humanity.

#### Dystopia outweighs everything.

Harel and Brownsword, 19—law professor at the Hebrew University of Jerusalem AND Professor in Law at King's College London (Alon and Roger, “Law, liberty and technology: criminal justice in the context of smart machines,” International Journal of Law in Context, Volume 15, Special Issue 2, June 2019, pp. 107-125, dml) [language modifications denoted by brackets]

Famously, Stephen Hawking (2018, p. 188) remarked that ‘the advent of super-intelligent AI would be either the best or the worst thing ever to happen to humanity’. At best, smart machines, smart policing and smart cities of the kind contemplated by Elizabeth Joh might signal the end of crime; but, at worst, we can imagine various dystopian futures where the existential and agential threats presented by AI have been realised. Given, in James Bridle's (2018, p. 2) words, that our technologies are complicit in ‘an out-of-control economic system that immiserates many and continues to widen the gap between rich and poor; the collapse of political and societal consensus across the globe resulting in increasing nationalisms, social divisions, ethnic conflicts and shadow wars; and a warming climate, which existentially threatens us all’, then Vincent Chiao might well be right in claiming that the turn to smart technology might not be the smartest [best] way of trying to achieve the end of crime.

In this collection, our contributors have not highlighted concerns of an existential nature. Nevertheless, we might fear that, in our quest for crime-free societies, for greater safety and well-being, we will develop and embed ever more intelligent devices to the point that there is a risk of the extinction of humans – or, if not that, then a risk of humanity surviving ‘in some highly suboptimal state or in which a large portion of our potential for desirable development is irreversibly squandered’ (Bostrom, 2014, p. 281, note 1; see also Ford, 2015). Our contributors have not yet recommended that we should follow the example of Samuel Butler's Erewhonians who, fearful for their liberty, destroyed their machines (Butler, 1872) – and who also, of course, inverted conventional wisdom by punishing those who fell ill while, by contrast, treating in hospital and sympathising with those who committed crimes such as forging cheques, setting property on fire or robbing with violence. Yet, the beauty of Erewhon is that, to some present-day readers – particularly readers who are familiar with, say, Harari's Homo Deus (2016) 15 or Häggerström's Here be Dragons (2016) – the practices of the Erewhonians might seem to be anything but benighted. Is it so ridiculous to think that, with the acceleration in technological development, machines might become much smaller and smarter, capable of reproducing themselves, communicating with one another and displaying various degrees of intelligence (if not consciousness as humans experience it) and agency? Most importantly, which policy would be the more crazy [imprudent]: to disregard machines as a threat to the human condition or to treat the threat as sufficiently serious to warrant at least some precautionary measures – albeit perhaps not precaution on the scale exercised by the Erewhonians, who destroyed ‘all the inventions that had been discovered for the preceding 271 years’ (Butler, 1872, p. 260)?

Such, however, are not the most explicit concerns of our contributors. Rather, the concerns expressed by Bowling and Iyer, by Lynskey and by Macdonald, Correia and Watkin relate to our agential interests and, in particular to our interests in privacy, in the fair collection and processing of our personal data and in access to (and the integrity of) the informational eco-system. Increasingly, it is being recognised that such interests are ‘contextual’ not only in the sense that their demands might vary from one context to another, but in the more fundamental sense that we have a common interest in a context that enables our self-development (Hu, 2017; Brincker, 2017). This is nicely expressed in a paper (discussing data governance) from the Royal Society and British Academy:

‘Future concerns will likely relate to the freedom and capacity to create conditions in which we can flourish as individuals; governance will determine the social, political, legal and moral infrastructure that gives each person a sphere of protection through which they can explore who they are, with whom they want to relate and how they want to understand themselves, free from intrusion or limitation of choice.’ (Royal Society and British Academy, 2016, p. 5)

With data being gathered, in both the public and the private sector, on an unprecedented scale (Vaidhyanathan, 2011; Galloway, 2017), we might treat such dataveillance as compromising the conditions for self-development and agency (Pasquale, 2015). Moreover, we might fear that, where data are used to train smart machines that sift and sort citizens (as mooted by the Chinese social credit system) (Chen and Cheung, 2017), then, in Glen Greenwald's (2014, p. 6) words, this could be the precursor to a truly dystopian ‘system of omnipresent monitoring and control’.

Finally, there is the subtle and insidious way in which smart machines might compromise the conditions for moral development. If we accept that the fundamental aspiration of any moral community is that its members should try to do the right thing, then this presupposes a process of moral reflection and action that accords with one's moral judgment. Of course, this does not imply that each agent will make the same moral judgment or apply the same reasons. A utilitarian community is very different to a Kantian community; but, in both cases, these are moral communities and it is their shared aspiration to do the right thing that is the lowest common denominator (Brownsword, 2013; 2018a). Arguably, liberty – in the sense of having the practical option of doing both the right thing and the wrong thing – is critical to moral community. On the East coast, where crime is rife and where prudential reasoning dominates, the moral project is poorly realised; but it is at least a community with moral possibilities and with room for moral improvement. By contrast, in the well-ordered technologically managed West coast, if the possibility of moral community is lost, then, as Beyleveld and Brownsword emphasise, this should certainly give us pause about the direction of travel in the criminal justice system.

The ability to do the right thing also hinges not only on individual deliberation, but also on public moral deliberation. The automated processes designed to disable crime also typically mute and disable public moral deliberation. If behaviour that previously was condemned and prohibited has become impossible to engage in (due to technological innovations), we are less likely to debate its justifiability. We will never know whether speed limits are justified unless some people violate them; we can never know whether certain restrictions on movement promote the public interest if such restrictions are enforced perfectly by using technological innovations. In other words, automated processes do not only erode individual moral sensibilities; they also erode public moral deliberation.

#### Decisional privacy infringements reduce societal cognitive functioning through gray matter recession and frontal lobe atrophy.

Day and Stemler, 20—Assistant Professor, University of Georgia, Terry College of Business AND Assistant Professor, Indiana University, Kelley School of Business (Gregory and Abbey, “Are Dark Patterns Anticompetitive?,” Alabama Law Review 72, no. 1 (2020): 1-46, dml)

Applying Solove's framework, first, platforms can collect a virtually unlimited amount of data through the Attention Cycle.1 23 Second, platforms can inadvertently disseminate data via porous security or intentionally transfer data through direct and indirect sales.1 24 Third, platforms can capitalize on inferences drawn from data by profiling users. Consider Uber, which has developed technology to identify when a user is intoxicated (is she holding her smartphone at an odd angle or walking in a staggered manner?). 125 Also, Tinder tracks interactions to calculate a "secret internal Tinder rating" for each user to match potential paramours, 126 and Airbnb has innovated algorithms to calculate a user's "trustworthiness score"-predicting "narcissism, Machiavellianism, or psychopathy"-drawn from the surveillance of one's social media, public records, blog posts, presence of false profiles, and other sources. 127

But the greatest harm may, fourth, derive from the privacy costs associated with influence, or decisional privacy. Decisional privacy erodes when manipulation invades internal thought processes, 128 reduces free will,1 29 or interferes with a user's self-interest.130 For autonomy to be possible, users must enjoy reasonable means to select among options to achieve their goals. 131 If persons are free of manipulation, they can roughly account for the reasons underlying their choices. 132

The Cambridge Analytica scandal of 2018 is a prime example of eroded decisional privacy. Investigations by the New York Times, The Observer of London, and The Guardian revealed that Facebook allowed Professor Aleksandr Kogan to access and sell the personal data of over 50 million Americans. 133 The data's purchaser, Cambridge Analytica, used it to influence political opinions while "'circumvent[ing] users' awareness of such influence." 134 These tactics included psychological profiles meant to identify individuals who are prone to persuasion via misinformation and suggestion to take certain political actions. 135 As stated by Cambridge Analytica's co-founder: "We exploited Facebook to harvest millions of people's profiles [and] built models to exploit what we knew about them and target their inner demons." 136 The FTC, implying the importance of decisional privacy, noted that remedial action was necessary given how "Facebook undermined consumers' choices."137

B. The Individual and Societal Costs of Online Manipulation

When interfaces and platforms impair decisional privacy, the injuries can be substantial. On one level, the Attention Cycle itself can invade decisional privacy. In fact, on occasion, recognized disorders, like internet and gaming addictions, can develop, animated by traditional symptoms of dependency, such as excessive use, withdrawal, and tolerance. 138

Research on this topic has even found physiological changes of the brain. Using structural Magnetic Resonance Imaging (sMRI), heightened levels of internet usage and gaming have been shown to cause gray matter recession. 139 Gray matter of the brain's surface controls the processing of information, such as speech, emotion, and motor control. 14 Tissue erosion was most pronounced-waning between 100 /-2 0 /--in users suffering from the greatest addictions. 141 Importantly, the shrinking of gray matter in the left posterior limb is associated with impaired self-control, which strengthens digital addiction. 142 Another area of atrophy was found in the frontal lobe, which governs planning and organizational skills. 143 One study of WeChat users deduced that reduction of gray matter leads users to experience enhanced reward sensitivity as well as impulsivity, suggesting that digital addiction begets more addiction.144

This type of dependency can even lead to alterations in the brain resembling prolonged narcotics abuse.1 45 One study, published in 2020, found that collegiate internet gamers who forewent gaming displayed withdrawal symptoms mirroring that of cocaine users.1 46 This creates particular concern when accounting for the rate of affected adolescents whose brains are still in the midst of developing.1 47

Internet addiction may also alter dopamine receptors. Scholarship has found that dopamine released during online activities diminishes the availability of D2 receptors.148 Lengthier addictions display greater changes.1 49 And like with the research on gray matter, the effects of prolonged exposure mirror narcotics usage. 150 Specifically, "a decrease in the number and function of D2 receptors, observed both in animals and in humans ... is functionally correlated to the enhancement in drug craving, drug intake and relapse." 151 Bolstering these findings, scholarship asserts that internet addiction is the cause of receptor damage rather than vice versa, 152 as increased exposure leads to increased damage.1 53 According to research published in the last year, debate exists about this topic, yet the majority of scholarship and the DSM-5 agree that online addiction entails a form of disorder. 154

In important part, the physiological effects of internet addiction are also shown to cause an array of economic and social problems. One of the primary findings links the Attention Cycle to heightened anxiety. Cortisol is a hormone that regulates the body's "alarm system" (i.e., the anxiety associated with fight or flight).1 55 When individuals separate from their devices, the body releases cortisol, generating survival reflexes and anxiety.156 Other problems associated with internet addiction include social impairment,15 7 risk-taking,158 depression,1 59 sleep deprivation,1 60 self-injurious behaviors, 161 impaired social capabilities,1 62 and, of course, altered decision-making.1 63

Even though internet addiction may occur without manipulation, firms have sought to design interfaces to embellish this outcome. Consider the company Dopamine Labs, which designs algorithms for clients that are meant to exploit dopamine in the most effective, addictive manners.1 64 With "just a few lines of code," their claim is that neuroscience and artificial intelligence allow them to "keep their users around longer and doing more. Way more. Up to 60% more." 165 As Anderson Cooper questioned, "Is Silicon Valley programming apps or are they programming people?" 166

#### Cognitive collapse causes extinction.

Annunziata and McManus, 19—former Chief Economist and Head of Business Innovation Strategy at General Electric AND Visiting Research Fellow at Autodesk, Senior Advisor at BCG (Marco and Mickey, “The Great Cognitive Depression,” <https://www.forbes.com/sites/marcoannunziata/2019/01/11/the-great-cognitive-depression/#49ed9dc174c1>, dml)

Our ability to think and make smart decisions is eroding just as our environment gets more complex and harder to grasp with our traditional tools.

Stone age tools for cognitive age challenges?

But wait, this is not the first time we face a rise in complexity and have to contend with multiple disruptions. We’ve faced tough challenges before and built structures to allow us to manage and make decisions at vast scales. Corporations, cities, markets, and governments are all technologies we’ve devised to manage complexity and make rational and actionable decisions in a hostile world. Steven Johnson—in his new book Farsighted—points out that we’ve evolved decision and scenario sciences to cope with increasingly complex issues—from the era of Darwin when he used the simple “pro/con” list to decide if he should get married (a non-trivial decision) to today’s advanced scenario-planning war games, science fiction foresight tools and other scalable management techniques.

This time, however, seems different—for a troubling simple reason. This time we face the rise of powerful new forces that undermine our very ability to react to these challenges and disruptions: our cognition itself is under attack. These toxic new forces leverage digital technology to exploit our behavioral biases, pushed by powerful financial incentives.

The early warning signs

What if the structures we had built to protect us against irrational decisions turn out to be rickety breakwaters laid down on the shore of a once placid sea and provide no protection from a 100-year flood? When the art and science of decisions-making itself collapses might we face a Great Cognitive Depression?

The early warning signs are troubling to say the least. Authoritarian governments and despots are enjoying a resurgence. In many democracies, voters faced with complex issues turn to simple answers and slogans, to the siren call of populism. They dismiss the experts (think of Brexit as a case in point), they look for scapegoats and easy fixes.

Could these be examples of human cognition reverting to evolutionary shortcuts to cope with complex threats? Authority bias is a quick way for us to decide things when we are faced with tough choices. If something is too ambiguous or non-deterministic we follow the authority figure with the most compelling and simple story, instead of doing the thinking for ourselves.

Social scientists have documented upwards of 200+ cognitive short cuts and biases that evolved to help us cope with danger, make decisions fast, and conserve our precious cognitive resources to fight another day. But sometimes those shortcuts have lived on far past their “sell by” date. Sometimes our brains lie to us. Buying behavior in our simian ancestors seem oddly similar to the ways humans make choices in markets. We believe we are rational actors but time and again we find out that it is very hard to see the thinking about our thinking. And now it’s getting harder.

Here is where we find a dangerous market failure.

A powerful combination of new technologies and financial incentives is fast overwhelming our old protective barriers.

Digital innovations are creating value. But this value is not given away for free, as some economists contend. There is no free lunch.

We all know that digital platforms are after our data. Sometimes they use it to our advantage, with more personalized offerings; often they sell it to advertisers. For them we are a different kind of “prosumer”: not a producer-consumer, but rather a product-consumer. We are more a commodity than a true customer. You might argue that well, almost everyone realizes this, and we still enter these transactions of our own free will, so what’s the problem?

But digital platforms are not just after our data—they crave our unwavering attention. Higher ratings command higher advertising rates—and the ratings are determined by how much time we spend with our eyeballs glued to the screen, our attention absorbed by the apps.

Therefore, these platforms have a financial incentive to hold our attention, and to grab it back whenever it drifts away—a powerful financial incentive. Hence the game of incessant notifications, of addictive updates on likes and shares, of instigations to chase followers, friends and connections.

See, the fact that digital platforms grab our data in exchange for their “free” services strikes us as a lesser distortion. The digital platform, be it Google, Amazon, Twitter or Facebook, most likely gets more value from my individual data than it gives back to me in services. But the truth is, my data is much less valuable to me than it is to them, because they can aggregate it with others’, whereas I cannot. And unless I find a way to get together with millions of other users, in a sort of modern trade union of the digital sheep, I will never have enough bargaining power to extract more of that value. Because as long as everybody else gives their data away, the marginal value of my data is close to zero. But as I said, my data is of little value to me, in isolation. Little ventured, little lost in this case.

Cognition is another matter.

Our attention, our cognition, is a very precious resource. We need it to study, to work, to run our daily lives, to take small and big and life-changing decisions. And it’s a limited resource. We can fool ourselves that we can multitask. That we have become a lot more productive as we track our Twitter feed and social media messages while we work, answer emails during conference calls.

Except that we can’t and we don’t. We become less productive, not more. The statistics—as we discussed earlier—bear this out. It should be no surprise. In this more complex world, we have a lot to study and understand—and we cannot do it in 20-seconds bursts. When we get distracted, we need over 20 minutes to refocus on the task at hand. In this more complex and high-tech world, knowledge and understanding have enormous value. The time and cognition we invest in acquiring knowledge, mastering skills, earning credentials, yields a very high rate of return in terms of career opportunities, earnings, and personal fulfillment.

Which means that the opportunity cost of every minute we spend looking at a digital ad, “catching up” on various messaging platforms, or watching a viral video is extremely high.

And the digital drugs we take on a daily basis not only absorb precious time today—they also erode our ability to concentrate. By pushing us to an obsessive-compulsive habit of constantly checking for something new online, they gradually destroy our slow-thinking ability (àla Kahneman), our power of concentration. Our attention spans are shortening, undermining our future productivity as well.

This could easily become a vicious spiral: powerful financial incentives will keep pushing digital platforms to grab more and more of our attention. And as the Internet of Things becomes more pervasive, they will have more and more tools at their disposal: soon the mirror in your bathroom and smart dust around you as you walk down the street will also compete for your attention. At the same time, these companies’ tactics exploit deep-rooted cognitive biases: we are programmed to pay attention to anything referring to us, to look for news and new things, and to crave the approval of our community. Left to itself, this is only going to get worse.

So just as we enter the most harrowing straits for ourselves and our planet, as we race to rebalance ever widening gaps between the powerful and the powerless; as we come to grips with extinction level threats to our way of lives, the structures we’ve erected to make rational decisions are collapsing. While we have new decision-making and scenario planning methodologies at our disposal, we may not have much actual brainpower to notice, care or bring our best thinking to the table. The Great Cognitive Depression is racing towards us and we don’t appear to be taking the early warning signs seriously and may not even notice before it’s too late. The counterfeit attention-based currency that is flooding our markets may soon bankrupt our cognitive reserves. Bad money (attention) drives out good, as Gresham’s Law predicts.

We’ve fostered the rise of industries that are rewarded for de-cognition attacks and we have put no incentives or taxes in place to do what markets can’t or won’t do themselves. It is as if our human odyssey has been blown off course, pushed by the rising tide toward the land of the sirens, seduced by deceptive songs, hypnotized and driven towards madness. If we do nothing we may ultimately wash up on the shores from a watery grave.

### AT: Turchin & Denkenberger---2AC

#### Concludes that AI is necessary to prevent other existential tech.

Alexey Turchin & David Denkenberger 20, Turchin is a Senior Researcher at the Science for Life Extension Foundation, Denkenberger is an Assistant Professor of Mechanical Engineering at University of Alaska Fairbanks and Researcher at the Global Catastrophic Risk Institute, “Classification of Global Catastrophic Risks Connected with Artificial Intelligence,” *AI and Society*, Vol. 35, No. 1, pp. 147–163, doi:10.1007/s00146-018-0845-5/micahw

3.6. Opportunity cost of not preventing other existential risks

Other global risks could appear if superintelligent AI does not emerge in time to prevent them (Bostrom 2003a). Superintelligent AI and its supposed ability to control many parameters and predict the future is our best chance of avoiding the risks of mature biotechnology and nanotechnology (Yudkowsky 2008). Without superintelligent AI, humanity may not be able to control the dissemination of dangerous biotechnologies, which will be available to thousands of potential biohackers, who could create thousands of pathogens and produce a global multipandemic (Turchin et al. 2017).

Thus, if the creation of a powerful and global control system is delayed for decades, perhaps because of a fear of superintelligence, it will increase other GCRs. A global control system would most likely require some form of limited superintelligence, like the AI Nanny suggested by Goertzel (2012).

### AT: AI Bad

#### AI governance solves every impact better than humans can.

Tim Urban 15 {BS from Harvard, citing Ray Kurzweil, Google’s Director of Engineering, co-founder of the Singularity University hosted by NASA, and has a strong record of technology predictions. 1-22-2015. “The AI Revolution: Our Immortality or Extinction.” https://waitbutwhy.com/2015/01/artificial-intelligence-revolution-2.html}//JM

Nick Bostrom describes three ways a superintelligent AI system could function:6 As an oracle, which answers nearly any question posed to it with accuracy, including complex questions that humans cannot easily answer—i.e. How can I manufacture a more efficient car engine? Google is a primitive type of oracle. As a genie, which executes any high-level command it’s given—Use a molecular assembler to build a new and more efficient kind of car engine—and then awaits its next command. As a sovereign, which is assigned a broad and open-ended pursuit and allowed to operate in the world freely, making its own decisions about how best to proceed—Invent a faster, cheaper, and safer way than cars for humans to privately transport themselves. These questions and tasks, which seem complicated to us, would sound to a superintelligent system like someone asking you to improve upon the “My pencil fell off the table” situation, which you’d do by picking it up and putting it back on the table. Eliezer Yudkowsky, a resident of Anxious Avenue in our chart above, said it well: There are no hard problems, only problems that are hard to a certain level of intelligence. Move the smallest bit upwards [in level of intelligence], and some problems will suddenly move from “impossible” to “obvious.” Move a substantial degree upwards, and all of them will become obvious.7 There are a lot of eager scientists, inventors, and entrepreneurs in Confident Corner—but for a tour of the brightest side of the AI horizon, there’s only one person we want as our tour guide. Ray Kurzweil is polarizing. In my reading, I heard everything from godlike worship of him and his ideas to eye-rolling contempt for them. Others were somewhere in the middle—author Douglas Hofstadter, in discussing the ideas in Kurzweil’s books, eloquently put forth that “it is as if you took a lot of very good food and some dog excrement and blended it all up so that you can’t possibly figure out what’s good or bad.”8 Whether you like his ideas or not, everyone agrees that Kurzweil is impressive. He began inventing things as a teenager and in the following decades, he came up with several breakthrough inventions, including the first flatbed scanner, the first scanner that converted text to speech (allowing the blind to read standard texts), the well-known Kurzweil music synthesizer (the first true electric piano), and the first commercially marketed large-vocabulary speech recognition. He’s the author of five national bestselling books. He’s well-known for his bold predictions and has a pretty good record of having them come true—including his prediction in the late ’80s, a time when the internet was an obscure thing, that by the early 2000s, it would become a global phenomenon. Kurzweil has been called a “restless genius” by The Wall Street Journal, “the ultimate thinking machine” by Forbes, “Edison’s rightful heir” by Inc. Magazine, and “the best person I know at predicting the future of artificial intelligence” by Bill Gates.9 In 2012, Google co-founder Larry Page approached Kurzweil and asked him to be Google’s Director of Engineering.5 In 2011, he co-founded Singularity University, which is hosted by NASA and sponsored partially by Google. Not bad for one life. This biography is important. When Kurzweil articulates his vision of the future, he sounds fully like a crackpot, and the crazy thing is that he’s not—he’s an extremely smart, knowledgeable, relevant man in the world. You may think he’s wrong about the future, but he’s not a fool. Knowing he’s such a legit dude makes me happy, because as I’ve learned about his predictions for the future, I badly want him to be right. And you do too. As you hear Kurzweil’s predictions, many shared by other Confident Corner thinkers like Peter Diamandis and Ben Goertzel, it’s not hard to see why he has such a large, passionate following—known as the singularitarians. Here’s what he thinks is going to happen:Timeline Kurzweil believes computers will reach AGI by 2029 and that by 2045, we’ll have not only ASI, but a full-blown new world—a time he calls the singularity. His AI-related timeline used to be seen as outrageously overzealous, and it still is by many,6 but in the last 15 years, the rapid advances of ANI systems have brought the larger world of AI experts much closer to Kurzweil’s timeline. His predictions are still a bit more ambitious than the median respondent on Müller and Bostrom’s survey (AGI by 2040, ASI by 2060), but not by that much. Kurzweil’s depiction of the 2045 singularity is brought about by three simultaneous revolutions in biotechnology, nanotechnology, and, most powerfully, AI. What AI Could Do For Us Armed with superintelligence and all the technology superintelligence would know how to create, ASI would likely be able to solve every problem in humanity. Global warming? ASI could first halt CO2 emissions by coming up with much better ways to generate energy that had nothing to do with fossil fuels. Then it could create some innovative way to begin to remove excess CO2 from the atmosphere. Cancer and other diseases? No problem for ASI—health and medicine would be revolutionized beyond imagination. World hunger? ASI could use things like nanotech to build meat from scratch that would be molecularly identical to real meat—in other words, it would be real meat. Nanotech could turn a pile of garbage into a huge vat of fresh meat or other food (which wouldn’t have to have its normal shape—picture a giant cube of apple)—and distribute all this food around the world using ultra-advanced transportation. Of course, this would also be great for animals, who wouldn’t have to get killed by humans much anymore, and ASI could do lots of other things to save endangered species or even bring back extinct species through work with preserved DNA. ASI could even solve our most complex macro issues—our debates over how economies should be run and how world trade is best facilitated, even our haziest grapplings in philosophy or ethics—would all be painfully obvious to ASI.

#### There’s no risk of errors---even if AI isn’t perfect, it’s great at admitting what it doesn’t know---human error is orders of magnitude worse

Patrick Tucker 20 {Patrick Tucker is technology editor for Defense One. 4-29-2020. “Artificial Intelligence Outperforms Human Intel Analysts In a Key Area.” https://www.defenseone.com/technology/2020/04/artificial-intelligence-outperforms-human-intel-analysts-one-key-area/165022/}//JM

In the 1983 movie WarGames, the world is brought to the edge of nuclear destruction when a military computer using artificial intelligence interprets false data as an imminent Soviet missile strike. Its human overseers in the Defense Department, unsure whether the data is real, can’t convince the AI that it may be wrong. A recent finding from the Defense Intelligence Agency, or DIA, suggests that in a real situation where humans and AI were looking at enemy activity, those positions would be reversed. Artificial intelligence can actually be more cautious than humans about its conclusions in situations when data is limited. While the results are preliminary, they offer an important glimpse into how humans and AI will complement one another in critical national security fields. DIA analyzes activity from militaries around the globe. Terry Busch, the technical director for the agency’s Machine-Assisted Analytic Rapid-Repository System, or MARS, on Monday joined a Defense One viewcast to discuss the agency’s efforts to incorporate AI into analysis and decision-making. Earlier this year, Busch's team set up a test between a human and AI. The first part was simple enough: use available data to determine whether a particular ship was in U.S. waters. “Four analysts came up with four methodologies; and the machine came up with two different methodologies and that was cool. They all agreed that this particular ship was in the United States,” he said. So far, so good. Humans and machines using available data can reach similar conclusions. The second phase of the experiment tested something different: conviction. Would humans and machines be equally certain in their conclusions if less data were available? The experimenters severed the connection to the Automatic Identification System, or AIS, which tracks ships worldwide. “It’s pretty easy to find something if you have the AIS feed, because that’s going to tell you exactly where a ship is located in the world. If we took that away, how does that change confidence and do the machine and the humans get to the same end state?” In theory, with less data, the human analyst should be less certain in their conclusions, like the characters in WarGames. After all, humans understand nuance and can conceptualize a wide variety of outcomes. The researchers found the opposite. “Once we began to take away sources, everyone was left with the same source material — which was numerous reports, generally social media, open source kinds of things, or references to the ship being in the United States — so everyone had access to the same data. The difference was that the machine, and those responsible for doing the machine learning, took far less risk — in confidence — than the humans did,” he said. “The machine actually does a better job of lowering its confidence than the humans do….There’s a little bit of humor in that because the machine still thinks they’re pretty right.” The experiment provides a snapshot of how humans and AI will team for important analytical tasks. But it also reveals how human judgement has limits when pride is involved. Humans, particularly experts in specific fields, have a tendency to overestimate their ability to correctly infer outcomes when given limited data. Nobel-prize winning economist and psychologist Daniel Kahneman has written on the subject extensively. Kahneman describes this tendency as the “inside view.” He cites the experience of a group of Israeli educators assigned to write a new textbook for the Ministry of Education. They anticipated that it would take them a fraction of the amount of time they knew it would take another similar team. They couldn’t explain why they were overconfident; they just were. Overconfidence is human and a particular trait among highly functioning expert humans, one that machines don’t necessarily share.

#### The utilitarianism constraint guarentees the AI makes decisions optimal under human morality

Henrik Skaug Sætra 19 {Political scientist working in the Faculty of Business, Languages and Social Science at Ostfold University College. 10-28-2019. “A shallow defence of a technocracy of artificial intelligence: Examining the political harms of algorithmic governance in the domain of government.” https://www.sciencedirect.com/science/article/pii/S0160791X19305925}//JM

4.3.1. The third objection – morality

Computers should not make decisions that affect people's lives and wellbeing

Some people believe that we can train a machine to become moral, e.g. by having a lot of people answer various questions on the morally superior decision in various instances of the trolley problem. The Moral Machine is one such endeavour that has attracted much attention [54]. It is an attempt to crowd-source the morality of people around the world in order to teach a computer to distinguish right from wrong, in order to find ethical principles to guide machine behaviour. This is an approach which could be related to the approach of WeBuildAI, in which social choice theory and popular participation is used to train algorithms [39].

Kurzweil [29] predicts that machines will gain human proficiencies and capabilities, including morality-related emotions. Maldonato and Valerio [55] and Scheutz [56] also discuss related topics, e.g. machines with value systems and the creation of machines with moral competences. Even if they do not gain anything akin to human morality, machines are becoming better at understanding human morality, as it can quantify, track and compare moral bias, for example, ‘across cultures and over time’ [57].

However, we could also approach this objection more pragmatically. If we decide that decisions that affect people's wellbeing require moral capabilities, we are already employing AI in situations where it does not belong. Self-driving cars could not then be allowed. Robots trading in markets would become highly problematic. Use of AI to determine whether or not criminal offenders should receive bail would be highly dubious.

AI is already involved in moral decisions in countless ways, and our current approach to this issue is to make someone other than the computer itself morally responsible for the decisions made. We will include the premise in the tentative discussion, but I will argue in the conclusion that this objection is better understood by way of handling objection 5 and the attribution of AI decisions.

Another obvious counterobjection would be that if machines cannot be moral, neither can they be immoral. To some people this situation would appear to be a huge advantage compared with the capacities of today's politicians. If indeed power corrupts, we should see it as an advantage that AI has no morally corruptible nature [58].

### AT: AI Governance Fails

#### Near term artificial intelligence will massively outperform humans in political predictions---we should give them control over our governmental decisions

Henrik Skaug Sætra 19 {Political scientist working in the Faculty of Business, Languages and Social Science at Ostfold University College. 10-28-2019. “A shallow defence of a technocracy of artificial intelligence: Examining the political harms of algorithmic governance in the domain of government.” https://www.sciencedirect.com/science/article/pii/S0160791X19305925}//JM

The title of this article promises a shallow defence of a technocracy of AI. This refers to the argument I will construct in the first part of the article, which consists of three proposition that lead to the conclusion that we should employ AI in politics, and erect a technocracy of AI. This argument will then be subjected to a set of objections to such a technocracy in section 4. The first two components of the shallow defence follow form the preceding consideration on technocracy and politics.

First of all, politics can be understood as a process aimed at implementing the best possible policies. But what policy is considered best can, of course, only be decided once we know what criteria to apply. Thus, the first and fundamental purpose of politics is to develop and elucidate what fundamental moral values a society is based on. Only then can politics as we know it in the day-to-day workings of society take place. And only then can we properly assess the value of technology [19]. This is the first building block in the defence of an AI technocracy:

Policies should be evaluated on the basis of the fundamental moral values of the society in question, and finding these values is the first purpose of politics.

Furthermore, if politics revolves around the question of finding the best policies, as Schumpeter [6] implies, we also have a second premise in the establishment of what will become the defence:

The best policies in accordance with the evaluation discussed in the first premise should be implemented.

3. Artificial intelligence and political decision-making

Artificial intelligence is superior to human intelligence for analysis of large and complex problems involving the need for strategy, prediction of long-term effects and analysis of vast amounts of data. One example is playing chess and Go [[26], [27], [28], [29]]. However, AI can beat humans at more than fun and games. Politics is complex, and it involves many considerations of notoriously uncertain short- and long-term consequences. As the literature on algorithmic governance shows, AI is already employed in many facets of government, as I show in section 3.1.

I will note at the outset that the potential benefits from AI in politics is heavily contested [4]. I agree with the idea that AI as of today is not some silver bullet that can be employed in order to create flourishing societies. However, as the many existing applications clearly show, there is undeniably a potential for the beneficial use of AI in politics. I will assume that some of this potential can be realised, and that we will continue to see certain improvements in the technologies involved. This means that I consider possible near-future technologies, and not speculative developments related to some form of singularity, etc. [29].

I will not discuss the technologies involved in great detail, but rely on the assumption that much of the future applications of AI is based on the technologies currently employed. de Sousa et al. [5] chart the technologies most often employed in public sector AI; various forms of machine learning are used, while artificial neural networks (ANN) is the most popular technique in terms of usage. Artificial neural networks (ANNs) imitate biological information-processing systems, and consist of artificial neurons that transmit signals to each other in reinforcement systems, for example [30]. Deep learning is our term for deeply layered neural networks, and this is the machine learning approach used by the AI economist I use as an example, as well as by Google's AlphaGo and AlphaZero [31,28,32,1].

#### Empirical analysis of computational improvements supports AI that can outperform the best experts coming soon

Scott Alexander 16 {LessWrong-rationalist blogger and psychiatrist, with a bachelor’s degree magna cum laude in Philosophy. 9-26-2016. “Superintelligence FAQ.” https://www.lesswrong.com/posts/LTtNXM9shNM9AC2mp/superintelligence-faq#2\_1\_\_What\_do\_you\_mean\_by\_\_fast\_takeoff\_\_}//JM

2.1: What do you mean by “fast takeoff”?

A slow takeoff is a situation in which AI goes from infrahuman to human to superhuman intelligence very gradually. For example, imagine an augmented “IQ” scale (THIS IS NOT HOW IQ ACTUALLY WORKS – JUST AN EXAMPLE) where rats weigh in at 10, chimps at 30, the village idiot at 60, average humans at 100, and Einstein at 200. And suppose that as technology advances, computers gain two points on this scale per year. So if they start out as smart as rats in 2020, they’ll be as smart as chimps in 2035, as smart as the village idiot in 2050, as smart as average humans in 2070, and as smart as Einstein in 2120. By 2190, they’ll be IQ 340, as far beyond Einstein as Einstein is beyond a village idiot.

In this scenario progress is gradual and manageable. By 2050, we will have long since noticed the trend and predicted we have 20 years until average-human-level intelligence. Once AIs reach average-human-level intelligence, we will have fifty years during which some of us are still smarter than they are, years in which we can work with them as equals, test and retest their programming, and build institutions that promote cooperation. Even though the AIs of 2190 may qualify as “superintelligent”, it will have been long-expected and there would be little point in planning now when the people of 2070 will have so many more resources to plan with.

A moderate takeoff is a situation in which AI goes from infrahuman to human to superhuman relatively quickly. For example, imagine that in 2020 AIs are much like those of today – good at a few simple games, but without clear domain-general intelligence or “common sense”. From 2020 to 2050, AIs demonstrate some academically interesting gains on specific problems, and become better at tasks like machine translation and self-driving cars, and by 2047 there are some that seem to display some vaguely human-like abilities at the level of a young child. By late 2065, they are still less intelligent than a smart human adult. By 2066, they are far smarter than Einstein.

A fast takeoff scenario is one in which computers go even faster than this, perhaps moving from infrahuman to human to superhuman in only days or weeks.

2.1.1: Why might we expect a moderate takeoff?

Because this is the history of computer Go, with fifty years added on to each date. In 1997, the best computer Go program in the world, Handtalk, won NT$250,000 for performing a previously impossible feat – beating an 11 year old child (with an 11-stone handicap penalizing the child and favoring the computer!) As late as September 2015, no computer had ever beaten any professional Go player in a fair game. Then in March 2016, a Go program beat 18-time world champion Lee Sedol 4-1 in a five game match. Go programs had gone from “dumber than children” to “smarter than any human in the world” in eighteen years, and “from never won a professional game” to “overwhelming world champion” in six months.

The slow takeoff scenario mentioned above is loading the dice. It theorizes a timeline where computers took fifteen years to go from “rat” to “chimp”, but also took thirty-five years to go from “chimp” to “average human” and fifty years to go from “average human” to “Einstein”. But from an evolutionary perspective this is ridiculous. It took about fifty million years (and major redesigns in several brain structures!) to go from the first rat-like creatures to chimps. But it only took about five million years (and very minor changes in brain structure) to go from chimps to humans. And going from the average human to Einstein didn’t even require evolutionary work – it’s just the result of random variation in the existing structures!

So maybe our hypothetical IQ scale above is off. If we took an evolutionary and neuroscientific perspective, it would look more like flatworms at 10, rats at 30, chimps at 60, the village idiot at 90, the average human at 98, and Einstein at 100.

Suppose that we start out, again, with computers as smart as rats in 2020. Now we get still get computers as smart as chimps in 2035. And we still get computers as smart as the village idiot in 2050. But now we get computers as smart as the average human in 2054, and computers as smart as Einstein in 2055. By 2060, we’re getting the superintelligences as far beyond Einstein as Einstein is beyond a village idio

This offers a much shorter time window to react to AI developments. In the slow takeoff scenario, we figured we could wait until computers were as smart as humans before we had to start thinking about this; after all, that still gave us fifty years before computers were even as smart as Einstein. But in the moderate takeoff scenario, it gives us one year until Einstein and six years until superintelligence. That’s starting to look like not enough time to be entirely sure we know what we’re doing.

2.1.2: Why might we expect a fast takeoff?

AlphaGo used about 0.5 petaflops (= trillion floating point operations per second) in its championship game. But the world’s fastest supercomputer, TaihuLight, can calculate at almost 100 petaflops. So suppose Google developed a human-level AI on a computer system similar to AlphaGo, caught the attention of the Chinese government (who run TaihuLight), and they transfer the program to their much more powerful computer. What would happen?

It depends on to what degree intelligence benefits from more computational resources. This differs for different processes. For domain-general intelligence, it seems to benefit quite a bit – both across species and across human individuals, bigger brain size correlates with greater intelligence. This matches the evolutionarily rapid growth in intelligence from chimps to hominids to modern man; the few hundred thousand years since australopithecines weren’t enough time to develop complicated new algorithms, and evolution seems to have just given humans bigger brains and packed more neurons and glia in per square inch. It’s not really clear why the process stopped (if it ever did), but it might have to do with heads getting too big to fit through the birth canal. Cancer risk might also have been involved – scientists have found that smarter people are more likely to get brain cancer, possibly because they’re already overclocking their ability to grow brain cells.

At least in neuroscience, once evolution “discovered” certain key insights, further increasing intelligence seems to have been a matter of providing it with more computing power. So again – what happens when we transfer the hypothetical human-level AI from AlphaGo to a TaihuLight-style supercomputer two hundred times more powerful? It might be a stretch to expect it to go from IQ 100 to IQ 20,000, but might it increase to an Einstein-level 200, or a superintelligent 300? Hard to say – but if Google ever does develop a human-level AI, the Chinese government will probably be interested in finding out.

Even if its intelligence doesn’t scale linearly, TaihuLight could give it more time. TaihuLight is two hundred times faster than AlphaGo. Transfer an AI from one to the other, and even if its intelligence didn’t change – even if it had exactly the same thoughts – it would think them two hundred times faster. An Einstein-level AI on AlphaGo hardware might (like the historical Einstein) discover one revolutionary breakthrough every five years. Transfer it to TaihuLight, and it would work two hundred times faster – a revolutionary breakthrough every week.

Supercomputers track Moore’s Law; the top supercomputer of 2016 is a hundred times faster than the top supercomputer of 2006. If this progress continues, the top computer of 2026 will be a hundred times faster still. Run Einstein on that computer, and he will come up with a revolutionary breakthrough every few hours. Or something. At this point it becomes a little bit hard to imagine. All I know is that it only took one Einstein, at normal speed, to lay the theoretical foundation for nuclear weapons. Anything a thousand times faster than that is definitely cause for concern.

There’s one final, very concerning reason to expect a fast takeoff. Suppose, once again, we have an AI as smart as Einstein. It might, like the historical Einstein, contemplate physics. Or it might contemplate an area very relevant to its own interests: artificial intelligence. In that case, instead of making a revolutionary physics breakthrough every few hours, it will make a revolutionary AI breakthrough every few hours. Each AI breakthrough it makes, it will have the opportunity to reprogram itself to take advantage of its discovery, becoming more intelligent, thus speeding up its breakthroughs further. The cycle will stop only when it reaches some physical limit – some technical challenge to further improvements that even an entity far smarter than Einstein cannot discover a way around.

To human programmers, such a cycle would look like a “critical mass”. Before the critical level, any AI advance delivers only modest benefits. But any tiny improvement that pushes an AI above the critical level would result in a feedback loop of inexorable self-improvement all the way up to some stratospheric limit of possible computing power.

This feedback loop would be exponential; relatively slow in the beginning, but blindingly fast as it approaches an asymptote. Consider the AI which starts off making forty breakthroughs per year – one every nine days. Now suppose it gains on average a 10% speed improvement with each breakthrough. It starts on January 1. Its first breakthrough comes January 10 or so. Its second comes a little faster, January 18. Its third is a little faster still, January 25. By the beginning of February, it’s sped up to producing one breakthrough every seven days, more or less. By the beginning of March, it’s making about one breakthrough every three days or so. But by March 20, it’s up to one breakthrough a day. By late on the night of March 29, it’s making a breakthrough every second.

#### Current governance structures emphasize bunk decision making processes that make resolving complex long-term problems impossible

Boston 14 [Jonathan Boston, Professor of Public Policy, School of Government, Victoria University of Wellington, Fulbright Fellow, American University. Governing for the Future: How to bring the long-term into short-term political focus. November 5, 2014. https://www.american.edu/spa/cep/upload/jonathan-boston-lecture-american-university.pdf]

Similarly, particular kinds of policy problems pose especially serious challenges for prudent long-term governance. The most difficult problems are those exhibiting one or more of the following characteristics: high complexity; low predictability and causal certainty; spatially dispersed effects; impacts that are mostly experienced in the future and/or are largely invisible and intangible (thus reducing the apparent urgency to respond); impacts that fall predominantly on politically weak or marginalized groups; and, as noted earlier, problems which require investment-type solutions (i.e. up-front costs are required in order to secure long-term benefits). Human-induced climate change exhibits most, if not all, of these features, which helps account for the difficulty of securing prudent policy responses. But many policy problems also exhibit investment-type payoff structures, thus creating a temptation for inter-generational buckpassing. Such temptations will be all the greater when the short-term costs are direct, specific, certain, tangible and visible while the long-term benefits are more generalized, less certain and more intangible.

### AT: AI Governance Hurts Democracy

#### People aren’t politically active now, but AI government increases the political power of the population

Henrik Skaug Sætra 19 {Political scientist working in the Faculty of Business, Languages and Social Science at Ostfold University College. 10-28-2019. “A shallow defence of a technocracy of artificial intelligence: Examining the political harms of algorithmic governance in the domain of government.” https://www.sciencedirect.com/science/article/pii/S0160791X19305925}//JM

4.1.1. The first objection – people's political nature People need full political participation in order to be satisfied This is, however, only one of the interpretations of Aristotle's view of humans and politics. Mulgan [44] shows that Aristotle can also be understood as supporting ‘the withdrawal from politics, or at least reluctant participation’. In both The Politics and Ethics the philosopher's lifestyle is portrayed as being superior to the life of the statesman [44]. Another immediate objection would be to ask: Are people politically active in today's political systems? What will really change if AI makes our decisions, instead of bureaucrats? The ‘political animal’ argument is against any move from direct democracy towards democracy by representation or republicanism, and this move could be said to be a necessary evil if we are to have large-scale, complex societies. This objection also relies on an agreement with Aristotle's hierarchical ordering of human activities. Other philosophies, such as hedonism, could easily portray a life of increased wealth and leisure as a potential improvement to a life material hardship and political activity. Philosophers such as F. A. Hayek have proposed that involvement in politics is not that important, and that economic liberty is what is essential to good societies [17]. Following this argument, he states that democracy is not necessarily the best way to rule, and that ‘… a democracy may well wield totalitarian powers, and it is conceivable that an authoritarian government may act on liberal principles’ [17]. However, a crucial point of this article is that a technocracy of AI may in fact lead to a revitalization of popular participation and the accessibility of the political domain. Through new ways of participation, such as algorithmic co-creation, we could find ourselves in a situation in which most people have, and experience, more political power than they do today. This is examined in more detail in the next objection.

### AT: AI Regulation Bad

#### This ensures bad AI.

New and Castro, 18—senior policy analyst at the Center for Data Innovation AND director of the Center for Data Innovation and vice president of the Information Technology and Innovation Foundation (Joshua and Daniel, “How Policymakers Can Foster Algorithmic Accountability,” <https://www2.datainnovation.org/2018-algorithmic-accountability.pdf>, dml)

Thus, it is wise to be skeptical of advocates rushing to regulate new technologies due to concerns about their hypothetical harms before it is clear how market forces, technological advancement, and existing regulations would shape their use as they mature. However, with algorithmic decision-making, dismissing any and all efforts to improve governance would be problematic. While explicit calls for the government to not regulate any algorithms and leave it entirely to industry to selfregulate are few and far between, some do advocate for it. For example, technology reporter Tristan Greene, writing for The Next Web, concluded that due to the speculative nature of many of the fears about AI, the “government is clueless about AI and shouldn’t be allowed to regulate it.”72 Mouloud Dey, director of innovation and business solutions at SAS France, argues that governments should not step in to regulate algorithms because of the burden regulations could have on innovation—and that industry selfregulation would be adequate to address any potential harms.73 In many cases however, more general anti-regulation attitudes could still lend credence to the notion that the government should not regulate algorithms at all, by overshadowing legitimate efforts to regulate the technology in an evenhanded, beneficial way. For example, Simon Constable, a fellow at the Johns Hopkins Institute for Applied Economics, Global Health, and the Study of Business Enterprise, writing in Forbes, erroneously concluded that due to the U.S. government’s failure to prevent or mitigate the 2008 financial crisis, “It's time to just say no to calls for more government regulation of the tech industry.”74

Given the steps some governments, such as the EU’s GDPR, have already taken that will clearly limit innovation, it is easy to be sympathetic to such positions. But while industry self-regulation, market forces, and tort law will likely play a large role in positively shaping the use of algorithms, there are reasons why these alone would be insufficient to protect against all potential harms of algorithmic decision-making, which likely fall into one of three categories. First, there are some potential applications of algorithms where traditional market forces that could mitigate the harms of algorithms, such as the threat of reputational damage if a company’s algorithm causes harm, are diminished, making the cost of this flawed decision-making one-sided. This is particularly true with government uses of AI wherein the costs of bad decisions are indeed problematic, but not borne directly by the government agency using the algorithm. In other words, even though a discriminatory algorithm is an inferior product, there are some situations where this would not deter an operator from deploying it. Second, there are applications of algorithmic decision-making where even though incentives to minimize harms exist, the potential harms could be significant enough to warrant regulation, such as is with autonomous vehicles. And third, certain applications of algorithms could cause harms, such as exacerbating inequality, but without an operator expressly or obviously breaking the law. For example, an online jobs board could utilize a targeted advertising algorithm that does not consider race but nonetheless uses variables that inadvertently serve as proxies for race, such as zip code, thereby favoring members of a certain race for job opportunities. This harm may not be immediately obvious to the public, regulators, or even the operator. In such cases, absent public outrage, businesses have reduced incentive to scrutinize their algorithms thoroughly to prevent this harm, as there is not a strong profit motive to do so.

### AT: AI Regulations Impossible

#### Strong AI regs are enforceable --- they’re necessary to prevent extinction risks that far outweigh nuclear war

Shulman 11 [Carl, Research Fellow at the Machine Intelligence Research Institute, “Arms races and intelligence explosions (extended abstract),” April, 2011, http://singularityhypothesis.blogspot.com/2011/04/arms-races-and-intelligence-explosions.html]

A second critical difference between the nuclear and AI cases is in the expected danger of development, as opposed to deployment and use. Manhattan Project scientists did consider the possibility that a nuclear test would unleash a self-sustaining chain reaction in the atmosphere and destroy all human life, conducting informal calculations at the time suggesting that this was extremely improbable. A more formal process conducted after the tests confirmed the earlier analysis (Konopinski, Marvin, & Teller, 1946), although it would not have provided any protection had matters been otherwise. The historical record thus tells us relatively little about the willingness of military and civilian leaders to forsake or delay a decisive military advantage to avert larger risks of global catastrophe. In contrast, numerous scholars have argued that advanced AI poses a nontrivial risk of catastrophic outcomes, including humane extinction. (Bostrom, 2002; Chalmers, 2010; Friedman, 2008; Hall, 2007; Kurzweil, 2005; Moravec, 1999; Posner, 2004; Rees, 2004; Yudkowsky, 2008). Setting aside anthropomorphic presumptions of rebelliousness, a more rigorous argument (Omohundro, 2007) relies on the instrumental value of such behavior for entities with a wide variety of goals that are easier to achieve with more resources and with adequate defense against attack. Many decision algorithms could thus appear benevolent when in weak positions during safety testing, only to cause great harm when in more powerful positions, e.g. after extensive self-improvement. Given abundant time and centralized careful efforts to ensure safety, it seems very probable that these risks could be avoided: development paths that seemed to pose a high risk of catastrophe could be relinquished in favor of safer ones. However, the context of an arms race might not permit such caution. A risk of accidental AI disaster would threaten all of humanity, while the benefits of being first to develop AI would be concentrated, creating a collective action problem insofar as tradeoffs between speed and safety existed. A first-pass analysis suggests a number of such tradeoffs. Providing more computing power would allow AIs to either operate at superhumanly fast timescales or to proliferate very numerous copies. Doing so would greatly accelerate progress, but also render it infeasible for humans to engage in detailed supervision of AI activities. To make decisions on such timescales AI systems would require decision algorithms with very general applicability, making it harder to predict and constrain their behavior. Even obviously risky systems might be embraced for competitive advantage, and the powers with the most optimistic estimates or cavalier attitudes regarding risk would be more likely to take the lead. IV. Barriers to AI arms control Could an AI arms race be regulated using international agreements similar to those governing nuclear technology? In some ways, there are much stronger reasons for agreement: the stability of nuclear deterrence, and the protection afforded by existing nuclear powers to their allies, mean that the increased threat of a new nuclear power is not overwhelming. No nuclear weapons have been detonated in anger since 1945. In contrast, simply developing AI capable of producing an intelligence explosion puts all states at risk from the effects of accidental catastrophe, or the military dominance engendered by a localized intelligence explosion. However, AI is a dual-use technology, with incremental advances in the field offering enormous economic and humanitarian gains that far outweigh near-term drawbacks. Restricting these benefits to reduce the risks of a distant, novel, and unpredictable advance would be very politically challenging. Superhumanly intelligent AI promises even greater rewards: advances in technology that could vastly improve human health, wealth, and welfare while addressing other risks such as climate change. Efforts to outright ban or relinquish AI technology would seem to require strong evidence of very high near-term risks. However, agreements might prove highly beneficial if they could avert an arms race and allow for more controlled AI development with more rigorous safety measures, and sharing of the benefits among all powers. Such an agreement would face increased problems of verification and enforcement. Where nuclear weapons require rare radioactive materials, large specialized equipment, and other easily identifiable inputs, AI research can proceed with only skilled researchers and computing hardware. Verification of an agreement would require incredibly intrusive monitoring of scientific personnel and computers throughout the territory of participating states. Further, while violations of nuclear arms control agreements can be punished after the fact, a covert intelligence explosion could allow a treaty violator to withstand later sanctions. These additional challenges might be addressed in light of the increased benefits of agreement, but might also become tractable thanks to early AI systems. If those systems do not themselves cause catastrophe but do provide a decisive advantage to some powers, they might be used to enforce safety regulations thereafter, providing a chance to “go slow” on subsequent steps. V. Game-theoretic model of an AI arms race In the full paper, we present a simple game-theoretic model of a risky AI arms race. In this model, the risk of accidental catastrophe depends on the number of competitors, the magnitude of random noise in development times, the exchange rate between risk and development speed, and the strength of preferences for developing safe AI first. VI. Ethical implications and responses The above analysis highlights two important possible consequences of advanced AI: a disruptive change in international power relations and a risk of inadvertent disaster. From an ethical point of view, the accidental risk deserves special attention since it threatens human extinction, not only killing current people but also denying future generations existence. (Matheny, 2007; Bostrom, 2003). While AI systems would outlive humanity, AI systems might lack key features contributing to moral value, such as individual identities, play, love, and happiness (Bostrom, 2005; Yudkowsky, 2008). Extinction risk is a distinctive feature of AI risks: even a catastrophic nuclear war or engineered pandemic that killed billions would still likely allow survivors to eventually rebuild human civilization, while AIs killing billions would likely not leave survivors. (Sandberg & Bostrom, 2008). However, a national monopoly on an AI intelligence explosion could also have permanent consequences if it was used to stably establish its position. Permanent totalitarianism is one possibility (Caplan, 2008).

#### Their defense is politicized skepticism to support an anti-regulatory stance

Seth D. Baum 18 {Executive Director, Global Catastrophic Risk Institute. 6-27-2018. “Superintelligence Skepticism as a Political Tool.” https://www.mdpi.com/2078-2489/9/9/209}//JM

The purpose of this paper is to explore the potential for skepticism about artificial superintelligence to be used for political ends. Artificial superintelligence (for brevity, henceforth just superintelligence) refers to AI that is much smarter than humans. Current AI is not superintelligent, but the prospect of superintelligence is a topic of much discussion in scholarly and public spheres. Some believe that superintelligence could someday be built, and that, if it is built, it would have massive and potentially catastrophic consequences. Others are skeptical of these beliefs. While much of the existing skepticism appears to be honest intellectual debate, there is potential for it to be politicized for other purposes. In simple terms (to be refined below), politicized skepticism can be defined as public articulation of skepticism that is intended to achieve some outcome other than an improved understanding of the topic at hand. Politicized skepticism can be contrasted with intellectual skepticism, which seeks an improved understanding. Intellectual skepticism is essential to scholarly inquiry; politicized skepticism is not. The distinction between the two is not always clear; statements of skepticism may have both intellectual and political motivations. The two concepts can nonetheless be useful for understanding debates over issues such as superintelligence. There is substantial precedent for politicized skepticism. Of particular relevance for superintelligence is politicized skepticism about technologies and products that are risky but profitable, henceforth risk–profit politicized skepticism. This practice dates to 1950s debates over the link between tobacco and cancer and has since been dubbed the tobacco strategy [1]. More recently, the strategy has been applied to other issues including the link between fossil fuels and acid rain, the link between fossil fuels and global warming, and the link between industrial chemicals and neurological disease [1,2]. The essence of the strategy is to promote the idea that the science underlying certain risks is unresolved, and therefore the implicated technologies should not be regulated. The strategy is typically employed by an interconnected mix of industry interests and ideological opponents of regulation. The target audience is typically a mix of government officials and the general public, and not the scientific community. As is discussed in more detail below, certain factors suggest the potential for superintelligence to be a focus of risk–profit politicized skepticism. First and foremost, superintelligence could be developed by major corporations with a strong financial incentive to avoid regulation. Second, there already exists a lot of skepticism about superintelligence, which could be exploited for political purposes. Third, as an unprecedented class of technology, it is inherently uncertain, which suggests that superintelligence skepticism may be especially durable, even within apolitical scholarly communities. These and other factors do not guarantee that superintelligence skepticism will be politicized, or that its politicization would follow the same risk–profit patterns as the tobacco strategy. However, these factors are at least suggestive of the possibility. Superintelligence skepticism may also be politicized in a different way: to protect the reputations and funding of the broader AI field. This form of politicized skepticism is less well-documented than the tobacco strategy, and appears to be less common. However, there are at least hints of it for fields of technology involving both grandiose future predictions and more mundane near-term work. AI is one such field of technology, in which grandiose predictions of superintelligence and other future AI breakthroughs contrast with more modest forms of near-term AI. Another example is nanotechnology, in which grandiose predictions of molecular machines contrast with near-term nanoscale science and technology [3]. The basis of the paper’s analysis is twofold. First, the paper draws on the long history of risk–profit politicized skepticism. This history suggests certain general themes that may also apply to superintelligence. Second, the paper examines characteristics of superintelligence development to assesses the prospect of skepticism being used politically in this context. To that end, the paper draws on the current state of affairs in the AI sector, especially for artificial general intelligence, which is a type of AI closely related to superintelligence. The paper further seeks to inform efforts to avoid any potential harmful effects from politicized superintelligence skepticism. The effects would not necessarily be harmful, but the history of risk–profit politicized skepticism suggests that they could be. This paper contributes to literatures on politicized skepticism and superintelligence governance. Whereas most literature on politicized skepticism (and similar concepts such as denial) is backward-looking, consisting of historical analysis of skepticisms that have already occurred [1,2,4–7], this paper is largely (but not exclusively) forward-looking, consisting of prospective analysis of skepticisms that could occur at some point in the future. Meanwhile, the superintelligence governance literature has looked mainly at institutional regulations to prevent research groups from building dangerous superintelligence and support for research on safety measures [8–11]. This paper contributes to a smaller literature on the role of corporations in superintelligence development [12] and on social and psychological aspects of superintelligence governance [13]. This paper does not intend to take sides on which beliefs about superintelligence are most likely to be correct. Its interest is in the potential political implications of superintelligence skepticism, not in the underlying merits of the skepticism. The sole claim here is that the possibility of politicized superintelligence skepticism is a worthy topic of study. It is worth studying due to: (1) the potential for large consequences if superintelligence is built; and (2) the potential for superintelligence to be an important political phenomenon regardless of whether it is built. Finally, the topic is also of inherent intellectual interest as an exercise in prospective socio-political analysis on a possible future technology. The paper is organized as follows. Section 2 presents a brief overview of superintelligence concerns and skepticisms. Section 3 further develops the concept of politicized skepticism and surveys the history of risk–profit politicized skepticism, from its roots in tobacco to the present day. Section 4 discusses prospects for politicized superintelligence skepticism. Section 5 discusses opportunities for constructive action. Section 6 concludes.

## AT Blockchain Bad

### 2AC – Blockchain Good

#### Blockchain solves nuclear war, climate change, and disease.

Burford 21 – Lyndon Burford is a Visiting Research Associate at the Centre for Science and Security Studies, King’s College London and a member of the New Technologies for Peace working group, a part of the Vatican’s COVID-19 Commission. (International Affairs, "Could blockchain technology help advance nuclear disarmament?" Medium, 2-19-2021, https://medium.com/international-affairs-blog/could-blockchain-technology-help-advance-nuclear-disarmament-6efaab35e277, Accessed 7-21-2022, LASA-SC)

New and maturing technologies are often seen as possible drivers of conflict, not least in the context of rising nuclear risks. In 2019, for example, the UK House of Lords Select Committee on International Relations concluded, “The risk of the use of nuclear weapons has increased, in the context of rising inter-state competition, a more multipolar world, and the development of new capabilities and technologies.” In a recent policy report published by the Centre for Science and Security Studies at King’s College London, I explored the flipside of that coin. The trust machine: blockchain in nuclear disarmament and arms control verification looks at how blockchain technology could help to reduce nuclear risks, by strengthening systems to verify the dismantlement of nuclear warheads.

The ‘trust machine’

Blockchain is best known as the technology that underpins the cryptocurrency Bitcoin, but it already has a wide range of alternative uses in areas such as medicine, transport, manufacturing, finance and governance. During the COVID-19 crisis, blockchain was used to produce a cheap, reliable solution for contact tracing. In Syria, blockchain is being used to create a permanent record of potential war crimes, increasing the security and integrity of the data and strengthening its admissibility as evidence in future war crimes prosecutions.

Blockchain is a de-centralized, digital record-keeping technology. It combines cryptography and social/economic incentives to build a shared, permanent, and virtually un-hackable record of events, without needing to trust a third party authority to manage the data. Unlike Bitcoin, which is a ‘public’ network that allows anyone to interact with it, a private blockchain creates a ‘permissioned’ network of participants who collectively store and manage data in a way that allows them to maintain extremely high confidence in the integrity of the data. The result is a shared, digital record of events — a blockchain — that is practically immutable, establishing a single, collective, and irrefutable ‘truth’ about the nature and sequence of events within the network. In a post-truth world, blockchain thus offers an invaluable technical foundation for cooperation among parties that have a limited basis to trust each other, leading to its nickname, ‘the trust machine’.

Blockchain as a disarmament mechanism

At present, extremely low levels of international trust hamper efforts to advance nuclear disarmament. The ongoing development of new nuclear weapons, warheads and increasingly capable ballistic missile defences are undermining the theories and practices of deterrence, and point to the resurgence of a spiral of mistrust that characterized the Cold War nuclear arms race. Developing robust, multilateral verification tools and processes could help to mitigate the trust deficit. It would enable countries to pursue their shared interests in nuclear disarmament — reduced costs, less chance of escalation and nuclear use, greater scope to cooperate on global threats like climate change and pandemics — by increasing confidence that other countries are fulfilling their disarmament commitments in good faith. One way to strengthen verification would be to use a private blockchain to manage and store the data that a disarmament process creates.

In a verified disarmament process, parties need to track and record things like the status and movements of individual inspectors and weapon parts, and the status and material holdings of different facilities. These activities create large amounts of data that need to be stored in a secure, permanent and transparent manner that also allows for its easy retrieval by permissioned actors. The core attributes of blockchain correspond closely to these requirements. The technology would allow parties to maintain very high confidence in the immutability of verification data, creating a strong technical foundation for future cooperation from a shared, trusted baseline.

International collaborations like the 25-country International Partnership for Nuclear Disarmament Verification and the Quad Nuclear Verification Partnership (made up of Norway, Sweden, the United Kingdom and the United States) are already exploring how nuclear-armed and non-nuclear-armed states can cooperate in verifying the dismantlement of nuclear warheads without revealing sensitive information. Blockchain could complement their approach, enabling countries to create a permanent, immutable record of verification data.

Nuclear weapons threaten the survival of humanity and divert tens of billions of dollars each year away from efforts to address other collective security challenges like mitigating and adapting to climate change and responding to pandemics like COVID-19. As such, we all share an interest in disarmament processes that can reduce the likelihood of deliberate or accidental nuclear explosions and free up urgently needed resources for other global security priorities. We owe it to ourselves and to future generations to consider all options that could help to advance nuclear disarmament. In addressing the regular obstacle of distrust between the nuclear powers, blockchain is one technological option that we should be exploring.

#### Solves water shortages

Stinson 18 – Project Lead, Water Initiative, World Economic Forum (Callie, "5 ways the Fourth Industrial Revolution could end water insecurity," World Economic Forum, 3-22-2018, https://www.weforum.org/agenda/2018/03/5-ways-the-fourth-industrial-revolution-could-make-water-insecurity-a-thing-of-the-past/, Accessed 7-21-2022, LASA-SC)

The global water and sanitation crisis is not a new story. Each World Water Day we review the sobering statistics with which we are becoming all too familiar: the expected 40% gap in global water supply and demand by 2050. The billions of additional dollars still needed to finance water infrastructure. The 4.5 billion people who lack access to safely managed sanitation services. The fact that water crises have ranked among the top global risks in terms of potential impact seven years in a row.

What these sorts of statistics remind us is that status quo approaches are not going to be enough to solve the world’s water and sanitation problems. Innovating in this domain is no longer an option but a necessity. Harnessing the rapid advancements in technology and information represented by the Fourth Industrial Revolution (4IR) holds great promise for improving the way we manage global commons challenges, including water. But how do we turn this promise into reality?

The World Economic Forum's Global Water Initiative, in collaboration with the World Bank Water Global Practice and the Swiss Agency for Development and Cooperation, has embarked on a journey over the past year to explore this very question. By convening water policy experts, entrepreneurs and technology innovators in a series of workshops and meetings, we gained valuable insight into several areas that are ripe for disruption in the water sector. Encouragingly, we also discovered many of the solutions we need are already at our fingertips. Here are five examples how the 4IR could help make water insecurity a thing of the past:

Blockchain for improved water resource management

By providing a secure, transparent and distributed ledger to record transactions between parties, blockchain-based technology could fundamentally transform the way water resources are managed and traded. First and foremost, harnessing this capability could enable everyone from households, industry consumers, water managers and policymakers to access the same data on water quality and quantity and make more informed decisions. Such transparency would help inform consumer decisions around when to conserve or use water. It could in turn help prevent corrupt behaviour in situations where there may be an incentive for local authorities to tamper with or withhold water quality data.

Blockchain technology could also support peer-to-peer trading of water rights in a given basin, empowering water users who have enough or are willing to share their excess resources with others in the area to do so 24/7 without relying on a centralized authority. Imagine a scenario where farmers in the same water basin could make the decision to trade their allocations based on the latest weather data, crop prices, market trends and longer term climate trends – much of which is already accessible via their mobile devices.

This type of transparent, real-time approach to water management could greatly mitigate tensions within and across certain localities by democratizing access to information and preventing the tampering of data. Power Ledger is among the companies pioneering blockchain applications for the water sector, as is evidenced by its current work with the city of Freemantle in Australia to create a blockchain-backed trading system that leverages smart water metering data.

#### Otherwise, extinction.

Engelke 15 – a Resident Senior Fellow with the Strategic Foresight Initiative at the Atlantic Council in Washington, DC. (Peter, "Water Wars: The Next Great Driver of Global Conflict?," National Interest, 9-15-2015, https://nationalinterest.org/feature/water-wars-the-next-great-driver-global-conflict-13842, Accessed 7-21-2022, LASA-SC)

We live in an age of great anxiety about threats to global peace and stability. Among these are worries that intense water-related stresses, now showing up in regions around the world, may become all-too-common sources of conflict. Just as often, however, concerns about water wars are dismissed as much ado about nothing. An influential school of thought has long contended future international conflicts will not be fought over this resource. Water, it says, is of such elemental importance to human existence that even long-time adversaries will be forced to accommodate one another’s needs in a water-scarce future. As water is too expensive to transport over long distances, moreover, it is very difficult to steal or plunder. And history gives some comfort to this forecast: as few wars have been fought specifically over water, it is highly unlikely humanity will start engaging in water conflicts now. Or so the thinking goes.

In the case of water, this logic — of the past as predictor of the future — is compelling and comforting. But it also is dangerously myopic, for it fails to consider the possibility that the future may look nothing at all like the past. From nearly any standpoint, the world we live in is a fundamentally different place compared with the past. Over just the last century, for example, the global population has rocketed upward from roughly two billion to well past seven billion. While population growth is hardly the only driver of social, economic, and ecological change at global and regional scale, it has been among the most important. Nor is this process at an end. Current demographic projections forecast a global population of at least nine billion by 2050 — and possibly more.

Water in the Anthropocene:

Population growth provides a fitting illustration of the rapid pace of change in the modern world. No consequence is more important than what has been done to nature. Humans have so drastically altered the Earth that scientists now question whether we remain in the Holocene, the 12,000-year-old geological epoch during which all of recorded human history has occurred. Instead, increasingly they speak of the Earth as having entered a new epoch, the Anthropocene. The basic idea behind the Anthropocene is that human activity has so thoroughly disrupted the Earth’s core processes (for instance, its nitrogen cycle or sediment flows) that the planet no longer can be said to function according to the familiar rhythms of the Holocene. Human interference in the Earth’s carbon cycle, for example, has changed the planet’s climate and in the process altered rainfall patterns, accelerated glacial melting, increased air and sea temperatures, and much else. Gone is the Holocene’s stable climate; here is the Anthropocene’s unstable one.

While there is some debate amongst scientists and others about whether the Anthropocene will lead to a better or worse future, nearly everyone involved in the discussion agrees that the Earth of the future will not resemble its past. From here forward, we face an unfamiliar planet that will throw our assumptions about nearly everything out the window.

No resource stands to be more affected by the arrival of the Anthropocene than fresh water. Finite and increasingly scarce in many parts of the world, fresh water remains the most vital single input for everything from food production, energy generation, and manufacturing to human health, social development, and economic modernization. Unlike oil, water has no substitute, making access to it nothing less than a matter of existential importance to every living creature on Earth.

Yet despite its monumental role in local and international affairs, water ironically remains completely undervalued, pumped and consumed virtually free of charge across much of the world. We essentially pump water as we breathe oxygen; it is a learned reflex, central to our ability to survive and thrive as a species. Nicknames like “blue gold” and “oil of the 21st century” attest to the value of fresh water and its importance to everyday affairs throughout the world.

While every country’s water equation is different, at a global scale the basic problem is that demand for water is soaring while water supplies are being squeezed. On the demand side, the challenge results from an inexorable combination of global economic and population growth combined with water-use inefficiencies. On the supply side, the problem results not just from exhaustion of the world’s stock of fresh water capital, as is happening to groundwater reservoirs nearly everywhere. Fresh water supply is also becoming less predictable as climate change sets in—shifting rainfall and snowfall patterns and increasing evaporation rates are giving us more frequent droughts and floods.

The upshot is that the arrival of the Anthropocene foreshadows a world where received wisdom may no longer be a reliable guide to the future. Water insecurity from drought, excessive groundwater extraction, and changed seasonal precipitation patterns is affecting — or soon will affect — regions as diverse as the Middle East, South Asia, the Caribbean, northern China, sub-Saharan Africa, the western United States, and many more.

Water Geopolitics:

Much as oil shaped the global geopolitics of the 20th century, water has the power to reorder international relations in the current century. The world’s emerging water geopolitics are complicated, as fresh water resources are distributed unevenly across the globe. There are great water powers, blessed with enormous renewable reserves (Brazil, Russia, the United States, Canada, and China round out the top five). But even within these huge countries, water availability is not uniform, with southern Brazil, the western United States, northern China, and other sub-regions facing intense water stress.

Far more numerous than the water powers are the water have-nots, a growing list of countries suffering through a perfect storm of rapid population growth, resource depletion, poor governance, economic stagnation, and unsettling climate change impacts, all within the context of chronic aridity. The most water-fragile among them are concentrated in a strategically significant belt stretching from North Africa across the Middle East and Horn of Africa into Central, South, and East Asia. It is in these naturally arid or semi-arid countries where water scarcity has the greatest potential to inflict serious harm.

Water stress is best understood as a precursor to conflict. While the environmental security community generally agrees that water disputes rarely leads to interstate violence, the same cannot be said of intrastate conflict. Here, at the subnational level, water disputes and instability can trigger violent conflict, particularly in situations of existing social, political, or economic fragility. Water stress acts as an accelerant, increasing the likelihood of conflict. Moreover, water scarcity-fueled instability can have dangerous security implications for wider geographic regions.

Take Syria as an example. Between 2006 and 2010, the country was hit hard by drought, which wiped out rural livelihoods for many and caused significant internal displacement across the country. Internal displacement in turn helped stir up a pot that boiled over into all-out civil war in Syria, eventually spreading to Iraq. Over the last two years, ISIS has viewed water access and control as a primary strategic objective of their campaign, and has commandeered hydroelectric dams, irrigation canals, reservoirs, pipelines, and other water infrastructure to cement territorial gains.

Water has played an important role in Yemen’s ongoing collapse. Decades of mismanagement have left the country — one of the world’s most water-scarce nations — with dilapidated water infrastructure, severely depleted groundwater reserves, and high rates of water-use inefficiency. Yemen’s capital, Sana’a, may become the first capital in the modern world to functionally run out of water, possibly as soon as 2025.

In Pakistan, meanwhile, runaway population growth and shifting rainfall patterns threaten its water outlook. With a massive population set to nearly double in the next 35 years, Pakistan’s demand on its very limited water resources will intensify in a way that is almost unimaginable. Already, the country is one of the most water scarce on earth. In a nod to water’s importance in shaping the region, many Pakistani militant groups long hostile to India have supplanted protests over Indian control of Kashmir with more specific protests over access to Kashmir’s most valuable resource — water.

Other countries join Syria, Iraq, Yemen, and Pakistan on the list of nations facing a similar combination of water stress and social and political insecurity. They include conflict-prone countries of geopolitical significance, including Iran, Afghanistan, Egypt, Libya, Nigeria, and Somalia. Even more worrisome, global heavyweights such as China, India, and even the United States face uncomfortable futures given mismatches between forecasted demand for water and squeezed sources of supply. While there is no reason to believe that the latter states will suffer from the same forms of insecurity as those countries in the arc of crisis, neither will they be exempted from the blunt realities of a water-stressed world.

### 2AC – AT: Terror

#### The impact of blockchain on terror is limited

Singer 21 – Andrew has been a professional writer and editor for more than 30 years. He received an M.A. in statistics from Columbia University in 2017 and has since been working as a freelance writer with a specialty in machine learning, artificial intelligence, blockchain technology and big data. (Andrew Singer, "Terrorists still raise money through crypto, but the impact is limited," Cointelegraph, 4-9-2021, https://cointelegraph.com/news/terrorists-still-raise-money-through-crypto-but-the-impact-is-limited, Accessed 7-23-2022, LASA-SC)

We’re living today “amidst an explosion of risk related to fraud, money laundering, terrorist financing, and data privacy,” said United States Treasury Secretary Janet Yellen in February — and she specifically cited cryptocurrencies as a “tool to finance terrorism.”

Yellen appeared to be flagging an important new turn in the war against terror, and it begged some questions: Is crypto in the hands of terrorists a real, present danger to governments and society? If so, should the cryptocurrency and blockchain industry be worried?

Recent evidence suggests that crypto’s role as an enabler of terrorism globally remains relatively minor. “Cryptocurrencies have been used in several terror finance cases, but it has not yet become a primary means of terror financing,” Matthew Levitt, director of the Jeanette and Eli Reinhard Program on Counterterrorism and Intelligence at The Washington Institute for Near East Policy, told Cointelegraph.

Gina Pieters, assistant teaching professor in the Department of Economics at the University of Chicago, told Cointelegraph: “Her [Yellen’s] statement is factually true — it is a tool.” But Yellen also chose her words carefully. “She did not say it was a major tool — she specifically said it was a growing one. And that is also true, as cryptocurrencies grow they will be used in more criminal activities.”

Increasing apprehensions about crypto?

Dave Jevans, CEO of CipherTrace, expressed some unease about the treasury secretary’s remarks. “If leaders like Janet Yellen set a fearful attitude toward cryptocurrencies associated with criminality, regulators could take harsh action to impose more strict rules on cryptocurrency transactions that may not be warranted,” he told Cointelegraph, adding: “Such action, like the blanket cryptocurrency ban in India, would greatly inhibit mass adoption and innovation in the space.”

“I think she wanted to raise the issue and put it on people’s radar,” remarked Levitt, who added that misuse of cryptocurrencies looms as more of a geopolitical concern with regard to states trying to evade Western political sanctions — like Russia, Iran or Venezuela — than with would-be terrorists.

Still, it doesn’t take much money to finance a terrorist act, so any help that Bitcoin (BTC) or other cryptocurrencies provide to terrorist groups that are trying to obscure their funding sources remains a worry. For that reason, Jesse Spiro, chief of government affairs at Chainalysis, told Cointelegraph that Yellen wasn’t exactly exaggerating the threat. That said, “Terrorism financing represents an incredibly small portion of cryptocurrency transactions.” In 2020, Chainalysis traced just 37.35 Bitcoin that went toward terrorism financing, or “a mere 0.00324 per cent of the overall illicit activity,” he said.

Crypto becoming more important for terror groups?

In August 2020, the U.S. Department of Justice seized the cryptocurrency accounts of three Middle East-based terrorist financing operations. This was the “largest ever seizure of terrorist organizations’ cryptocurrency accounts,” according to the DoJ. “It is a fact that jihadi groups, led by ISIS and Al-Qaeda, have been using cryptocurrency for years,” Steven Stalinsky, executive director at the Middle East Media Research Institute, told Cointelegraph. “Following the fall of ISIS’s caliphate, it quickly became even more important for them.”

In its daily monitoring of jihadi groups online, MEMRI sees groups and individuals discussing the use of different cryptocurrencies, “But this use has not recently developed to the extreme proportions that it could have and still might,” said Stalinsky. “Any arrests and public news of jihadis using cryptocurrency has so far led to the companies acting to shut down these and related accounts, and this seems to be creating a balance to curb the problem.”

A 2019 Rand Corporation study noted that “No current cryptocurrency can address all of the terrorist organizations’ financial needs” — which include anonymity, usability, security, reliability and acceptance — but cryptocurrencies like Bitcoin, “particularly with improved usability, could be appealing to use in fundraising, and some evidence is emerging that terrorist organizations might be using cryptocurrencies for this purpose.” It is critical for such groups to be able to receive money from donors, beyond the gaze of governments.

In an intelligence brief, Chainalysis noted that advertisements and messages from BitcoinTransfer, a Syrian-based cryptocurrency exchange that has been publicly cited as being run by jihadis, “often emphasize security and anonymity, as well as its ability to facilitate transfers from European countries without submitting identification documents or ‘exposing your friend or family to danger.’”

Bitcoin, the world’s oldest and largest blockchain network, isn’t really anonymous, as Al-Qaeda and affiliated terrorist groups discovered with the DoJ’s August 2020 takedown. Internal Revenue Service, Homeland Security Investigations and Federal Bureau of Investigation agents tracked and seized all 150 crypto accounts that laundered funds to and from the al-Qassam Brigades’ accounts, for instance. The group had advertised that its Bitcoin donations were untraceable and would be used for militant activities.

## AT China Heg Good

### aff – china heg bad

#### China rise causes violent transition wars, territorial conflicts, and erosion of democracy

Pathak 15 – Sriparna Pathak, assistant professor and assistant Academic Dean at the Jindal School of International Affairs of O.P. Jindal Global University in India, Ph.D. from the Centre for East Asian Studies at Jawaharlal Nehru University, fellow at the South Asia Democratic Forum, former visiting faculty at the Centre for Southeast Asian Studies, recipient of the joint fellowship awarded by the Ministry of Human Resources Development of India and the China Scholarship Council of the People’s Republic of China (“The ‘Peace’ in China’s Peaceful Rise”, 10/15/15, <https://www.e-ir.info/2015/10/15/the-peace-in-chinas-peaceful-rise/>) FGY

The international system has undergone a number of changes, the latest of which include the ‘emergence’ or ‘re-emergence’ (as in the case of China and India) of ‘new’ countries as powerful players in the system. This is primarily due to the economic growth of Asian countries, which has lead to a greater degree of multipolarity in the international system; power is now calculated not only in military terms but in economic terms as well. With the end of the Cold War in 1989 and the subsequent collapse of the USSR, the U.S. emerged as the most powerful state in the global arena. However, rapid economic growth of countries like China also meant that players emerged in the global arena that, as a virtue of their growing economic clout, now have a **voice in determining international affairs**. The rise of China as a significant player in international politics is often viewed with suspicion, and questions emerge whether it will challenge the traditional hegemony that the U.S. has had. In order to answer whether the rise of China in international relations is a peaceful one or whether it is a Thucydides trap, it is **essential to understand what China means by a “peaceful” rise** (later replaced with peaceful development) followed by a closer look at the theory and history of great power politics.

The concept of “peaceful rise” (Zhongguo heping jueqi) was an official policy which emerged under the leadership of Hu Jintao. The term was an attempt to rebut against the “China threat theory”. The “peaceful rise” concept sought to characterise China as a responsible world player, emphasising soft power and that China is committed to its own internal issues and improving the welfare needs of its citizens before interfering in world affairs. However, the usage of the term “rise” was seen as controversial since the word could lead to perceptions that China’s “rise” is a threat to the established international order. Therefore, since 2004, the term has been replaced with “peaceful development” (Zhongguo heping fazhan). The need to come up with such a concept arose because, as has been seen in the past, the emergence of a new pole of power has often resulted in drastic changes in the global political structures and even war – which is well-explained through the theory of hegemonic stability and that of offensive realism in particular in International Relations.

The term “peaceful rise” was coined by Zheng Bijian in late 2003. According to Zheng, the rise of new powers in the past lead to an imbalance in the global political structures and war because these powers chose the road of aggression and expansion. Zheng Bijian’s inspiration for the concept arose during an official visit to the U.S. in December 2002 where he reportedly experienced the pervasive discourse of the “China threat” and “China collapse” first hand. As prescribed by Zheng, the People’s Republic of China will develop peacefully and, in turn, help to maintain a peaceful environment. The speech given by Zheng was at the Boao Forum for Asia in Hainan province. The real attempt behind the introduction of the concept was to provide the international audience an introductory glimpse of the new strategic thinking that was emerging in China based on newer conceptualizations of power.

In addition to the promotion of the concept of peaceful development, the leadership of the country has also embarked on a program of “neighbourhood diplomacy,” emphasising good neighbourliness and friendship and partnership; China has furthermore asserted that, unlike Western powers, it can rise peacefully due to its unique Confucian cultural tradition. However, **history suggests that when a rapidly rising power threatens an established power, competition inevitably leads to conflict** – the Thucydides trap in other words. According to a reading of European imperial history by scholars such as Kenneth Waltz and Raler & Thomson, states seek to maximise their security and therefore their power, which inevitably leads to inter-state military competition. More recently, John Mearsheimer has undertaken an analysis of the Asia-Pacific region, which is now a region of emerging powers. In his book titled the Tragedy of Great Power Politics (published in 2001) he stated that the rise of China in the 21st century will be fraught with challenges. Against this, as stated previously, stands the Chinese leadership’s concept of peaceful development, which essentially states that Chinese development will not threaten the established order. Dr. Yuan-kan Wang, in his book Harmony and War: Confucian Culture and Chinese Power Politics, seeks to address the question of whether the Confucian exceptionalism will exempt China from the traditional patterns of conflict or not. The study undertaken by Dr. Wang challenges the popular narrative of China’s historic cultural pacifism, and states that the Confucian tradition is used as a legitimising mechanism for its development and growing military power. Dr. Wang’s conclusion posits that **China will gradually shift to an offensive grand strategy once it has accumulated sufficient power.**

As posited by offensive realism, China’s attempts to dominate the region will increase with its increasing clout, just the way the U.S. dominates the Western Hemisphere. The reason behind this is that the best way to survive in international anarchy is to be the sole regional hegemon. China has ongoing and often violent territorial conflicts with the Philippines, Japan, Vietnam, Indonesia, India, Malaysia and Brunei. With growing economic clout, **China’s policies towards territorial disputes have become more aggressive**. This is exactly in line with what has happened in the Western Hemisphere and the U.S., and what is posited by the theory of offensive realism. With increasing economic might, domination is the best way to survive under international anarchy. The more powerful China is, the better it will be able to settle its disputes according to terms that it favours.

An example of Beijing’s hegemonic aspirations is the Asia Investment and Infrastructure Bank (AIIB), which is an alternative that China is providing to the multilateral institutions of the Bretton Woods system. This is a potential vanguard for an alternative economic order. It also is a reflection of Chinese ambitions to emerge as a powerful alternative in the international economic order – clearly what is prescribed by the theory of offensive realism. AIIB’s creation and existence simply mean that the International Monetary Fund (IMF) and the World Bank, which have been the dominant players in development lending and financial regulation, now have an Asian counterpart. The Bretton Woods institutions in the form of the IMF and the World Bank so far have been promoting the political world views of their most powerful members. Now, the AIIB will play a similar role – promoting political and economic interests of its powerful members, and China’s interest will certainly feature prominent on the agenda.

Another example of the fact that the “rise” will not be as peaceful as has been put forth by the concepts of peaceful rise/peaceful development, and will be more on the lines of a Thucydides trap, are incursions undertaken by the People’s Liberation Army in September 2014 when Xi Jinping was on an official visit to India and in discussions with the Indian Prime Minister, Narendra Modi, on issues that would impact peace and development of the entire region. Concepts of **“neighbourhood diplomacy” and “peaceful development” dissipated in the face of Chinese aggression**. This is remindful of the American attempts at regional hegemony in history. After independence in 1783, the U.S. over the next seven decades created a powerful country. Wiping out Native Americans in large numbers, plundering land and property, purchasing Florida from Spain in 1819, annexing Texas in 1845 and waging war with Mexico in 1846 – these were all a part of its goal of establishing American hegemony in the region. President James Monrof e articulated the Monroe Doctrine in 1823. According to the Doctrine, U.S. intervention was deemed necessary to prevent European nations’ colonisation efforts. By the end of the nineteenth century, the European great powers had become minor players in the Americas. The U.S. achieved regional hegemony and this, in turn, led it to become a secure great power.

If this example from history was to be taken and the Chinese case was to be juxtaposed, then not too many differences would be found. The **increased aggression that China has been displaying in Asia**, its **active suppression of Tibetan/Uyghur dissent**, and the setting up of alternative economic structures among others are all evidences of the fact that the Thucydides trap exists and that **there is nothing “peaceful” about China’s rise** or development. It is simply offensive realism – and even though China attempts to camouflage this with sugar-coats of Confucian traditions, concepts of “peaceful development” and “peaceful rise”, this can be **regarded as nothing less than attempts at achieving hegemony**.

## AT Cyberattacks Good

### 2AC---Cyber Attacks---Retal

#### Even attempted cyber-attacks cause retal.

Vladimir Orlov, 20 (Vladimir Orlov, Founder & Director, PIR Center, President of the Trialogue Club International, Co-Founder & Academic Supervisor, International Dual Degree MA Program in Nonproliferation & Global Security Studies from MGIMO University, 5-12-2020, accessed on 7-18-2022, Security Index #1, “'No Holds Barred' and the New Vulnerability: Are We in for a Re-Run of the Cuban Missile Crisis in Cyberspace?”, <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3538078>, HBisevac)

Not hundred per cent of the dialogue has been frozen, fortunately. Certain informal, mostly off the-record, meetings of US and Russian experts on cyber agenda continue taking place, both through Track 2 and Track 1.5. One of the most intellectually stimulating meetings, with frank exchanges, took place in Vienna in December 2018. The report produced after the meeting stressed “the significant risk […] that cyber-attacks could conceivably lead to a **military escalation** that may further trigger a **nuclear weapons exchange**, a fact that became more explicit with the adoption of the current **N**uclear **P**osture **R**eview. This issue gets complicated given that third parties may have the capabilities to **invoke** a **cyber conflict** between **Russia** and the **U**nited **S**tates. Whether a country or a non-state actor, they could put the two countries on the verge of an armed conflict by attacking **critical** **infra**structure of either of them and making it **look** as if the **aggressor** were the **other one**”[22]. However, one should have no illusion: such informal meetings may be fully fruitful only when their reports and policy recommendations are utilized by the governments. And for that, a warmer climate in bilateral relations is a must. So far, we see exactly the opposite: mercury falling to freezing levels.

Risk of cyber clashes growing into a **chaotic global cyber war** has been emphasized by the UN Secretary-General Antonio Guterres in his Agenda for Disarmament: “Malicious acts in cyberspace are contributing to **diminishing trust** among States… States should implement the recommendations elaborated under the auspices of the General Assembly, which aim at building international confidence and greater responsibility in the use of cyberspace.[23]” However, as the members of the US-Russian Track 1.5 working group on strategic stability recently concluded, “without a constructive dialogue on cyber issues between the United States and Russia, the world would most likely fail to agree on any norms of responsible behavior of states in cyber space”[24].

Do we really have to survive a cyber equivalent of the Cuban Missile Crisis to realize the importance of achieving some kind of agreement on cyber issues, and on the broader agenda of international information security?[25] Or is that kind of talk plain old alarmism?

I don’t want to sound a fatalist, but I am even less keen on sounding like an ostrich that’s buried its head in the sand. We **cannot ignore** the **obvious**: whether the world’s most powerful actors like it or not, the world is sliding to **another major crisis** like the one in 1962. The cyber war is ***already raging***. There are **no rules** of **engagement** in that war. The **uncertainty** is **high**. The **spiral of tension** is getting **out of control**. The cyber **arms race** is gaining **momentum**. And there are no guarantees that the next crisis will be controllable, or that it will result in a catharsis as far as international information security regulation is concerned. There’s **no telling what will happen** once the *cyber genie* is out of the bottle.

### 2AC---Cyber Attacks---Escalates

#### Non-kinetic attacks prompt miscalc and escalate into conventional warfare.

John Arquilla & Andrew Szarejko, 21 (John Arquilla is an American analyst and academic of international relations and Andrew Szarejko is a Donald R. Beall defense fellow in the Defense Analysis Department at the Naval Postgraduate School, 12-22-2021, accessed on 5-29-2022, War on the Rocks, “Accidents and Escalation in a Cyber Age”, <https://warontherocks.com/2021/12/accidents-and-escalation-in-a-cyber-age/>, HBisevac)

Sometimes wars, from small ones to big ones, start with **accidents**. In early American history, for example, accidents associated with good-faith errors and unauthorized acts of violence precipitated several conflicts between the United States and Native American groups. On a larger scale, Scott Sagan has argued that the 18th-century Seven Years’ War was sparked by a false warning of French invasion and that the Japanese invasion of Manchuria in 1931 was an unauthorized attack orchestrated by army officers against the expressed wishes of the civilian government. The potential for these sorts of accidents — human or technical errors and unauthorized actions — to induce **subsequent escalation** has produced much diplomatic effort to mitigate the risks of stumbling into armed conflict. There are hotlines, summits, “open skies” agreements, confidence-building measures, and more. Yet today the risk of accidents **producing escalation** **persists**, especially where states see a **first-mover advantage** and fear the consequences of **underreacting** more than the risks of over-reacting.

The rising **salience** of **cyber warfare** contributes dangerously to the traditional set of concerns about the **onset** of **armed conflict**. Now, in addition to wars waged with bombs and bullets, militaries have become **highly dependent** upon the security of the ***bits*** and ***bytes*** that **empower** their “sensing and shooting” **capabilities**. And the link between incidents starting in cyberspace and ending up in battlespaces on land, at sea, and in the aerospace environment is getting the attention of policymakers. So much so that, as President Joe Biden noted that “we’re going to end up, if we end up in a war — a real shooting war with a major power — it’s going to be a consequence of a cyber breach of great consequence.”

Some have argued that cyber operations are actually unlikely to prompt military escalation, but we would argue that this possibility ought to receive policymaking attention to reduce its probability. There remains **much uncertainty** about the **frequency** and **severity** of cyber accidents that are **occurring now** and that will **arise** in the **future**. This uncertainty extends to whether any given cyber accident will spark military escalation. But a growing body of evidence, beginning with the Moonlight Maze cyber intrusions into military systems in the late 1990s and other serious events that have continued to this day, make clear that potential **adversaries** are testing out **virtual ways** to **disrupt physical operations**.

What sorts of accidents might occur in cyberspace, and how might they prompt military escalation? We have three basic categories in mind. First, there are human actions in cyberspace that could provoke escalation. These include human errors, such as mistaken perceptions. During the Cuban Missile Crisis, for example, a U.S. destroyer’s use of training depth charges to target a Soviet submarine very nearly led the submarine’s captain to launch a nuclear torpedo because he reportedly believed a war might have already started. The difficulties of ascertaining intent and attributing responsibility for actions in cyberspace may produce similar human errors. Alternatively, **intentional actions** not **authorized** by any proper authority would fit this category. Non-state-affiliated **hackers**, for example, could individually or collectively target or unintentionally affect **highly sensitive systems** such as those related to critical infrastructure, conventional military systems, or nuclear command-and-control processes. Similarly, state-linked **cyber proxies** could engage in such actions of their **own volition** and have their actions **incorrectly attributed** to their state sponsor.

As a case in point, in 2001 through 2002, Gary **McKinnon**, a Briton whose autism played a central role in his legal defenses after he was caught, hacked into U.S. military systems in a purported effort to uncover information about unidentified flying objects he believed the U.S. government was hiding. This hack kept about **2,000 military computers offline** for **days**, caused alarm in the Pentagon — American air defenses and the Atlantic Fleet’s logistics had been compromised — and led to questions about who was targeting the United States and who ought to face retribution. The prosecutor in charge of the effort to extradite him from the United Kingdom described the incident as “the biggest military computer hack of all time.” Needless to say, had this occurred during a major international crisis — and had the United States failed to sufficiently harden those military networks despite being in a crisis — the consequences could have been **dire**.

Our second category of concerns is about **technical errors** that could lead to military escalation. During the Cold War, for example, there were occasions on which the United States and the Soviet Union each thought the **other** had begun a **nuclear attack**. In the American case, a war-scenario training tape was mistakenly inserted and played at a strategic command. On the Soviet side, a computer malfunction reported that five American missiles were heading toward the Soviet Union. Fortunately, those involved in both cases waited long enough before retaliating to ascertain that their identification of an incoming attack was mistaken, but there is **no guarantee** that such events will always **resolve** so well. That we are all still here speaks to the caution that nuclear weapons can induce. In the case of escalation to conventional military action from cyber operations, however, those involved may be **less cautious**.

The third category of potential problems consists of intentional cyber operations that may have **unintended consequences**. Due to the **complexity** and **interconnectedness** of advanced information systems, any offensive cyber operation engenders **uncertainty** as to the effects it will cause. Thus, to the extent that human and/or technical errors could be the source of such effects, it is worth considering them here. One could imagine, for example, that either Israeli or Iranian cyber operations targeting the other in their current “virtual conflict” might yield greater consequences than the attacker intended. In an **already tense**, volatile situation, such a perceived escalation, **even if unintended**, might prompt an armed, “**kinetic**” response.

### 2AC---Cyber Attacks---Escalates---Ambiguity

#### Cyber law ambiguity causes miscalc that escalates.

Ryan Goodman, 18 (Ryan Goodman, Anne and Joel Ehrenkranz Professor of Law at New York University School of Law and ssor of Politics and Professor of Sociology at NYU, 3-8-2018, accessed on 5-29-2022, Just Security, “Cyber Operations and the U.S. Definition of ‘Armed Attack’”, <https://www.justsecurity.org/53495/cyber-operations-u-s-definition-armed-attack/>, HBisevac)

A widely accepted view of the UN Charter is that a State can use force in self-defense only in response to an “armed attack,” which is importantly defined as the gravest forms of force in scale and effects. In contrast, the United States has **long maintained** that a State can use force in **self-defense** in response to **any amount** of **force** by another State. The U.S. view might have worked well when it came to bombs and battleships. There are reasons, however, to think that the application of the U.S. view in the **cyber realm** may risk **unintended**, **accidental**, and unnecessary **militarized conflicts**. That’s partly because of the uncertainty of the law in cyberspace and partly because of the uncertainty of facts when cyber operations occur.

The U.S. position, one might think, reduces the overall risk of militarized conflicts between States. One reason to recommend the U.S. view is that it might enable a government to prevent escalation—for example by using cyber-ops to impede another State’s test missiles—in response to the latter’s low-level uses of force, and thus buy more time for diplomacy to avoid a larger battle. What’s more, if a State’s **hands** are **tied** such that it **cannot use force** to respond to a **low-level** use of force by an aggressor, it will put **pressure** on governments to **expand** what is meant by an “**armed attack**,” which has potentially dangerous precedential effects in the future. Those concerns, however, may not be as relevant for the United States, which, above and beyond other States, has a broader range of potential diplomatic, economic, and other non-forcible, non-military means to defend its interests.

More important is deterrence. In favor of the U.S. view of the law is that a **lower threshold** for triggering the right of **self-defense** can **deter** **aggressors** from acting **in the first place**. In terms of defensive posture, the United States deters others who know that the American military can use its mighty arsenal in response to any illegal use of force. That empirical claim, however, is **weaker** in a world in which States very **frequently** engage in **low-level uses** of force in cyber, or might be thought to have done so by their adversaries. In that world, many States will have the legal right to use force in self-defense against others on an ongoing basis. Also, consider the U.S. offensive posture. The **greater extent** to which the United States, in particular, is engaged in cyber activities across the world that will be considered a use of force by **other States**, the greater license the United States may be handing those States to use force—whether in the cyber or kinetic realm—in response. That is, if those States adopt a view similar to the United States that “the inherent right of self-defense potentially applies against any illegal use of force.”

It may have been more satisfying to the United States to operate in world in which it maintained the legal prerogative to adopt a forcible response in reaction to any illegal use of force while other States did not maintain that position. Our legal world may be changing, however. Witness, for example, Japan’s recent shifts toward the U.S. position. Taken in light of Mutual Defense Agreements, in which the United States has accepted an obligation to support other States who have been subject to an “armed attack,” and the kinds of calculations of what makes the world safer and better protects U.S. national security must surely shift. More specifically, if more U.S. allies start moving toward the U.S. view of “armed attack,” the United States may be **drawn into far-flung cyber conflicts** as an **unintended consequence**.

Now add to this mix the **legal uncertainties** that exist in this specific area of **cyber law**. The legal definition of what exactly is a use of force in the cyber realm is far less settled than in the kinetic realm. What’s more, it is safe to assume that several States around the world are frequently engaging in actions that others might consider a use of force. Is the laying of specific types of malware on the systems of another State in preparation for possible future activation analogous to laying landmines in another State’s territory? The Tallinn Manual’s definition of cyberattacks (at least in the context of jus in bello) may lead one to think so, but widespread State practice would appear to contradict that conclusion. So which is it? Also, could the alteration or destruction of data count as a use of force or attack? This is an area where views are developing in one direction, but what happens in the limbo period between now and then, when some States and legal authorities hold one view and others hold different ones? That seems like a dangerous period for calibrating the use of force in cyber. And those are just two examples of legal uncertainties out of many that one could describe.

These types of legal uncertainties are compounded by factual uncertainties in the cyber realm. While the United States appears to have an increasingly impressive ability to **determine attribution**, many other States **lack** that **sophistication** and are thus more **likely** to make **costly errors**. State D may **mistake** a cyber operation launched by a **rogue hacker** or organized non-State group operating out of country Y as being perpetrated by State Y **itself**. And governmental or non-governmental cyber hackers in a third country may very purposefully make it look like State Y conducted a cyberattack. Another difficulty in the cyber realm is determining whether certain effects of a hostile cyber operation were intended by the attacker. For example, State D may detect an imminent threat of malware in its systems that appears would at least temporarily compromise its most sensitive military arsenal—but is that what the perpetrator **intended** (and how, as a legal issue, should that question of intentionality matter)?

In cyberspace, many of these actions and interactions will take place at greater speeds thanks, in part, to artificial intelligence. These conditions may **shrink** the **window of time** for political and military leaders to **make decisions**, and place **pressure** on them **to pre-authorize** or create **automated responses**. It is not hard to imagine tit-for-tat uses of force quickly ascending a ladder of escalation. And there is no legal reason the rungs of that ladder will remain confined to the cyber realm.

### 2AC---AT: Iran---No War

#### Defenses are improving and Iranian capabilities are declining due to brain drain---makes future attacks unlikely

Collin Anderson 18, Fellow in the TechCongress Congressional Innovation Fellowship program, Washington, DC–based Researcher Focused on Cybersecurity and Internet Regulation, and Karim Sadjadpour, Senior Fellow at the Carnegie Endowment for International Peace, Adjunct Professor at Georgetown University’s School of Foreign Service, MA from Johns Hopkins School of Advanced International Studies, “Iran’s Cyber Threat: Conclusion and Prescriptions”, in Iran’s Cyber Threat: Espionage, Sabotage, and Revenge, 1/4/2018, https://carnegieendowment.org/2018/01/04/iran-s-cyber-threat-conclusion-and-prescriptions-pub-75143

Yet Iran will continue to be limited by resource constraints for the foreseeable future. Tehran has rarely appeared able to conduct large-scale exfiltration of classified business and government data, differing, for example, from Chinese efforts to steal Boeing’s industrial secrets or extensive databases from the U.S. Office of Personnel Management.142 What’s more, the threshold of difficulty for compromising such targets will increase over time, and it is unclear whether Iranian capabilities will improve proportionally.

Iran’s massive brain drain, with many of its brightest engineers leaving for political and economic reasons, imposes further constraints on the development of its cyber capabilities. Iran’s minister of science, research and technology estimated that 150,000 highly talented people emigrate from Iran every year, a $150 billion annual economic loss.143 When Iranian engineers leave for Silicon Valley and Europe, the country’s capacity for effective offensive and defensive cyber operations goes with them.

In the absence of a historical comparison of Iranian cyber operations, new incidents or the rise of new groups is often incorrectly perceived as a dramatic improvement to capacity. Despite systemic challenges stemming from bureaucratic dysfunction and underinvestment in cybersecurity, Iran has the potential to foster more effective operations. Attempts by the government, universities, and the private sector to create a professional cybersecurity community, such as hosting Capture the Flag tournaments, will inevitably result in a deeper talent pool. Observing other nation-state actors provides a set of benchmarks that can be a reliable indicator of improvement or change in posture, including:

#### No US-Iran war – spiral theory is wrong, no domestic interest, and no diversionary pressures.

Michael C. Horowitz And Elizabeth N. Saunders 19, professor of political science and the associate director of Perry World House at the University of Pennsylvania. He is the co-author of “Why Leaders Fight.” AND one of The Monkey Cage's senior editors, is an associate professor in the School of Foreign Service at Georgetown University, and a nonresident senior fellow at the Brookings Institution. She is the author of Leaders at War: How Presidents Shape Military Interventions., 6-17-2019, "War with Iran is probably less likely than you think," Washington Post, https://www.washingtonpost.com/politics/2019/06/17/war-with-iran-is-probably-less-likely-than-you-think/

Why war with Iran might be less likely than you think. Last week, an attack on two tankers in the Gulf of Oman raised tensions between the United States and Iran — on the heels of a similar attack in May. Though Iran denied responsibility, Secretary of State Mike Pompeo said intelligence evidence showed Iran was to blame, and President Trump concurred that “Iran did do it.” Although questions remain in some quarters about the attack’s nature and source, on Sunday on CBS’s “Face the Nation,” Rep. Adam Schiff (D-Calif.) said the evidence Iran was responsible is “very strong and compelling.” As was true when the United States and North Korea exchanged bellicose rhetoric in 2017 and early 2018, many are now worried that the U.S. and Iran are heading for war. When Trump was warning that North Korea faced “fire and fury” if it threatened the United States, we wrote about why, despite the rhetoric, war was unlikely. This time, some factors are indeed pushing the two sides toward conflict. But forces of restraint are also reducing the likelihood of war. Tensions can lead to a “spiral” of escalation. Both the United States and Iran say that they do not want a war, but that they are prepared to fight if the other side starts one. What’s worrisome is what political scientists call the spiral model of conflict escalation. Sometimes, when countries take measures they think will improve their own security, potential opponents can perceive that as threatening — a classic security dilemma. Those potential opponents then take measures to improve their own security — which the first country sees as threatening. And so on. When countries do not trust each other, and perhaps even fear that the other side wants war, they are unlikely to believe conciliatory signals from the other side, and nobody wants to appear weak. The result is a spiral of conflict. The past few weeks’ events have certainly ratcheted up tensions. The recent tanker attack and America’s decision to quickly blame Iran only raises them further. And as Tyler Jost and Rob Schub wrote here at TMC last month, the Trump administration’s decision-making process could make it even more difficult to navigate the tricky problem of reading and responding to signals in a crisis like this. War would be very costly in this case. A conflict between Iran and the United States could be very costly. For instance, in such a war, Iran might use mines to keep ships from traveling through traffic in the Strait of Hormuz — a crucial, narrow passage for world energy supplies. If that happened, the U.S. options for clearing the mines would be complicated and costly, as Caitlin Talmadge argues. Such an operation might require hitting targets inside Iran or risk Iranian retaliation from coastal positions given the narrow geographic chokepoint — all pointing toward further escalation. Knowing this, the United States might instead choose to go straight to a bombing campaign. But coercive bombing might also lead to escalation. Despite these dangers, there are still important constraints on both sides. Misperception rarely causes war. The spiral model may not be the right way to think about how conflicts escalate. Missed signals and miscalculation can indeed generate tension. But leaders have many ways to avoid conflicts that they do not want to fight. The historical record suggests that misperception and accidental escalation rarely lead to war — as Dan Reiter noted here at TMC during the height of North Korea tensions in 2018. Domestic political pressures don’t seem to be pushing toward war. The United States and Iran also face domestic pressures that may make both sides hesitate before escalating. Iran’s economy has suffered under the Trump administration’s renewed sanctions, and parliamentary elections are coming up. Although the country’s president, Hassan Rouhani, has used tough rhetoric recently, a costly war might not benefit Iran’s leaders, since it could inflict further economic and human costs, or even lead to regime change or collapse. Likewise, after nearly two decades of war in the Middle East and Afghanistan, Americans are unlikely to welcome another major conflict. Neither Trump’s own party nor the opposition Democrats has rallied the U.S. public to pressure Trump to escalate. As TMC’s Michael Tesler noted in December, although Trump’s base supporters tend to have hawkish views, they supported his decision to withdraw troops from Syria. If Trump does not want war with Iran, his base would likely follow. The president doesn’t seem eager for war. There has been much talk about a replay of the Iraq War, with the United States using possibly flawed intelligence to justify war. But although Trump has used limited military force in Syria, he seems generally opposed to costly wars in the Middle East, and unlikely to embrace a new one. Both Pompeo and national security adviser John Bolton are much more hawkish on Iran, but Trump has distanced himself from his advisers’ hawkish rhetoric, particularly the most costly option: regime change. Here’s what to watch for. So which will win out: the risks of escalation or the pressures for restraint? Amid all the tension, Iran wants its regime to survive, and Trump probably does not want to absorb a costly war. In the coming days and weeks, it will be telling to see if there is further daylight between Trump and his advisers. Here’s one more risk: if Trump’s hawkish advisers present an option that seems like it could be kept limited, but actually carries a strong likelihood of escalation. Trump has embraced limited displays of force, such as airstrikes in Syria in 2017 and 2018, and he issued a threatening tweet on Iran in May. But he has also pivoted away quickly from harsh rhetoric to diplomacy before — as he did toward North Korea — and has already achieved his campaign goal of pulling out of the nuclear deal he disdained. The bottom line: Despite rising tension, powerful factors reduce the likelihood of war between the U.S. and Iran. That’s unlikely to change anytime soon.

#### It won’t escalate

Max Fisher 20, international reporter and columnist for The New York Times. He has reported from five continents on conflict, diplomacy, social change and other topics. With Amanda Taub, he co-authors The Interpreter, a column exploring the ideas and context behind major world events, 1-3-2020, "Is There a Risk of Wider War With Iran?," New York Times, https://www.nytimes.com/2020/01/03/world/middleeast/us-iran-war.html

Would a conflict go wider? Iran could call upon proxy militias in Lebanon, Yemen, Iraq and Syria. But no governments are eager to join it in an outright war. American allies in the region — Israel and Gulf States such as Saudi Arabia — would be unlikely to join unless dragged in by Iranian attacks. Iraq is coming under growing pressure to choose between the United States and Iran. Should American forces be expelled, Washington would lose a point of significant influence in Iraq, likely granting Iran greater sway in the country. While the possibility of an unintended slide to war is impossible to rule out, fears of World War Three — a phrase that trended overnight on social media — are overblown. Russia and China might strenuously object to American attacks, but they are no more likely to join the fight than they were when the United States invaded Iraq or helped to topple Libya’s government.

### 2AC---AT: Iran---No War

#### No US iran war

Rick Gladstone 18, editor and writer on the International Desk, based in New York., 7-23-2018, "Should We Be Anticipating War With Iran? No, but It Could Get Nasty," New York Times, https://www.nytimes.com/2018/07/23/world/middleeast/iran-us-conflict-explainer.html

There is little question that the United States would prevail in a conventional war, an outcome not lost on the Iranians when the United States quickly toppled the Iraqi leader Saddam Hussein and routed the Taliban from power in Afghanistan. Just judging by statistics, the conventional United States military dwarfs Iran’s in every way. There are roughly 1.3 million active American military personnel, nearly triple that of Iran. Annual military spending by the United States exceeded $600 billion last year, versus about $16 billion in Iran. The Americans have nearly 6,000 tanks, versus fewer than 1,700 in Iran. The aerial and naval forces of the United States — more than 13,000 aircraft and nearly 300 battle vessels — vastly outnumber Iran’s. That does not mean Mr. Trump is ready to back his threats by invading Iran — such a possibility, on the contrary, is seen as nonexistent. Mr. Trump has said he wants to get the United States out of foreign military entanglements, and Americans have shown little appetite for another war. “I don’t see an actual war — it’s not in anyone’s interest,” said Barbara Slavin, director of the Future of Iran Initiative at the Atlantic Council, a Washington-based research group. “Trump doesn’t even want to keep boots on the ground in Syria.”

#### COVID guarantees de-escalation.

Bohl 20, Middle East and North Africa analyst at Stratfor. He holds a bachelor's degree in history and a master's degree in education from Arizona State University, where he studied Middle Eastern history and education. (Ryan, Updated: 5-20-2020, "US-Iran war unlikely amid coronavirus – but nuclear program always a risk", *Al Arabiya English*, https://english.alarabiya.net/views/news/middle-east/2020/04/26/US-Iran-war-unlikely-amid-coronavirus-but-nuclear-program-always-a-risk)

Tensions are rising between the United States and Iran, but war is still unlikely – especially as the coronavirus pandemic gives both countries increasingly dire domestic problems to manage. If the tensions do escalate into a regional conflict, it will likely be as a result of miscalculations or mistakes rather than deliberate strategy – and only then if the miscalculations are lethal enough to compel a cycle of retaliation and violence.

While American war threats and Iranian harassment tactics serve as useful distractions from the domestic problems caused by COVID-19, neither power has a core desire for major conflict. However, Iran’s nuclear program is always lurking. If the Iranians continue to advance the program, eventually they will trigger a major regional conflict, pandemic or not.

COVID-19 is siphoning the limited political and social energy in both countries for further serious escalation. That was already evident in the most recent cycle of Iran-US confrontation back in March. On March 12, US forces launched airstrikes on Iran’s Iraqi proxy, Kata’ib Hezbollah, for a rocket attack that killed two US service members and one UK soldier.

But rather than repeating the cycle of escalation that happened in late December and early January – when the US assassinated senior Iranian commander Gen. Qassem Soleimani, prompting Iran to launch a cruise missile attack on the al-Assad airbase – this time the US conducted proportional strikes on Kata’ib Hezbollah targets. Iran did not retaliate, and Kata’ib Hezbollah, taking its cue from its patron, avoided escalation.

This was because by mid-March, both Iran and the US were coming to grips with the massive impact of COVID-19 on their societies and economies, adding to pre-existing inclinations to avoid a major war. Now the two are entering a phase of increasingly compartmentalized competition and conflict.

Iraq is the clearest proxy theater that will continue to see cycles of violence as Iranian proxies harass US forces and US forces respond. But it is clear that both sides want to keep that confrontation confined to Iraq and limited to tit-for-tat exchanges.

In the Arabian Gulf, the site of the most recent rhetorical confrontation between Iran and the US (when President Donald Trump threatened to destroy Iranian ships that harassed US naval vessels), the situation remains similarly contained, with a less likely path to escalation than Iraq.

Iran faces a huge military disadvantage against the US Navy, and so Iranian provocation will be likely designed to increase tension rather than intentionally strike US ships, as Tehran knows that the US is capable of rapidly gutting much of the Iranian navy – as it did in 1988’s Operation Praying Mantis.

Moreover, it is in Iran’s interests to avoid being seen as the aggressor in the Gulf, which would likely undermine Tehran’s efforts to bring in international aid for its COVID-19 crisis, exposing the regime to domestic criticism that its hardline tactics are imposing yet more suffering on the Iranian people and eroding even more legitimacy from the Islamic Republic. These two factors mean that Tehran is not in a position to risk humanitarian corridors in exchange for near-suicidal attacks on the US Navy.

For that matter, the US is increasingly turning to a strategy of sanctions first, military retaliation second. That’s because Iran’s sanctions barely register in the US public, giving the president wide leeway to continue that strategy.

Meanwhile, Americans have consistently shown a willingness to support presidents who retaliate to provocations, meaning that it’s very likely that future harassment will be met with a US response. But that response will also be limited by politics: few Americans in 2020 want to see the country embroiled in another major Middle Eastern war as they come to terms with what the pandemic has done to their economy and society.

### 2AC---AT: NoKo---No Cyber

#### No NoKo cyber-attacks.

James Andrew Lewis, 17 (James Andrew Lewis is the Senior Vice President at the Center for Strategic and International Studies and Director of the Technology Policy Program, 9-7-2017, accessed on 6-4-2022, Center for Strategic and International Studies, “The Likelihood of North Korean Cyber Attacks”, <https://www.csis.org/analysis/likelihood-north-korean-cyber-attacks>, HBisevac) \*\*edited in brackets\*\*

Under what circumstances would it make sense for North Korea’s Kim regime to begin a war with the United States? The primary goal of any state is survival, and this is even more important for politically fragile regimes that provide immense benefit to the ruling family. An **upper limit** to North Korean activities is that, though it will use threats and coercive acts to pursue its larger policy goals, it will not do so at the **expense** of its own **survival**. There is some risk that Kim Jong-un could miscalculate when it comes to coercive acts. Shooting missiles over Guam would provoke a reaction, as would an inadvertent impact on Japanese territory of a missile intended to overfly it. But in general, behind the bluster, the **Kim regime** has been **calculating** and **careful**. This is the **lens** through which we should measure the risk of **No**rth **Ko**rea launching a **cyber attack** against the **U**nited **S**tates. North Korea is the **least capable** of our opponents when it comes to cyber attack. It uses cyber techniques for **coercive diplomacy**, for criminal activities to generate **hard currency**, and for disruptive actions in the South and against deployed U.S. forces. If war breaks out, the North might also consider cyber attacks against military or symbolic targets in the United States. However, short of armed conflict, disruptive actions here are **unlikely**. How disruptive a North Korean cyber attack would be depends on the victim’s weaknesses. North Korean successes depend on relatively basic techniques that exploit vulnerabilities in poorly defended systems. Though the North has used cyber attacks several times against South Korean banks and media outlets, and against Sony in the United States, none of those attacks caused physical destruction or casualties. To be fair, no cyber attack has ever caused casualties, and only three or four resulted in physical damage. North Korea, despite progress in developing its cyber-attack capabilities, **does** **not possess** the **advanced skills** needed to **cause** physical **damage**. What the North can do with cyber operations is disrupt data and online services. A 2011 cyber attack on a South Korean bank left customers unable to use ATMs or online services for several days. The action deleted customer accounts and tried to erase evidence of the attack from the bank’s computers. Similar attacks took place in 2013 against banks and media outlets in Seoul, with data erased and services disrupted. The 2014 attack on Sony Pictures also disrupted services and data and saw leaks of embarrassing e-mails. The most recent North Korean cyber incident used false credentials to steal $81 million from the Bangladesh Central Bank. While these count as successes, they may have also increased North Korea’s caution. If you think you are invisible and suddenly discover that you are not, it dampens your enthusiasm for crime. The ability of the United States to identify North Korea in the Sony incident probably led the North to revise upward the risk of cyber action against U.S. targets. We can run through one popular scenario to explore how North Korea might think about cyber attacks. Though it is **unlikely** that North Korea has the ability to cause blackouts in the United States, if it did have the capability and decided to use it, this would not reduce our ability to retaliate militarily. Blackouts **do not** produce **catastrophe** or **military advantage**. A cyber-induced blackout would, however, put the regime’s survival at risk—in diplomatic parlance, this is called poking a bear with a stick. In any event, the notion of **cyber catastrophe** is **wildly exaggerated**, reflecting a **popular culture** prone to **exaggerating risk** rather than **seriously assessing** an opponent’s **capability** and **intent**. North Korea uses cyber attacks to advance its **policy agenda**; **none** of its **actions** has been **capricious** or **haphazard**. Cyber attacks do not come out of the blue. They are not random acts (and they are not launched by groups with funny names) but are calculated to achieve either political or financial goals. A decision to launch a cyber attack would be made by Kim Jong-un, and he would consider this in the context of the larger efforts to manipulate decisionmakers and public opinion in the United States, Japan, and South Korea. An attack on critical infrastructure located in the domestic United States would be extremely provocative, and there are plenty of other provocative things the North can do that do not create existential risk for the Kim regime. Kim and his advisers probably know that China and Russia would look unfavorably on a cyber attack against the United States at this tense juncture, and while the North may be ready to ignore its patrons in some matters, starting an armed conflict with the United States is not one of them. It is commonplace to call **Kim** ~~crazy~~ [irrational], but his decisions are **rational** in the context of North Korea’s **strategic culture**. An attack on the United States that the North believes is likely to be detected, that will not produce significant harm, and that could generate a **damaging response** is **unattractive**. The goal is to **manipulate** the United States and its North Asian allies **without provoking war**, and cyber attacks on the U.S. **homeland**, catastrophic or otherwise, run **counter** to this.

### 2AC---AT: NoKo---NoKo Econ Collapse Good

#### NoKo economic instability is key to denuclearization.

Evans J.R. Revere, 21 (Evans J.R. Revere, Nonresident Senior Fellow, Foreign Policy, Center for East Asia Policy Studies, 2-26-2021, accessed on 7-20-2022, Brookings, “North Korea’s economic crisis: Last chance for denuclearization?”, <https://www.brookings.edu/research/north-koreas-economic-crisis-last-chance-for-denuclearization/>, HBisevac)

**No**rth **Ko**rea **is in trouble**. The COVID-19 pandemic, self-imposed isolation and lockdowns, crop failures, sanctions, and more have put the **economy** in a **parlous state**, a fact acknowledged by Kim Jong Un himself. The state planning mechanism seems broken, foreign exchange holdings are down, **state revenue** is **shrinking**, foreign **trade** numbers have **collapsed**, and **growth** is **declining**. The measures taken thus far by the regime to deal with the crisis seem unlikely to turn things around. Indeed, they may make matters worse, especially if Pyongyang follows through on plans to divert scarce resources to expand its nuclear weapons and missile programs.

Despite its difficulties, don’t count Pyongyang out. For decades, the North Korean regime has demonstrated remarkable determination, diplomatic dexterity, and uncanny survival skills. And the DPRK has the support of China, which is prepared to live with Pyongyang’s nuclear status and committed to keeping the regime on “life support.” North Korea is down, but hardly out.

In the midst of this economic crisis, Kim Jong Un is gambling that expanding his nuclear and missile arsenals will convince the United States to engage in “**arms control talks**” that would tacitly accept the DPRK as a nuclear power and give Pyongyang the **sanctions** **relief** it needs.

But North Korea’s economic crisis represents a **major vulnerability** for Pyongyang. It presents an opportunity to apply **overwhelming pressure** on the regime across a broad front and **convince** Kim Jong Un that his **pursuit** of nuclear weapons could **end his regime**. Previous efforts to do so were half-hearted and failed to change Kim’s calculus. The current crisis may be the last opportunity to try.

Today, prospects for North Korea’s denuclearization are **all but gone**. But that goal may still be achievable if the United States, its allies, and partners recognize that Kim Jong Un and his regime are standing on **shaky ground**, and that now is the time to convince Kim that the **trembling** he feels is a sign that the **regime’s days** could be **numbered**.

#### Otherwise, waiting causes Kim sells nukes to Iran and conducts EMP attacks on the grid.

Peter Pry, 19 (Peter Pry, chief of staff of the congressional Electromagnetic Pulse Commission, served on the House Armed Services Committee and the CIA, Executive Director of the Task Force on National and Homeland Security and Director of the U.S. Nuclear Strategy Forum, 3-26-2019, accessed on 7-23-2022, Washington Times, “Military options for denuclearizing North Korea”, <https://www.washingtontimes.com/news/2019/mar/26/military-options-for-denuclearizing-north-korea/>, HBisevac) \*\*edited for ableist language\*\*

Decades of failed talks, and the failed Hanoi nuclear summit proves again, North Korea will not **denuclearize peacefully**.

Dictator Kim Jong-un’s game is to **buy time** through pretend negotiations to build enough ICBMs so nuclear-armed North Korea, with a Mutual Assured Destruction (**MAD**) **relationship** with the United States, becomes **irreversible**.

Economic sanctions designed to pressure North Korea’s denuclearization peacefully **never worked**, and are **not working now**. According to a recent United Nations report obtained by the Associated Press, leaked in the UK Guardian (March 11, 2019):

“United Nations experts are investigating possible **violations** of UN sanctions on North Korea in about **20 countries**, from alleged **clandestine nuclear procurement** in **China** to **arms brokering** in **Syria** and **military cooperation** with **Iran**, **Libya** and **Sudan**. The expert panel’s 66-page report to the security council also detailed the appearance in North Korea of a Rolls-Royce Phantom, Mercedes-Benz limousines and Lexus LX 570 all-wheel-drives in violation of a ban on luxury goods. And it noted a trend in North Korea’s evasion of financial sanctions by using cyberattacks to ‘illegally force the transfer of funds from financial institutions and cryptocurrency exchanges.’”

Moreover, according to the UN report: “North Korea’s nuclear and missile programs **remained intact** and its leaders were dispersing **missile assembly** and **testing facilities** to prevent ‘**decapitation**’ **strikes**.”

The White House should be alarmed North Korea is now reneging on **dismantlement** of their **Sohae satellite** launch facility, **rebuilding** Sohae to orbit satellites, possibly **nuclear-armed** for **EMP attack**.

The Congressional EMP Commission warns two North Korean satellites presently orbit over the United States that, if nuclear-armed, could **blackout** North America — posing potentially the single greatest nuclear threat from North Korea.

The EMP Commission recommends shooting-down these satellites over uninhabited regions. The United States has intercepted satellites before, in the 1980s, and is significantly more capable of anti-satellite operations today.

Destruction of North Korea’s two satellites would be the least escalatory military option, as it would not entail striking North Korea’s homeland, yet would eliminate the greatest potential nuclear threat to the United States.

Downing North Korea’s satellites alone, one of the smallest and most easily executed military operations, might be enough to bring about a diplomatic solution. For the first time the United States will be striking against the North Korean nuclear threat — proving to Pyongyang, China, and Russia the United States is determined to denuclearize North Korea, forcefully if necessary.

Another military option, more ambitious and riskier, would destroy North Korea’s: 2 satellites, 12-20 ICBMs, 30-50 IRBMs, 60 mostly non-nuclear bombers, 1 Sinpo missile submarine, 12 retired Golf missile submarines (purchased from Russia), the Sohae satellite launcher and Yongbyon Nuclear Complex, including a nearby clandestine uranium enrichment facility.

**Tunnels** can become **graveyards** for North Korean missiles by bombing entrances. North Korean **air defenses** are **antiquated**, ineffective, and can be suppressed non-lethally with **electronic countermeasures**. **Aegis cruisers** and other anti-missile defenses can be surged to **intercept** any **launched missiles**.

All of this, fewer than 150 targets, could probably be destroyed by three aircraft carriers and Global Strike forces using conventional weapons in a few hours. Any surviving or future new ICBMs or IRBMs should be destroyed on sight. This campaign would **eliminate** the North Korean nuclear missile threat to North America and U.S. territories and severely cripple their nuclear program. Another military option, even more ambitious and even riskier, would do all the above and destroy North Korea’s almost entirely non-nuclear 300-450 MRBMs and 600-800 SRBMs. This would eliminate Pyongyang’s nuclear threat to Japan and South Korea, but would probably require days to execute and entail much higher escalatory risks.

Striking **quickly**, surgically, against the smallest number of targets, is **least likely** to be **misconstrued** as attempting to destroy the North Korean regime in an all-out war — and therefore least likely to result in North Korean escalation using nuclear or other weapons of mass destruction.

~~Psychopaths~~ [dictators] like Kim Jong-un have been **attacked**, and **defeated**, **without** their **using** weapons of mass destruction (**WMDs**):

• Adolf **Hitler** during World War II refrained from using Tabun and Sarin nerve gas, fearing Allied retaliation.

• Iraq’s Saddam **Hussein** did not retaliate for Israel’s destruction of his Osirik nuclear reactor in 1981, or launch chemical and biological missiles during wars with the United States in 1991 and 2003.

• Syria’s Bashar **Assad** did not retaliate for Israel’s destruction of his clandestine Al Kibir nuclear reactor in 2007, or for U.S. destruction of his Barzah chemical-biological weapons complex in 2018.

Denuclearizing North Korea forcibly is very risky. The United States should be prepared to respond to North Korean use of WMDs — including with nuclear strikes to destroy the regime, if necessary.

But “**living**” **with** **nuclear**-**armed** North Korea, surrendering to Mutual Assured Destruction with Kim Jong-un, is **reckless** and **will** **surely kill millions**.

If North Korea **defies denuclearization** successfully, **nuclear-armed Iran is next**. Tehran on March 18 announced Russia will build them two more nuclear reactors.

#### Iran prolif causes extinction.

Futter ’21 [Andrew; School of History, Politics and International Relations @ University of Leicester; *The Politics of Nuclear Weapons*; Palgrave Macmillan; AS]

We can think of five possible negative implications of the Iranian quest for a bomb. The first is that a nuclear-armed Iran could cause other nations in the region to develop their own nuclear weapons capability (primarily for security purposes, but also for regional prestige). The most likely candidates for this would be Saudi Arabia and the Gulf Emirates but might also include Turkey and Egypt. The second is the possibility that if Iran is able to acquire nuclear weapons, it will fundamentally undermine the international nuclear non-proliferation regime and provide a green light to others thinking of developing nuclear weapons. It may also present a signal, perhaps even existential crisis, for the Non-Proliferation Treaty (see Chap. 8). Third, an emboldened Iran could lead to regional instability. This is because there are fears that a nuclear-armed Iran would be much bolder and more active in the Middle East region, acting to destabilise and undermine its adversaries. A nuclear Iran would also likely make any outside efforts to address instability more difficult. Fourth, is the impact on the threat felt by Israel. Iran has previously threatened Israel; in 2005 President Mahmoud Ahmadinejad was quoted as saying that Israel should be “wiped of the map”,71 and a nucleararmed Iran would therefore not be tolerable in Tel Aviv. Heightened tension between the two seems likely, and a direct military confrontation cannot be discounted. As Eric Edelman et al. explain: “The greatest concern in the near term would be that an unstable Iranian-Israeli nuclear contest would emerge, with a significant risk that either side would launch a first strike on the other despite the enormous risks and costs involved.”72 Fifth, is the possible link with terrorism and the concern that a nuclear-armed Iran could potentially supply terrorists with nuclear material or even a nuclear bomb, perhaps through its proxy Hezbollah. This is the subject of much debate, and on balance it is probably unlikely that Iran would give Hezbollah a bomb (for more on this see Chap. 9).

#### EMPs causes extinction

Alice Friedemann, 16 — Alice Friedemann; transportation expert, founder of EnergySkeptic.com and author of “When Trucks Stop Running, Energy and the Future of Transportation,” worked at American Presidential Lines for 22 years, where she developed computer systems to coordinate the transit of cargo between ships, rail, trucks, and consumers, citing Dr. Peter Vincent Pry. Pry is executive director of the Task Force on National and Homeland Security, a Congressional advisory board dedicated to achieving protection of the United States from electromagnetic pulse and other threats. Dr. Pry is also the director of the United States Nuclear Strategy Forum, an advisory body to Congress on policies to counter weapons of mass destruction. Dr. Pry has served on the staffs of the Congressional Commission on the Strategic Posture of the United States, the Commission to Assess the Threat to the U.S. from an EMP Attack, the House Armed Services Committee, as an intelligence officer with the CIA, and as a verification analyst at the U.S. Arms Control and Disarmament Agency. (1-24-16, “Electromagnetic pulse threat to infrastructure (U.S. House hearings)” http://energyskeptic.com/2016/the-scariest-u-s-house-session-ever-electromagnetic-pulse-and-the-fall-of-civilization/)

Modern civilization cannot exist for a protracted period without electricity. Within days of a blackout across the U.S., a blackout that could encompass the entire planet, emergency generators would run out of fuel, telecommunications would cease as would transportation due to gridlock, and eventually no fuel. Cities would have no running water and soon, within a few days, exhaust their food supplies. Police, Fire, Emergency Services and hospitals cannot long operate in a blackout. Government and Industry also need electricity in order to operate. The EMP Commission warns that a natural or nuclear EMP event, given current unpreparedness, would likely result in societal collapse. Terrorists, criminals, and even lone individuals can build a non-nuclear EMP weapon without great trouble or expense, working from Unclassified designs publicly available on the internet, and using parts available at any electronics store. In 2000, the Terrorism Panel of the House Armed Services Committee sponsored an experiment, recruiting a small team of amateur electronics enthusiasts to attempt constructing a radiofrequency weapon, relying only on unclassified design information and parts purchased from Radio Shack. The team, in 1 year, built two radiofrequency weapons of radically different designs. One was designed to fit inside the shipping crate for a Xerox machine, so it could be delivered to the Pentagon mail room where (in those more unguarded days before 9/11) it could slowly fry the Pentagon’s computers. The other radiofrequency weapon was designed to fit inside a small Volkswagon bus, so it could be driven down Wall Street and disrupt computers— and perhaps the National economy. Both designs were demonstrated and tested successfully during a special Congressional hearing for this purpose at the U.S. Army’s Aberdeen Proving Ground. Radiofrequency weapons are not merely a hypothetical threat. Terrorists, criminals, and disgruntled individuals have used home-made radiofrequency weapons. The U.S. military and foreign militaries have a wide variety of such weaponry. Moreover, non-nuclear EMP devices that could be used as radiofrequency weapons are publicly marketed for sale to anyone, usually advertised as ‘‘EMP simulators.’’ For example, one such simulator is advertised for public sale as an ‘‘EMP Suitcase.’’ This EMP simulator is designed to look like a suitcase, can be carried and operated by one person, and is purpose-built with a high energy radiofrequency output to destroy electronics. However, it has only a short radius of effect. Nonetheless, a terrorist or deranged individual who knows what he is doing, who has studied the electric grid for a major metropolitan area, could—armed with the ‘‘EMP Suitcase’’— black out a major city. A CLEAR AND PRESENT DANGER. An EMP weapon can be used by state actors who wish to level the battlefield by neutralizing the great technological advantage enjoyed by U.S. military forces. EMP is also the ideal means, the only means, whereby rogue states or terrorists could use a single nuclear weapon to destroy the United States and prevail in the War on Terrorism or some other conflict with a single blow. The EMP Commission also warned that states or terrorists could exploit U.S. vulnerability to EMP attack for coercion or blackmail: ‘‘Therefore, terrorists or state actors that possess relatively unsophisticated missiles armed with nuclear weapons may well calculate that, instead of destroying a city or military base, they may obtain the greatest political-military utility from one or a few such weapons by using them—or threatening their use—in an EMP attack.’’ The EMP Commission found that states such as Russia, China, North Korea, and Iran have incorporated EMP attack into their military doctrines, and openly describe making EMP attacks against the United States. Indeed, the EMP Commission was established by Congress partly in response to a Russian nuclear EMP threat made to an official Congressional Delegation on May 2, 1999, in the midst of the Balkans crisis. Vladimir Lukin, head of the Russian delegation and a former Ambassador to the United States, warned: ‘‘Hypothetically, if Russia really wanted to hurt the United States in retaliation for NATO’s bombing of Yugoslavia, Russia could fire an SLBM and detonate a single nuclear warhead at high altitude over the United States. The resulting EMP would massively disrupt U.S. communications and computer systems, shutting down everything.’’ China’s military doctrine also openly describes EMP attack as the ultimate asymmetric weapon, as it strikes at the very technology that is the basis of U.S. power. Where EMP is concerned, ‘‘The United States is more vulnerable to attacks than any other country in the world’’: ‘‘Some people might think that things similar to the ‘Pearl Harbor Incident’ are unlikely to take place during the information age. Yet it could be regarded as the ‘Pearl Harbor Incident’ of the 21st Century if a surprise attack is conducted against the enemy’s crucial information systems of command, control, and communications by such means as… electromagnetic pulse weapons… Even a superpower like the United States, which possesses nuclear missiles and powerful armed forces, cannot guarantee its immunity…In their own words, a highly computerized open society like the United States is extremely vulnerable to electronic attacks from all sides. This is because the U.S. economy, from banks to telephone systems and from power plants to iron and steel works, relies entirely on computer networks… When a country grows increasingly powerful economically and technologically…it will become increasingly dependent on modern information systems… The United States is more vulnerable to attacks than any other country in the world.’’ Iran—the world’s leading sponsor of international terrorism—in military writings openly describes EMP as a terrorist weapon, and as the ultimate weapon for prevailing over the West: ‘‘If the world’s industrial countries fail to devise effective ways to defend themselves against dangerous electronic assaults, then they will disintegrate within a few years… American soldiers would not be able to find food to eat nor would they be able to fire a single shot.’’ The threats are not merely words. The EMP Commission assesses that Russia has, as it openly declares in military writings, probably developed what Russia describes as a ‘‘Super-EMP’’ nuclear weapon—specifically designed to generate extraordinarily high EMP fields in order to paralyze even the best protected U.S. strategic and military forces. China probably also has Super-EMP weapons. North Korea too may possess or be developing a Super-EMP nuclear weapon, as alleged by credible Russian sources to the EMP Commission, and by open-source reporting from South Korean military intelligence. But any nuclear weapon, even a low-yield first generation device, could suffice to make a catastrophic EMP attack on the United States. Iran, although it is assessed as not yet having the bomb, is actively testing missile delivery systems and has practiced launches of its best missile, the Shahab–III, fuzing for high- altitude detonations, in exercises that look suspiciously like training for making EMP attacks. As noted earlier, Iran has also practiced launching from a ship a Scud, the world’s most common missile—possessed by over 60 nations, terrorist groups, and private collectors. A Scud might be the ideal choice for a ship-launched EMP attack against the United States intended to be executed anonymously, to escape any last-gasp U.S. retaliation. Unlike a nuclear weapon detonated in a city, a high-altitude EMP attack leaves no bomb debris for forensic analysis, no perpetrator ‘‘fingerprints.’’ Under present levels of preparedness, communications would be severely limited, restricted mainly to those few military communications networks that are hardened against EMP. Today’s microelectronics are the foundation of our modern civilization, but are over 1 million times more vulnerable to EMP than the far more primitive and robust electronics of the 1960s, that proved vulnerable during nuclear EMP tests of that era. Tests conducted by the EMP Commission confirmed empirically the theory that, as modern microelectronics become ever smaller and more efficient, and operate ever faster on lower voltages, they also become ever more vulnerable, and can be destroyed or disrupted by much lower EMP field strengths. Microelectronics and electronic systems are everywhere, and run virtually everything in the modern world. All of the civilian critical infrastructures that sustain the economy of the United States, and the lives of 310 million Americans, depend, directly or indirectly, upon electricity and electronic systems. Of special concern is the vulnerability to EMP of the Extra-High-Voltage (EHV) transformers, that are indispensable to the operation of the electric grid. EHV transformers drive electric current over long distances, from the point of generation to consumers (from the Niagara Falls hydroelectric facility to New York City, for example). The electric grid cannot operate without EHV transformers—which could be destroyed by an EMP event. The United States no longer manufactures EHV transformers. They must be manufactured and imported from overseas, from Germany or South Korea, the only two nations in the world that manufacture such transformers for export. Each EHV transformer must be custom-made for its unique role in the grid. A single EHV transformer typically requires 18 months to manufacture. The loss of large numbers of EHV transformers to an EMP event would plunge the United States into a protracted blackout lasting years, with perhaps no hope of eventual recovery, as the society and population probably could not survive for even 1 year without electricity. Another key vulnerability to EMP are Supervisory Control And Data Acquisition systems (SCADAs). SCADAs essentially are small computers, numbering in the millions and ubiquitous everywhere in the critical infrastructures, that perform jobs previously performed by hundreds of thousands of human technicians during the 1960s and before, in the era prior to the microelectronics revolution. SCADAs do things like regulating the flow of electricity into a transformer, controlling the flow of gas through a pipeline, or running traffic control lights. SCADAs enable a few dozen people to run the critical infrastructures for an entire city, whereas previously hundreds or even thousands of technicians were necessary. Unfortunately, SCADAs are especially vulnerable to EMP. EHV transformers and SCADAs are the most important vulnerabilities to EMP, but are by no means the only vulnerabilities. Each of the critical infrastructures has their own unique vulnerabilities to EMP: The National electric grid, with its transformers and generators and electronic controls and thousands of miles of power lines, is a vast electronic machine—more vulnerable to EMP than any other critical infrastructure. Yet the electric grid is the most important of all critical infrastructures, and is in fact the keystone supporting modern civilization, as it powers all the other critical infrastructures. As of now it is our technological Achilles Heel. The EMP Commission found that, if the electric grid collapses, so too will collapse all the other critical infrastructures. But, if the electric grid can be protected and recovered, so too all the other critical infrastructures can also be restored. Transportation is a critical infrastructure because modern civilization cannot exist without the goods and services moved by road, rail, ship, and air. Cars, trucks, locomotives, ships, and aircraft all have electronic components, motors, and controls that are potentially vulnerable to EMP. Gas stations, fuel pipelines, and refineries that make petroleum products depend upon electronic components and cannot operate without electricity. Given our current state of unpreparedness, in the aftermath of a natural or nuclear EMP event, transportation systems would be ~~paralyzed~~. Traffic control systems that avert traffic jams and collisions for road, rail, and air depend upon electronic systems, that the EMP Commission discovered are especially vulnerable to EMP. Communications is a critical infrastructure because modern economies and the cohesion and operation of modern societies depend to a degree unprecedented in history on the rapid movement of information—accomplished today mostly by electronic means. Telephones, cell phones, personal computers, television, and radio are all directly vulnerable to EMP, and cannot operate without electricity. Satellites that operate at Low-Earth-Orbit (LEO) for communications, weather, scientific, and military purposes are vulnerable to EMP and to collateral effects from an EMP attack. Within weeks of an EMP event, the LEO satellites, which comprise most satellites, would probably be inoperable. Banking and finance are the critical infrastructure that sustain modern economies. Whether it is the stock market, the financial records of a multinational corporation, or the ATM card of an individual—financial transactions and record keeping all depend now at the macro- and micro-level upon computers and electronic automated systems. Many of these are directly vulnerable to EMP, and none can operate without electricity. The EMP Commission found that an EMP event could transform the modern electronic economy into a feudal economy based on barter. Food has always been vital to every person and every civilization. The critical infrastructure for producing, delivering, and storing food depends upon a complex web of technology, including machines for planting and harvesting and packaging, refrigerated vehicles for long-haul transportation, and temperature-controlled warehouses. Modern technology enables over 98 percent of the U.S. National population to be fed by less than 2 percent of the population. Huge regional warehouses that resupply supermarkets constitute the National food reserves, enough food to feed the Nation for 30–60 days at normal consumption rates, the warehoused food preserved by refrigeration and temperature control systems that typically have enough emergency electrical power (diesel or gas generators) to last only about an average of 3 days. Experience with storm-induced blackouts proves that when these big regional food warehouses lose electrical power, most of the food supply will rapidly spoil. Farmers, less than 2 percent of the population as noted above, cannot feed 310 million Americans if deprived of the means that currently makes possible this technological miracle. Water too has always been a basic necessity to every person and civilization, even more crucial than food. The critical infrastructure for purifying and delivering potable water, and for disposing of and treating waste water, is a vast networked machine powered by electricity that uses electrical pumps, screens, filters, paddles, and sprayers to purify and deliver drinkable water, and to remove and treat waste water. Much of the machinery in the water infrastructure is directly vulnerable to EMP. The system cannot operate without vast amounts of electricity supplied by the power grid. A natural or nuclear EMP event would immediately deprive most of the U.S. National population of running water. Many natural sources of water—lakes, streams, and rivers—would be dangerously polluted by toxic wastes from sewage, industry, and hospitals that would backflow from or bypass wastewater treatment plants, that could no longer intake and treat pollutants without electric power. Many natural water sources that would normally be safe to drink, after an EMP event, would be polluted with human wastes including feces, industrial wastes including arsenic and heavy metals, and hospital wastes including pathogens. Emergency services such as police, fire, and hospitals are the critical infrastructure that upholds the most basic functions of government and society—preserving law and order, protecting property and life. Experience from protracted storm-induced blackouts has shown, for example in the aftermath of Hurricanes Andrew and Katrina, that when the lights go out and communications systems fail and there is no gas for squad cars, fire trucks, and ambulances, the worst elements of society and the worst human instincts rapidly takeover. The EMP Commission found that, given our current state of unpreparedness, a natural or nuclear EMP event could create anarchic conditions that would profoundly challenge the existence of social order.

### ---AT: Denuclearization Impossible

#### It’s possible!

Sang Ki Kim & Eun-ju Choi, 21 (Sang Ki Kim is a research fellow at the Korea Institute for National Unification and he served as a policy advisor to the Unification Minister and received Ph.D. in political science from the University of Iowa, and M.A. and B.E. from Chung-Ang University, Eun-ju Choi is a research fellow at the Sejong Institute and she received her Ph.D. in economics, M.A. and B.A. from Korea University, 2-1-2021, accessed on 7-21-2022, Stimson Center, “The Fallacy of North Korean Collapse”, <https://www.38north.org/2021/02/the-fallacy-of-north-korean-collapse/>, HBisevac)

Denuclearization Is Still an Option

Fourth, Cha contends that at this Party Congress, Kim Jong Un made it clear that he does not intend to negotiate on denuclearization with the Biden administration. However, such an argument is based on a priori assumptions, not observation or analysis of what actually transpired at the Congress. At the eight-day-long Congress, Kim neither mentioned denuclearization nor stated that he has no intention to denuclearize.

Before this Congress, the DPRK government has repeatedly announced that it will persist in developing strategic weapons until the United States withdraws its hostile policy towards North Korea. The DPRK’s position on denuclearization has always been conditional. Therefore, the plan for developing strategic weapons announced at this Congress cannot be interpreted as a final statement that North Korea does not have a willingness to denuclearize.

Recent moves by North Korea show that although it will not approach the United States with flexibility first, it has a willingness to negotiate on denuclearization with the Biden administration. During this transition period of American leadership, North Korea has not made any provocations against the United States in rhetoric or action from the election to the present. This is contrary to the past when North Korea made provocations to test the United States whenever a new US administration was about to start its term, including the time before and after President Obama’s inauguration. Additionally, the military parade commemorating the Party Congress, held shortly before President Biden’s inauguration, did not display any ICBM (intercontinental ballistic missile) that always appeared to provoke the United States in previous military parades.

What do these signs point to? It is fair to interpret that if the United States does not provoke North Korea first, it will likewise not provoke the United States and that the government in Pyongyang is leaving room open for nuclear negotiations with the Biden administration. At the recent Party Congress, Kim Jong Un reaffirmed that the future relationship between North Korea and the United States would depend on changes in the United States’ position. Contrary to Cha’s argument that North Korea does not intend to denuclearize, the North is sending a message that it will wait for the United States to take a new approach.

### 2AC---AT: NoKo---NoKo Collapse

directly answers the Cha ’21 ev in the file but applies to the other cards

#### The chance of NoKo collapse is zero---assumes all their warrants.

Sang Ki Kim & Eun-ju Choi, 21 (Sang Ki Kim is a research fellow at the Korea Institute for National Unification and he served as a policy advisor to the Unification Minister and received Ph.D. in political science from the University of Iowa, and M.A. and B.E. from Chung-Ang University, Eun-ju Choi is a research fellow at the Sejong Institute and she received her Ph.D. in economics, M.A. and B.A. from Korea University, 2-1-2021, accessed on 7-21-2022, Stimson Center, “The Fallacy of North Korean Collapse”, <https://www.38north.org/2021/02/the-fallacy-of-north-korean-collapse/>, HBisevac)

In an op-ed in the Washington Post on January 15, 2021, Dr. Victor Cha, a senior adviser at the Center for Strategic and International Studies, warned that the United States may confront a military crisis arising from North Korea’s regime instability or its collapse. He argued that the North Korean economy could not survive “for another year or longer” due to existing sanctions and border blockades for quarantine measures, and thus the North Korean government may be tempted to take military actions against external enemies, or it may lose control of its nuclear weapons.

Cha is one of the most influential North Korea analysts in Washington; unfortunately, in this case, his argument is closer to fiction than reality. The inaccuracies and distorted description of North Korea’s situation themselves create risks. Such a view not only makes it more difficult to solve the North Korean nuclear problem, but also might even lead to policy miscalculations, such as a military option. In this article, we rebut Cha’s claim in hopes of providing a more accurate basis for considering diplomatic and policy options.

Flawed Economic Analysis

First, there is almost **no possibility** that the North Korean **economy** will **collapse**. Cha argues that the recent North Korean economy is in a situation “comparable to the Great Famine in the 1990s.” However, the reality is entirely different from his assertion. North Korea experienced a terrible crisis in the years after the end of the Cold War, during which about two million people starved to death despite foreign aid. There were no strong sanctions and a border blockade at that time, but there was mass starvation. On the contrary, recently, starvation is **not pervasive** in North Korea even with tough economic sanctions and border blockades as far as we know.

Why does this difference exist? The reason is that North Korea has already developed **internal conditions** for **survival** with which it can manage to **muddle** **through strong sanctions**. Since the early 2010s, the government in Pyongyang has pursued an economic policy of reform and openness to **strengthen** its **survival capacity** and **resilience**. In 2018, its national strategy shifted from a military-first approach to an **economy-first one**. New economic changes in North Korea encompass a wide range of areas such as facilitating **import substitution** and **domestic production**, adopting **competitive systems**, **expanding markets**, reforming financial institutions, establishing **commercial banks**, and **promoting** **s**cience **and** **t**echnology. However, the opening-up policy has been postponed because of strong economic sanctions caused by North Korea’s nuclear program.

In particular, the adoption of both the “socialist corporate responsible management system” and “field responsibility system” has **increased production** and **facilitated distribution** in light industry and agriculture. The former grants firms substantive management rights to run business autonomously, and the latter permits individual farmers to be rewarded for their crop yields. As a result of an **import substitution** policy, the proportion of domestically manufactured products has **rapidly increased** in markets.

Also, **exchange rates** and **market prices** for items such as rice and gasoline have become relatively **stable**. North Korea has secured internal economic conditions that enable people to have **at least three** modest **meals a day**. Comparing the current North Korean economy to the **Arduous March** in the mid-to-late-1990s is a **deeply flawed approach** that considers **only** the **magnitude** of challenges facing North Korea, ignoring its **enhanced ability** to ***cope*** with them.

Of course, the decline in trade and investment due to sanctions and border blockades poses a major obstacle to North Korea’s economic development. However, North Korea has already secured an internal economic foundation, thanks to which citizens do not starve to death amid intensified sanctions. At the Eighth Congress of the Korean Workers’ Party last month, General Secretary Kim Jong Un admitted that the five-year economic development strategy had fallen short of meeting its goals in almost every category, but this should not be construed as a complete failure of North Korean economy. Besides, the economic recession caused by COVID-19 is a global phenomenon, not just for North Korea.

Under the sanctions regime, it will be difficult for North Korea to achieve economic prosperity through its self-reliance strategy, but it will have no problem in maintaining the status quo or achieving a low level of **gradual economic development**.[1]

Conquering COVID-19

Second, Cha argues that North Korea will not be able to obtain a vaccine for COVID-19 in the near future; thus, it will have no choice but to continuously block its borders and, as a result, the economy will not be able to survive for a year or longer. However, his claim is **groundless speculation**. We find it hard to agree with the argument that **China** will **not provide** its **close ally** with vaccines, especially since it has **already supplied them** to **Southeast Asian** and **African countries**. According to our research, the North Korean government has already secured **hundreds of thousands** of vaccine doses from China. Given that the North Korean government desperately wants the revitalization of foreign trade that is not subject to sanctions, it is **highly likely** to vaccinate **trade workers first**.

Depending on whether the COVID-19 situation improves, trade between North Korea and China is expected to resume as early as this spring or in the fall at the latest. Therefore, the North Korean economy is predicted to gradually turn to a **recovery path** after hitting a low point in 2020 and the first half of 2021, when it faced a triple whammy of sanctions, natural disasters and the coronavirus pandemic.

At the recent Party Congress, 7,000 people attended meetings without wearing masks for the main events.[2] This suggests that North Korea is in control of COVID-19, or there is at least no massive infection. Although a combination of COVID-19 and sanctions negatively impacts the North Korean economy, **it is improbable to lead to economic collapse**.

The Market Rules

Third, although Dr. Cha contends that via this Party Congress, North Korea hinted at pursuing anti-market policies to overcome economic difficulties, the government is unlikely to do so. If anything, Cha’s argument seems to be based on a **lack of understanding** of the changes in economic policies in the **Kim** Jong Un **era**.

In the past, North Korean markets existed outside the national economy and were spontaneously expanded by people seeking their own survival. But in the Kim Jong Un era, markets have become part of the **structure** of the **national economy**. In other words, the markets belong to the economic arena managed by the government. In fact, Kim’s economic policy **enables factories**, **enterprises** and **citizens** to **utilize markets** for facilitating the **supply** and **distribution** of products.

As economic reforms have expanded and been institutionalized since Kim’s ascension to power, the government has not pursued a policy of suppressing market activity. Therefore, it is **highly unlikely** that the government would transform its economic policy in the direction of **cracking down** **on** or trying to **eliminate** markets, unless serious abnormal symptoms spring up. The failed currency reform in 2009 makes the government in Pyongyang likely to refrain from undertaking an anti-market policy.

### 2AC---AT: NoKo---Prolif Defense

#### No spread AND no impact

Jonas Schneider 20. Senior researcher at the Center for Security Studies, held post-​doctoral fellowships at the German Institute for International and Security Affairs (SWP) in Berlin and at the CSS and worked as a research associate at the Institute for Security Policy at the University of Kiel, holds a PhD in Political Science from the University of Kiel. 2020. “Chapter 26 Nuclear Proliferation and International Security.” Understanding Global Politics: Actors and Themes in International Affairs, edited by Klaus Larres and Ruth Wittlinger, Routledge, pp. 409–425.

Other analysts have sounded a much less alarmist tone, however. Some scholars even suggested that an Iranian bomb held great potential for stabilising an unbalanced and volatile Middle East (Waltz, 2012). Closer to the mainstream of Western strategic discourse, various experts have argued that despite the risks of proliferation, nuclear weapons, and the deterrent they provide should get (more) credit for contributing, in combination with other factors, to what has been labelled ‘the Long Peace’ among the great powers since 1945 (Gaddis, 1999, p. 268–271; Gavin, 2012a, p. 164; Acton 2010, pp. 16–17). Still others have contended that because nuclear proliferation is such a rare phenomenon, and since robust nonproliferation measures tend to be disruptive, the net destabilising effect of new nuclear countries is quite small and, therefore, manageable (Mueller 2010, pp. 95–99; Hymans 2013, pp. 293–296).

The question of whether nuclear proliferation has stabilising or destabilising effects is not just fascinating for scholars of the nuclear age, but also highly consequential for practical policy issues. For in order to debate the merits of particular policy choices – such as preventive military strikes against nuclear facilities, grand bargains with potential proliferators or complete nuclear disarmament – we need to understand first how the spread of nuclear weapons impacts regional and global security.

The chapter proceeds in three steps. The first section provides the foundation for the other parts by summarising what we know about empirical patterns of proliferation and the utility of nuclear weapons for statecraft. The second section then engages the literature on the consequences of proliferation, focusing in particular on how proliferation has influenced international stability. The final section explores whether some states have been more affected than others, and what measures these states have taken to prevent proliferation, or at least mitigate its negative consequences.

Patterns of nuclear proliferation and the utility of nuclear weapons

Nuclear proliferation is commonly defined as the spread of nuclear weapons to states that did not previously have them. Within a broader conceptual framework that is rarely used by scholars, yet popular in the arms control community, this diffusion of nuclear weapons to additional states is labelled horizontal proliferation. It is conceptually accompanied by the notion of vertical proliferation, which refers to qualitative improvements and increases in the number of nuclear weapons in the stockpiles of existing nuclear weapon states. In accordance with the typical usage of the term in the scholarly debate, this chapter focuses only on how the horizontal proliferation of nuclear weapons affects international stability.

One important empirical pattern that has shaped how nuclear proliferation is understood concerns the way in which nuclear weapons have spread. The word ‘spread’ appears to suggest that the established nuclear powers have provided other interested nations with (at least a few) operational nuclear warheads. Yet such transfers have never been undertaken. Certainly, states that sought nuclear weapons have often received significant assistance from other nations (Schofield, 2014; Fuhrmann, 2012), sometimes in the form of highly sensitive technologies (Kroenig, 2010). Nonetheless, since all these transfers remained well below the weapons threshold, nations seeking nuclear weapons always had to build them indigenously. Hence, in reality, the spread of nuclear weapons has meant that merely the ambition to possess a nuclear arsenal has spread to additional states, each of which then had to pursue that goal primarily through indigenous efforts.

Importantly, since a state’s national efforts to turn its desire for nuclear weapons into reality naturally span several (and sometimes many) years, nuclear proliferation must be conceived of as a process, as opposed to just a single step (Meyer, 1986). This point is reinforced by the fact that 29 out of 39 states that have embarked upon that path (Müller and Schmidt, 2010, p. 157; Mikoyan, 2012; Santoro, 2017) have not acquired a nuclear arsenal. Hence, a lot of nuclear proliferation activity has been undertaken by nations that did not ultimately become nuclear weapon states. Three patterns explain this situation.

First, owing not just to the technological, but also the institutional and managerial challenges of the task, some nations simply failed in their efforts to build the bomb (Hymans, 2012; Braut-Hegghammer, 2016). Second, a few countries have chosen a nuclear ‘hedging’ strategy, intentionally confining their efforts to developing the technological capability to build an arsenal quickly while refraining from exercising that option (Narang, 2016–17, p. 134). Third, several states have undertaken a ‘nuclear reversal’, abandoning their nuclear weapons activities before developing nuclear explosive devices (Müller and Schmidt, 2010).

### 1AR---AT: NoKo---Prolif Defense

#### Preemption in response to anticipated prolif is rare and doesn’t escalate.

Christopher J. Fettweis 19. Associate professor of political science at Tulane University in New Orleans. 2019. “Pessimism and Nostalgia in the Second Nuclear Age.” Strategic Studies Quarterly, vol. 13, no. 1, pp. 12–41. JSTOR.

Preventive War

How much credit can prevention take for these negative proliferation trends? The only unambiguously preventive war of the second nuclear age—the 2003 invasion of Iraq—had nothing to do with nuclear weapons, even if it was occasionally (and disingenuously) sold that way. “We know he [Saddam Hussein] has been absolutely devoted to trying to acquire nuclear weapons,” Vice President Dick Cheney said on Meet the Press four days before the tanks rolled. “And we believe he has, in fact, reconstituted nuclear weapons.”49 It is unclear who the vice president meant by “we,” because no one in the US government or security community thought that Iraq had “reconstituted” nuclear weapons in March 2003.50 Erroneous beliefs regarding other weapons of mass destruction were among the reasons for the war, but it was not the kind of preventive strike on a nuclear program foreseen by SNA theorists.

Iran was not the only rogue state to abandon its nuclear program without a fight. At times de-nuclearization occurred by choice, as with South Africa and Libya, while at other times nonproliferation was thrust upon states, as was the case with the inchoate Syrian program. Colonel Mu‘ammar Gadhafi’s motivation for his decision to shut down his WMD programs has been the subject of ferocious and heavily partisan debate. At issue is the extent to which the war in Iraq affected his calculations: Was Gadhafi concerned about being the next target of US counterproliferation, or was his decision a reflection of a broader effort to remove his government from the list of international pariahs? Supporters of the Bush administration posit a direct connection between the war and Gadhafi’s sudden change of heart. Negotiations with him had begun some years earlier under the Clinton administration, however, leading a number of observers to conclude that Libya would have abandoned its program regardless of what happened in Iraq.51 More recent work on the issue suggests that fear of being next on the US target list did affect Gadhafi’s thinking and can at the very least account for the timing of his offer to disarm.52 “Disarm” is probably not the right word, however, since Libya had nowhere near the requisite state capacity to build a bomb, and Gadhafi probably knew it. International Atomic Energy Agency inspectors found centrifuges and other crucial materials in their original packing crates, where they had apparently been for years.53 Libya may have announced it would not be joining the nuclear club following the invasion of Iraq, but that was likely a conclusion it had reached some time before. For these purposes, it is sufficient to note that Libya abandoned its program for the foreseeable future. Diplomacy worked, the nonproliferation regime held, and the rogue-state list shrank by one member.54

While it cannot yet be said that the 2007 Israeli airstrikes on a reactor construction site permanently removed the possibility of a Syrian nuclear weapon, the program has not restarted since the attack. Threeand-a-half years passed between those strikes and the current civil war, during which Assad presumably had plenty of time to re-establish his reactors, should he have desired to do so. Instead it appears that his government abandoned its efforts, which had not progressed very far anyway.55 American intelligence had never been confident about Syria’s desire to build nuclear weapons in the first place, in large part because additional facilities required for such an effort were not under construction.56

Overall, while prevention occurred in the second nuclear age, its pace is not increasing.57 Israel, for example, struck facilities of its Arab neighbors during the first nuclear age as often as in the second. Nonproliferation in the Middle East has come in different forms in the unipolar era, from high-level diplomacy to air strikes. But the outcomes have been roughly the same, and nightmares of a region in a “nuclear context,” or a gallery of nuclear-armed rogues, have not come to pass.

#### No prolif---but EVEN IF, no impact.

Mueller 20, senior fellow at the Cato Institute, member of the political science department and senior research scientist with the Mershon Center for International Security Studies at Ohio State University. (John, 06/24/20, “Nuclear Alarmism: Proliferation and Terrorism”, *Cato Institute*, <https://www.cato.org/publications/publications/nuclear-alarmism-proliferation-terrorism>)

Nuclear Proliferation

In an influential book, Graham Allison argues that “no new nuclear weapons states” should be a prime foreign policy principle, and analyst Joseph Cirincione very much agrees, insisting that nonproliferation should be “our number one national‐​security priority.”5 There are good reasons to avoid alarmism in this area, however. First, the pace of nuclear proliferation has been far slower than has been commonly predicted primarily because the weapons convey little advantage to their possessor. Second, the consequences of such proliferation that has taken place have been substantially benign: those who have acquired the weapons have “used” them simply to stoke their egos or to deter real or imagined threats.6 And thirdly, the costs of anti‐​proliferation policy have been very substantial: the number of people who have died as a consequence of dedicated efforts to contain nuclear proliferation runs well into six figures. Pace Alarmists have been wrong for decades about the pace of nuclear proliferation. Dozens of technologically capable countries have considered obtaining nuclear arsenals, but very few have done so. Indeed, as Jacques Hymans has pointed out, even supposedly optimistic forecasts about nuclear dispersion have proved to be too pessimistic.7 Thus, in 1958, the National Planning Association predicted “a rapid rise in the number of atomic powers … by the mid‐​1960s.”8 A few years later, C. P. Snow sagely predicted, “Within, at the most, six years, China and several other states [will] have a stock of nuclear bombs,” and John Kennedy observed that there might be “ten, fifteen, twenty” countries with a nuclear capacity by 1964.9 As part of that forecasting, it has generally been assumed that nuclear weapons would be important status — or virility — symbols; therefore, all advanced countries would want to have them in order to show how “powerful” they were. Thus, France’s de Gaulle opined in the 1960s, “No country without an atom bomb could properly consider itself independent,” and Robert Gilpin concluded that “the possession of nuclear weapons largely determines a nation’s rank in the hierarchy of international prestige.”10 In Gilpinian tradition, some analysts who describe themselves as “realists” have insisted for years that Germany and Japan must soon come to their senses and quest after nuclear weapons.11 Such punditry has gone astray in part because the pundits insist on extrapolating from the wrong cases. A more pertinent prototype would have been Canada, a country that could easily have had nuclear weapons by the 1960s but declined to make the effort.12 In fact, over the decades, a huge number of countries capable of developing nuclear weapons have neglected even to consider the opportunity — for example, Canada, Italy, and Norway — even as Argentina, Brazil, Libya, South Korea, and Taiwan have backed away from or reversed nuclear weapons programs, and Belarus, Kazakhstan, South Africa, and Ukraine have actually surrendered or dismantled an existing nuclear arsenal.13 Some of that reduction is no doubt due to the hostility of the nuclear nations, but even without that, the Canadian case seems to have proved to have rather general relevance. To begin with, as Stephen Meyer has shown, there is no “technological imperative” for countries to obtain nuclear weapons once they have achieved the technical capacity to do so.14 Moreover, like military prowess in general, the weapons have not proved to be crucial status symbols. As Robert Jervis has observed, “India, China, and Israel may have decreased the chance of direct attack by developing nuclear weapons, but it is hard to argue that they have increased their general prestige or influence.”15 How much more status would Japan have if it possessed nuclear weapons? Would anybody pay a great deal more attention to Britain or France if their arsenals held 5,000 nuclear weapons, or would anybody pay much less if they had none? Did China need nuclear weapons to impress the world with its economic growth? Or with its Olympics? As Jennifer Mackby and Walter Slocombe observe, “Germany, like its erstwhile Axis ally, Japan, has become powerful because of its economic might rather than its military might, and its renunciation of nuclear weapons may even have reinforced its prestige.”16 Decades of alarmist predictions about proliferation chains, cascades, dominoes, waves, avalanches, epidemics, and points of no return have proved to be faulty. The proliferation of nuclear weapons has been far slower than routinely expected because, insofar as most leaders of most countries (even rogue ones) have considered acquiring the weapons, they have come to appreciate several defects: the weapons are dangerous, distasteful, costly, and likely to rile the neighbors. Moreover, as Jacques Hymans has demonstrated, the weapons have also been exceedingly difficult to obtain for administratively dysfunctional countries like Iran.17 Consequences Although we have now suffered through two‐​thirds of a century during which there has been great hysteria about the disasters inherent in nuclear proliferation, the consequences of the proliferation that has occurred have been substantially benign. The few countries to which the weapons have proliferated have quietly kept them in storage and haven’t even found much benefit in rattling them from time to time. And even the deterrence value of the weapons has been questionable — the major Cold War participants, for example, scarcely needed visions of mushroom clouds to conclude that any replication of World War II, with or without nuclear weapons, was a decidedly bad idea.18 Moreover, there has never been a militarily compelling — or even minimally sensible — reason to use the weapons, particularly because of an inability to identify suitable targets or ones that could not be attacked about as effectively by conventional munitions. And it is difficult to see how nuclear weapons benefited their possessors in specific military ventures. Israel’s presumed nuclear weapons did not restrain the Arabs from attacking in 1973, nor did Britain’s prevent Argentina’s seizure of the Falklands in 1982. Similarly, the tens of thousands of nuclear weapons in the arsenals of the enveloping allied forces did not cause Saddam Hussein to order his occupying forces out of Kuwait in 1990. Nor did possession of the bomb benefit America in Korea, Vietnam, Iraq, or Afghanistan; France in Algeria; or the Soviet Union in Afghanistan.

### 2AC---AT: NoKo---Middle East Defense

#### Middle East war is more unlikely than ever

Mara Karlin 19, International Studies Professor at John Hopkins University, Nonresident Senior Fellow at the Brookings Institution, and U.S. Deputy Assistant Secretary of Defense for Strategy and Force Development 2015-2016, & Tamara Cofman Wittes, a Senior Fellow in Foreign Policy at the Brookings Institution and U.S. Deputy Assistant Secretary of State for Near Eastern Affairs from 2009-2012. [America’s Middle East Purgatory: The Case for Doing Less, Foreign Affairs, January/February 2019, 98(1)]//BPS

LESS RELEVANT REGION In response to the Iraq war, the United States has aimed to reduce its role in the Middle East. Three factors have made that course both more alluring and more possible. First, interstate conflicts that directly threatened U.S. interests in the past have largely been replaced by substate security threats. Second, other rising regions, especially Asia, have taken on more importance to U.S. global strategy. And third, the diversification of global energy markets has weakened oil as a driver of U.S. policy. During the Cold War, traditional state-based threats pushed the United States to play a major role in the Middle East. That role involved not only ensuring the stable supply of energy to Western markets but also working to prevent the spread of communist influence and tamping down the Arab-Israeli conflict so as to help stabilize friendly states. These efforts were largely successful. Beginning in the 1970s, the United States nudged Egypt out of the pro-Soviet camp, oversaw the first Arab-Israeli peace treaty, and solidified its hegemony in the region. Despite challenges from Iran after its 1979 revolution and from Saddam Hussein’s Iraq throughout the 1990s, U.S. dominance was never seriously in question. The United States contained the Arab-Israeli conflict, countered Saddam’s bid to gain territory through force in the 1990–91 Gulf War, and built a seemingly permanent military presence in the Gulf that deterred Iran and muffled disputes among the Gulf Arab states. Thanks to all these efforts, the chances of deliberate interstate war in the Middle East are perhaps lower now than at any time in the past 50 years.

### 1AR---AT: NoKo---Middle East Defense

#### No global escalation

Abdulrahman Al-Rashed 16, Veteran and Internationally Acclaimed Columnist, Former General Manager of Al Arabiya News Channel and Former Editor-in-Chief of Asharq Al-Awsat, “The Specter of World War III?”, Arab News, 10/22/2016, http://www.arabnews.com/node/1000701/columns#

Deputy Prime Minister of Turkey Numan Kurtulmus recently warned against the risks of disagreements over the battle of Mosul. He said that this could even mark the beginning of World War III.

Despite the sectarian and ethnic nature of the conflict, the battle of Mosul is not likely to cause a third world war, not even a broad regional war. Similarly, the war in Aleppo, Syria or Iraq would not turn into a broad war. All that is being talked about are mere incendiary talks. They have nothing to do with strategists, planners and decision-makers who sit in air-conditioned rooms thousands of miles away from our region in the United States or Russia.

The world is already grappling with several conflicts and is not likely to witness any of these turning into as devastating as a world war. World War II took 60 million lives, mostly from the West, and a World War III would be atrocious because it is estimated to kill a billion people. It will use the only weapon that can ensure “victory”, i.e., nuclear and chemical weapons.

The United States, Russia, Europe and other countries or regions of vital influence will disappear. There will be no winner and the whole world will go back to the Stone Age. The earth will no longer remain inhabitable for humans. This is why no direct wars have been engendered by the escalation of international conflicts.

What was known as the Cold War between the US and the former Soviet Union was nothing but proxy or indirect war. As many as 140,000 American soldiers were killed in the Vietnam War. However, the US did not resort to the use of nuclear weapons and withdrew after the defeat. There were 4,000 casualties in Iraq before the Americans withdrew.

The Soviet Union crumbled and Russia lost 14 countries that were part of its empire. It even lost three-quarters of its land and half of its population, and yet, the Soviets did not talk about a World War III. They did not launch a single nuclear missile. Instead, they continue with the old chess strategy in the struggle with their rivals to gain back influence and regions.

It is not impossible to imagine a lunatic leader using nuclear weapons in the future. This scenario has haunted the world since the end of World War II. Many regulations and protocols have been put in place to avoid this madness. Even if it happens, the reason won’t be conflicts such as the one taking place in Mosul, Aleppo or other parts of our region.

Super powers consider our wars as side conflicts that do not call for a suicidal war that would destroy their countries. What is being circulated in the Arab and Iranian media about World War III, and being attributed to Russian president or Henry Kissinger, is all forged.

What are the circumstances in which major countries would wage a crazy global nuclear war? It would only happen when their security is directly threatened and is on the verge of collapse. This scenario is extremely unlikely.

We imagine that the world is keen to ensure our security and stability whereas its main concern is safeguarding against terrorists and refugees. Some are only worried about our oil wells, as they are their sources of energy. Our governments are solely in charge of the region’s war and peace.

#### Containment checks

Ekaterina Stepanova 16, researcher at the Institute of World Economy and International Relations, Summer 2016, “Russia in the Middle East: Back to a “Grand Strategy” – or Enforcing Multilateralism?” http://www.cairn-int.info/article-E\_PE\_162\_0023--russia-in-the-middle-east.htm

In contrast to the 20th century and the early years of the 21st century, the regional crisis in the 2010s developed at a time when, overall, the role and leverage of major powers external to the Middle East, as either active meddlers or security guarantors in the region, or both, actually declined rather than increased. The United States serves as the most evident case in point: the “post-interventionist” US administration has clearly become “tired of the Middle East”, struggling and often failing to keep pace with the dynamically changing situation and unable to alter or decisively affect the course of events. The same even more strongly applies to the European powers. In terms of activity and impact, regional actors (Iran, Saudi Arabia, Qatar, UAE and Turkey) increasingly appeared to outplay external powers and influence. For external powers, however, that did not remove a number of risks and threats connected to, or emanating from, the Middle East. The increase and diversification of global energy supply and the latest crisis in energy prices made the region less central to the global economy than it had been in the past. At the same time, the fundamental socio-political, statehood and security crisis in the Middle East brought with it new security concerns and implications. They mostly stemmed from reinforced perceptions about the long-term nature of regional instability, the continuing potential for further destabilization, and the related consequences and implications beyond the region, ranging from terrorist connections to migration flows. These challenges affect external powers unevenly. For instance, the role of the Iraq-Syria area as the main focal point for global terrorism activity and magnet for transnational flows of violent extremists in the mid-2010s poses a threat to everyone (but mostly to the countries of the region itself, as well as to those in Europe and Eurasia). In contrast, the avalanche of refugee and migrant flows from the Middle East primarily targets Europe (rather than North America, Eurasia, or other regions). Until recently, the main type of response by key (Western) external powers to turbulent developments in the Middle East, while not amounting to a hands-off approach, boils down to limited containment. Examples range from limited air strikes against “Islamic State” positions in Iraq and Syria, carried out by the US-led coalition since 2014, to the 2013 deal on Syria’s chemical disarmament co-brokered by the United States and Russia. Not surprisingly, this limited-containment approach has had equally limited results for Syria, Iraq and the region – as well as for the West itself (as shown, e.g., by the persistent migrant flows and accelerating terrorist attacks in Europe). Despite the growing centrality of the Middle East to global politics and security, and its more direct impact on and ties to the West, this damage limitation course taken by key external actors has not been very different from, e.g., the approach taken by the United States and its Western allies (and also by Russia and China) to the Afghanistan problem in recent years.

### 2AC---AT: China---Bioterror Defense

**Bioterror fails**---too complex and terrorists will opt for something else

James Revill 17 (James Revill is a Research Fellow with the Harvard Sussex Program, SPRU, University of Sussex, UK. Revill has worked as a consultant to the United Nations Institute for Disarmament Research, 9/29/17, accessed 8/8/21, “Past as Prologue? The Risk of Adoption of Chemical and Biological Weapons by Non-State Actors in the EU”, https://www.cambridge.org/core/journals/european-journal-of-risk-regulation/article/past-as-prologue-the-risk-of-adoption-of-chemical-and-biological-weapons-by-nonstate-actors-in-the-eu/6B824CDE0E25FD86AC3D0BD07822A743)AGabay

In most cases terrorist groups appear to have **largely opted** for the **simplest pathway** towards the **achievement** of their **goals** and the **weapons** used **tend to be vernacular**, **functional devices** drawing on **local** and **readily-available materials**, rather than **sophisticated**, “baroque” **technologies**. This is certainly the case with IEDs, the history of which is characterised largely by incremental innovations – although nevertheless frequently effective ones – with many means of delivery recycled from the past.44 Complexity can therefore be seen as important in the adoption of technology by terrorists generally, but is perhaps particularly acute in the case of CBW technology. Some CBW can be relatively simple: “chlorine-augmented, vehicle-borne IEDs,” as employed by Al-Qaeda in Iraq (AQI) from 2006 to 2007 are not sophisticated weapons.45 Attacks on chemical production facilities, an apparent tactic of Serbian forces in the early to mid-1990s,46 employed relatively simple technologies – specifically explosives – with toxicity a secondary by-product. Direct contamination of food,47 drink48 or healthcare products49 does not require particularly sophisticated technology for the purposes of delivery – although may require some considerable skill to culture and scale-up a biological agent – and has been a common approach in European CBW incidents.50 Similarly, the contamination of water systems, something familiar to Europe,51 can also be relatively easily attempted. However, in most cases such methods of dissemination have generated results that are far short of the “mass destruction” that CBW are associated with, although this does not mean such a possibility can be ignored by those working on public health preparedness. Although some relatively simple approaches could cause significant harm, mass casualty attacks still require **considerable expertise**, something particularly **acute** in the **context** of **biological weapons**.52 The most effective route to weaponising biology is arguably through the process of aerosolising agents, something recognised mid-way through the last century as opening up the theoretical possibility of using biological weapons on a gigantic scale.53 However, realising such **theoretical** **potential** is difficult and it **took states decades** to **develop** required for CBW.62 more **predictable biological weapons**,54 and even then **such weapons** were acutely **vulnerable** to **environmental factors**.55 For non-state groups such **complexity** has proven a **significant barrier** to **CBW development**. By means of an example, one of the best-resourced biological weapons programs, that of Aum Shinrikyo, failed variously because the group acquired the wrong strain, contaminated fermenters and were faced with insurmountable production and dissemination difficulties.56 There are of course exceptions, such as the 2001 anthrax Letter Attacks in the US. However, if one accepts the conclusions of the FBI that this sophisticated attack with aerosolised anthrax in the US postal system was perpetrated by a US biodefence researcher, Dr Bruce Ivins,57 it is an exception that proves the rule. To circumvent the difficulties with aerosolisation, arguably one could use **human-tohuman** transmissible **biological agents** as part of a suicide bioterror operation. There are good reasons for concern over how crude suicide bioterrorists could employ such a tactic. However, the **use** of **highly contagious agents** is also poorly **predictable** and would have to **deal** with **social factors**, such as the “**spatial contact process** among **individuals**”, which can spell “out the **difference** between **large-scale epidemics** and **abortive ones**”. 58 The counter to this argument is the growing access to data and the changing human geography of the life sciences. Some 83% of European households reportedly are online, effectively allowing access to what is a growing body of available data on CBW, including so-called bioterrorist “recipes” and “blueprints” that are available in both mainstream scientific as well as more subversive literatures online. It is also clear that there is a changing human geography in European life sciences (for peaceful purposes), with the emergence of 30 DIY-bio groups located in Europe59 and some 80 European teams in the international Genetically Engineered Machines (IGEM) competition in 2016.60 This is compounded by reports that groups such as Daesh have deliberately sought to recruit foreign fighters “including some with degrees in physics, chemistry, and computer science, who experts believe have the ability to manufacture lethal weapons from raw substances”. 61 Whilst it would be unwise to ignore such developments, there is a need for **caution** in looking at the **extent** to which new **tech**nologies and **geographies** will **facilitate** the **adoption** of **chemical** and **biological weapons** by groups seeking to target European countries. First, data is not **information**, and **information** is **not knowledge**, let alone the **tacit knowledge** required for **CBW**.62 In many cases a degree of determination and dedication will be required merely to separate online fantasy from fact and identify operationally useful information (of relevance to the European context) from nonsense (or information pertinent to contexts other than Europe). Second, with new technologies there is the potential for such tools to enable some, but certainly not all, actors, and even then new technologies bring new challenges. CRISPR, gene editing technology is currently seen as a particular source of promise and peril, which purportedly enables “even largely untrained people to manipulate the very essence of life”. 63 As much may be technically true, yet “untrained people” would nonetheless require some guidance in identifying suitable areas of genetic structures to manipulate. Moreover, CRISPR would only get **aspiring weaponeers** so **far**, with the process of **culturing**, **scaling-up** and **weaponisation** still requiring **considerable attention** and **interdisciplinary skills**, typically generated through “large interdisciplinary teams of scientists, engineers, and technicians”, 64 in order to be **effective**.

### 1AR---AT: China---Bioterror Defense

#### the most generous probability estimate (model 1) is…0.02 extinction events in the next century!

Piers Millett 17, International Relations and Affairs Ph.D. from the University of Bradford; Andrew Snyder-Beattie, Biomathematics M.S. at North Carolina University, 8/1/2017, “Existential Risk and Cost-Effective Biosecurity,” *Health Security* 15(4), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5576214/>, Stras

Table

Description automatically generated

#### No means and too difficult

Filippa Lentzos 17 (Filippa Lentzos is a Senior Lecturer in Science & International Security at the Department of War Studies and Co-Director of the Centre for Science and Security Studies (CSSS) at King’s College London, 7/3/17, accessed 12/26/21, “Ignore Bill Gates: Where bioweapons focus really belongs”, <https://thebulletin.org/2017/07/ignore-bill-gates-where-bioweapons-focus-really-belongs/)AGabay>

I disagree. At a stretch, terrorists taking advantage of advances in biology might be able to create a viable pathogen. That does not mean they could create a **sophisticated** **biological** **weapon**, and certainly not a weapon that could kill 30 million people. Terrorists in any event tend to be **conservative**. They use **readily available weapons** that have a proven track record—not unconventional weapons that are more difficult to develop and deploy. Available evidence shows that few terrorists have ever even contemplated using **biological agents**, and the extremely small number of bioterrorism incidents in the historical record shows that biological agents are **difficult** to use as weapons. The skills required to undertake even the most basic of bioterrorism attacks are more **demanding** than often assumed. These technical barriers are likely to persist in the near- and medium-term future. Gates does a disservice to the global health security community when he draws media and policy attention to amateurs such as terrorists. Where biological weapons are concerned, the focus should remain on national militaries and state-sponsored groups. These are the entities that might have the capability, now or in the near future, to develop dangerous biological weapons. The real threat is that sophisticated biological weapons will be used by state actors—or by financially, scientifically, and militarily well-resourced groups sponsored by states. So far, state-level use of biology to deliberately inflict disease or disrupt human functions has been limited by the strong **international** **norm** against biological weapons enshrined in the 1925 Geneva Protocol and the 1972 Biological and Toxin Weapons Convention. These two biological cornerstones of the rules of war uphold the international prohibition against the development, production, stockpiling, and use of biological weapons. But this norm may not survive indefinitely.

#### Costs thump.

Sasika Popescu 14 (Saskia Popescu, 5/20/14, accessed 3/23/21, “Capabilities Analysis of Bioterrorism: Roadblocks Facing Non-State Actors’ Use of Bioweapons”, https://globalbiodefense.com/2014/05/20/bioterrorism-roadblocks-facing-non-state-actors-use-of-bioweapons/)AGabay

Beyond the **accessibility** and **availability** of biological agents is the hurdle of having **financial means** to acquire them. Aum Shinrikyo had considerable options, as they were one of the most well funded terrorist organizations. With roughly $1 billion in funds, they owned several buildings, including hidden medical facilities, and were able to fund bioweapon trials (Thompson, 2006). While individuals like Larry Wayne Harris were able to pay for these organisms online, the availability of these pathogens has been regulated in recent years to prevent such events from occurring (Tucker, 2000). Acquiring an agent via theft can also be monetarily taxing, as **bribes** and the **equipment** to transport the pathogen could be **costly**. Attempting to isolate a pathogen naturally is also **extremely expensive**, requiring all the necessary laboratory equipment, which in the case of viruses, is extensive. Beyond the technical know-how needed for this method, the purchasing of the equipment alone is a **major deterrent**. One can not simply collect dirt and isolate anthrax.

### 2AC---AT: China---Disease

#### Disease doesn’t cause extinction.

Halstead 19 – John Halstead, doctorate in political philosophy. [Cause Area Report: Existential Risk, Founders Pledge, https://founderspledge.com/research/Cause%20Area%20Report%20-%20Existential%20Risk.pdf]//BPS

However, there are some reasons to think that naturally occurring pathogens are unlikely to cause human extinction. Firstly, Homo sapiens have been around for 200,000 years and the Homo genus for around six million years without being exterminated by an infectious disease, which is evidence that the base rate of extinction-risk natural pathogens is low.82 Indeed, past disease outbreaks have not come close to rendering humans extinct. Although bodies were piled high in the streets across Europe during the Black Death,83 human extinction was never a serious possibility, and some economists even argue that it was a boon for the European economy.84 Secondly, infectious disease has only contributed to the extinction of a small minority of animal species.85 The only confirmed case of a mammalian species extinction being caused by an infectious disease is a type of rat native only to Christmas Island. Having said that, the context may be importantly different for modern day humans, so it is unclear whether the risk is increasing or decreasing. On the one hand, due to globalisation, the world is more interconnected making it easier for pathogens to spread. On the other hand, interconnectedness could also increase immunity by increasing exposure to lower virulence strains between subpopulations.87 Moreover, advancements in medicine and sanitation limit the potential damage an outbreak might do.

#### Its billions of dollars

Samp 20 (Tony advises clients on public policy issues related to artificial intelligence (AI), defense, space, and emerging technologies and specializes in congressional strategies, the legislative process, and the regulatory process. He leads DLA Piper’s AI Practice in Washington D.C. and brings 12 years of experience working with members of Congress on emerging technologies having served as senior policy advisor to Senator Martin Heinrich, a member of the Senate Armed Services Committee, the Senate Select Committee on Intelligence and Senate Committee on Energy and Natural Resources, 3-27-2020, "US $2T stimulus COVID-19 package includes significant R&D funding," DLA Piper, <https://www.dlapiper.com/en/us/insights/publications/2020/04/us-2t-stimulus-covid-19-package-includes-significant-randd-funding/>)

R&D funding in the CARES Act is being appropriated for agencies across the federal government and is dedicated to a wide range of research topics, including the development of vaccines, testing diagnostics, spatial analysis and mapping of infectious COVID-19 hot spots, and public health data analytics and infrastructure. Notably, $3.5 billion is provided to the Biomedical Advanced Research and Development Authority (BARDA), which is part of the HHS Office of the Assistant Secretary for Preparedness and Response, to support the manufacturing, production, and purchase of vaccines, therapeutics, diagnostics, and other similar initiatives.

### 1AR---AT: China---Disease

#### Every empiric AND basic theories of evolution disprove any risk of extinction from disease

Bryan Walsh 20, Future Correspondent for Axios, Editor of the Science and Technology Publication OneZero, Former Senior and International Editor at Time Magazine, BA from Princeton University, End Times: A Brief Guide to the End of the World, Orion Publishing Group, Limited Edition, p. 183-185

Yet despite epidemic after epidemic, despite mass killers like smallpox and the 1918 flu, at no point has disease threatened humans with extinction. Even the Black Death, likely the most concentrated epidemic of all time, now appears as little more than a minor downturn in what has otherwise been a bull market for long-term human population growth. That’s true for animals as well. The International Union for Conservation of Nature reports that of the 833 plant and animal extinctions that have been documented since 1500, less than 4 percent can be attributed to infectious disease. Those species that were eradicated by disease tended to be small in number and geographically isolated—very much unlike human beings, who are both numerous and have spread to every corner of the world.38

With the exception of HIV—which can now be managed as a chronic condition with antiviral drugs—every major epidemic mentioned above took place before the dawn of modern medicine, before the development of antibiotics and widespread vaccines. Smallpox was even fully eradicated from the wild in 198039—the only known samples of the virus are kept at highly secure government facilities in Atlanta and Koltsovo, Russia.40 Plague is now so rare that when it breaks out in countries like Madagascar, it makes global news—yet fewer than 600 deaths from the disease were reported between 2010 and 2015. Studies have shown that most of the fatalities from the 1918 flu were actually due to secondary bacterial infections that today could be controlled by antibiotics,41 which were introduced less than a century ago. Influenza pandemics remain the great fear of infectious disease experts, but the most recent one in 2009 killed only about 284,000 people worldwide.42 That was fewer than the number of people who die from seasonal flu in an ordinary year.43

Modern science has defanged most infectious diseases, at least outside the developing world—and great progress has been made there in recent years—but basic evolution also plays a role in limiting the catastrophic potential of natural disease. Every pathogen faces a trade-off. In general, the more rapidly it kills, the harder it is to spread widely, because an extremely virulent disease would run out of victims and hit an epidemiological dead end. Pathogens that are highly transmissible, like influenza, rarely kill, even absent the countermeasures of modern medicine. The 1918 flu had a fatality rate of about 2.5 percent.44 That’s tremendously high by the standards of the flu, but it still meant that more than 97 out of every 100 patients survived. Even a virus like HIV—which kills slowly and shows no symptoms for years, permitting the infected plenty of time to spread the disease—is hindered because transmission requires direct contact with blood or with bodily fluids. The self-replication that makes infectious disease such an effective weapon also prevents it from becoming a true existential threat. What viruses and bacteria want—if packets of genes and single-celled organisms can be said to want anything—is to survive and to replicate. They can’t do that if they kill all humans.

#### The risk of existential disease is .01%

Dr. Ilan Noy 22, Chair in the Economics of Disasters and Climate Change at the Victoria University of Wellington, PhD from the University of California, Santa Cruz, and Dr. Tomáš Uher, PhD, Professor at Masaryk University, “Four New Horsemen of an Apocalypse? Solar Flares, Super-volcanoes, Pandemics, and Artificial Intelligence”, Economics of Disasters and Climate Change, 1/15/2022, SpringerLink

High-Mortality Pandemics

A naturally occurring pandemic (i.e., not from an engineered pathogen) that would threaten human extinction is a very small probability event. However, historical accounts point to several instances where disease spread played an important role in causing very significant decline of specific populations. For example, the introduction of novel diseases to the Native American population during the European colonization of the Americas had deadly consequences. It is difficult to distinguish the effects of the diseases that came with the Europeans from the war and conflict they also brought with them. Nevertheless, during the first hundred years of the colonization period, the American population may have been reduced by as much as 90% (Ord 2020).

Moreover, two major pandemic events, the Justinian Plague in the sixth century and the Black Death in the fourteenth century appear to have been severe enough to cause a significant population decline of tens of percent in the populations they affected. Both events are believed to have been caused by plague, an infectious disease caused by the bacteria Yersinia Pestis (Christakos et al. 2005; Allen 1979). While there is a certain degree of uncertainty involved in studying these events’ societal impacts, historical accounts in combination with modern scientific methods provide us with some valuable insights into the effects they may have had on the societies of the time.

With respect to the possibility of a future catastrophic global pandemic, it appears that this risk is increasing significantly along with the advances in the field of synthetic biology and the rising possibility of an accidental or intentional release of an engineered pathogen. While some of the scientific efforts in the field of synthetic biology are directed towards increasing our understanding and our ability to prevent future catastrophic epidemic threats, the risk stemming from these activities is non-trivial, and may outweigh their benefits.

The Justinian Plague

The Justinian Plague severely affected the people of Europe and East Asia, though estimates of its overall mortality vary. Focusing exclusively on the first wave of the pandemic (AD 541–544), Muehlhauser (2017) suggests the pandemic was associated with a 20% mortality in the Byzantine empire. This estimate is based on the mortality rate estimated for the empire’s capital, Constantinople, by Stathakopoulos (2007) to produce a death toll of roughly 5.6 million. For a longer time span, AD 541 to 600, which included subsequent waves of the plague, scholars estimate a higher mortality rate of 33–50% (Allen 1979; Meier 2016).

The demographic changes associated with this high mortality led to a significant disruption of economic activity in the Byzantine empire (Gârdan 2020). A decline in the labour force caused a decline in agricultural production which led to food shortages and famine (Meier 2016). Trade also collapsed. Decreased tax revenues caused by the population decline initiated a major fiscal contraction and consequently a military crisis for the empire (Sarris 2002; Meier 2016). In the longer run, however, the massive reduction of the labour force appears to have had a positive economic effect for the surviving laborers, as the increased marginal value of labour caused a rise in real wages and per capita incomes. These beneficial effects for the survivors were also observed after the Black Death (Pamuk and Shatzmiller 2014; Findlay and Lundahl 2017).

The mortality and the disruption of activity the plague caused in the Byzantine empire also led to further direct and indirect cultural and religious consequences. Meier (2016) particularly highlights the plague’s indirect effect of an increase in liturgification (a process of religious permeation and internalization throughout society as defined by Meier 2020), the rise of the Marian cult, and the sacralization of the emperor.

The direct and indirect effects of the plague also appear to have had far-reaching and long-term political repercussions. The societal disruptions caused by the plague are believed to have significantly weakened the position of the Byzantine empire and arguably led to the decline of the Sasanian empire (Sabbatani et al. 2012). Interestingly, the pandemic indirectly favoured the nomadic Arab tribes who were less vulnerable to the contagion while traveling through desert and semi-desert environments during the initial expansion of Islam (Sabbatani et al. 2012).

Of note is the absence of a scientific consensus on the severity of the Justinian Plague’s impacts. For example, Mordechai and Eisenberg (2019) and Mordechai et al. (2019) argue against the maximalist interpretation of the historical evidence described above. They suggest that the estimated mortality rate of the plague is exaggerated, and that the pandemic was not a primary cause of the transformational demographic, political and economic changes in the Mediterranean region between the sixth and eighth century. Recently, White and Mordechai (2020) highlighted the high likelihood of the plague having different impacts in the urban areas of the Mediterranean outside of Constantinople.

The Black Death

The Black Death which ravaged Europe, North Africa, and parts of Asia in the middle of the fourteenth century is considered the deadliest pandemic in human history and potentially the most severe global catastrophe to have ever struck mankind. With respect to its mortality, Ord (2020) argues that the best estimate of its global mortality rate is 5–14% of the global population, largely based on Muehlhauser (2017).

The plague created a large demographic shock in the affected regions. It reduced the European population by approximately 30–50% during the 6 years of its initial outbreak (Ord 2020). It took approximately two centuries for the population levels to recover (Livi-Bacci 2017; Jedwab et al. 2019b). As the mortality rates appear to have been the highest among the working-age population, the effects on the labour force were acute (Pamuk 2007).

The plague's mortality, morbidity and the associated societal disruption led to a major decline in economic output both in Europe (Pamuk 2007) and the Middle East (Dols 2019). In Europe, however, this decline in economic output was smaller than the decline in population; output per capita began to increase within a few years of the initial outbreak (Pamuk 2007).

The large demographic shock caused by the plague led to a shift in the relative price of labour which, similarly to the Justinian Plague, had a positive impact on wages. With a reduced labour force, real wages and per capita incomes in many European countries increased and were sustained at higher levels for several centuries (Voigtländer and Voth 2013a; Jedwab et al. 2020; Pamuk and Shatzmiller 2014). Scott and Duncan (2001) point out that real wages approximately doubled in most countries of Europe in the century following the plague.

An additional insight into the long-run relationship between the Black Death’s mortality and per capita incomes in Europe is offered by Voigtländer and Voth (2013a). Using a Malthusian model, they suggest that over time, the rise in income caused by the plague’s mortality led to an increase in urbanization and trade. Furthermore, the increased tax burden (per capita), combined with the contemporary political climate, increased the frequency of wars. Consequently, higher urbanization and trade led to an increase in disease spread which along with a more frequent war occurrence caused a long-term increase in mortality and a further positive effect on per capita incomes. In this way, the Black Death appears to have created a long-lasting environment of high-mortality and high-income specifically in Western Europe, functioning as an important contributing factor to its economic growth in the next centuries (Alfani 2020). However, while in Western Europe incomes remained elevated over the next centuries, in Southern Europe they began to decline as the Southern European population started recovering after AD 1500 (Jedwab et al. 2020).

Apart from the positive effects on wages, the increased marginal value of labour combined with other factors had further economic and social implications. A decreased relative value of land and the lack of workforce to use it effectively caused land prices and land rents to decrease (Jedwab et al. 2020; Pamuk 2007). A decreased marginal value of capital assets in general led to a lapse in the enforcement of property rights (Haddock and Kiesling 2002). Interest rates and real rates of return on assets also decreased (Pamuk 2007; Jedwab et al. 2020; Pamuk and Shatzmiller 2014; Jordà et al. 2021; Clark 2016).

Higher wages in combination with a relative abundance of land increased people’s access to land/home ownership, likely reducing social inequality (Alfani 2020). On the other end of the income distribution, decreased incomes for landowners led to an overall decrease in income inequality (Jedwab et al. 2020; Alfani and Murphy 2017).

With respect to the effects on agriculture, the structure of agricultural output moved away from cereals to other crops following the plague. Furthermore, the workforce shortages and the incentives to increase the labour supply are believed to have caused a shift from male-labour intensive arable farming towards pastoral farming, consequently raising the demand for female labour (Voigtländer and Voth 2013b). However, while the Black Death appears to have caused certain structural agricultural changes, Clark (2016) finds no effect of the plague on agricultural productivity in the long run.

In terms of other social consequences, the evidence suggests that the plague's mortality reduced labour coercion, particularly throughout Western Europe (Jedwab et al. 2020; Haddock and Kiesling 2002; Gingerich and Vogler 2021). The increased bargaining power of labour caused by the plague’s demographic shock contributed to and accelerated the decline in serfdom and development of a free labour regime. Gingerich and Voler (2021) further argue that these effects may have had long-lasting political implications and that a decline of repressive labour practices (such as serfdom) permitted the development of more inclusive political institutions. They find that the regions with the highest mortality were more likely to develop participatory political institutions and more equitable land ownership systems. They find that centuries later, In Germany, the populations in these high-mortality regions were less likely to vote for Hitler’s National Socialist (Nazi) Party in the 1930 and 1932 elections in Germany.

However, the positive effects on the emergence of freer labour did not take place in Eastern Europe, where serfdom was sustained and even intensified. Robinson and Torvik (2011) attempt to explain this asymmetry arguing that these differential outcomes may have been caused by the varying power and quality of institutions. The authors suggest that opportunities generated by the increased bargaining power of labour, in an environment of weak institutions, were less likely to lead to a positive effect than in the case of regions with stronger institutions (with more robust rule-of-law or less corrupt or predatory practices).

Apart from causing a negative demographic shock to the affected populations, the Black Death appears to have caused further indirect demographic changes, particularly in Western Europe. The increased employment opportunities for females caused by worker shortages and a higher female labour demand led to a decline in fertility rates and an increased age of marriage (Voigtländer and Voth 2013b). This demographic transition to a population characterized by lower birth rates likely helped to preserve the high levels of per capita incomes and contributed to further economic development of certain parts of Europe, enabling it to escape the “Malthusian trap” in the following centuries (Pamuk 2007). Siuda and Sunde (2021) confirm the pandemic’s effect on the accelerated demographic transition empirically, as they find that greater pandemic mortality was associated with an earlier onset of the demographic transition across the various regions of Germany.

Unfortunately, the Black Death also led to an increase in the persecution of Jews (Finley and Koyama 2018; Jedwab et al. 2019a). Interestingly, Jedwab et al. (2019a) were able to estimate that in the case of regions with the highest mortality rates, the probability of persecution decreased if the Jewish minority was believed to benefit the local economy.

It is important to highlight that the long-term repercussions of the Black Death were highly asymmetrical. While in Western Europe the pandemic appears to have led to some long-term dynamic shifts associated with increased wages, decreased inequality and a decrease in labour coercion, this was not the case for other regions. A decrease in wages was observed for example in Spain (Alfani 2020) and Egypt. In Spain, the plague's demographic impact on an already scarce population caused a long-lasting negative disruption to the local trade-oriented economy. The workforce disruption in Egypt led to a collapse of the labour-intensive irrigation system for growing crops in the Nile valley, with consequent disastrous effects on the rural economy (Alfani 2020). Borsch (2005) argues that the economic decline in Egypt caused by the Black Death “put an end to the power in the heartland of the Arab world” (p. 114) and to the impressive scientific and technological developments that came out of this region.

A consensus for an explanation of the Black Death’s varied impacts across regions, and their determinants, does not appear to exist. However, several researchers attempt to provide partial insights. For example, Alfani (2020) considers the differential outcomes to be broadly dependent upon the initial conditions in each region. More specifically, both Robinson and Torvik (2011) and Pamuk (2007) propose that the asymmetry of impacts can largely be explained by the differences in the institutional environments of the affected societies.

It is argued that the Black Death defined the threshold between the medieval and the modern ages, similarly to the way the Justinian Plague did for antiquity and the Middle Ages (Horden 2021). Furthermore, the differential long-term outcomes of the Black Death likely provided a significant contribution to the so-called “Great Divergence” between Europe and the rest of the world and the “Little Divergence” between North-western and Southern and Eastern Europe (Jedwab et al. 2020; Pamuk 2007).

From this perspective, it would seem rational to conclude that apart from causing substantial and long-term demographic, economic, political, and cultural changes, both the Justinian Plague and the Black Death likely significantly altered the course of human history.

Considering the above, it is not unreasonable to expect that a pandemic of a similar magnitude to these past catastrophes would do the same in the present day. However, what societal impacts a pandemic of similar or higher mortality would inflict in the twenty-first century has not really been the subject of any study, as far as we were able to identify. A possibility exists, given the newly developed capacity of humanity to create new pathogens, that the outcomes of a future catastrophic pandemic will be even more adverse than those of the Justinian Plague and the Black Death.

Probability

In terms of the probability of naturally occurring pandemics, an informal survey of participants of the Global Catastrophic Risk Conference in Oxford in 2008 shows that the median estimate for a probability of a natural pandemic killing more than 1 billion people before the year 2100 was surveyed to be 5%, and the probability of such pandemic to cause human extinction was 0.05%. Ord (2020) uses a slightly broader definition of existential risk, which apart from human extinction also includes a permanent reduction of human potential. He estimates the probability of an existential risk stemming from a natural pandemic in the next 100 years to be 0.01%.

#### Islands check

Hannah Osborne 19 (Hannah Osborne is a Nature Editor at News Week, 10/3/19, accessed 1/4/22, “These Are the Best Places on Earth to Survive a Global Pandemic Threatening to Wipe Humans Out—according to Scientists”, https://www.newsweek.com/countries-safest-global-pandemic-human-extinction-1462869)AGabay

In the event of a global pandemic threatening mankind with extinction, Australia and New Zealand would be the best **safe havens** where humans could **survive** and eventually **repopulate** the planet, scientists have said. "Discoveries in biotechnology could see a genetically-engineered pandemic threaten the survival of our species," Nick Wilson, from the University of Otago, said in a statement. "Though carriers of disease can easily circumvent land borders, a closed self-sufficient island could harbour an isolated, technologically-adept population that could repopulate the earth following a disaster."

#### Empirics go NEG

Sebastian Farquhar 17 (Sebastian Farquhar is the leader of GPP at the Centre for Effective Altruism, et al., 1/23/17, accessed 3/24/21, “Existential Risk Diplomacy and Governance”, https://www.fhi.ox.ac.uk/wp-content/uploads/Existential-Risks-2017-01-23.pdf)AGabay

For most of human history, natural pandemics have posed the greatest risk of mass global fatalities.37 However, there are some reasons to believe that natural pandemics are **very unlikely** to cause human **extinction**. Analysis of the International Union for Conservation of Nature (IUCN) red list database has shown that of the 833 recorded plant and animal species extinctions known to have occurred since 1500, **less than 4%** (31 species) were ascribed to infectious disease.38 None of the mammals and amphibians on this list were **globally dispersed**, and **other factors** aside from infectious disease also **contributed** to their extinction. It therefore seems that our own species, which is very **numerous**, globally **dispersed**, and **capable of a rational response** to problems, is very **unlikely** to be **killed off** by a natural pandemic. One underlying explanation for this is that highly lethal pathogens can kill their hosts before they have a chance to spread, so there is a **selective pressure** for pathogens **not to be** highly **lethal**. Therefore, pathogens are likely to **co-evolve** with their hosts rather than **kill all possible hosts**.39

### 2AC---AT: China---China Pharma Bad

#### Chinese sector overtaking American pharma causes extinction.

Scott Moore 20, Director of the Penn Global China Program at the University of Pennsylvania, Foreign Policy, “China’s Biotech Boom Could Transform Lives—or Destroy Them,” 11/8/2020, <https://foreignpolicy.com/2019/11/08/cloning-crispr-he-jiankui-china-biotech-boom-could-transform-lives-destroy-them/>

When James Clapper, the U.S. director of national intelligence at the time, appeared before Congress in early January 2016 for an annual briefing of threats to the United States, he didn’t lack for material. Just a few weeks earlier, North Korea had tested a nuclear device, and Russia had begun deploying cruise missiles that appeared to violate a crucial arms-control agreement. But to the surprise of many experts, Clapper devoted a good chunk of his time to describing a much more exotic threat: biomedical research. Specifically, [Clapper warned](https://thebulletin.org/2016/04/how-genetic-editing-became-a-national-security-threat/), “Research in genome editing conducted by countries with different regulatory or ethical standards than those of Western countries probably increases the risk of the creation of potentially harmful biological agents or products.”

Clapper’s statement didn’t explicitly mention China—but it didn’t need to. As his testimony went on to make clear, while in the 20th century the United States and Soviet Union held the keys to preventing planetary catastrophe, in the 21st the principal players are the United States and China. And while in a previous age keeping Pandora’s box closed meant preventing nuclear war, today it’s about preventing biotech dangers.

In just the past few years, the development of inexpensive gene-editing techniques has democratized biomedical research, producing a biotech bonanza in places such as China and creating a whole new category of security threats in the process, from the use of genetic information to persecute dissidents and minority groups to the development of sophisticated bioweapons.

When it comes to the United States, China, and technology, artificial intelligence tends to grab most of the attention. But policymakers need to come to grips with the even bigger threat of biotechnology—and soon. Fortunately, though, shared concerns about China’s role in biotechnology also provide a rare chance for meaningful and productive engagement in shaping the rules of a new world.

China’s starring role in preventing the 21st century’s biotech perils stems from its skyrocketing investment in biomedical research. Historically, Western countries, and especially the United States, have been the epicenter of research in the life sciences. The United States alone accounted for some [45 percent](https://itif.org/publications/2018/03/26/how-ensure-americas-life-sciences-sector-remains-globally-competitive) of biotech and medical patents filed in the 14-year period ending in 2013. But now, thanks to heavy state-backed investment, China is catching up. Economic plans instituted in 2015 call for the biotechnology sector to account for more than 4 percent of China’s total GDP by 2020, and [estimates suggest](https://www.nature.com/articles/d41586-018-00542-3) that as of 2018, central, provincial, and local governments had already invested over $100 billion in the life sciences. Chinese venture capital and private equity investment in the life sciences, meanwhile, totaled some $45 billion just from 2015 to 2017.

China has also invested considerable effort in competing with countries like the United States for biotech talent. Of some [7,000 researchers recruited](http://www.nature.com/articles/d41586-018-00542-3) under the Thousand Talents Plan since 2008, more than 1,400 specialized in the life sciences. A leading American geneticist, Harris Lewin, has [warned](https://www.wired.com/story/wildebeest-okapi-giraffe-ibex-come-peruse-their-genomes/) that the United States is “starting to fall behind … the Chinese, who have always been good collaborators, [are] now taking the lead.”

For the United States and other Western countries, China’s growing role in biomedical research is raising plenty of concern. Several Chinese researchers have shown a willingness to ignore ethical and regulatory constraints on genetic research. In 2018, He Jiankui became a poster child for scientific irresponsibility when he announced he had edited the genes of two twins in utero without following basic safety protocols. He [reportedly dismissed](https://dev.biologists.org/content/146/3/dev175778) them as guidelines, not laws.

Yet the reaction at home was not what He had hoped for. His research had been made possible by the relatively lax standards of Chinese universities, even as he had kept the true nature of it secret from many involved – while discussing it with a [small group](https://www.nytimes.com/2019/04/16/health/stanford-gene-editing-babies.html) of Western bioethicists and scientists, who stressed their disapproval. It’s not uncommon in China to break the rules and be lauded for the results anyway, whatever the field. For He, though, the vast international attention that came after the story broke cost him his career and possibly [his freedom](https://www.nytimes.com/2019/01/21/world/asia/china-gene-editing-babies-he-jiankui.html?module=inline). Chinese media rushed to stress [official disapproval](https://www.sciencemag.org/news/2019/08/untold-story-circle-trust-behind-world-s-first-gene-edited-babies) of the experiments. Even the [overt purpose](https://www.statnews.com/2019/04/15/jiankui-embryo-editing-ccr5/) of the editing – to ensure that the babies, born to HIV+ mothers, enjoyed protection against the virus – turned out to be scientifically weak.

As China’s biotech sector grows, so too do fears that Chinese researchers like He will be more willing to push the limits of both science and ethics than those in the United States. Earlier this year, Chinese researchers recorded another mind-bending milestone when they [implanted](https://www.technologyreview.com/s/613277/chinese-scientists-have-put-human-brain-genes-in-monkeysand-yes-they-may-be-smarter/) human genes linked to intelligence into monkey embryos—and then said that the monkeys performed better on memory tests.

The dominance of the party-state in China raises serious concerns around biotechnology, especially because it carries increasingly ethnonationalist tone. When in 2018 Chinese researchers created the world’s first primate clones, for example, they dubbed them Zhong Zhong and Hua Hua, from the term zhonghua meaning “The Chinese Nation”—an oddly jingoistic moniker for a pair of monkeys. Chinese government policies often blur the line between eugenics and education, lumped together as improving the “quality” (suzhi) of the population, which received another stamp of official [endorsement](https://twitter.com/globaltimesnews/status/1191681436635451392) following the recent Fourth Plenum. These programs are carried out through the country’s huge so-called family planning bureaucracy—originally established to enforce the one-child policy.

Moreover, Beijing is increasingly extending its formidable social control apparatus into the realm of genetics. While there are considerable restrictions on private firms sharing biomedical data, largely because of an ugly history of [popular discrimination](https://www.theatlantic.com/china/archive/2013/12/chinas-struggle-with-hepatitis-b-discrimination/281994/) against hepatitis carriers, the government has no such restrictions. A [New York Times report](https://www.nytimes.com/2019/02/21/business/china-xinjiang-uighur-dna-thermo-fisher.html) earlier this year suggested, for example, that Chinese authorities had assembled a vast trove of genetic data on Chinese citizens without their consent, with the Uighur minority group having been specifically targeted.

Beijing’s brand of bio-nationalism also directly threatens the United States. U.S. officials have been [warning](https://www.nytimes.com/2019/11/04/health/china-nih-scientists.html) universities and research institutions that the biotech sector is a focal point for Chinese industrial espionage activities in the United States. And this past August, a senior Defense Department official warned Congress that China’s growing role in pharmaceutical manufacturing could allow it to disrupt deliveries of critical battlefield medicines, or potentially even [alter them to harm](https://www.washingtonpost.com/opinions/we-rely-on-china-for-pharmaceutical-drugs-thats-a-security-threat/2019/09/10/5f35e1ce-d3ec-11e9-9343-40db57cf6abd_story.html) U.S. forces.

Yet the biggest risks posed by biotech, for China, the United States, and other countries, pertain to nonstate actors. A critical feature of modern biotech, in contrast to technology like nuclear weapons, is that it’s cheap and easy to develop. A technique known as CRISPR, which the Chinese researcher He used in his illicit gene-editing work, makes it practical for just about anyone to manipulate the genomes of just about any organism they can lay their hands on. CRISPR makes it much simpler to skirt ethical restrictions and terrifyingly straightforward for terrorist groups to develop fearsome biological weapons.

Researchers have already [shown](https://doi.org/10.1371/journal.pone.0188453) it’s possible to reconstruct the smallpox virus, which was eradicated in the real world in the 1970s, for as little as $200,000 using DNA fragments you can order online. If a terrorist or rogue state were to successfully do so, virtually no one alive would have any resistance to the virus—and most stockpiles of the vaccine were destroyed long ago. There is an organization, the [International Gene Synthesis Consortium](https://genesynthesisconsortium.org/), that tries to screen suspicious orders for DNA fragments that might be used to build such bioweapons. And while most of the world’s major DNA synthesis firms belong to the consortium, membership is completely voluntary, and there’s also a [thriving and entirely unregulated](https://www.wired.com/story/synthetic-biology-vaccines-viruses-horsepox/) black market—much of it based in China.

All of this means that biosecurity standards in places like China matter more than ever. After all, if a major bioweapon were to be unleashed, it’s unlikely that any major, globally integrated country could escape unharmed. Fortunately, there are growing signs China is open to better regulation of its biotech sector. In February, the Chinese government announced that “[high risk](https://www.statnews.com/2019/02/27/china-unveils-new-rules-on-biotech-after-gene-editing-scandal/)” biomedical research would be overseen by the State Council, China’s equivalent of the cabinet—a sign of the concern with which Beijing views incidents like the He Jiankui CRISPR scandal. In a further sign of this concern, in August, the Chinese Communist Party announced the creation of a [new committee](http://www.nature.com/articles/d41586-019-02362-5) to advise top leaders on research ethics.

#### [ ] Bioterror kills all – short timeframe.

Bryan Walsh 20 (Bryan; Future Correspondent for Axios, Editor of the Science and Technology Publication OneZero, Former Senior and International Editor at Time Magazine, BA from Princeton University, End Times: A Brief Guide to the End of the World, Orion Publishing Group, Limited Edition, p. 204-206)

I’ve lived through disease outbreaks, and in the previous chapter I showed just how unprepared we are to face a widespread pandemic of flu or another new pathogen like SARS. But a deliberate outbreak caused by an engineered pathogen would be far worse. We would face the same agonizing decisions that must be made during a natural pandemic: whether to ban travel from affected regions, how to keep overburdened hospitals working as the rolls of the sick grew, how to accelerate the development and distribution of vaccines and drugs. To that dire list add the terror that would spread once it became clear that the death and disease in our midst was not the random work of nature, but a deliberate act of malice. We’re scared of disease outbreaks and we’re scared of terrorism—put them together and you have a formula for chaos.

As deadly and as disruptive as a conventional bioterror incident would be, an attack that employed existing pathogens could only spread so far, limited by the same laws of evolution that circumscribe natural disease outbreaks. But a virus engineered in a lab to break those laws could spread faster and kill quicker than anything that would emerge out of nature. It can be designed to evade medical countermeasures, frustrating doctors’ attempts to diagnose cases and treat patients. If health officials manage to stamp out the outbreak, it could be reintroduced into the public again and again. It could, with the right mix of genetic traits, even wipe us off the planet, making engineered viruses a genuine existential threat.

And such an attack may not even be that difficult to carry out. Thanks to advances in biotechnology that have rapidly reduced the skill level and funding needed to perform gene editing and engineering, what might have once required the work of an army of virologists employed by a nation-state could soon be done by a handful of talented and trained individuals. Or maybe just one.

When Melinda Gates was asked at the South by Southwest conference in 2018 to identify what she saw as the biggest threat facing the world over the next decade, she didn’t hesitate: “A bioterrorism event. Definitely.”2

She’s far from alone. In 2016, President Obama’s director of national intelligence James Clapper identified CRISPR as a “weapon of mass destruction,” a category usually reserved for known nightmares like nuclear bombs and chemical weapons. A 2018 report from the National Academies of Sciences concluded that biotechnology had rewritten what was possible in creating new weapons, while also increasing the range of people capable of carrying out such attacks.3 That’s a fatal combination, one that plausibly threatens the future of humanity like nothing else.

“The existential threat that would be most available for someone, if they felt like doing something, would be a bioweapon,” said Eric Klien, founder of the Lifeboat Foundation, a nonprofit dedicated to helping humanity survive existential risks. “It would not be hard for a small group of people, maybe even just two or three people, to kill a hundred million people using a bioweapon. There are probably a million people currently on the planet who would have the technical knowledge to pull this off. It’s actually surprising that it hasn’t happened yet.”

### 2AC---AT: China---Pharma Innovation High

#### Pharma innovation is high now.

Samuel Thangiah, 21 (Samuel Thangiah, Co-Founder and Executive Director of Life Science Integrates, 8-9-2021, accessed on 6-7-2022, Royal Society of Chemistry, “People, partnerships, pharma: exploring the science of innovation”, <https://www.chemistryworld.com/eureka-moments/people-partnerships-pharma-exploring-the-science-of-innovation/4014059.article>, HBisevac)

Pharmaceutical innovation is moving at a **staggering pace**. And behind every great research group driving the industry, there is also a team of collaborators, patients and experts from various backgrounds playing a key part in enabling discoveries and bringing novel therapeutics to market. As the world has been focused on tackling the **Covid**-19 pandemic over the last 18 months, it’s no surprise to see the pharmaceutical sector **increasingly develop** and **strengthen partnerships** to **accelerate innovations**. From the **growing range** of **patient entities** through to new possibilities stemming from technology and patient-generated data, the pharmaceutical industry has continued to identify more and more ways to **improve** the sector. This includes more collaboration with patients, advocacy groups and its workforce. Opening a dialogue within the industry, and extending that to include patients, is creating a new culture that fosters those **all-important lightbulb moments** more rapidly than ever before. As the pharmaceutical industry continues to emerge from the setbacks of Covid-19, it has been noted that the companies that have come back stronger than before are the same ones that have spent time training and upskilling their workers. However, the need for this attitude shift has not just come from the pandemic: the digitalised industrial revolution has also forced a need to retrain staff in certain positions.

#### China is soaring!

John Cumbers & Kevin Costa, 21 (John Cumbers is a molecular biologist and founder and chief executive officer of SynBioBeta, Kevin Costa is the Associate Professor of Medicine and Director of Cardiovascular Cell and Tissue Engineering at the Cardiovascular Research Center at the Mount Sinai School of Medicine, 2021, accessed on 6-1-2022, SynBioBeta, “China’s Plan To Beat The U.S. In The Trillion-Dollar Global Bioeconomy”, <https://www.builtwithbiology.com/read/chinas-plan-to-beat-the-u-s-in-the-trillion-dollar-global-bioeconomy>, HBisevac)

China: the **biotech elephant** in the room

I’ve written previously written how the Chinese government is already making substantial investments in its bioeconomy. Here are three scary statistics, courtesy of Greg B. Scott of the ChinaBio Group:

China is **out-investing** the U.S. China’s private investors poured **$14.4 billion** into its bioeconomy in 2019. That compares to the United States**’** more **meager** investment of **$10.4 billion**.

China is building a **bigger bioeconomy workforce**. China graduates about 8-10 million students each year. In the U.S., that number is closer to 400,000. Many Chinese students graduating from U.S. institutions stay here, but they are increasingly returning home to start **highly innovative companies**.

China is investing in **itself**. Historically, China has invested heavily in foreign companies, tech, and debt. Now we’re seeing an uptick in **China-to-China** investments—the country no longer needs to look abroad to find plenty of good biotech opportunities.

Chinese investments have led to centers of excellence in the regional technology hub of Shenzhen, including the Institute of Synthetic Biology at the Shenzhen Institute of Advanced Sciences (SIAT) and BGI Genomics. Shenzhen will compete for technological and economic leadership with U.S. regional biotech powerhouses such as San Francisco/Silicon Valley and Boston/Cambridge in the years to come. Many of China’s long-standing challenges—environment, food, water, waste management, and rapid innovation to retain its global manufacturing competitiveness—are areas where synthetic biology is seen as a key technology for the future. In other words, synthetic biology is not just an academic pursuit for China. Rather, its leaders are thinking **proactively** about how biological engineering can be used to address the country’s strategic national interests—while U.S. leadership **stands idly by**.

### 1AR---AT: China---Pharma Innovation High

#### Pharma innovation is strong now. Solves emerging diseases.

Tanja Dowe 21,CEO of Debiopharm Innovation Fund, the strategic investment arm of the Swiss pharmaceutical company Debiopharm. 10/5/21, “The ‘patient of the future’ is driving radical innovation in healthcare.” https://pharmaphorum.com/patients/future-patient-radical-innovation-healthcare-debiopharm/

Digital data collection, utilisation of real-word data and patient-centric thinking will all contribute to the rapid development of a new healthcare landscape, says Debiopharm Innovation Fund’s Tanja Dowe.

In recent years, we have seen thinking shift from focusing on a disease’s treatment to seriously considering the wider potential for its prevention, enabled by dramatic advances in data science and supported by a pressing need to reduce healthcare costs.

Leaps forward in both digital tools and widespread collection of medical and health data have provided many opportunities for the healthcare industry to adapt and change. The advent of COVID-19 has been a great testing environment for these technologies where, for example, the adoption of telemedicine was no longer an option but an urgent need to plug the gap in face-to-face medical care.

The healthcare industry is also changing as its ‘customers’ move from ‘boomer’ patients to digital natives. These individuals no longer accept the patient role of past generations. They want to be involved, proactive contributors to their own health, with access to their own health information.

This was also one of the key messages from the recent Healthcare Automation and Digitalization Congress (AUTOMA+) 2021, at which I led a round-table discussion on the ‘prevention versus treatment’.

The traditional patient role is rapidly changing

The world over, a dramatic shift is occurring in the characteristics of the typical patient. The time of individuals relying entirely on face-to-face interaction with their doctors is long past. In its place, a new persona has emerged. The ‘patient of the future’ demands control of their own healthcare – they are proactive individuals who follow their own health status with one of the almost 400 wearable devices on the market already today, and receive personalised health improvement advice through an app. They want personalised care all across the medical care pathway as well.

We can start to understand how we, in the healthcare industry, must respond to this seismic shift by looking initially at what is driving the transformation and, in particular, at three key factors.

Firstly, there is an ever-present need to reduce healthcare costs. This was a priority for healthcare services pre-COVID and is even more critical now in order to manage the huge burden of disease as we start to re-open the world. Prevention and treatment services for non-communicable diseases (NCDs) alone have been severely disrupted since the pandemic began, and the World Health Organization predicts a long-term upsurge in deaths from NCDs in the months and years that follow. Without finding a way to make healthcare more cost-efficient, the outcomes for patients are likely to fall sharply.

Secondly, there has been an unprecedented technological drive in the last decade, accelerated by increased medical data, advances in artificial intelligence (AI) and an abundance (and increased consumerisation) of digital tools, sparked by growing market appeal – as seen with the popularisation of health apps and digital monitoring systems, for example.

### 2AC---AT: China/NoKo---No Link---Deterrence

#### this might take out the scenario…idrk…

Christian Reuter, 20 (Christian Reuter is Full Professor at Technical University of Darmstadt, chair Science and Technology for Peace and Security in the Department of Computer Science with secondary appointment in the Department of History and Social Sciences, 2019, accessed on 7-20-2022, Springer, “Information Technology for Peace and Security”, <https://link.springer.com/book/10.1007/978-3-658-25652-4?noAccess=true>, HBisevac)

Alternatively, deterrence may be achieved with laws that punish malicious activities. However, laws are often **ineffective to deter cyber espionage**, because there is no credible threat of being caught. Firstly, **attribution** of an attack to a particular perpetrator is difficult, because attackers can use techniques to obfuscate their true location. Secondly, even if an attacker is identified, due to the global nature of the internet, a successful **prosecution** requires the collaboration of law enforcement agencies in multiple nation states, which often **does not work efficiently** yet.

## AT IoT Bad

### 2AC – Nuclear War

#### IoT key to prevent war

Schwartz 14 – futurist, co-founder of the Global Business Network. (Peter, "WARNING: The Internet Might End in December," HuffPost, 9-22-2014, https://www.huffpost.com/entry/end-of-internet\_b\_5856168, Accessed 7-20-2022, LASA-SC)

THE END OF THE WORLD AS WE KNOW IT If they succeed, it very well may lead to the end of the world as we know it. There will be no Internet. There will be many nets: ChinaNet, Euronet, maybe Deutsche Net and France net and Brazil Net and Russia Net. It will resemble the world before the Internet with many private networks and a constant challenge of interconnection. I remember carrying around all the devices I needed to use to connect to the early Internet because of a variety of technical standards. The Internet was created to take the friction out of digital communications, whether those borders were university boundaries or national borders. The digital borders will begin to rise and with it the cost of doing everything will begin to grow. The nations of the world will once again begin to diverge. Economies of scale will disappear. A HIGH FRICTION FUTURE As we disconnect, nationalism is likely to grow. We will be in a high friction world with the opportunities for conflict growing fast. It is a recipe for poverty and war. Just as Smoot-Hawley was a staggeringly self-destructive act that made the Great Depression much worse, so the fragmentation of the Internet driven by the desire for national control will accelerate the end of the second era of globalization.

### 2AC – Ag

#### IoT key to Ag

Shah 21 – researcher at the National University of Singapore. (Kwok Wei Shah, “Potential Applications of 5G Network Technology for Climate Change Control: A Scoping Review of Singapore,” Sustainability, 2021, https://doi.org/10.3390/ su13179720, Accessed 7-18-2022, LASA-SC)

Zhao et al. [78] proposed the integration of IoT technology to real-time production of agriculture crops with remote monitoring and wireless communication using the internet. This constitutes a management system of information which is also designed to handle the crop data for research purposes. Ning and Wang [79] differentiated IoT in two aspects, namely Unit IoT and Ubiquitous IoT, where man's like neural model (MLN) is considered in unit IoT and a global integration of unit IoT is considered as ubiquitous IoT. Using this combination, a social organization framework model (SOF) was constructed for the relationship and development of IoT. Yane [80] discussed various methods to design the IoT architecture for agriculture wherein the Agriculture information technology (AIT) concept was used to analyze the features of agriculture data. Ma et al. [81] reported the use of sensor networks design on IoT in agriculture for monitoring the crops, and the design is evaluated using parameters such as reliability, cost, interoperability, and management to ensure the right design. Hu et al. [71] proposed the concept of embedding the IoT applications with crops growth, which makes the system adaptive and intelligent by experimenting on different fields. All these abovementioned studies emphasized the challenges faced in developing an intelligent system.

According to International Business Machines Corporation (IBM), IoT implementation should increase agricultural yields by 70% within the coming thirty years. In fact, IoT is well equipped to tackle problems encountered by today's growers. There are a large number of smart technologies within the Agritech sector that are designed to satisfy farmers. On-site monitoring of watering, planting, crop intake, and pest levels allows for more effective site control. The most common use for IoT in agriculture is in considering weather patterns. The unsettled nature of climatic conditions mean that expected crop yields change regularly. Changes in the elements, such as humidity, temperature, rainfall, sunlight, and wind, can be monitored from sites in specific fields. The delicate nature of cultivating under glass means that constant monitoring is needed. Therefore, many opportunities are there to introduce smart technologies for assisting this from afar, as they are readily able to monitor variables such as light, humidity, temperature, and atmospheric compositions, as well as adjust them to keep within a desired range. The ability to transmit real time warnings when levels are exceeded ensures operational efficiency. Both indoor and outdoor farming spaces are suitable for smart sensor installations, and can lead to a stronger, more unified approach to agricultural management. It is anticipated that any such system should aim to interface freely with other smart elements aimed at account and procurement management, so that whole system efficiency may be maximized. The data collected from sensors monitoring soil moisture, humidity, and crop condition can be analyzed using a variety of pre-planned or adaptive techniques in a smart system, which allows for the irrigation of said crops to be dynamically managed.

#### Great power war.

**Castellaw 17** (John – 36-year veteran of the U.S. Marine Corps and the Founder and CEO of Farmspace Systems LLC, “Opinion: Food Security Strategy Is Essential to Our National Security,” 5/1/17, https://www.agri-pulse.com/articles/9203-opinion-food-security-strategy-is-essential-to-our-national-security)

The **U**nited **S**tates faces many threats to our National Security. These threats include continuing wars with extremist elements such as **ISIS** and potential wars with rogue state **North Korea** or regional nuclear power **Iran.** The heated economic and diplomatic competition with **Russia** and a surging **China** could **spiral out of control**. Concurrently, we face threats to our future security posed by growing civil strife, famine, and refugee and migration challenges which create incubators for extremist and anti-American government factions. Our response cannot be one dimensional but instead must be a nuanced and comprehensive National Security Strategy combining all elements of National Power including a Food Security Strategy. An **American Food Security Strategy** is an imperative factor in **reducing the multiple threats impacting our National wellbeing.** Recent history has shown that **reliable food supplies and stable prices produce more stable and secure countries.** Conversely, food insecurity, particularly in poorer countries, can lead to instability, unrest, and violence. **Food insecurity** drives **mass migration** around the world from the Middle East, to Africa, to Southeast Asia, destabilizing neighboring populations, **generating conflicts**, and threatening our own security by **disrupting** our **economic, military, and diplomatic relationships**. Food system shocks from extreme food-price volatility can be correlated with protests and riots. Food price related protests toppled governments in Haiti and Madagascar in 2007 and 2008. In 2010 and in 2011, food prices and grievances related to food policy were one of the major drivers of the Arab Spring uprisings. Repeatedly, history has taught us that **a strong agricultural sector** is **an unquestionable requirement** for inclusive and sustainable growth, broad-based development progress, and **long-term stability**. The impact can be remarkable and far reaching. **Rising income**, in addition to reducing the opportunities for an upsurge in extremism, leads to changes in diet, producing **demand** for more diverse and nutritious foods provided, in many cases, from **American farmers** and ranchers. **Emerging markets** currently purchase **20 percent of U.S. agriculture** exports and that figure is **expected to grow** as populations boom. Moving early to ensure stability in strategically significant regions requires long term planning and a disciplined, thoughtful strategy. To combat current threats and work to prevent future ones, our national leadership must employ the entire spectrum of our power including diplomatic, economic, and cultural elements. The best means to prevent future chaos and the resulting instability is positive engagement addressing the causes of instability before it occurs. This is not rocket science. We know where the instability is most likely to occur. The world population will grow by 2.5 billion people by 2050. Unfortunately, this massive population boom is projected to occur primarily in the most fragile and food insecure countries. This alarming math is not just about total numbers. Projections show that the greatest increase is in the age groups most vulnerable to extremism. There are currently 200 million people in Africa between the ages of 15 and 24, with that number expected to double in the next 30 years. Already, 60% of the unemployed in Africa are young people. Too often **these situations deteriorate into shooting wars** requiring the deployment of our military forces. We should be continually mindful that the price we pay for committing military forces is measured in our most precious national resource, the blood of those who serve. For those who live in **rural America**, this has a disproportionate impact. Fully 40% of those who serve in our military come from the farms, ranches, and non-urban communities that make up only 16% of our population. Actions taken now to increase agricultural sector jobs can provide economic opportunity and stability for those unemployed youths while helping to feed people. A recent report by the Chicago Council on Global Affairs identifies agriculture development as the core essential for providing greater food security, economic growth, and population well-being. Our active support for **food security**, including agriculture development, has helped **stabilize key regions** over the past 60 years. A robust food security strategy, as a part of our overall security strategy, can mitigate the growth of terrorism, build important relationships, and support continued American economic and agricultural prosperity while materially contributing to our Nation’s and the world’s security.

### 2AC – Warming

#### The Internet of Things solves a global transition to renewable energy – that solves global warming

Rifkin, 10/26/15- author of over 20 books on the environment and economics and Senior Lecturer at the Wharton School of Business (Jeremy Rifkin, 10/26/15, “The Rise of the Internet of Things and the Race to a Zero Marginal Cost Society,” <http://www.huffingtonpost.com/jeremy-rifkin/internet-of-things_b_8306112.html>)

The bulk of the energy we use to heat our homes and run our appliances, power our businesses, drive our vehicles and operate every part of the global economy will be generated at near zero marginal cost and be nearly free in the coming decades. That's already the case for several million early adopters in the European Union who have transformed their homes and businesses into micro power plants to harvest renewable energy onsite. Currently, around 25 percent of the electricity powering Germany comes from renewable energies. By 2020, the country aims to increase that to 35 percent. The quickening pace of renewable energy deployment is due, in large part, to the plunging cost of solar and wind energy harvesting technologies. The fixed costs of solar and wind harvesting technologies have been on exponential curves for more than 20 years, not unlike the exponential curve in computing. In 1977, the cost of generating a single watt of solar electricity was more than $76. By the last quarter of 2012, the cost of generating a watt had fallen to $0.50, and by 2017 the cost is projected to fall to $0.36 per watt. After the fixed costs for the installation of solar and wind are paid back -- often in as little as 2 to 8 years -- the marginal cost of the harvested energy is nearly free. Unlike fossil fuels and uranium for nuclear power, in which the commodity itself always costs something, the sun collected on rooftops and the wind traveling up the side of buildings are free. In some regions of Europe and America, solar and wind energy is already as cheap, or cheaper, than fossil fuel or nuclear generated energy. The impact on society of near zero marginal cost solar and wind energy is all the more pronounced when we consider the enormous potential of these energy sources. The sun beams 470 exajoules of energy to Earth every 88 minutes -- equaling the amount of energy human beings use in a year. If we could grab hold of one-tenth of 1 percent of the sun's energy that reaches Earth, it would give us six times the energy we now use across the global economy. Like solar radiation, wind is ubiquitous and blows everywhere in the world -- although its strength and frequency varies. A Stanford University study on global wind capacity concluded that if 20 percent of the world's available wind was harvested, it would generate more than seven times more electricity than we currently use to run the entire global economy. The Internet of Things will enable businesses and prosumers to monitor their electricity usage in their buildings, optimize their energy efficiency and share surplus green electricity generated on-site with others across nations and continents. The Energy Internet is comprised of five foundational pillars, all of which have to be phased in simultaneously for the system to operate efficiently. 1. Buildings and other infrastructure will need to be refurbished and retrofitted to make them more energy-efficient so that renewable energy technologies -- solar, wind, etc. -- can be installed to generate power for immediate use or for delivery back to the electricity grid for compensation. 2. Ambitious targets must be set to replace fossil fuels and nuclear power with renewable energy sources. To achieve this goal, feed-in tariffs need to be introduced to encourage early adopters to transform buildings and property sites into micro power generation facilities. The feed-in tariffs guarantee a premium price above market value for renewable energies generated locally and sent back to the electricity grid. 3. Storage technologies including hydrogen fuel cells, batteries, water pumping, etc., will need to be embedded at local generation sites and across the electricity grid to manage both the flow of intermittent green electricity and the stabilization of peak and base loads. 4. Advanced meters and other digital technologies will need to be installed in every building to transform the electricity grid from servo-mechanical to digital connectivity in order to manage multiple sources of energy flowing to the grid from local generators. The distributed smart electricity infrastructure will enable passive consumers of electricity to become active producers of their own green electricity, which they can then use off-grid to manage their facilitates or sell back to the Energy Internet. 5. Every parking space will need to be equipped with a charging station to allow electric and fuel cell vehicles to secure power from the Energy Internet, as well as sell power back to the electricity grid. Millions of electric and fuel cell vehicles connected to the Energy Internet also provide a massive backup storage system that can send electricity to the grid during peak demand, when the price of electricity has spiked, allowing vehicle owners to be appropriately compensated for contributing their electricity to the network. The phase-in and the integration of the above five pillars transforms the electricity grid from a centralized to a distributed electricity system, and from fossil fuel and nuclear generation to renewable energy. In the new system, every business, neighborhood and homeowner becomes the producer of electricity, sharing his or her surplus with others on a smart Energy Internet that is beginning to stretch across national and continental landmasses. The democratization of energy is forcing electricity companies to rethink their business practices. A decade ago, four giant vertically integrated electricity-generating companies -- E.ON, RWE, EnBW and Vattenfall -- produced much of the electricity powering Germany. Today, these companies are no longer the exclusive arbiters of power generation. In recent years, farmers, urban dwellers and small and medium-sized enterprises established electricity cooperatives across Germany. Virtually all of the electricity cooperatives were successful in securing low-interest loans from banks to install solar, wind and other renewable energies onsite. The banks were more than happy to provide the loans, assured that the funds would be paid back by the premium price the cooperatives would receive -- via feed-in tariffs -- from selling the new green electricity back to the grid. Today, the majority of the green electricity powering Germany is being generated by small players in electricity cooperatives. While these traditional vertically integrated power companies proved quite successful in generating relatively cheap electricity from traditional fossil fuels and nuclear power, they have not been able to effectively compete with local electricity cooperatives whose laterally scaled operations are better at managing energy harnessed by thousands of small players in broad collaborative networks. Peter Terium, CEO of RWE, the German energy company, told Reuters that a massive shift is taking place in Germany from centralized to distributed power, and said that the bigger power and utility companies "have to adjust to the fact that, in the longer term, earning capacity in conventional electricity generation will be markedly below what we've seen in recent years." A growing number of electricity-generating companies are coming to grips with the new reality of democratized energy and are changing their business models to accommodate the new Energy Internet. In the future, their income will increasingly rely on erecting and operating the Energy Internet managing their customers' energy use. The electricity companies will mine Big Data across each of their clients' value chains and use analytics to create algorithms and applications to increase their aggregate energy efficiency and productivity, and reduce their marginal cost. Their clients, in turn, will share the efficiency and productivity gains back with the electricity companies in what are called "performance contracts." In short, power companies will profit more from managing energy use more efficiently and selling less rather than more electricity. The Automated, GPS-Guided Transportation and Logistics Internet The meshing of the Communication Internet and the Energy Internet makes possible the build-out and scale-up of the automated Transportation and Logistics Internet. The convergence of these three Internets comprise the kernel of the Internet of Things platform for managing, powering and transporting goods in a Third Industrial Revolution economy. The automated Transportation and Logistics Internet is made up of four foundational pillars, which, like the Energy Internet, have to be phased-in simultaneously for the system to operate efficiently. 1. As mentioned previously, charging stations will need to be installed ubiquitously across land masses, allowing cars, buses, trucks and trains to power up or send back electricity to the grid. 2. Sensors need to be embedded in devices across logistics networks to allow factories, warehouses, wholesalers, retailers and end users to have up-to-the-moment data on logistical flows that affect their value chain. 3. The storage and transit of all physical goods will need to be standardized so that they can be efficiently passed off to any node and sent along any passageway, operating across the logistics system in the same way that information flows effortlessly and efficiently across the World Wide Web. 4. All of the operators along the logistics corridors need to aggregate into collaborative networks to bring all of their assets into a shared logistical space to optimize the shipment of goods, taking advantage of lateral economies of scale. For example, thousands of warehouses and distribution centers might establish cooperatives to share unused spaces, allowing carriers to drop off and pick up shipments using the most efficient path on route to their destination. The Internet of Things platform will provide real-time logistical data on pick-up and delivery schedules, weather conditions, traffic flows and up-to-the-moment information on warehouse storage capacities en route. Automated dispatching will use big data and analytics to create algorithms and applications to ensure the optimization of aggregate efficiencies along the logistical routes and, by so doing, dramatically increase productivity while reducing the marginal cost of every shipment. By 2025, at least some of the shipments on roads, railways and water will likely be carried out by driverless electric and fuel cell transport, powered by near zero marginal cost renewable energies, and operated by increasingly sophisticated analytics and algorithms. Driverless transport will accelerate productivity and reduce the marginal labor cost of shipping goods toward near zero on a smart automated Transportation and Logistics Internet. The erection of the automated Transportation and Logistics Internet also transforms the very way we view mobility. Today's youth are using mobile communication technology and GPS guidance on an incipient automated Transportation and Logistics Internet to connect with willing drivers in car-sharing services. Young people prefer "access to mobility" over ownership of vehicles. Future generations will likely never own vehicles again in a smart, automated mobility era. Larry Burns, the former executive vice president of General Motors and now a professor at the University of Michigan, did a study of mobility patterns in Ann Arbor, a mid-sized American city, and found that car-sharing services can reduce the cost of traveling a mile by 80 percent compared to privately owned vehicles. He also found that a "shared fleet provides almost instantaneous access to a vehicle with a fleet of only 15 percent of the number of privately owned vehicles that would have been used for these trips." There are currently at least a billion cars, buses and trucks crawling along around the world. Gasoline-powered internal combustion vehicles were the centerpiece of the Second Industrial Revolution. The mass production of these vehicles devoured vast amounts of the Earth's natural resources. Cars, buses and trucks also burn massive amounts of oil and are a major contributor to global warming gas emissions. Burns' study suggest a large number of vehicles currently on the road are likely to be eliminated with widespread adoption of car-sharing services over the course of the next generation. Those that remain will be electric and fuel cell transport, powered by near zero marginal cost renewable energy. Those shared vehicles, in turn, will be driverless and running on automated, smart road systems. The long-term transition from ownership of vehicles to access to mobility in driverless vehicles on smart road systems will fundamentally alter the business model for the transportation industry. While the big auto manufacturers around the world will produce fewer vehicles over the course of the next 30 years, they will likely increasingly reposition themselves as aggregators of the global automated Transportation and Logistics Internet, managing mobility services and logistics. The convergence of the Communication Internet, renewable Energy Internet, and automated Transportation and Logistics Internet in an operating kernel becomes the global brain for an Internet of Things cognitive infrastructure. This new digital platform fundamentally changes the way we manage, power and move economic activity across the numerous value chains and networks that make up the global economy. The digitalized Internet of Things platform is the core of the Third Industrial Revolution. Distributed Manufacturing Virtually every industry will be transformed by the Internet of Things platform and the ushering in of a Third Industrial Revolution. For example, a new generation of micro-manufacturers are beginning to plug in to the incipient Internet of Things and dramatically increasing their productivity while reducing their marginal costs, enabling them to outcompete the formerly invincible global manufacturing firms, which are organized around vertically integrated economies of scale. It's called 3-D printing, and it is the manufacturing model that accompanies an Internet of Things economy. In 3-D printing, software directs molten feedstock inside a printer to build up a physical product layer by layer, creating a fully formed object, even with movable parts, which then pops out of the printer. Like the replicator in the Star Trek television series, the printer can be programmed to produce an infinite variety of products. Printers are already producing products from jewelry and airplane parts to human prostheses, and even parts of cars and buildings. And cheap printers are being purchased by hobbyists interested in printing out their own parts and products. The consumer is beginning to give way to the prosumer as increasing numbers of people become both the producer and consumer of their own products. Three-dimensional printing differs from conventional centralized manufacturing in several important ways. To begin with, there is little human involvement aside from creating the software. The software does all the work, which is why it's more appropriate to think of the process as "infofacture" rather than "manufacture." The early practitioners of 3-D printing have made strides to ensure that the software used to program and print physical products remains open source, allowing prosumers to share new ideas with one another in do-it-yourself hobbyist networks. The open design concept conceives of the production of goods as a dynamic process in which thousands -- even millions -- of players learn from one another by making things together. The elimination of intellectual property protection also significantly reduces the cost of printing products, giving the 3-D printing enterprise an edge over traditional manufacturing enterprises, which must factor in the cost of myriad patents. The open-source production model has encouraged exponential growth. The 3-D printing production process is organized completely differently than the manufacturing process of the First and Second Industrial Revolutions. Traditional factory manufacturing is a subtractive process. Raw materials are cut down and winnowed and then assembled to manufacture the final product. In the process, a significant amount of the material is wasted and never finds its way into the end product. Three-dimensional printing, by contrast, is additive infofacturing. Software is directing the molten material to add layer upon layer, creating the product as a whole piece. Additive infofacturing uses one-tenth of the material of subtractive manufacturing, giving the 3-D printer a dramatic leg up in efficiency and productivity. 3-D printing is projected to grow at a blistering rate in the future. 3-D printers can print their own spare parts without having to invest in expensive retooling and the time delays that go with it. With 3-D printers, products can also be customized to create a single product or small batches designed to order, at minimum cost. Centralized factories, with their capital-intensive economies of scale and expensive fixed production lines designed for mass production, lack the agility to compete with a 3-D production process that can create a single customized product at virtually the same unit cost as producing 100,000 copies of the same item. Making 3-D printing a truly local, self-sufficient process requires that the feedstock used to create the filament is abundant and locally available. Staples -- the office supply company -- has introduced a 3-D printer, manufactured by Mcor Technologies in its store in Almere, in the Netherlands, that uses cheap paper as feedstock. The process, called selective deposition lamination, prints out hard 3-D objects in full color with the consistency of wood. The 3-D printers are used to "infofacture" craft products, architectural designs and even surgical models for facial reconstruction. The paper feedstock costs a mere 5 percent of previous feedstocks. Other 3-D printers are using recycled plastic, paper and metal objects as feedstock at near zero marginal cost. Someone with a 3-D printer can also power his or her fabrication lab with green electricity harvested from renewable energy onsite or generated by local producer cooperatives. Small and medium-sized enterprises in Europe and elsewhere are already beginning to collaborate in regional green electricity cooperatives to take advantage of lateral scaling. With the cost of centralized fossil fuels and nuclear power constantly increasing, the advantage skews to small and medium-sized enterprises that can power their factories with renewable energies whose marginal cost is nearly free. Marketing costs also plummet in an Internet of Things economy. The high cost of centralized communications in both the First and Second Industrial Revolutions -- in the form of magazines, newspapers, radio and television -- meant that only the bigger manufacturing firms with integrated national operations could afford advertising across national and global markets, greatly limiting the market reach of smaller manufacturing enterprises. In the Third Industrial Revolution, a small 3-D printing operation anywhere in the world can advertise infofactured products on the growing number of global Internet marketing sites at nearly zero marginal cost. Plugging into an Internet of Things infrastructure at the local level gives the small infofacturers one final, critical advantage over the vertically integrated, centralized enterprises of the 19th and 20th centuries: they can power their vehicles with renewable energy whose marginal cost is nearly free, significantly reducing their logistics costs along the supply chain and in the delivery of their finished products to users. The new 3-D printing revolution is an example of "extreme productivity." The distributed nature of manufacturing means that anyone and eventually everyone can access the means of production, making the question of who should own and control the means of production increasingly irrelevant for a growing number of goods. Many of Europe's global manufacturing enterprises will continue to flourish, but will be fundamentally transformed by the democratization of manufacturing, which favors a high-tech renaissance for small and medium-sized enterprises. Europe's manufacturing giants will increasingly partner with a new generation of 3-D-printing, small and medium-sized enterprises in collaborative networks. While much of the manufacturing will be done by SMEs that can take advantage of the increased efficiencies and productivity gains of lateral economies of scale, the giant enterprises will increasingly find value in aggregating, integrating and managing the marketing and distributing of products. The peer-to-peer nature of the Internet of Things platform allows millions of disparate players -- small and medium-sized businesses, social enterprises and individuals -- to come together and produce and exchange goods and services directly with one another, eliminating the remaining middle men that kept marginal costs high in the Second Industrial Revolution. This fundamental technological transformation in the way economic activity is organized and scaled portends a great shift in the flow of economic power from the few to the multitudes -- the democratization of economic life. It is important to emphasize that the transition from the Second to the Third Industrial Revolution will not occur overnight, but, rather, take place of over 30 to 40 years. Many of today's global corporations will successfully manage the transition by adopting the new distributed and collaborative business models of the Third Industrial Revolution while continuing their traditional Second Industrial Revolution business practices. In the coming years, capitalist enterprises will likely find more value in aggregating and managing laterally scaled networks than in selling discrete products and services in vertically integrated markets.

### 2AC – AT: Cyberattacks

#### IoT key to cybersecurity

Soni 20 - (Sandeep, "Data localisation may cause cyber attacks, hurt privacy, business competitiveness, says think tank," Financial Express, 1-19-2020, https://www.financialexpress.com/industry/data-localisation-may-cause-cyber-attacks-hurt-privacy-business-competitiveness-says-think-tank/1827985/, Accessed 1-3-2021, LASA-SC)

The need for data localisation mandated under the Personal Data Protection Bill may lead to enhanced risks of privacy violations, cyber attacks, and data breaches, according to trade and regulatory think-tank Cuts International. According to a study titled Consumer Impact Assessment of Data Localisation conducted by Cuts on data localisation impact from the consumer perspective, consumers perceiving higher risks showed lower levels of data usage. Data localisation, if implemented, without adequate preparation and accountability measures, may reduce freedom of speech while enhancing risks of censorship, privacy violations, data breaches and cyber-attacks, the study said. Data localisation may “lead to loss of international competitiveness among service providers along with creating a ‘honeypot of data’ based in a single location and hence increasing risks of data breaches and cyber-attacks,” Udai S Mehta, Deputy Executive Director, Cuts International told Financial Express Online. The study, which surveyed around 1,300 users of data-led services and interacted with 40 experts in government, legal, service providers, civil society organisation and academia, added that experts were “sceptical of the state having adequate cyber-security experts and vulnerability proof digital infrastructure for securing personal data stored within the country.” The experts also questioned the ability of law enforcement agencies in fighting cyber crimes even as they stressed on chances of government’s excessive tracking of personal data, said Mehta. The changes made to the data localisation provisions in the bill last year from 2018 included non-sensitive and non-critical personal data may not be stored in India from earlier requirement of storage of a copy all personal data in India. However, it may be difficult to separately store different types of personal data, said Cuts. Among other changes, the 2019 bill also expanded the scope of personal data to include online and offline features potentially increasing the scope of sensitive personal data and critical personal data. The report also pointed towards the possible adverse impact on the availability of services and innovation as data localisation may enhance the costs of operation (due to the need of setting up data centres in India) to serve Indian consumers. This may impact small businesses as they may not be able to “justify with respect to their commercial interests, forcing them to pull out of the Indian market.” Hence, the government should “focus on enhancing consumers privacy by avoiding unjustified data access by third parties, pruning state exemptions, and making the government’s request for data subject to judicial review. (It should) combat data breaches and cyber-attacks, prescribe an effective grievance redress mechanism, and foster data-driven innovation,” the study recommended. It also suggested a separate policy to incentivise processing of data in India instead of forced data localisation.

#### Even a worst-case cyber-attack wouldn’t prompt nuclear retaliation — prefer official military clarification to alarmist speculation.

Tucker, 18 — Patrick Tucker; technology editor for Defense One, citing Gen. Paul Selva, vice chairman of the Joints Chiefs of Staff. (2-2-2018; "No, the US Won’t Respond to A Cyber Attack with Nukes;" *Defense One*; https://www.defenseone.com/technology/2018/02/no-us-wont-respond-cyber-attack-nukes/145700/; //GrRv)

The idea that the U.S. is building new low-yield nuclear weapons to respond to a cyber attack is “not true,” military leaders told reporters in the runup to the Friday release of the new Nuclear Posture Review.

“The people who say we lowered the threshold for the use of nuclear weapons are saying, ‘but we want these low-yield nuclear weapons so that we can answer a cyber attack because we’re so bad at cyber security.’ That’s just fundamentally not true,” Gen. Paul Selva, vice chairman of the Joints Chiefs of Staff, said Tuesday at a meeting with reporters.

It’s an idea that military leaders have been pushing back against since the New York Times ran a Jan. 16 story headlined, “Pentagon Suggests Countering Devastating Cyberattacks With Nuclear Arms.”

When would the U.S. launch a nuclear attack in response to a non-nuclear event? The Defense Department says the threshold hasn’t changed since the Obama administration’s own nuclear posture review in 2010, but a draft of the new review that leaked online caused a bit of drama in its attempts to dispel “ambiguity.”

The new review gives examples of “non-nuclear strategic attacks,” Robert Soofer, deputy assistant secretary for nuclear and missile defense policy, told reporters on Thursday. “It could be catastrophic attacks against civilian populations, against infrastructure. It could be an attack using a non-nuclear weapon against our nuclear command-and-control [or] early-warning satellites. But we don’t talk about cyber.”

In his own conversation with reporters, Selva broadened “early warning” systems to include ones that provide “indications of warning that are important to our detection of an attack.” He also emphasized, “We never said ‘cyber.’”

There’s a reason for that. While cyber attacks on physical infrastructure can be very dangerous, they are unlikely to kill enough people to provoke a U.S. nuclear response.

An National Academies of Science and Engineering analysis of the vulnerability of U.S. infrastructure makes that point. A major cyber attack could cut off electrical power, resulting in “people dying from heat or cold exposure, etc.,” said Granger Morgan, co-director of the Carnegie Mellon Electricity Industry Center and one of the chairs of the report. “A large outage of long duration could cover many states and last for weeks or longer. Whether and how many casualties there could be would depend on things like what the weather was during the outage.”

It’s a huge problem but not an event resulting in tens of thousands of immediate deaths.

Contrast that with a nuclear attack on a city like Moscow, even one using a device of 6 kilotons, much smaller than the ones the United States used against Japanese targets in World War II. The immediate result: there would be 40,000 deaths, according to the online nuclear simulation tool NukeMap.

Russia has demonstrated a willingness to take down power services with cyber attacks, as they did in Ukraine on Christmas Eve 2015. But these attacks were brief and occured in the context of actual fighting.

In other words, the worst cyber physical attack that top experts believe credible likely does not meet the threshold that the Defense Department has set out for deploying a nuclear weapon.

## AT Hypersonics Good

### at hypersonics good

#### Hypersonic weapons proliferation causes crisis instability due to speed and maneuverability and destabilizing countermeasures like launch on warning – also zaps power projection including carriers through asymmetric leverage

Richard H. Speier 17, Adjunct Staff with the RAND Corp. He received a Bachelor of Arts degree in Physics from Harvard College and a Ph.D. in Political Science from the Massachusetts Institute of Technology, Hypersonic Missile Nonproliferation: Hindering the Spread of a New Class of Weapons, https://www.rand.org/pubs/research\_reports/RR2137.html

To understand the implications of hypersonic missile proliferation, it is necessary to understand the advances these missiles offer compared with current military capabilities. Hypersonic vehicles have been in existence since the dawn of the space age. Manned hypersonic air vehicles were flown over 50 years ago, when the National Aeronautics and Space Administration (NASA) first flew the X-15 hypersonic test vehicle in 1959. (Appendix A contains more details about hypersonic flight vehicles.) The focus of this study, however, is on two new types of hypersonic vehicles and their constituent enabling technologies: HGVs and HCMs.

The principal concerns about HGVs and HCMs are the current development efforts by the major powers (Russia, China, and the United States) and the potential interest by other countries to acquire these systems because of their unique military utility, i.e., their reach and ability to penetrate most air defense systems, derived from the missile’s maneuverability, speed, and altitude.1 It is the combination of these characteristics that makes these systems challenging to develop and to defend against. In contrast, subsonic cruise missiles offer good maneuverability but relatively low speeds, and ballistic missiles offer hypersonic speed but little or no maneuverability We believe that the unpredictable trajectories, resulting in target ambiguity, and the ability to penetrate most defenses, will affect some nations’ defense postures and increase instability in some regions. We note that these new missiles will almost exclusively affect nations that are otherwise equipped with effective defenses against ballistic missiles. This may be a substantial number of nations over the coming decades. The next sections describe the major advantages and attributes of HGVs and HCMs and their strategic implications.

Principal Characteristics of HGVs

HGVs are unpowered vehicles that “glide” to their target at the “top” of the atmosphere, reaching between about 40 km to 100 km in altitude. Even in this rarified atmosphere, they are designed to produce lift that is equal to their weight to keep them aloft at hypersonic speeds. A typical operational concept of an HGV involves launching it on a ballistic missile and releasing it at the appropriate altitude, velocity, and flight path angle to enable it to glide to its target. The initial release conditions are driven by the intended trajectory (downrange and crossrange) and the characteristics of the vehicle, e.g., lift and drag. We note that HGV trajectories are very different from maneuvering reentry vehicles (MaRVs) developed in the past. As Figure 2.1 shows, the MaRV trajectory is mostly in ballistic mode above 100 km with some maneuvers executed post-reentry. In contrast, the HGV spends a negligible portion (if any) of its flight in ballistic mode. The capabilities of hypersonic missiles give them both offensive and defensive advantages. From an offensive perspective, maneuverability can potentially provide HGVs the ability to use in-flight updates to attack a different target than originally planned (within the reach of the weapon system) as shown in Figure 1.32 With the ability to fly at unpredictable trajectories, these missiles will hold extremely large areas at risk throughout much of their flights. 3 There are also major defensive differences between MaRVs and HGVs. The post-reentry high–gforce maneuvers for both missiles would challenge terminal defenses, but because the majority of the MaRV trajectory is ballistic, midcourse ballistic missile defense systems that operate in the exo-atmospheric region remain effective against MaRVs but not against HGVs. In other words, a MaRV has all the attributes and vulnerabilities of a ballistic RV with the exception of the post-reentry phase.

Although HGVs are not usually powered, a small propulsion system providing additional velocity or some attitude or directional control could also be integrated into the vehicle. However, the value of such an engine would need to be traded against the costs associated with additional weight and added complexity.

HGVs as Weapons

Defense Penetration

The trajectory and capabilities of HGVs provide them with some unprecedented attributes that may be disruptive to current military doctrines of advanced nations. HGVs have the reach and speed of ballistic missiles, but, unlike these missiles, they fly at lower altitudes and have relatively unpredictable trajectories that can include significant cross-range and terminal maneuvers. These characteristics make HGVs challenging to defend against because they tend to fly outside the altitude and speed envelopes of most modern air and missile defense systems. They can defeat current ballistic missile defense systems because of their unpredictable long-range trajectories, maneuverability, and flight altitudes. Terminal air defense systems would also be challenged by HGVs because of their high speeds and potential endgame maneuverability. Nations that do not possess advanced defense systems capable of defending against ballistic missiles would likely not experience as great a change in threat from these new weapons because they are already vulnerable to ballistic missiles. The possible exception is warning time. Hypersonic weapons do substantially increase the threat for nations with otherwise effective missile defenses. Hypersonic weapons will not be fielded in quantity for perhaps another decade, and the proliferation to lesser nations would come later—after ballistic missile defenses had been improved and more widely deployed.

Compressed Timelines

Nations that do not possess (or have access to) space-based sensor systems to detect ballistic missile launches and that rely on ground-based sensors, such as radars, to detect incoming mid- to long-range ballistic missiles, could experience a further compression of their decision/ response timelines. The reasoning is that typical ballistic missiles tend to fly at higher altitudes than HGVs and should therefore be detectable earlier. Figure 2.2 illustrates this effect. Due to the Earth’s curvature and the HGV’s low-gliding altitude as compared with that of a similar range ballistic missile, radar or other line-of-site sensors will likely not detect an HGV as early as they would a ballistic missile. For example, a radar operating from the surface of a smooth Earth would detect a 3,000-km-range RV about 12 minutes before impact, but would not detect an HGV until about six minutes before impact. We note that potential defensive systems that intend to intercept incoming ballistic missiles before they deploy their payload, e.g., in the boost phase, would retain their effectiveness against HGV weapons.

Principal Characteristics of HCMs

As the name implies, an HCM is a cruise missile that operates at hypersonic speeds. As such, it compresses the defense response timeline and challenges many of the current defense systems because of its high speed and maneuverability. Hypersonic weapons could be launched from the ground, from aircraft, or from ships. An HCM would likely accelerate to around Mach 4 or 5 before an air-breathing engine capable of producing thrust at hypersonic speeds, e.g., a supersonic combustion ramjet (scramjet), further accelerates and then maintains the missile’s speed.

There are different options for propelling an HCM to Mach 4 or 5, where the scramjet would take over. Rocket boosters are the most likely option especially for early generation HCMs, because they offer simplicity and affordability, although they may be the largest and heaviest option because they need to carry both their propellant and oxidizer.4 Of course, any acceleration option must be affordable, because it is a one-time-use propulsion system. In order to achieve appropriate pressures for combustion in the scramjet engine, an HCM will likely cruise at an altitude of 20 to 30 km.

HCMs as Weapons

The principal advantages of an HCM would be its speed and maneuverability. Combined, these would provide a very responsive and flexible offensive weapon that could, for example, hold targets within a 1,000-km radius of the launch aircraft at risk and could strike these targets within several minutes. Cruise missiles are difficult to defend against because of their unpredictable trajectories. The additional speed provided by an HCM, relative to other cruise missiles, would further complicate defense system timelines, as well as potentially be more effective against kinetic defenses, e.g., missile interceptors. Compounding the defensive challenges even further, HCMs would fly at altitudes higher than most current surface-to-air missile systems are capable of reaching. Defenses could be designed to fly higher, but the interceptors still would need to confront the HCM’s speed and maneu verability. Furthermore, as described next, an HGV’s high kinetic energy affords significant destructive power, even without, or in addition to, the destructive power of an explosive warhead.

Destructive Power from High Speed

Hypersonic weapons can deliver nuclear or conventional warheads. However, another attribute common to both HCMs and HGVs is the potential to use solely kinetic energy to destroy or damage an unhardened target. This is made possible by the combination of their high speed, or kinetic energy, and their accuracy. Their high impact speed can also be leveraged to help defeat underground facilities.5 Figure 2.3 provides a rough estimate of the effective explosive TNT equivalence of a high-speed mass, such as a conventional strike vehicle with no onboard explosives. The effective TNT equivalence calculation assumed that the explosive force is directional and focused within the approximate cross-sectional area of the impacting vehicle.

Summary of Challenges for Defensive Systems

As mentioned previously, speed complements hypersonic missiles’ maneuverability to significantly increase effectiveness. Defenders with capable terrestrial and space sensors will have only a few minutes to know these missiles are inbound, and lesser adversaries will likely not have any significant warning. Given short timelines and high speed, only very responsive and capable defensive measures would have any chance of defeating the incoming missiles. This likely means that new, space- or terrestrial-based area defense systems, such as boost intercept6 or highly capable midcourse intercept systems,7 would be required. These types of systems do not currently exist and would require significant investments to develop and deploy. Advanced terminal (or point) defenses could provide some effectiveness against these high-speed maneuverable missiles. However, such point defenses would likely only be deployed to protect high-value facilities or weapon systems; protecting all potential targets including civilian facilities could be costprohibitive. Furthermore, even if a target is equipped with advanced point defenses such that it is able to defend against an HCM or HGV, it may still be vulnerable to salvos of such weapons, especially if these simultaneous attacks use maneuverable vehicles capable of controlling the timing and direction of the attacks.

Defenders may work to develop directed energy defenses, such as lasers, but if such systems were terrestrial-based, they would be challenged by clouds or other atmospheric disturbances and by the need to hit and destroy fast-maneuvering missiles that are equipped with capable thermal protection systems. While a laser beam travels at the speed of light, rendering a near instantaneous time of flight, the beam must dwell continuously and for a significant length of time on a spot on the target to destroy it. The hypersonic weapon’s thermal protection system may inherently harden the missile against laser weapons, such that the required laser spot dwell time may be relatively long to burn through or sufficiently degrade the thermal protection system (potentially several tens of seconds or longer).8 Altitude will also contribute to these missiles’ effectiveness, at least in the near term. HCMs will likely be capable of flying at altitudes between 20 km and 30 km, and HGVs will fly at altitudes between about 40 km and 100 km. While the HCM’s flight altitudes may be within the upper end of the operating envelope of today’s most capable surface-to-air missiles, the combination of altitude, maneuverability, and speed would greatly limit the effectiveness of these defenses. HGVs will fly above the maximum effective altitudes of most surface-to-air missiles, but very likely below the altitudes where exo-atmospheric defenses are designed to intercept inbound RVs.

Long-Term Planning Perspectives for HGV and HCM

Technologies

Both HGVs and HCMs offer advanced warfighting capabilities. However, the HCM is also an important stepping-stone to larger manned and unmanned hypersonic vehicles with the potential for military and civilian uses. Prospective applications include military strike and intelligence, surveillance, and reconnaissance aircraft. Furthermore, these vehicles will offer the opportunity to test new flight designs under actual flight conditions. For example, once an HCM is fielded, states will be less reliant on ground test facilities and computer models. Instead, test vehicles will be able to investigate different materials, flight control mechanisms, and flight envelopes under actual flight conditions. Further, availability of flight test data to calibrate ground test facilities and computational models will increase greatly.

Strategic Implications of Hypersonic Weapons

Compressed Timelines

The U.S. military uses an acronym to describe the decisionmaking and action process cycle: OODA (Observe, Orient, Decide, Act). These four steps take time, and hypersonic missiles compress available response time to the point that a lesser nation’s strategic forces might be disarmed before acting. As an illustration of the time required to act with respect to an existential missile threat, the Nuclear Threat Initiative organization estimated a timeline for a U.S. response to a massive Russian intercontinental ballistic missile (ICBM) attack, as follows:9 • 0 minutes—Russia launches missiles • 1 minute—U.S. satellite detects missiles • 2 minutes—U.S. radar detects missiles • 3 minutes—North American Aerospace Defense Command (NORAD) assesses information (2 minutes max) • 4 minutes—NORAD alerts White House • 5 minutes—first detonations of submarine-launched ballistic missiles • 7 minutes—locate president and advisers, assemble them, brief them, get decision (8 minutes max) • 13 minutes—decision • 15 minutes—transmit orders to start launch sequence • 20 minutes—launch officers receive, decode, and authenticate orders • 23 minutes—complete launch sequence (2 minutes max) • 25 minutes—Russian ICBM detonations.

This timeline is not, of course, representative of two hostile parties in closer proximity or with less effective warning systems than Russia and the United States. Nor is it representative of less-than-Armageddon possibilities. However, for adjacent enemies within a 1,000-km range, a hypersonic missile traveling at ten times the speed of sound could cover that distance and reduce response times to about six minutes. 10

Targets

As discussed earlier, hypersonic missiles increase the threat over current generations of missiles in cases where the target nation has missile defenses. The targets in such nations would primarily be high value and heavily defended. Prime targets could include destroying a nation’s leadership and command and control, referred to as “decapitation,” to prevent the target nation from responding with an effective follow-on attack. Other key targets could be carrier strike groups, with the objective of striking a key blow or pushing the naval formation further from the coast. And, because of their time sensitivity, strategic forces and storage facilities for weapons of mass destruction (WMDs) could warrant hypersonic attack.

Implications for Targeted Nations

Any government faced with the possibility that hypersonic missiles would be employed against it—particularly in a decapitating attack— would plan countermeasures, many of which could be destabilizing. For example, countermeasures could include devolution of strategic forces’ command and control so that lower levels of authority could execute a strategic strike, which would obviously increase the risk of accidental strategic war; or strategic forces could be more widely dispersed— a tactic risking greater exposure to subnational capture. An obvious measure would be a launch-on-warning posture—a hair-trigger tactic that would increase crisis instability. Or the target nation could adopt a policy of preemption during a crisis—guaranteeing highly destructive military action.

To be sure, such measures could be invoked against threats from current types of missiles.11 But, for nations with effective ballistic mis sile and/or cruise missile defenses in the time frame when hypersonic missiles might proliferate, the hard choices would be forced when facing hypersonic threats.

Advanced nations with adequate resources could take other steps against hypersonic threats. They could strengthen the resilience of their command and control, harden the siting of their strategic forces, and make a deterrent force mobile or sea-based. These tactics may or may not be effective, especially for lesser nations. And they certainly will be expensive—putting them out of reach of some. Even for major powers, the proliferation of hypersonic missiles will create new threats by allowing lesser powers to hold them at risk of effective missile attacks especially against “unhardened” targets, e.g., cities. Over the coming decades, the ability of a lesser nation with a handful of ICBMs to threaten major powers will continue to decrease as wide area missile defenses continue to improve. However, HGVs and HCMs will be more difficult to defend against.

Implications for Major Powers

The ability of hypersonic missiles to penetrate advanced missile defenses will increase the risks for nations with such defenses. Lesser powers with hypersonic weapons may see these weapons as a deterrent against greater power intervention, and feel free to pursue potentially destabilizing regional agendas. Moreover, lesser nations with hypersonic missiles could affect the force deployments of major powers. As noted above, carrier strike groups might be pushed further out to sea or an intervening power’s regional military bases might become exposed to more effective attacks.

#### Hypersonics are uniquely destabilizing

Klare, 19 — Michael T. Klare; PhD, Professor emeritus of peace and world security studies at Hampshire College and senior visiting fellow at the Arms Control Association.; (June 2019; "An ‘Arms Race in Speed’: Hypersonic Weapons and the Changing Calculus of Battle;" Arms Control Association; https://www.armscontrol.org/act/2019-06/features/arms-race-speed-hypersonic-weapons-changing-calculus-battle; //GrRv)

Escalation Risks and ‘Entanglement’ Many weapons can be employed for offensive and defensive purposes, but hypersonic weapons, especially those designed for use in a regional context, are primarily intended to be used offensively, to destroy high-value enemy assets, including command-and-control facilities. This raises two major concerns: the risk of rapid escalation from a minor crisis to a full-blown war and the unintended escalation from conventional to nuclear warfare.That hypersonic weapons are being designed for offensive use at an early stage in a conflict has been evident in U.S. strategic policy from the beginning. Claiming that a major adversary might try to hide or move critical assets at the outbreak of a crisis to protect them from U.S. air and missile strikes, the Pentagon hoped the prompt global-strike program would enable U.S. forces to attack those targets with minimal warning. As this program got under way, hypersonic weapons became the technology of choice for its implementation. “Systems that operate at hypersonic speeds … offer the potential for military operations from longer ranges with shorter response times and enhanced effectiveness compared to current military systems,” states the U.S. Defense Advanced Research Projects Agency. Such munitions, it adds, “could provide significant payoff for future U.S. offensive strike operations, particularly as adversaries’ capabilities advance.”12 Most of the hypersonic weapons being developed by the U.S. military, including the Air Force cruise missile and the Navy’s sea-launched system, are intended for strikes against key enemy assets at an early stage of conflict, when speed confers a significant advantage. Certain Russian weapons, such as the Kinzhal, also seem intended for this purpose. Some analysts fear that the mere possession of such weapons might induce leaders to escalate a military clash at the very outbreak of a crisis—believing their early use will confer a significant advantage in any major engagement that follows—while reducing the chances of keeping the fighting limited. It is easy to imagine, for example, how a clash between U.S. and Chinese naval vessels in the South China Sea, accompanied by signs of an air and naval mobilization on either or both sides, might prompt one combatant to launch a barrage of hypersonic weapons at all those ships and planes and their command-and-control systems, hoping to prevent their use in any full-scale encounter. This might make sense from a military perspective, but would undoubtedly prompt a fierce counterreaction from the injured side and restrict efforts to halt the fighting at a lower level of violence. The introduction of hypersonic weapons also raises concerns over the escalation from conventional to nuclear warfare. The United States has focused primarily on the development of hypersonic weapons carrying conventional warheads, but there is no fundamental reason why they could not be nuclear armed. Indeed, Russia’s Avangard missile is intended to deliver a nuclear warhead, and it is assumed that China’s DF-ZF is also designed with this in mind. This leads to what is called “warhead ambiguity”: the risk that a defending nation, aware of an enemy’s hypersonic launch and having no time to assess the warhead type, will assume the worst and launch its own nuclear weapons.13 Concern over this risk has led the U.S. Congress to bar funding for the development of ICBM-launched hypersonic glide vehicles, thereby helping to propel the Pentagon’s shift away from such systems and toward the development of medium-range weapons more suitable for use in a regional context. Nevertheless, warhead ambiguity will remain a feature of any future landscape involving the deployment of multiple hypersonic weapons, as a defender will never be certain that an enemy’s assault is entirely non-nuclear. With as little as five minutes to assess an attack—the time it would take a hypersonic glide vehicle to traverse 2,000 miles—a defender would be understandably hard pressed to avoid worst-case assumptions. Equally worrisome is the danger of “target ambiguity”: the possibility that a hypersonic attack, even if conducted with missiles known to be armed only with conventional warheads, would endanger the early-warning and command-and-control systems a defender uses for its nuclear and conventional forces, leading it to fear the onset of a nuclear attack. This is especially dangerous in light of what James Acton, a security analyst at the Carnegie Endowment for International Peace, calls the “entanglement” problem. Although almost everything involving nuclear decision-making is secret, the nuclear and conventional command-and-control systems of the major powers are widely assumed to be interconnected, or entangled, making it difficult to clearly distinguish one from another. Therefore, any attack on command-and-control facilities at the onset of crisis, however intended, could be interpreted by the defender as a prelude to a nuclear rather than a conventional attack and prompt the defender to launch its own nuclear weapons before they are destroyed by an anticipated barrage of enemy bombs and missiles.14 All this points to yet another concern related to the impact of emerging technologies on the future battlefield: the risk that nuclear-armed nations, fearing scenarios of just this sort, will entrust more and more of their critical decision-making to machines, fearing that humans will not be able to make reasoned judgments under such enormous time pressures. With hypersonic weapons in the arsenals of the major powers, military leaders may conclude that sophisticated artificial intelligence (AI) systems should be empowered to determine the nature of future missile attacks and select the appropriate response. This is a temptation that can only increase as hypersonic weapons are themselves equipped with AI systems, a capability being developed at Sandia National Laboratories, enabling them to select and navigate to an array of potential targets.15 This convergence of advanced technologies is one of the greatest concerns of analysts who fear the loss of human control over the pace of combat. Paul Scharre, a program director at the Center for a New American Security, has warned of a “flash war” erupting when machines misinterpret radar signals and initiate catastrophic, possibly nuclear responses. “Competitive pressures in fast-paced environments threaten to push humans further and further out of the loop,” he wrote. “With this arms race in speed come grave risks,” including “a war that spirals out of control in mere seconds.”16

### 2AC – AT: China

#### Chinese hypersonics are fake.

Acton 19 – James Acton is co-director of the Nuclear Policy Program at the Carnegie Endowment for International Peace. (James Acton, "China’s ballyhooed new hypersonic missile isn’t exactly a game-changer," Washington Post, 10-4-2019, https://www.washingtonpost.com/opinions/2019/10/04/chinas-ballyhooed-new-hypersonic-missile-isnt-exactly-game-changer/, Accessed 7-20-2022, LASA-SC)

In the show of military might Tuesday to celebrate the 70th anniversary of the People’s Republic of China, one of the highlights among the weapons trundling through Tiananmen Square in Beijing was a hypersonic boost-glide missile. The exhibition of 16 DF-17 missiles (or possibly models of the real thing), displayed in public for the first time, will probably add to disquiet in the United States about a growing military imbalance, but that unease should be tempered by a few practical considerations.

For the past few years, scientists, Pentagon officials and uniformed military leaders have warned about China’s apparent lead in hypersonic technology, which they often describe as a “game changer.” Over the long term, hypersonic missiles could indeed provide China (and Russia, too) with a uniquely threatening capability, but there is time for a considered response: The DF-17 and its immediate successors are unlikely to add much, if anything, to China’s already impressive military forces.

To be sure, the DF-17 is a powerful weapon, even armed with a conventional warhead, as it will be, according to the parade announcer in Beijing. The missile consists of a rocket that launches a glider, presumably at more than five times the speed of sound. (That’s what “hypersonic” means.) The U.S. intelligence community reportedly estimates the missile’s range at 1,100 to 1,550 miles, and Chinese state media has described it as being capable of conducting “precision strikes.” Not on the U.S. mainland, though; Beijing is nearly 6,000 miles from San Francisco.

But the important question isn’t whether the DF-17 poses a danger to U.S. and allied forces in the western Pacific. It does. Better to ask whether the DF-17 significantly enhances the threat from China’s formidable arsenal of existing weapons, in particular its force of between 900 and 1,950 ballistic missiles, most of them conventionally armed, with ranges of less than 1,850 miles.

There are good reasons to question how much additional capability the DF-17 will provide. Chinese ballistic missiles are based on mature technology, and the Pentagon has determined that they are able to strike their targets precisely. Chinese propaganda, by contrast, is the only unclassified source for the accuracy of the first-of-its-kind DF-17.

Moreover, hypersonic gliders are actually at a speed disadvantage compared with ballistic missiles of the same range. Ballistic missiles are also boosted to high speed by large rockets, before arcing through the vacuum of space. A glider, by contrast, spends most of its trajectory in the atmosphere, using aerodynamic lift to extend its range. The increased range comes at the cost of faster deceleration caused by atmospheric friction. One implication of this reduced speed is that hypersonic gliders may be more vulnerable to interception by U.S. “point” missile defenses (especially after such defenses have been optimized for that purpose). Like cornerbacks in football, point missile defenses are intended to protect small but important areas — such as U.S. military bases in the western Pacific.

The main advantage claimed for hypersonic gliders is their ability to maneuver during flight. If capable of adjusting their heading rapidly enough, these gliders could indeed defeat defenses by dodging interceptors. But executing rapid maneuvers without sacrificing the accuracy necessary for military effectiveness presents a significant technical challenge. There is no evidence that China, or any other state, has yet surmounted it.

That said, hypersonic weapons do present a serious challenge for the United States — but the threat is likely to emerge slowly.

### 2AC – AT: Russia

#### Ukraine proves Russian hypersonics fail.

Grady 22 – John Grady, a former managing editor of Navy Times, retired as director of communications for the Association of the United States Army. His reporting on national defense and national security has appeared on Breaking Defense, GovExec.com, NextGov.com, DefenseOne.com, Government Executive and USNI News. (John Grady, "Russian Hypersonic Missiles Underperforming in Ukraine Conflict, NORTHCOM Says," USNI News, 5-19-2022, https://news.usni.org/2022/05/19/russian-hypersonic-missiles-underperforming-in-ukraine-conflict-northcom-says, Accessed 7-20-2022, LASA-SC)

The Kremlin’s most advanced missile systems are not operating effectively in Russia’s conflict with Ukraine, U.S. Northern Command chief Air Force Gen. Glen VanHerck said Wednesday before the Senate Armed Services strategic forces subcommittee.

The Russians have “had challenges with some of their hypersonic missiles as far as accuracy,” he told the panel.

“I will tell you, originally, we thought they weren’t working at a rate that was as good as ours. But what I would say is, they’re on par with our capabilities, not all of them, specifically their cruise missiles,” VanHerck said.

Despite Russia’s overall inaccuracy in firing all of its missiles, John Plumb, the assistant secretary of defense for space policy, said “the sobering reality” is that the estimated 1,500 missiles Russia has fired since the Feb. 24 invasion targeted Ukrainian civilians.

The witnesses agreed it was the largest employment of missile systems since World War II.

As the fighting in Ukraine has evolved, Army Lt. Gen. Daniel Karbler said Kyiv needs offensive and defensive missile systems for a layered defense and to stymie maneuvers on the ground. Among the systems he mentioned were Patriot, Terminal High Altitude Area Defense (THAAD) and specialized mortars.

## AT Meltdowns Good

### 2AC---Meltdowns Bad

#### Meltdowns cause global fallout.

Sidney D. Drell 09. Professor emeritus of theoretical physics at the SLAC National Accelerator Laboratory at Stanford University, senior fellow at the Hoover Institution, and a member of the President's Foreign Intelligence Advisory Board and Science Advisory Committee. The Nuclear Enterprise, High-Consequence Accidents: How to Enhance Safety and Minimize Risks in Nuclear Weapons and Reactors, pg. 1-3

We live in dangerous times for many reasons. Prominent among them is the existence of a global nuclear enterprise made up of weapons that can cause damage of unimaginable proportions and power plants at which accidents can have severe, essentially unpredictable consequences for human life. For all of its utility and promise, the nuclear enterprise is unique in the enormity of the vast quantities of destructive energy that can be released through blast, heat, and radioactivity. We addressed just this subject in a conference in October 2011 at Stanford University's Hoover Institution. The complete set of papers prepared for the conference is reproduced in this book. The conference included experts on weapons, on power plants, on regulatory experience, and on the development of public perceptions and the ways in which these perceptions influence policy7. The reassuring outcome of the conference was a general sense that the U.S. nuclear enterprise currently meets very high standards in its commitment to safety and security. That has not always been the case in all aspects of the nuclear enterprise. And the unsettling outcome of the conference was that it will not be the case globally unless governments, international organizations, industry7, and media recognize and address the nuclear challenges and mounting risks posed by a rapidly changing world. The acceptance of the nuclear enterprise is now being challenged by concerns about the questionable safety and security of programs primarily in countries relatively new to the nuclear enterprise, and the potential loss of control to terrorist or criminal gangs of fissile material that exists in such abundance around the world. In a number of countries, confidence in nuclear energy production was severely shaken in the spring of 2011 by the Fukushima nuclear reactor plant disaster. And in the military sphere, the doctrine of deterrence that remains primarily dependent on nuclear weapons is seen in decline due to the importance of non-state actors such as al Qaeda and terrorist affiliates that seek destruction for destruction's sake. We have two nuclear tigers by the tail. When risks and consequences are unknown, undervalued, or ignored, our nation and the world are dangerously vulnerable. Nowhere is this risk-consequence equation more relevant than with respect to the nucleus of the atom. The nuclear enterprise was introduced to the world by the shock of the devastation produced by two atomic bombs hitting Hiroshima and Nagasaki. Modern nuclear weapons are far more powerful than those early bombs, which presented their own hazards. Early research depended on a program of atmospheric testing of nuclear weapons. In the early years following World War II, the impact and the amount of radioactive fallout in the atmosphere generated by above-ground nuclear explosions was notfully appreciated. During those years, the United States and also the Soviet Union conducted several hundred tests in the atmosphere that created fallout. The recent Stanford conference focused on a regulatory weak point from that time that exists in many places today, as the Fukushima disaster clearly indicates. The U.S. Atomic Energy Commission (AEC) was initially assigned conflicting responsibilities: to create an arsenal of nuclear weapons for the United States to confront a growing nuclear-armed Soviet threat; and, at the same time, to ensure public safety from the effects of radioactive fallout. The AEC was faced with the same conundrum with regard to civilian nuclear power generation. It was charged with promoting civilian nuclear power and simultaneously protecting the public. Progress came in 1963 with the negotiation and signing of the Limited Test Ban Treaty (LTBT) banning all nuclear explosive testing in the atmosphere (initially by the United States, the Soviet Union, and the United Kingdom). With the successful safety7 record of the U.S. nuclear weapons program, domestic anxiety about nuclear weapons receded somewhat. Meanwhile, public attitudes toward nuclear weapons reflected recognition of their key role in establishing a more stable nuclear deterrent posture in the confrontation with the Soviet Union. The positive record on safety of the nuclear weapons enterprise in the United States—there have been accidents involving nuclear weapons, but none that led to the release of nuclear energy—was the result of a strong effort and continuing commitment to include safety as a primary criterion in new weapons designs, as well as careful production, handling, and deployment procedures. The key to the health of today's nuclear weapons enterprise is confidence in the safety7 of its operations and in the protection of special nuclear materials against theft. One can imagine how different the situation would be today if there had been a recognized theft of material sufficient for a bomb, or if one of the two four-megaton bombs dropped from a disabled B-52 Strategic Air Command bomber overflying Goldsboro, North Carolina, in 1961 had detonated. In that event, just one switch in the arming sequence of one of the bombs, by remaining in its "off position" while the aircraft was disintegrating, was all that prevented a full-yield nuclear explosion. A close call indeed! In the twenty-six years since Chernobyl, the nuclear power industry has strengthened its safety practices. Over the past decade, growing concerns about global warming and energy independence have actually strengthened support for nuclear energy in the United States and many nations around the world. Yet despite these trends, the civil nuclear enterprise remains fragile. Following Fukushima, opinion polls gave stark evidence of the public's deep fears of the invisible force of nuclear radiation, shown by public opposition to the construction of new nuclear power plants in close proximity. It is not simply a matter of getting better information to the public but of actually educating the public about the true nature of nuclear radiation and its risks. Of course, the immediate task of the nuclear power component of the enterprise is to strive for the best possible safety record with one overriding objective: no more Fukushimas. Another issue that must be resolved involves the continued effectiveness of a policy of deterrence that remains primarily dependent upon nuclear weapons, and the hazards these weapons pose due to the spread of nuclear technology and material. There is growing apprehension about the determination of terrorists to get their hands on weapons or, for that matter, on the special nuclear material—plutonium and highly enriched uranium—that fuels them in the most challenging step toward developing a weapon. The global effects of a regional war between nuclear-armed adversaries such as India and Pakistan would also wield an enormous impact, potentially involving radioactive fallout at large distances caused by a limited number of nuclear explosions. This is true as well for nuclear radiation from a reactor explosion—fallout at large distances would have a serious societal impact on the nuclear enterprise. There is little understanding of the reality and potential danger of consequences if such an event were to occur halfway around the world. An effort should be made to prepare the public by providing information on how to respond to such an event.

#### Extinction

Dave Hodges 19—Editor and Host of The Common Sense Show, internally citing Judy Haar, a recognized expert in nuclear plant failure analyses AND a source at the Palo Verde Nuclear power plant, 12/3/2019, “How the Coming Cascadia Subduction Zone Event Will Produce An Extinction Level Event (Part One)”, The Common Sense Show, <https://thecommonsenseshow.com/activism-agenda-21-conspiracy/how-coming-cascadia-subduction-zone-event-will-produce-extinction-level-event-part-one>]

A more detailed analysis reveals that the spent fuel pools carry depleted fuel for the reactor. Normally, this spent fuel has had time to considerably decay and therefore, reducing radioactivity and heat. However, the newer discharged fuel still produces heat and needs cooling. Housed in high density storage racks, contained in buildings that vent directly into the atmosphere, radiation containment is not accounted for with regard to the spent fuel racks. In other words, there is no capture mechanism. In this scenario, accompanied by a lengthy electrical outage, and with the emergency power waning due to either generator failure or a lack of diesel needed to power the generators, the plant could lose the ability to provide cooling. The water will subsequently heat up, boil away and uncover the spent fuel rods which required being covered in at least 25 feet of water to remain benign from any deleterious effects. Ultimately, this would lead to fires as well and the release of radioactivity into the atmosphere. This would be the beginning of another Fukushima event right here on American soil. Both my source and Haar shared exactly the same scenario about how a meltdown would occur. Subsequently, I spoke with Roger Landry who worked for Raytheon in various Department of Defense projects for 28 years, many of them in this arena and Roger also confirmed this information and that the above information is well known in the industry.

Now that the danger is exposed, let's ask the earthquake question. When the Canadian Subduction Zone goes critical, this will cause a loss of power. Will the power be restored in 7-30 days, which is the time that all nuclear power plants are designed to be offline and still meet the cooling of the fuel rods question? The answer is frightening. If power is not restored, and that is assuming the structure of the plant is still intact following the earthquake, the authorities would have 1-4 weeks to restore power, at most.

In conclusion, we must face the possibility that when we mix in nuclear power plants with the Cascadian Subduction Zone event, we are facing an extinction level event. Through the presence of multiple nuclear power plant failures, all life on the planet will eventually be put at risk.

#### Meltdowns cause extinction

Christopher Allen Slocum 15, VP @ AO&G, “A Theory for Human Extinction: Mass Coronal Ejection and Hemispherical Nuclear Meltdown,” 07/21/15, The Hidden Costs of Alternative Energy Series, http://azoilgas.com/wp-content/uploads/2018/03/Theory-for-Human-Extinction-Slocum-20151003.pdf

With our intelligence we have littered the planet with massive spent nuclear fuel pools, emitting lethal radiation in over-crowded conditions, with circulation requirements of electricity, water-supply, and neutron absorbent chemicals. The failure of any of these conditions for any calculable or incalculable reason, will release all of a pool’s cesium into the atmosphere, causing 188 square miles to be contaminated, 28,000 cancer deaths and $59 billion in damage. As of 2003, 49,000 tons of SNF was stored at 131 sites with an additional 2,000-2,400 metric tons produced annually. The NRC has issued permits, and the nuclear industry has amassed unfathomable waste on the premise that a deep geological storage facility would be available to remediate the waste. The current chances for a deep geological storage facility look grim. The NAS has required geologic stability for 1,000,000 years. It is impossible to calculate any certainty 1,000,000 years into the future. Humanity could not even predict the mechanical failures at Three Mile Island or Chernobyl, nor could it predict the size of the tsunami that triggered three criticality events at Fukushima Daiichi. These irremediable crises span just over 70 years of human history.

How can the continued production and maintenance of SNF in pools be anything but a precedent to an unprecedented human cataclysm? The Department of Energy’s outreach website explains nuclear fission for power production, providing a timeline of the industry. The timeline ends, as does most of the world’s reactor construction projects in the 1990s, with the removal of the FCMs from Three Mile Island. One would think the timeline would press into the current decade, however the timeline terminates with the question, “How can we minimize the risk? What do we do with the waste?” (The History of Nuclear Energy 12). Nearly fifteen years into the future, these questions are no closer to an answer. The reactors at Fukushima Daiichi are still emitting radioisotopes into the atmosphere, and their condition is unstable. TEPCO has estimated it could take forty years to recover all of the fuel material, and there are doubts as to whether the decontamination effort can withstand that much time (Schneider 72). A detailed analysis of Chernobyl has demonstrated that nuclear fall-out, whether from thermonuclear explosions, spent fuel pool fires, or reactor core criticality events are deleterious to the food-chain. Cesium and strontium are taken into the roots of plants and food crops, causing direct human and animal contamination from ingestion, causing cancer, teratogenicity, mutagenesis and death. Vegetation suffers mutagenesis, reproductive loss, and death. Radioactive fields and forest floors decimate invertebrate and rodent variability and number necessary to supply nature’s food-chain and life cycles. The flesh and bones of freshwater and oceanic biota contribute significantly to the total radiation dose in the food-chain. Fresh water lakes, rivers and streams become radioactive. Potable aquafers directly underlying SNFs and FCMs are penetrated by downward migration of radioisotopes. Humans must eat to live. Humans must have water. No human can survive 5 Sv of exposure to ionizing radiation, many cannot survive exposure to 1 Sv.

Realizing the irremediable devastation caused by one thermonuclear warhead, by one Chernobyl, by one Fukushima Daiichi, it remains to be said that the earth can handle as many simultaneous loss of coolant failures as nature can create. Humanity cannot. It is not good enough to lead by relegating probable human wide extinction phenomena to an appeal to lack of evidence. Policy cannot indefinitely ignore responsibility by requiring further study. Nor can leadership idle into cataclysm by relying on the largest known natural phenomena of the last 200 years. Permitting construction and continued operation of malefic machinery, based on 200 years of cataclysmic experience is a protocol for calamity. Of coronal mass ejections, Hapgood warns, that we need to prepare for a once-in-1000-year event, not just simulate infrastructure safeties by the measure of what we have seen in the past. The same is true for all natural phenomena. The future of humanity is too precious to operate with such insouciance. The engineering is not good enough. It never will be. Nature is too unpredictable, and nuclear power is too dangerous.

### 2AC---Nuclear Good

#### Nuclear energy is at a crossroads---capital costs and burdensome regulations prevent it from solving existential warming and resource conflicts

**Gray 9** [John Gray, Associate at Perkins Coie, Spring, 2009, “Comment: Choosing the Nuclear Option: The Case for a Strong Regulatory Response to Encourage Nuclear Energy Development,” Arizona State Law Journal, 41 Ariz. St. L.J. 315, lexis]

Although these events are significant, this Comment's thesis remains. If anything, the current economic and political situation heightens the need for alternative energy. The nuclear genie is out of the bottle, and countries' quests for nuclear weapons are inevitable. This quest will continue with or without nuclear energy. Policymakers and the nuclear industry must encourage nuclear development in a cautious and transparent way, ensuring safe domestic development and responsible international leadership. The stakes are too high to abandon nuclear energy immediately: Nuclear power is essential to environmental protection and economic sustainability, but the industry requires strong governmental support to spur nuclear power's development. Furthermore, these events do not appear to have dissuaded the nuclear industry, as nuclear power seems primed for a revival. n8 For the first time in several decades, energy companies are pursuing nuclear energy, waiting to build new power plants as soon as construction becomes affordable. n9 This [\*317] revival, however, depends on the proper governmental support. n10 One recently-proposed support would have the federal government guarantee up to $ 122 billion in loans for nuclear power plant construction, which would lower the perceived financial risk involved in alternative energy investment. n11 Particularly given current economic conditions, policymakers should consider loan guarantees as part of a multi-faceted nuclear power development strategy. Loan guarantees alone, however, should not be the sole instrument by which to encourage nuclear energy. Fossil fuel regulation must also occur to help make nuclear power economically competitive and profitable for investors in the short-term, regardless of whether loan guarantees lessen investment risk. Government also must take steps to give nuclear power the same treatment other alternative energies receive. Including nuclear power in renewable portfolio standards and lowering nuclear power licensing costs would be two important steps to that end. I. The Changing Energy Economy Few deny that today's energy economy is rapidly changing - increasing oil and natural gas prices, instability in fossil-fuel-supplier nations, and uncertainty about various energy sources' feasibility put the nation at an energy crossroad. Some feel comfortable leaving our energy future to the free market, letting circumstances decide which energy technology carries (or drops) the nation through the rest of the twenty-first century. Another view looks beyond the free market, holding that the changing global energy economy provides only the backdrop for the broad-sweeping changes that assertive action could establish. For decades, scholars have commented extensively on this changing global energy economy. More recently, however, scholarly concerns have become a mainstay in public discourse as well - soaring oil and natural gas prices, the Iraq War, and even Al Gore's An Inconvenient Truth n12 have reified the nation's energy concerns. n13 This renewed public interest n14 gives [\*318] policymakers a unique opportunity either to take advantage of this inertia, carefully crafting a solvent energy policy, or to allow the unpredictable market to choose the direction itself. Policymakers must choose the former. As this Comment will show, many energy sources have the opportunity to come to the forefront; only an active strategy ensures the proper energy sources carry us into the latter part of this century. These many energy options span the spectrums of cheap to expensive, clean to dirty, efficient to inefficient, popular to unpopular, and feasible to unfeasible. They include, among others: Oil, natural gas, coal and clean coal, solar, hydro, wind, geothermal, ethanol, biofuel, hydrogen, and nuclear. Of all these options, nuclear energy is essential to carry the nation into the next energy economy. For the first time in over thirty years, nuclear energy is primed for a potential renaissance. Although the last United States nuclear plant currently in operation was ordered in 1973, and although nuclear power has failed to emerge as a dominant energy source, n15 some predict nuclear energy could be ready for a revival. n16 With the growing cost of energy, the increased awareness of nuclear power's environmental safety, and nuclear [\*319] power's historically safe n17 and efficient performance, n18 nuclear energy has a window of opportunity to grow. However, this potential renaissance will not occur without a strong governmental commitment to the nuclear industry. Despite nuclear energy's long-term economic benefits, capital costs and regulatory requirements thwart nuclear power's continued development. Thus, policymakers must compensate for nuclear power's artificially high short-term costs and procedural requirements. While several policy options to encourage nuclear power exist, Congress should avoid the political temptations to focus on only one of several options or to give only facial support to the nuclear industry. Rather, policymakers must take a strong policy stance, combining regulations and incentives, to encourage nuclear power development. This should include a combination of several governmental actions: placing a hard cap on fossil fuel emissions, which would make alternative energy economically competitive with fossil fuels in the short term; allowing businesses to include nuclear energy as a "renewable energy" for purposes of renewable portfolio standards ("RPS"); providing additional tax credits for nuclear power development, which would allow businesses to overcome nuclear plants' high capital construction expenses; and lowering the artificially high licensing and approval costs, which would help decrease the capital cost and time required for new nuclear power plants. This combination of strong policy options would make nuclear energy more economically viable in the shortterm, allowing nuclear power's long-term efficiency to replace fossil fuels. Although this Comment's purpose is not to fully examine the benefits and detriments of various energy options, a brief discussion of some of the energy sources that could be relevant in the coming decades contextualizes the energy economy and policy alternatives. Therefore, this Comment begins by analyzing the fossil fuel energy economy, concluding that its economic and environmental implications make the current energy path unsustainable. The Comment then discusses renewable energy as a possible alternative; although renewable energies are often seen as the energies of the future, they alone cannot meet United States energy demand in a cost-efficient manner. The next analysis focuses on nuclear power as the best combination of environmental friendliness and economic feasibility. This section concludes that nuclear energy should be an important part of the next energy economy because it provides the best opportunity for long-term [\*320] economic and environmental sustainability. The Comment concludes by discussing some of the proposed methods for increasing nuclear power and by recommending a fossil fuel emissions cap, nuclear power's inclusion in renewable portfolio standards, and eased licensing and capital requirements. Such a combination strategy could help create an equal playing field, allowing nuclear power to become a substantial energy source for the coming energy economy. II. Today's Non-Nuclear Energy Options Fossil fuels dominate today's energy economy. Eighty-five percent of United States energy, including two-thirds of the electricity sector, is produced from fossil fuels, such as coal, oil, and natural gas. n19 In contrast, renewable energies, such as wind, solar, hydro, geothermal, and biomass, comprise only about seven percent of the energy sector. n20 Nuclear currently comprises approximately twenty percent of the electricity sector, far below its overall future generating capacity. n21 Fossil fuel emissions have two main negative environmental impacts: pollution, which causes health problems and environmental damage, and global warming, which has broad-reaching and potentially apocalyptic implications. n22 Although pollution's harmful effects often go unnoticed due to their systemic nature, air pollution presents serious problems. Estimates [\*321] predict worldwide pollution kills tens or even hundreds of thousands each year and puts millions more at risk through heart disease, respiratory conditions, mercury poisoning, and even ecosystem collapse. n23 If pollution is the silent killer, global warming may be the slightly longer-term, yet ultimately more dangerous, foe. Rising sea levels, giant storms, droughts, ice ages, heat waves, crop failures, disease, and plant and animal species loss are just some of the possible impact scenarios. n24 Any one of these scenarios, at its most dangerous level, has the potential to alter life on the planet permanently and beyond recognition. Furthermore, experts predict that global warming may rear its head sooner rather than later. n25 By some estimates, the planet has already begun to experience climate change's impact, making quick and effective energy policy changes essential. This section analyzes coal, oil, natural gas, and renewable energy sources in the face of the urgent need for energy policy change. A. Coal Each fossil fuel energy source also has its individual harms. Coal is the most popular electricity source in the United States, accounting for over fifty percent of the country's electricity. n26 Unfortunately, coal is also the dirtiest and most environmentally harmful energy source. Coal plants produce carbon dioxide, sulfur dioxide, and other emissions that accumulate [\*322] in the upper atmosphere, breathing air, water, and soil. n27 Specifically, coal plants produce approximately three-fifths of U.S. sulfur dioxide emissions, one-third of mercury emissions, one-quarter of nitrogen oxide emissions, and one-third of carbon dioxide air emissions. n28 Of all energy sources, therefore, coal contributes to global warming and pollution's environmental and health concerns to the greatest degree. Even "clean coal" technology, meant to reduce emissions or increase efficiency, is simply an ineffective misnomer. n29 First, businesses have not implemented clean coal on a wide scale because they lack strong immediate incentives or obligations to do so and because the technology is not substantially developed, leaving any potential positive impact very speculative. n30 In fact, the Department of Energy recently cancelled FutureGen, a new clean coal research plant, in favor of "younger, cheaper and disappointing alternatives." n31 Even when implemented, clean coal does not substantially decrease harmful emissions, but instead acts as a small band-aid to coal's systematic pollution problem. n32 In fact, even the most advanced clean coal technology realistically can provide no more than forty-three percent power plant efficiency; even this optimum level of efficiency releases huge amounts of harmful emissions. n33 [\*323] B. Oil Oil provides a smaller portion of the nation's electricity supply than coal does, but nonetheless is a major energy source and presents both extreme environmental and economic concerns. n34 Oil is the largest overall energy source in the United States, although its share of the electricity grid is smaller than its share in the transportation or home heating sectors. n35 Environmentally, oil creates large amounts of greenhouse gases and other pollutants that cause the pollution and global warming discussed above. n36 Other environmental risks from oil stem from its shipment and pipeline transportation. n37 Oil pipeline leaks pose environmental risks if oil flows from the pipes to the soil or water sources. n38 Oil tanker leaks or accidents also risk releasing millions of gallons of dangerous oil, threatening both wildlife and plant life. n39 Additionally, the oil economy threatens American and global security in several ways. First, oil-exporting countries use their trade positions to constrain American foreign policy objectives. n40 The United States must carefully frame its foreign policy such that it does not upset oil markets. n41 As long as the United States relies so heavily on oil, it must pay credence to those who control the oil supply, effectively giving both friendly and hostile nations a critical bargaining chip. n42 Second, oil dependency may create conflict between oil purchasers, who must compete for the planet's limited supply; namely, oil could strain relations between the United States and the emerging economies of China and India, all of whom must power growing [\*324] industrialized societies. n43 In other words, as fossil fuel demand continues to outpace supply, this limited-resource economy inevitably creates conflict, whether military or otherwise. n44 Third, oil dependency forces the United States to mortgage its energy future on volatile regions of the world, such as the Middle East, South Asia, and South America. n45 Such reliance allows regional instability to threaten United States oil supply and may even force the United States into conflict simply to protect its oil assets. Furthermore, although the average American likely sees rising gasoline prices as a harbinger of economic problems caused by oil's limited supply, the actual economic impact of declining oil supply will extend far beyond the gas pumps. Dangerously, this economic collapse will come sooner, rather than later, as peak oil approaches in the coming decades. n46 Even the last remaining oil is largely unavailable, because cost, technological, and political barriers prevent its use; remaining oil in other words, is only "theoretical." n47 Peak oil is the point at which global oil output reaches its maximum, the point at which the rate of production enters a terminal decline. n48 At this point, oil prices rise at an exponential and unstoppable rate because global supply cannot meet demand. n49 Peak oil would have an economic ripple effect "that would make 1929 look like a dress rehearsal and could touch off a deperate and probably violent contest for whatever oil supplies remained." n50 The rising price of oil is already impacting the economy in nearly all sectors - transportation, electricity, manufacturing. n51 Anticipated higher prices would force businesses either to endure the costs or to pass the costs on to consumers. n52 In either event, the wide-ranging economic effect would be devastating beyond recovery. Until this economic crash occurs, oil will continue to destroy the environment by depositing dangerous emissions into the atmosphere. As with coal, oil contributes strongly to pollution and global warming, risking extreme environmental damage to the planet and endangering populations' well-being. n53 Whether oil's legacy is systemic environmental and health [\*325] damage or an eventual economic or planetary collapse, oil is ultimately unsustainable. C. Natural Gas Natural gas was once hailed as a "bridge fuel", an energy source that could transition the energy economy toward an emissions-free system, but this promise was never fulfilled. n54 Natural gas is cleaner than coal and oil, and its peak is, by some estimates, less pressing than that of oil. n55 Nonetheless, honoring natural gas as an energy solution is like appreciating the frying pan vis-a-vis the fire. Ultimately, natural gas is still a limited fossil fuel resource, meaning it raises the same major concerns that oil does: It produces harmful emissions that contribute to global warming and it risks economic and political instability as global demand continues to outpace supply. n56 Natural gas also carries additional dangers related to its transportation. Namely, natural gas's flammability makes natural gas tankers a prime target for terrorist attacks. n57 A well-placed explosive could create a blast with fifty-five times the energy of the nuclear bomb detonated on Hiroshima. n58 With natural gas tankers docking in highly-populated harbor cities like New York or Boston, the casualty count of such an attack could easily number in the thousands, if not millions. n59 Finally, in addition to the terrorist risks associated with transportation, natural gas tankers inherently pose a serious environmental risk; the Federal Energy Regulatory Commission's failure to address such environmental concerns has left precious habitats, such as Mount Hope and the Taunton River, permanently damaged. n60 [\*326] D. Renewable Energies Aside from fossil fuels, a number of alternative sources produce a portion of the nation's energy. These include, among others, wind, solar, hydro, geothermal, biofuel, and ethanol. Unlike natural gas, these alternatives would be welcome because, for the most part, they create less environmental damage. n61 However, renewable energies are, at least for the foreseeable future, not technologically developed enough for policymakers to consider them as a viable solution alone. At their current levels, these alternatives can meet only a small portion of the nation's energy demand and are unlikely to provide more than twenty percent of U.S. energy consumption. n62 Renewable energies also operate at a much higher cost than that of fossil fuels or nuclear power, creating an economic drain due to its use and a business disincentive to invest in the technologies. n63 Even more discouraging, some "renewable" energy sources, such as ethanol and biodiesel, actually waste more energy than they produce. n64 Accounting for the energy costs of producing the crop and converting the crop to a usable energy resource, the overall energy loss ranges from just under thirty percent for corn and soybean energy, to 118% for sunflower energy. n65 In addition, technologies must advance not only to improve efficiency, but also to compensate for the geographical fact that certain energies are impractical in certain areas. n66 For example, solar power is impractical in the [\*327] Pacific Northwest, while hydropower and wind power are impractical in the Southwest. Furthermore, given the relative inefficiency of each renewable unit, the land area and construction required to provide a substantial power source would overburden states. n67 "Building enough wind farms, damming enough rivers, and growing enough biomass to meet global energy demands [would] wreck the environment." n68 For example, wide-scale economic and environmental impacts would result if the United States developed enough new wind turbines to provide substantial energy. n69 Such a large-scale commitment is geographically, aesthetically, environmentally, and economically unreasonable. In a vacuum, long-term feasibility and efficiency problems would be less of a concern; society could wait until the technology developed further. Certainly, renewable energies can and should play an important role in an interwoven energy economy. n70 However, today's energy economy does not exist in a vacuum. With fossil fuel use creating continual environmental damage and looming economic downfall, society does not have the luxury of waiting until alternative energies develop sufficiently. The issue becomes more time-sensitive each day, as global energy demand continues to outpace supply. Renewable energies may be a welcome addition to a diversified energy economy, but the country cannot exclusively rely on renewable sources to solve the economic and environmental problems of fossil fuels. III. Why the Nuclear Option? A. Nuclear Power's Viability Nuclear energy is the only alternative that combines current economic viability with environmental protection. Skeptics note that nuclear energy accounts for only about twenty percent of the nation's energy and that no nuclear plants currently in use have been ordered since 1973. n71 However, [\*328] these disappointing facts indicate only a historical lack of political support and capital construction initiative. As other energies become decreasingly economical and as the public becomes more supportive of alternative energy, alternative energies, such as nuclear energy, become prime targets for expansion. With nuclear plants' high energy capacity and operating efficiency, nuclear power could fill the energy demand currently met by fossil fuels, thus lowering the adverse economic and environmental impacts that coal, oil, and natural gas present. Currently, 104 licensed nuclear power plants exist in the United States, producing over 95,000 net megawatts of electricity. n72 Additionally, although new plants have not been built, nuclear plants are becoming more efficient, improving nuclear power's capability to meet the nation's energy demand. n73 Even without the benefit of strong governmental support, the nuclear industry has already proven its capacity to comprise a large portion of the nation's energy. In the electricity sector, expanded nuclear power could quickly displace coal, oil, and natural gas. n74 Even given decades of public and governmental admonishment, nuclear power still comprises about twenty percent of the nation's energy consumption. n75 Nuclear energy's true potential could be realized by building new nuclear power plants, which could compensate for growing energy demand, especially given today's efficiency standards. Furthermore, unlike renewable energies, nuclear power's high generating capacity means that nuclear power can provide a major portion of the country's energy in only a few square miles, avoiding costly expansion over large areas of land. n76 [\*329] In addition to its "land efficiency," nuclear power has extremely cost-efficient operation. For example, even accounting for the costs of uranium enrichment, management, and disposal, the average nuclear power plant is approximately three times more cost-efficient than a typical coal plant. n77 Nuclear power technology also continually improves, such as with power uprates, n78 new fuels, n79 or other methods of improving power and efficiency, therefore making the technology viable both today and in the future. Additionally, nuclear power has the most stable operating budget because its costs are more predictable; for example, uranium supply is plentiful and inexpensive, while oil and natural gas prices are volatile and increasingly expensive. n80 This stability makes nuclear power less vulnerable to price spikes that could damage the industry's viability and strain businesses. Perhaps most importantly, nuclear power is both a short and long-term solution. In the short-term, it can currently provide for the country's growing energy demand, with cost-efficient technology already in place. Nuclear technology currently exists to provide powerful and efficient energy; the fact that nuclear power is already developed to this efficiency gives it a unique advantage over other alternative energies, which are still in their infancy and thus unable to provide a large amount of power in a cost-effective manner at this time. In the long-term, nuclear power is a critical part of a cost-effective and sustainable energy economy. Nuclear power's many advantages and opportunities make it an essential energy alternative capable of providing for the country's changing needs in an environmentally-safe manner. It can prevent the pending economic collapse caused by oil and natural gas shortages, avoid the pollution and global warming dangers of fossil fuel emissions, and fill the energy gap quickly and efficiently, before fossil fuel's dangers become irreversible. n81 [\*330]

#### Warming outweighs---its *irreversible*, and *turns every impact*.

Torres 16 (Phil Torres; author, Affiliate Scholar @ Institute for Ethics and Emerging Technologies, founder of the X-Risks Institute, published articles for Bulletin of the Atomic Scientists, Salon, Journal of Future Studies, and the Journal of Evolution and Technology; 7-22-2016, "Op-ed: Climate Change Is the Most Urgent Existential Risk," FLI - Future of Life Institute, http://futureoflife.org/2016/07/22/climate-change-is-the-most-urgent-existential-risk/, accessed 8-9-2016)

For example, according to the Intergovernmental Panel on Climate Change, the effects of climate change will be “severe,” “pervasive,” and “irreversible.” Or, as [a 2016 study](http://www.climate.unibe.ch/~stocker/papers/clark16natcc.pdf) published in Nature and authored by over twenty scientists puts it, the consequences of climate change “will extend longer than the entire history of human civilization thus far.” Furthermore, [a recent article](http://advances.sciencemag.org/content/1/5/e1400253.full?con=&dom=pscau&src=syndication) in Science Advances confirms that humanity has already escorted the biosphere into the sixth mass extinction event in life’s 3.8 billion year history on Earth. Yet [another study](http://www.nature.com/nature/journal/v486/n7401/full/nature11018.html) suggests that we could be approaching a sudden, irreversible, catastrophic collapse of the global ecosystem. If this were to occur, it could result in “widespread social unrest, economic instability and loss of human life.” Given the potential for environmental degradation to elevate the likelihood of nuclear wars, nuclear terrorism, engineered pandemics, a superintelligence takeover, and perhaps even an [impact winter](https://en.wikipedia.org/wiki/Impact_winter), it ought to take precedence over all other risk concerns — at least in the near-term. Let’s make sure we get our priorities straight.

### Nuclear Good---Resource Wars

#### Energy insecurity causes nuclear war

**Cabral**, Landmark College IR professor, **2010** (Jim, “Book Review – Rising Powers, Shrinking Planet”, July, http://www.zcommunications.org/rising-powers-shrinking-planet-by-jim-cabral)

Not surprisingly, the accelerating militarization of energy procurement increases the possibilities for armed international conflict. With typical insight, Klare explains how nationalism provides momentum to this process: "The long-term risk of escalation is growing even more potent because major energy importers and exporters regularly appeal to that most dangerous of emotions, nationalism, in making their claim over the management of energy flows. Nationalistic appeals, once they have gripped a populace, almost invariably promote fierce emotion and irrationality. Add to this the fact that the leaders of most countries involved in the great energy race have come to view the struggle over hydrocarbon assets as a "zero-sum" contest—one in which a gain for one country almost always represents a loss for others. A zero-sum mentality leads to a loss of flexibility in crisis situations, while the lens of nationalism turns the pursuit of energy assets into a sacred obligation of senior government officials." The "competitive arms transfers" that represent the militarization of energy procurement also have another disturbing upshot: strengthening and legitimizing repressive, corrupt regimes. In the case of U.S. arms recipients, the list is long and growing. It includes long-time allies in the Persian Gulf region—Saudi Arabia most notably—whose anachronistic social policies effectively reduce women to the status of second class citizens; corruptible African governments in Nigeria, Chad, and Angola, where— along with off-shore drilling sites along the continent's west coast —U.S.-based oil companies such as Exxon and Chevron currently operate; and more recent allies in the energy rich Caspian Sea region, including what Klare refers to as the "autocratic regimes" of Kazakhstan, Kyrgyzstan, and Uzbekistan. While the governments of the oil rich Persian Gulf have long been wooed with deficit countries' military largess, the emergence of the Caspian Sea region's governments as coveted allies may come as a bit of a surprise to some. Klare soberly sketches out a "three-way struggle for geopolitical advantage" in the Caspian Sea basin, as the U.S., Russia (Caspian states having formerly been Soviet republics), and China funnel arms and other forms of military assistance into the region in competition for influence there. Again stressing the dangers of an escalation of conflict, Klare notes that: "This three-way struggle…is militarizing the Caspian basin, inundating the region with advanced arms and an ever growing corps of military advisers, instructors, technicians, and combat-support personnel. [It will] heighten traditional suspicions and rivalries that have long plagued the region. The Great Powers are not only adding tinder to possible future fires, but also increasing the risk that they will be caught in any conflagration."

#### Independently scale up of nuclear energy solves conflict

Michael Shellenberger, 8-29-2018, President of Environmental Progress, "For Nations Seeking Nuclear Energy, The Option To Build A Weapon Remains A Feature Not A Bug", Forbes, https://www.forbes.com/sites/michaelshellenberger/2018/08/29/for-nations-seeking-nuclear-energy-the-option-to-build-a-weapon-remains-a-feature-not-a-bug/#55aaf61b2747

In 2015, two scholars at Texas A&M university, Matthew Fuhrmann and Benjamin Tkach, set out to answer two questions: how many nations have the ability to build a weapon? And what impact does nuclear weapons “latency” have on war? A growing body of research had found that latency deters against military attacks, Fuhrmann and Tkach noted. But with Israel and U.S. threatening pre-emptive action against Iran, could latency also be a threat to peace? Fuhrmann and Tkach found that 31 nations had the capacity to enrich uranium or reprocess plutonium, and that 71 percent of them created that capacity to give themselves weapons latency. What was the relationship between nuclear latency and military conflict? It was negative. “Nuclear latency appears to provide states with deterrence-related benefits,” they concluded, “that are distinct from actively pursuing nuclear bombs.” Why might this be? Arriving at an ultimate cause is difficult if not impossible, the authors note. But one obvious possibility is that the “latent nuclear powers may be able to deter conflict by (implicitly) threatening to ‘go nuclear’ following an attack.” Nuclear isn’t the first energy technology whose adoption was driven by national security. Before World War I, the British Navy switched to petroleum-powered ships that could travel twice as far, emit less smoke (that potential enemies could see), and refuel more quickly than coal-powered ones. And today’s efficient natural gas turbines exist in large part thanks to decades of military procurement of jet turbines. Every past energy transition has followed the same progression. The new fuel, whether coal, oil, natural gas, or uranium, starts out as a premium product more expensive than the incumbent and comes down in price over time. For early adopters of the new fuel-technology combination, notes economist Roger Fouquet, a new energy source must offer some “superior or additional characteristics (e.g. easier, cleaner or more flexible to use).” After over 60 years of national security driving nuclear power into the international system, we can now add “preventing war” to the list of nuclear energy’s superior characteristics. “Your view that weapons drove nations to energy, not the other way around,” M.I.T.’s Narang told me, “may be more accurate given what we now know about many of these countries.” He pointed to Sweden and Switzerland: Both are neutral nations outside of NATO that had a very deep interest in weapons and a program through the 1960s. Today they are championed as nonproliferation nations, but both militaries were very interested in having the basis for a nuclear weapons program if necessary. Both used nuclear energy to explore those options. Before Iran, Narang notes, the nation most famous for nuclear weapons hedging was Japan. After six decades of peaceful nuclear power, it’s an open secret that Japan has created enough plutonium to create 6,000 bombs — as well as an excellent rocket program. That doesn’t mean nuclear power is a sure thing in nations with nuclear weapons. France officially pledged under its last government to sharply reduce its reliance on nuclear power. But then President Emmanuel Macron explicitly said late last year that he would not carry out the policy. Japan, which lacks a weapon, closed all of its nuclear reactors after the 2011 Fukushima panic and intends to restart just two-thirds of them. At the same time, it has shown no interest in giving up its weapons latency, with its plutonium program continuing.

### XT---Warming

#### It’s the only way to solve warming

Richard Rhodes, 7-19-2018, been a visiting scholar at Harvard, MIT, and Stanford University, "Why Nuclear Power Must Be Part of the Energy Solution", Yale E360, https://e360.yale.edu/features/why-nuclear-power-must-be-part-of-the-energy-solution-environmentalists-climate

In the late 16th century, when the increasing cost of firewood forced ordinary Londoners to switch reluctantly to coal, Elizabethan preachers railed against a fuel they believed to be, literally, the Devil’s excrement. Coal was black, after all, dirty, found in layers underground — down toward Hell at the center of the earth — and smelled strongly of sulfur when it burned. Switching to coal, in houses that usually lacked chimneys, was difficult enough; the clergy’s outspoken condemnation, while certainly justified environmentally, further complicated and delayed the timely resolution of an urgent problem in energy supply. For too many environmentalists concerned with global warming, nuclear energy is today’s Devil’s excrement. They condemn it for its production and use of radioactive fuels and for the supposed problem of disposing of its waste. In my judgment, their condemnation of this efficient, low-carbon source of baseload energy is misplaced. Far from being the Devil’s excrement, nuclear power can be, and should be, one major component of our rescue from a hotter, more meteorologically destructive world. Like all energy sources, nuclear power has advantages and disadvantages. What are nuclear power’s benefits? First and foremost, since it produces energy via nuclear fission rather than chemical burning, it generates baseload electricity with no output of carbon, the villainous element of global warming. Switching from coal to natural gas is a step toward decarbonizing, since burning natural gas produces about half the carbon dioxide of burning coal. But switching from coal to nuclear power is radically decarbonizing, since nuclear power plants release greenhouse gases only from the ancillary use of fossil fuels during their construction, mining, fuel processing, maintenance, and decommissioning — about as much as solar power does, which is about 4 to 5 percent as much as a natural gas-fired power plant. Nuclear power releases less radiation into the environment than any other major energy source. Second, nuclear power plants operate at much higher capacity factors than renewable energy sources or fossil fuels. Capacity factor is a measure of what percentage of the time a power plant actually produces energy. It’s a problem for all intermittent energy sources. The sun doesn’t always shine, nor the wind always blow, nor water always fall through the turbines of a dam. In the United States in 2016, nuclear power plants, which generated almost 20 percent of U.S. electricity, had an average capacity factor of 92.3 percent, meaning they operated at full power on 336 out of 365 days per year. (The other 29 days they were taken off the grid for maintenance.) In contrast, U.S. hydroelectric systems delivered power 38.2 percent of the time (138 days per year), wind turbines 34.5 percent of the time (127 days per year) and solar electricity arrays only 25.1 percent of the time (92 days per year). Even plants powered with coal or natural gas only generate electricity about half the time for reasons such as fuel costs and seasonal and nocturnal variations in demand. Nuclear is a clear winner on reliability. Third, nuclear power releases less radiation into the environment than any other major energy source. This statement will seem paradoxical to many readers, since it’s not commonly known that non-nuclear energy sources release any radiation into the environment. They do. The worst offender is coal, a mineral of the earth’s crust that contains a substantial volume of the radioactive elements uranium and thorium. Burning coal gasifies its organic materials, concentrating its mineral components into the remaining waste, called fly ash. So much coal is burned in the world and so much fly ash produced that coal is actually the major source of radioactive releases into the environment. In the early 1950s, when the U.S. Atomic Energy Commission believed high-grade uranium ores to be in short supply domestically, it considered extracting uranium for nuclear weapons from the abundant U.S. supply of fly ash from coal burning. In 2007, China began exploring such extraction, drawing on a pile of some 5.3 million metric tons of brown-coal fly ash at Xiaolongtang in Yunnan. The Chinese ash averages about 0.4 pounds of triuranium octoxide (U3O8), a uranium compound, per metric ton. Hungary and South Africa are also exploring uranium extraction from coal fly ash. What are nuclear’s downsides? In the public’s perception, there are two, both related to radiation: the risk of accidents, and the question of disposal of nuclear waste. There have been three large-scale accidents involving nuclear power reactors since the onset of commercial nuclear power in the mid-1950s: Three-Mile Island in Pennsylvania, Chernobyl in Ukraine, and Fukushima in Japan. The partial meltdown of the Three-Mile Island reactor in March 1979, while a disaster for the owners of the Pennsylvania plant, released only a minimal quantity of radiation to the surrounding population. According to the U.S. Nuclear Regulatory Commission: “The approximately 2 million people around TMI-2 during the accident are estimated to have received an average radiation dose of only about 1 millirem above the usual background dose. To put this into context, exposure from a chest X-ray is about 6 millirem and the area’s natural radioactive background dose is about 100-125 millirem per year… In spite of serious damage to the reactor, the actual release had negligible effects on the physical health of individuals or the environment.” The explosion and subsequent burnout of a large graphite-moderated, water-cooled reactor at Chernobyl in 1986 was easily the worst nuclear accident in history. Twenty-nine disaster relief workers died of acute radiation exposure in the immediate aftermath of the accident. In the subsequent three decades, UNSCEAR — the United Nations Scientific Committee on the Effects of Atomic Radiation, composed of senior scientists from 27 member states — has observed and reported at regular intervals on the health effects of the Chernobyl accident. It has identified no long-term health consequences to populations exposed to Chernobyl fallout except for thyroid cancers in residents of Belarus, Ukraine and western Russia who were children or adolescents at the time of the accident, who drank milk contaminated with 131iodine, and who were not evacuated. By 2008, UNSCEAR had attributed some 6,500 excess cases of thyroid cancer in the Chernobyl region to the accident, with 15 deaths. The occurrence of these cancers increased dramatically from 1991 to 1995, which researchers attributed mostly to radiation exposure. No increase occurred in adults. “The average effective doses” of radiation from Chernobyl, UNSCEAR also concluded, “due to both external and internal exposures, received by members of the general public during 1986-2005 [were] about 30 mSv for the evacuees, 1 mSv for the residents of the former Soviet Union, and 0.3 mSv for the populations of the rest of Europe.” A sievert is a measure of radiation exposure, a millisievert is one-one-thousandth of a sievert. A full-body CT scan delivers about 10-30 mSv. A U.S. resident receives an average background radiation dose, exclusive of radon, of about 1 mSv per year. The statistics of Chernobyl irradiations cited here are so low that they must seem intentionally minimized to those who followed the extensive media coverage of the accident and its aftermath. Yet they are the peer-reviewed products of extensive investigation by an international scientific agency of the United Nations. They indicate that even the worst possible accident at a nuclear power plant — the complete meltdown and burnup of its radioactive fuel — was yet far less destructive than other major industrial accidents across the past century. To name only two: Bhopal, in India, where at least 3,800 people died immediately and many thousands more were sickened when 40 tons of methyl isocyanate gas leaked from a pesticide plant; and Henan Province, in China, where at least 26,000 people drowned following the failure of a major hydroelectric dam in a typhoon. “Measured as early deaths per electricity units produced by the Chernobyl facility (9 years of operation, total electricity production of 36 GWe-years, 31 early deaths) yields 0.86 death/GWe-year),” concludes Zbigniew Jaworowski, a physician and former UNSCEAR chairman active during the Chernobyl accident. “This rate is lower than the average fatalities from [accidents involving] a majority of other energy sources. For example, the Chernobyl rate is nine times lower than the death rate from liquefied gas… and 47 times lower than from hydroelectric stations.” The accident in Japan at Fukushima Daiichi in March 2011 followed a major earthquake and tsunami. The tsunami flooded out the power supply and cooling systems of three power reactors, causing them to melt down and explode, breaching their confinement. Although 154,000 Japanese citizens were evacuated from a 12-mile exclusion zone around the power station, radiation exposure beyond the station grounds was limited. According to the report submitted to the International Atomic Energy Agency in June 2011: “No harmful health effects were found in 195,345 residents living in the vicinity of the plant who were screened by the end of May 2011. All the 1,080 children tested for thyroid gland exposure showed results within safe limits. By December, government health checks of some 1,700 residents who were evacuated from three municipalities showed that two-thirds received an external radiation dose within the normal international limit of 1 mSv/year, 98 percent were below 5 mSv/year, and 10 people were exposed to more than 10 mSv… [There] was no major public exposure, let alone deaths from radiation.” Nuclear waste disposal, although a continuing political problem in the U.S., is not any longer a technological problem. Most U.S. spent fuel, more than 90 percent of which could be recycled to extend nuclear power production by hundreds of years, is stored at present safely in impenetrable concrete-and-steel dry casks on the grounds of operating reactors, its radiation slowly declining. The U.S. Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico currently stores low-level and transuranic military waste and could store commercial nuclear waste in a 2-kilometer thick bed of crystalline salt, the remains of an ancient sea. The salt formation extends from southern New Mexico all the way northeast to southwestern Kansas. It could easily accommodate the entire world’s nuclear waste for the next thousand years. Finland is even further advanced in carving out a permanent repository in granite bedrock 400 meters under Olkiluoto, an island in the Baltic Sea off the nation’s west coast. It expects to begin permanent waste storage in 2023. A final complaint against nuclear power is that it costs too much. Whether or not nuclear power costs too much will ultimately be a matter for markets to decide, but there is no question that a full accounting of the external costs of different energy systems would find nuclear cheaper than coal or natural gas. Nuclear power is not the only answer to the world-scale threat of global warming. Renewables have their place; so, at least for leveling the flow of electricity when renewables vary, does natural gas. But nuclear deserves better than the anti-nuclear prejudices and fears that have plagued it. It isn’t the 21st century’s version of the Devil’s excrement. It’s a valuable, even an irreplaceable, part of the solution to the greatest energy threat in the history of humankind.

#### Newest studies prove nuclear energy is critical to stave off the worst effects of warming

Jonathan Tirone, 9-3-2018 Reporter citing a study by MIT “Nuclear Has to Use Climate Crisis to Justify High Cost, MIT Says” https://www.bloomberg.com/news/articles/2018-09-03/nuclear-has-to-use-climate-crisis-to-justify-high-cost-mit-says

To stave off runaway global warming by mid-century, the world’s current crop of leaders need to institute policies that dial down greenhouse gases emitted by power producers more than 90 percent, according to scientists at the Massachusetts Institute of Technology. The clearest way to get there may be by putting a price on carbon emissions and supporting clean technologies. “As of today and for decades to come, the main value of nuclear energy lies in its potential contribution to de-carbonizing the power sector,” reads the 246-page report published Monday. “Cost is the main barrier to realizing this value. Without cost reductions, nuclear energy will not play a significant role.” The study casts doubt on whether President Donald Trump’s attempts to rescue money-losing U.S. reactors while undoing climate policies can succeed. A more straightforward path to supporting the nuclear industry would be to follow the lead of other countries that have put a price on emissions, either through direct taxation or carbon-trading markets. That would give atomic operators more room to compete against cheap gas, wind and solar. In order to stabilize climate change and keep temperature rises well below 2 degrees Celsius (3.6 degrees Fahrenheit) by 2050, utilities need to cut carbon dioxide emissions to an average of about 10 grams from 500 grams a kilowatt-hour, according to the study. Failure to deploy nuclear could mean missing enormous costs savings, especially in emerging markets like China, that still rely heavily on burning coal for electricity.

#### Nuclear energy is the only technology to resolve global warming

Brook et al 14 (Barry W., Barry W. ecologist and modeler, Professor of Environmental Sustainability, University of Tasmania, “Why nuclear energy is sustainable and has to be part of the energy mix”, http://www.sciencedirect.com/science/article/pii/S2214993714000050)

Humanity must face the reality that it cannot depend indefinitely on combustion of coal, gas and oil for most of its energy needs. In the unavoidable process of gradually replacing fossil fuels, many energy technologies may be considered and most will be deployed in specific applications. However, in the long term, we argue that nuclear fission technology is the only developed energy source that is capable of delivering the enormous quantities of energy that will be needed to run modern industrial societies safely, economically, reliably and in a sustainable way, both environmentally and as regards the available resource base. Consequently, nuclear fission has to play a major role in this necessary transformation of the 21st century energy-supply system. In a first phase of this necessary global energy transformation, the emphasis should be on converting the major part of the world's electrical energy generation capacity from fossil fuels to nuclear fission. This can realistically be achieved within a few decades, as has already been done in France during the 1970s and 1980s. Such an energy transformation would reduce the global emissions of carbon dioxide profoundly, as well as cutting other significant greenhouse gases like methane. Industrial nations should take the lead in this transition. Because methane is a potent greenhouse gas, replacing coal-fired generating stations with gas-fired stations will not necessarily result in a reduction of the rate of greenhouse-gas emission even for relatively low leakage rates of the natural gas into the atmosphere. The energy sources popularly known as ‘renewables’ (such as wind and solar), will be hard pressed to supply the needed quantities of energy sustainably, economically and reliably. They are inherently intermittent, depending on backup power or on energy storage if they are to be used for delivery of base-load electrical energy to the grid. This backup power has to be flexible and is derived in most cases from combustion of fossil fuels (mainly natural gas). If used in this way, intermittent energy sources do not meet the requirements of sustainability, nor are they economically viable because they require redundant, under-utilized investment in capacity both for generation and for transmission. Intermittent energy installations, in conjunction with gas-fired backup power installations, will in many cases be found to have a combined rate of greenhouse-gas emission that is higher than that of stand-alone coal-fired generating stations of equal generating capacity. A grid connection fee, to be imposed on countries with a large intermittent generating capacity, should be considered for the purpose of compensating adjacent countries for the use of their interconnected electric grids as back-up power. Also, intermittent energy sources tend to negatively affect grid stability, especially as their market penetration rises. The alternative — dedicated energy storage for grid-connected intermittent energy sources (instead of backup power) — is in many cases not yet economically viable. However, intermittent sources plus storage may be economically competitive for local electricity supply in geographically isolated regions without access to a large electric grid. Yet nuclear fission energy will, even then, be required for the majority displacement of fossil fuels this century.

#### Nuclear powered desalination plants solve global scarcity

**Footprint Coalition 22** [Footprint Coalition, 6-24-2022, accessed on 7-23-2022, FootPrint Coalition, "Can nuclear power help solve the world's water crisis? ", https://www.footprintcoalition.com/post/can-nuclear-power-help-solve-the-world-s-water-crisis mimou]

Scientists think that nuclear-powered desalination plants could help bring potable water to drought stricken communities, accordint to a [report by the BBC](https://www.bbc.com/news/business-61483491).

According to the United Nations, [communities on every continent](https://www.unwater.org/water-facts/scarcity/) are currently experiencing water scarcity. Northern Mexico is currently experiencing [historic water shortages](https://www.reuters.com/world/americas/dams-taps-running-dry-northern-mexico-amid-historic-water-shortages-2022-06-20/). Low water levels in Iraq are [straining harvests](https://abcnews.go.com/International/wireStory/severe-water-shortages-strain-wheat-harvest-iraq-85048697). East Scotland is currently on a [high water scarcity alert](https://news.stv.tv/scotland/east-coast-of-scotland-placed-on-water-scarcity-alert-as-dry-conditions-affecting-supplies). And right now, India is experiencing a [deadly water crisis that affects the country every summer](https://www.bbc.com/news/world-asia-india-61679615).

In the United States, 32 percent of contiguous states were affected by “severe to extreme” drought, as [reported by the National Drought Report](https://www.ncei.noaa.gov/access/monitoring/monthly-report/drought/202205). Earlier this month, BBC called the events in the western US, [“a once-in-a-lifetime drought.”](https://www.bbc.com/news/world-us-canada-61669233) Climate-intensified water scarcity is one of the most prevalent problems across the globe, and nuclear power desalination plants might pose a solution.

Desalination plants help supply fresh water by removing salt from seawater. When only 2.5% of the planet’s abundance of ocean and sea water is drinkable fresh water, the demand for desalination is high. The demand for fresh water is expected to exceed the existing sustainable water supply by 40% by 2030 [as reported](https://www.google.com/search?q=drinking+water+expected+to+exceed+supply&oq=drinking+water+expected+to+exceed+supply&aqs=chrome..69i57j33i160l3j33i22i29i30.7877j0j7&sourceid=chrome&ie=UTF-8) by the U.S. Intelligence Community Assessment of Global Water Security. This is projected to be the result of a trifecta: population growth, scaling industrialization, and climate change.

However, desalination plants are one of the most expensive ways of creating safe drinking water and are an extremely energy-intensive process. However, powered by nuclear reactors, floating vessels equipped with desalination plants could travel to islands and coastlines affected by drought, bringing them not only safe drinking water but power.

#### Nuclear is the best climate option and doesn’t cause water scarcity

**ONE 19** [ONE, Office of Nuclear Energy, 10-16-2019, accessed on 7-23-2022, Office of Nuclear Energy, "5 Problems You Didn’t Know Nuclear Could Solve", https://www.energy.gov/ne/articles/5-problems-you-didnt-know-nuclear-could-solve mimou]

1. Electricity emissions

Nuclear produces clean power 24 hours a day, 7 days a week. In 2021, it generated a record 778 billion kilowatt hours of electricity and provided [50% of America’s carbon-free power](https://www.energy.gov/ne/articles/5-fast-facts-about-nuclear-energy). That’s because nuclear reactors produce massive amounts of energy through [fission — a physical process](https://www.youtube.com/watch?v=2W-GEE6YU4M) that splits uranium atoms to generate heat.  Fission doesn’t emit greenhouse gases and allows nuclear to avoid more than 471 million metric tons of carbon each year in the United States.

2. Industrial sector emissions

Nuclear power plants aren’t just an excellent source of carbon-free electricity, but they’re also a great source of thermal energy.  According to the [Environmental Protection Agency](https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions), the industrial sector accounted for 24% of U.S. greenhouse gas emissions in 2020. Many of its crucial processes require high-quality steam which is currently produced using fossil fuels. Directing heat from nuclear reactors toward industrial processes such as oil refining, district heating and fertilizers could help rapidly decarbonize these and other energy-intensive manufacturing processes.

3. Transportation sector emissions

Nearly 30% of greenhouse gas emissions comes from the transportation sector, making it the largest contributor of U.S. carbon pollution. But what if we could harness the high-temperature heat from current reactors and, in the future, advanced reactors? Nuclear’s thermal heat could be used to produce [hydrogen](https://www.energy.gov/ne/articles/could-hydrogen-help-save-nuclear), an energy carrier that is primarily created through steam methane reforming from natural gas. This process converts high-temperature steam and methane into hydrogen gas, but it also produces carbon dioxide. Nuclear can completely decarbonize the process using heat from reactors and electrolysis, the splitting of water into hydrogen and oxygen using electricity. This approach cuts carbon emissions and opens the door to other environmentally friendly advancements in electric vehicles, biofuel upgrades, and synthetic fuel production.

4. Water scarcity

Almost a third of the world doesn’t have access to clean drinking water with more than 2 billion people living in countries affected by water scarcity. These numbers are only expected to rise. Current desalination plants around the world produce 10 trillion gallons of drinking water each year. More are coming on-line to meet future water needs, which is expected to grow by up to 30% in the next three decades. Existing desalination plants are energy intensive and rely heavily on fossil fuels. An increase in plants will lead to an increase in emissions. Nuclear energy could play a major role in providing low emission energy that would get us closer to obtaining worldwide water security. A new fleet of reactors could expedite this process. [Small modular reactors (SMRs)](https://www.energy.gov/ne/nuclear-reactor-technologies/small-modular-nuclear-reactors) will offer greater flexibility in size and operation to generate both electrical energy and thermal energy right at the seawater desalination plant.

### 2AC---Nuclear Now

#### Global shift away from nuclear power now

**Rueter 21** [Gero Rueter, Rueter is an environmental reporter and editor, 4-2-2021, accessed on 7-23-2022, DW.COM, "A global nuclear phaseout or renaissance? | DW | 04.02.2021", https://www.dw.com/en/germany-looking-for-final-repository-for-nuclear-waste-global-outlook/a-56449115 mimou]

US: Future of nuclear power uncertain

The US currently has [94 nuclear reactors](https://www.worldnuclearreport.org/+-United-States-+.html) — more than any other country in the world. In 2019, they met 20% of the country's electricity demand. The US also has the oldest reactors in the world, with an average age of 40 years.

Most reactors went into operation by 1985; only one started up within the last 20 years. Construction of two new reactors began in 2013. These are expected to begin working in the next few years.

The future of nuclear power in the US is uncertain. Although there are concepts for a new generation of reactors, it is questionable whether they can one day generate electricity as cheaply as the renewable energy sector.

There is [no final repository](https://www.boell.de/en/2019/11/11/world-nuclear-waste-report) for highly radioactive waste in the US. It is stored on-site at the power plants.

Russia wants to export nuclear power

Russia currently operates 38 nuclear reactors. In 2019, they covered about 20% of electricity demand. Ten new reactors have come online over the past decade. Two nuclear power plants have been under construction and are expected to start up in the next few years. The average age of Russian reactors is 28 years.

As [Russia no longer wants to subsidize the construction](https://world-nuclear-news.org/Articles/Rosatom-postpones-fast-reactor-project-report-say) of nuclear power plants in its own country, new domestic construction projects are uncertain. Instead, the state corporation Rosatom wants to focus on building reactors abroad in the future. According to WNISR, 10 Russian reactors are currently under construction abroad, two each in Bangladesh, India, Turkey and Slovakia, and one each in Iran and Belarus.

Russia does not have a final storage facility for its highly radioactive nuclear waste. Critics have complained about the lack of transparency in the handling of nuclear waste.

Nuclear power too expensive in India

India currently has 21 nuclear reactors. In 2019, the share of nuclear power in the grid was 3%. Three reactors went online over the last 10 years, and six power plants are under construction. The average age of reactors is 23 years.

However, the expansion of nuclear power in India has been plagued by delays and mounting costs.

In 2012, the Planning Commission of India projected that the total capacity of all reactors would increase from just under 5 gigawatts (GW) to as much as 30 GW by 2027.

Today, reactors with a capacity of less than 7 GW are connected to the grid. The reactors under construction have a total capacity of 4 GW. Since the construction time of reactors in India is more than 10 years, a maximum of 11 GW will be on the grid in 2027, almost three times less than originally planned.

India does not have a final storage facility for highly radioactive nuclear waste.

China: More renewables instead of nuclear power

China is the world leader in the construction of new nuclear power plants. In the last 10 years, 37 reactors have come online. According to WNISR, 49 reactors were generating electricity at the beginning of 2021 and 17 more reactors are under construction. The share of nuclear power in the country's electricity mix was 5% in 2019.

But China also built significantly fewer reactors than originally planned in the country's five-year plan. At the same time, the expansion of renewable energies is eclipsing nuclear.

According to the National Energy Administration, 72 GW of wind power, 48 GW of photovoltaics and 13 GW of hydropower were connected to the grid in 2020. Nuclear power plants contributed only 2 GW of new capacity in the same year.

China does not have a repository for highly radioactive waste, but it is [exploring one in the Gobi Desert.](https://www.world-nuclear.org/information-library/country-profiles/countries-a-f/china-nuclear-fuel-cycle.aspx) Its nuclear waste is currently stored at various reactor sites.

France: Nuclear industry with huge losses

France has relied on nuclear power like no other country in the world in recent decades. In 2019, almost 71% of electricity demand was covered by nuclear power. Currently, 56 power plants are still in operation and one is under construction. The power plants have an average age of 36 years, and the last reactor went online in 1999.

The world's largest nuclear energy supplier and [state-owned group EDF](https://www.edf.fr/en/the-edf-group/dedicated-sections/journalists/all-press-releases/2020-half-year-results), which operates the French reactors, is indebted to the tune of €42 billion ($50.3 billion) and will have to invest an estimated [€100 billion by 2030](https://www.assemblee-nationale.fr/dyn/15/rapports/cenucl/l15b1122-tii_rapport-enquete) to keep the old reactors in operation.

It is still unclear whether new reactors for nuclear power will be built in France. The decision has been postponed and is to be taken by the new French government after the next election in 2022.

There is [no final repository](https://www.dw.com/en/germany-launches-new-search-for-permanent-nuclear-waste-disposal-site/a-55077967) for highly radioactive waste in France.

Poland: No investor for nuclear power

Poland has been planning to go nuclear since 1980 and started building two reactors, but stopped construction after the Chernobyl reactor disaster of 1986.

After that, there were repeated and ultimately unsuccessful attempts to restart construction. In 2014, the government adopted a plan to build six new reactors, with the first unit coming online in 2024. However, little has happened since then because it remains unclear how this costly program is to be financed.

#### Renewable shift is here now but rising costs and ineffective policy prevent adoption – best-case scenario still can’t solve warming

**IEA 21** [IEA, International Energy Agency, 12-1-2021, accessed on 7-23-2022, IEA, "Renewable electricity growth is accelerating faster than ever worldwide, supporting the emergence of the new global energy economy - News - IEA", https://www.iea.org/news/renewable-electricity-growth-is-accelerating-faster-than-ever-worldwide-supporting-the-emergence-of-the-new-global-energy-economy mimou]

The growth of the world’s capacity to generate electricity from solar panels, wind turbines and other renewable technologies is on course to accelerate over the coming years, with 2021 expected to set a fresh all-time record for new installations, the IEA says in a new report.

Despite rising costs for key materials used to make solar panels and wind turbines, additions of new renewable power capacity this year are forecast to rise to 290 gigawatts (GW) in 2021, surpassing the previous all-time high set last year, according to the latest edition of the IEA’s annual Renewables Market Report.

By 2026, global renewable electricity capacity is forecast to rise more than 60% from 2020 levels to over 4 800 GW – equivalent to the current total global power capacity of fossil fuels and nuclear combined. Renewables are set to account for almost 95% of the increase in global power capacity through 2026, with solar PV alone providing more than half. The amount of renewable capacity added over the period of 2021 to 2026 is expected to be 50% higher than from 2015 to 2020. This is driven by stronger support from government policies and more ambitious clean energy goals announced before and during the COP26 Climate Change Conference.

“This year’s record renewable electricity additions of 290 gigawatts are yet another sign that a new global energy economy is emerging,” said IEA Executive Director Fatih Birol. “The high commodity and energy prices we are seeing today pose new challenges for the renewable industry, but elevated fossil fuel prices also make renewables even more competitive.”

The growth of renewables is forecast to increase in all regions compared with the 2015-2020 period. China remains the global leader in the volume of capacity additions: it is expected to reach 1200 GW of total wind and solar capacity in 2026 – four years earlier than its current target of 2030. India is set to come top in terms of the rate of growth, doubling new installations compared with 2015-2020. Deployments in Europe and the United States are also on track to speed up significantly from the previous five years. These four markets together account for 80% of renewable capacity expansion worldwide.

“The growth of renewables in India is outstanding, supporting the government’s newly announced goal of reaching 500 GW of renewable power capacity by 2030 and highlighting India’s broader potential to accelerate its clean energy transition,” said Dr Birol. “China continues to demonstrate its clean energy strengths, with the expansion of renewables suggesting the country could well achieve a peak in its CO2 emissions well before 2030.”

Solar PV remains the powerhouse of growth in renewable electricity, with its capacity additions forecast to increase by 17% in 2021 to a new record of almost 160 GW. In the same time frame, onshore wind additions are set to be almost one-quarter higher on average than during the 2015-20 period. Total offshore wind capacity is forecast to more than triple by 2026.

The IEA report expects this record growth for renewables to take place despite today’s high commodity and transport prices. However, should commodity prices remain high through the end of next year, the cost of wind investments would go back up to levels last seen in 2015 and three years of cost reductions for solar PV would be erased.

Despite rising prices limiting growth, global biofuel demand in 2021 is forecast to surpass 2019 levels, rebounding from last year’s huge decline caused by the pandemic. Demand for biofuels is set to grow strongly to 2026, with Asia accounting for almost 30% of new production. India is expected to rise to become the third largest market for ethanol worldwide, behind the United States and Brazil.

Governments can further accelerate the growth of renewables by addressing key barriers, such as permitting and grid integration challenges, social acceptance issues, inconsistent policy approaches, and insufficient remuneration. High financing costs in the developing world are also a major obstacle. In the report’s accelerated case, which assumes some of these hurdles are overcome, average annual renewable capacity additions are one-quarter higher in the period to 2026 than is forecast in the main case.

However, even this faster deployment would still fall well short of what would be needed in a global pathway to net zero emissions by mid-century. That would require renewable power capacity additions over the period 2021-26 to average almost double the rate of the report’s main case. It would also mean growth in biofuels demand averaging four times higher than in the main case, and renewable heat demand almost three times higher.

### AT: Renewables Trade-Off

#### Nuke power backs up renewables and is the only way to solve in the short term – renewables aren’t clean or fast enough

Joshua S. Goldstein and Staffan A. Qvist, 10-10-2018, a professor of international relations, and Staffan A. Qvist, a clean energy engineer, "If We’Re Going To Save The Planet, We’Ve Got To Use The Nuclear Option", HuffPost, https://www.huffingtonpost.com/entry/opinion-nuclear-power-climate-change\_us\_5bbe08b0e4b01470d057b4c0

The main mitigation scenarios in the IPCC’s new report depend heavily on wind and solar power. These are both important parts of a solution, but they are harder and harder to deploy as they constitute more of the power grid. That’s because the outputs of wind and solar sources vary ― between day and night, between winter and summer, and often unpredictably. The desperately needed technologies to affordably store such renewable energy are still developing. Furthermore, renewable energies are diffuse, using large amounts of land, steel and concrete per unit of electricity generated, which makes it harder to expand them at the scale and pace called for by the IPCC’s dire timeline. Other steps can also move us in the right direction without getting close to the goal. Individuals can stop eating meat and start taking public transportation. Air conditioners can become more efficient. Farmers can change fertilizer practices. But all of these put together won’t do nearly enough, and time is running out. Here’s a different idea: Let’s look at countries or regions that have successfully cut carbon emissions. For the all-important electricity sector, the website electricitymap.org shows how many grams of carbon pollution a region creates for each kilowatt-hour of electricity it generates. For the world, the average is now about 500. It needs to drop below 50 within a couple of decades to prevent disaster. In this effort, the world can be divided into three general tiers: places that use mostly coal, including Poland, India, China and Australia (they produce about 700 to 800 grams CO2/kWh); places that have mostly replaced coal with natural gas and some renewables, such as the United States and Germany (about 500 grams; California has reached 200-300 grams with great effort); and places that have miraculously decarbonized their grids to below 50 grams. It’s true ― some places have already reached that goal. Only two methods of electricity generation account for this. Some countries such as Norway and Uruguay are lucky enough to have vast hydroelectric capacity. Most nations don’t, and new hydropower comes at enormous cost to ecosystems. The other decarbonized grids can be found in places that rely on nuclear power, such as France, Sweden, and Ontario, Canada. Nuclear power is free of carbon pollution; is highly concentrated, which minimizes environmental impacts such as those from mining and waste; and operates 24/7 without needing batteries. Most importantly, it can scale up rapidly ― exactly what’s needed to bring the IPCC’s goals out of fantasyland. Based on our analysis of many countries’ experiences, what might take a century to do with renewables alone could be done in 20 years with nuclear power. Isn’t n-n-nuclear too dangerous, too expensive, too creepy? Well, no. It’s thousands of times safer than coal, which kills hundreds of thousands of people each year. Actually, nuclear power is the safest form of energy ever used, in terms of deaths per unit of energy. Nuclear also generates far less waste than other energy sources, including renewables. The spent fuel from a lifetime of electricity use by an average American generated entirely from nuclear power would fit in a soda can. Someday we’ll bury it, but for now the waste can be left safely in its dry casks, certified for a hundred years, while we attend to bigger issues like saving the planet.

#### Won’t crowd out renewables and even if it does those aren’t feasible

Hong, Ph.D. in Sustainable energy network planning & analysis, 5/21/2015 Sanghyun, “A sustainable South Korea should stick with nuclear” http://www.eastasiaforum.org/2015/05/21/a-sustainable-south-korea-should-stick-with-nuclear/

Since the 1970s, nuclear power has provided cheap, stable and clean electricity that has fuelled South Korea’s rapid economic growth. Currently, 23 nuclear power plants with a total capacity of 21 gigawatts of electric energy are generating 27 per cent of South Korea’s total electricity needs. The wholesale price of nuclear power, US$52 per megawatt hour (MWh) in 2014, is still cheaper than coal (US$61/MWh) without any form of carbon pricing. Nuclear power, which is a zero-emission source, also has limited greenhouse gas (GHG) emissions at below 500 kilograms per megawatt hour each year. A fire drill is underway at the Weolseong Nuclear Power Complex in Gyeongju, North Gyeongsang Province, on 28 October 2014. (Photo: AAP) Is renewable energy a viable alternative to coal and nuclear in South Korea? The simple answer is no. There are already no rivers in South Korea that flow to the ocean without passing through a hydropower station. Solar power is not feasible due to low levels of solar irradiance. And even if all South Korea’s wetlands were used for tidal power, all the terrestrial and marine natural parks were changed to wind farms and all buildings were covered by photovoltaic cells, the maximum electricity generation from renewables could not provide more than 30 per cent of total electricity consumed in 2010. Since 2011 there have been a series of nuclear-related events that could change not only South Korea’s future nuclear policy, but also its environmental and economic sustainability. The Fukushima-Daiichi nuclear accident prompted aggressive anti-nuclear movements. This could have been a blow to South Korea’s nuclear industry, but there was practically no adverse impact. A survey conducted a year after the accident found that about 90 per cent of respondents still understood the need for nuclear power and about 80 per cent agreed with maintaining or increasing the share of nuclear energy in South Korea. To safeguard public support for nuclear power, the government has spent US$1 billion on safety measures to improve technological systems, including higher seismic resistance design requirements that well exceed the strongest earthquake ever observed in South Korea. But the South Korean government still decided to reduce the planned nuclear capacity share from 41 per cent to 29 per cent by 2035 after considering ‘public emotion’. This decision was not based on any scientific or economic reasoning and did not even match with the public consensus. Due to this decision, coal power capacity will increase by 85 per cent compared with 2012, while the current share of renewables will be maintained. This change does not align with the national climate change policy target of reducing GHG emissions by 30 per cent compared with ‘business as usual’ by 2035. In fact, to reduce the electricity sector’s GHG emissions while maintaining cheap prices, the share of nuclear power capacity needs to increase by over 50 gigawatts — or more than 70 per cent of total electricity consumption — by 2035. Given the current construction trend of 1.4 gigawatts per year, this target is achievable. But financing the additional nuclear power plants would cost about $US55 billion. Increasing the share of nuclear power could cause two additional problems: spent-fuel management and aged nuclear plants. By the end of 2014, overall accumulated spent-fuel in South Korea amounted to about 80 per cent of the total storage capacity. Between 2023 and 2029, 12 nuclear power plants with the capacity of 9.7 gigawatts will reach their expiration date. At the end of April 2015, the US and South Korea signed a new US–South Korea Civil Nuclear Agreement. The details have not yet been fully revealed, but this agreement is regarded as the most important move so far in dealing with spent fuel in South Korea. Since South Korea imports all its nuclear fuel, pyro-processing — which is partly allowed by the agreement — would be the ideal approach for dealing with spent fuel while securing a stable nuclear fuel supply. In the long term, new generation IV reactor technologies that will be available commercially before 2030 in South Korea could provide a technical solution for these issues. These technologies, coupled with full fuel recycling, can generate a huge amount of energy from spent fuel. The advanced reactors also have inherent passive safety features that do not require any external manipulation in the case of an emergency. But a delicate medium-term plan is also needed to extend the reactors’ lifespans. This plan should focus not only on technical issues but also on regaining public trust after widely publicised corruption scandals. After the issue of forged evaluation documents was reported in 2012, installed service parts with fake certificates were re-evaluated and replaced, following an intense investigation. There is no simple, short-term answer to tackling the endemic transparency and corruption problems in South Korea. In the long term, a public body with fairness, like a nuclear safety commission, must be established to monitor nuclear power plants, alongside internal measures proposed and implemented by KHNP. South Korea must embrace nuclear power for environmental and economic reasons. Contrary to the expectations of many ‘green’ organisations in Korea, a nuclear phase-out policy will not increase the share of renewables. Instead, it will increase coal power production to maintain the price of electricity, while abandoning the hope of a more sustainable future. The main issues surrounding nuclear power in South Korea are social and institutional problems, not technological issues. To ensure a sustainable future for South Korea, public trust must be regained and issues concerning the safe management of nuclear power plants must be resolved.

### AT: Nuclear Terror

#### US leadership prevents extinction from meltdowns and nuclear terrorism

Shultz et al 12 (George, former U.S. Secretary of State and PhD in industrial economics, and Sidney Drell – PhD in physics, arms control specialist and senior fellow at the Hoover Institution at Stanford University and a professor of theoretical physics emeritus at Stanford’s SLAC National Accelerator Laboratory, Steven P. Andreasen -- lecturer at the Humphrey School of Public Affairs at the University of Minnesota, “Reducing the Global Nuclear Risk” October 2, 2012, Policy Review, No. 175, Hoover Institution, <http://www.hoover.org/research/reducing-global-nuclear-risk>)

In the 26 years since the meltdown of the nuclear reactor at Chernobyl in Soviet-era Ukraine, the nuclear power industry has strengthened its safety practices. Over the past decade, growing concerns about global warming and energy independence have actually strengthened support for nuclear energy in the United States and many nations around the world. Yet despite these trends, the civil nuclear enterprise remains fragile. Following Fukushima, opinion polls gave stark evidence of the public’s deep fears of the invisible force of nuclear radiation, shown by public opposition to the construction of new nuclear power plants in close proximity. It is not simply a matter of getting bet­ter information to the public but of actually educating the public about the true nature of nuclear radiation and its risks. Of course, the immediate task of the nuclear power component of the enterprise is to strive for the best possible safety record. The overriding objective could not be more clear: no more Fukushimas. Another issue that must be resolved involves the continued effectiveness of a policy of deterrence that remains primarily dependent on nuclear weapons, and the hazards these weapons pose due to the spread of nuclear technology and material. There is growing apprehension about the determination of terrorists to get their hands on weapons or, for that matter, on the special nuclear material — plutonium and highly enriched uranium — that fuels them in the most challenging step toward develop­ing a weapon. The global effects of a regional war between nuclear-armed adversaries such as India and Pakistan would also wield an enormous impact, potentially involving radioactive fallout at large distances caused by a limited number of nuclear explosions. This is true as well for nuclear radiation from a reactor explosion — fallout at large distances would have a serious societal impact on the nuclear enterprise. There is little understanding of the reality and poten­tial danger of consequences if such an event were to occur halfway around the world. An effort should be made to prepare the public by providing information on how to respond to such an event. An active nuclear diplomacy has grown out of the Cold War efforts to regulate testing and reduce superpower nuclear arsenals. There is now a welcome focus on rolling back nuclear weapons proliferation. Additional important measures include the Nunn-Lugar program, started in 1991 to reduce the nuclear arsenal of the former Soviet Union. Such initiatives have led to greater investment by the United States and other governments in better security for nuclear weapons and material globally, including billions of dollars through the g8 Global Partnership Against the Spread of Weapons and Materials of Mass Destruction. The commitment to improving security of all dangerous nuclear material on the globe within four years was made by 47 world leaders who met with Presi­dent Obama in Washington, D.C., in April 2010; this commitment was reconfirmed in March 2012 at the Nuclear Security Summit in Seoul, South Korea. Many specific commitments made in 2010 relating to the removal of nuclear materials and conversion of nuclear research reactors from highly enriched uranium to low-enriched uranium fuel have already been accomplished, along with increasing levels of voluntary commitments from a diverse set of states, improving prospects for achieving the four-year goal. Three principles It is evident that globally, the nuclear enterprise faces new and increasingly difficult challenges. Successful leadership in national security policy will require a continu­ous, diligent, and multinational assessment of these newly emerging risks and consequences. In view of the seriousness of the potentially deadly consequences associated with nuclear weapons and nuclear power, we emphasize the importance of three guiding principles for efforts to reduce those risks globally: First, the calculations used to assess nuclear risks in both the military and the civil sectors are fallible. Accurately analyzing events where we have little data, identifying every variable associated with risk, and the possibility of a single variable that goes dangerously wrong are all factors that complicate risk calculations. Governments, industry, and concerned citizens must constantly reexamine the assumptions on which safety and security measures, emergency preparations, and nuclear energy production are based. When dealing with very low-probability and high-consequence operations, we typically have little data as a basis for making quantitative analyses. It is therefore difficult to assess the risk of a nuclear accident and what would contribute to it, and to identify effective steps to reduce that risk. It's important to remember that the calculations used to assess nuclear risks in the military and civil sectors are fallible. In this context, it is possible that a single variable could exceed expec­tations, go dangerously wrong, and simply overwhelm safety systems and the risk assessments on which those systems were built. This is what happened in 2011 when an earthquake, followed by a tsunami — both of which exceeded expectations based on history — overwhelmed the Fuku­shima complex, breaching a number of safeguards that had been built into the plant and triggering reactor core meltdowns and radiation leaks. This in turn exposed the human factor, which is hard to assess and can dramatically change the risk equation. Cultural habits and regulatory inadequacy inhibited rapid decision-making and crisis management in the Fukushima disaster. A more nefarious example of the human factor would be a determined nuclear terrorist attack specifically targeting either the military or civilian component of the nuclear enterprise. Second, risks associated with nuclear weapons and nuclear power will likely grow substantially as nuclear weapons and civilian nuclear energy production technology spread in unstable regions of the world where the potential for conﬂict is high. States that are new to the nuclear enterprise may not have effective nuclear safeguards to secure nuclear weapons and materials — including a developed fabric of early warning systems and nuclear confidence-building measures that could increase warn­ing and decision time for leaders in a crisis — or the capability to safely manage and regulate the construction and operation of new civilian reactors. Hence there is a growing risk of accidents, mistakes, or miscal­culations involving nuclear weapons, and of regional wars or nuclear ter­rorism. The consequences would be horrific: A Hiroshima-size nuclear bomb detonated in a major city could kill a half-million people and result in $1 trillion in direct economic damage. On the civil side of the nuclear ledger, the sobering paradox is this: While an accident would be con­siderably less devastating than the detonation of a nuclear weapon, the risk of an accident occurring is probably higher. Currently, 1.4 billion people live without electricity, and by 2030 the global demand for energy is projected to rise by about 25 percent. With the added need to mini­mize carbon emissions, nuclear power reactors will become increasingly attractive alternative sources for electric power, especially for develop­ing nations. These countries, in turn, will need to meet the challenge of developing appropriate governmental institutions and the infrastruc­ture, expertise, and experience to support nuclear power efforts with a suitably high standard of safety. As the world witnessed in Fukushima, a nuclear power plant accident can lead to the spread of dangerous radia­tion, massive civil dislocations, and billions of dollars in cleanup costs. Such an event can also fuel widespread public skepticism about nuclear institutions and technology. Some developed nations — notably Germany — have interpreted the Fukushima accident as proof that they should abandon nuclear power altogether, primarily by prolonging the life of existing nuclear reactors while phasing out nuclear-produced electricity and developing alternative energy sources. Third, we need to understand that no nation is immune from risks involving nuclear weapons and nuclear power within their borders. There were 32 so-called “Broken Arrow” accidents — nuclear accidents that do not pose a danger of an outbreak of nuclear war — involving U.S. weapons between 1950 and 1980, mostly involving U.S. Strategic Air Command bombers and earlier bomb designs not yet incorporating modern nuclear detonation safety designs. The U.S. no longer maintains a nuclear-armed, in-air strategic bomber force, and the record of incidents is greatly reduced. In several cases, accidents such as the North Caro­lina bomber incident came dangerously close to triggering catastrophes, with disaster averted simply by luck. The United States has had an admirable safety record in the area of civil nuclear power since the 1979 Three Mile Island accident in Pennsylvania, yet safety concerns persist. One of the critical assumptions in the design of the Fukushima reactor complex was that, if electrical power was lost at the plant and back-up generators failed, power could be restored within a few hours. The combined one-two punch of the earthquake and tsunami, however, made the necessary repairs impossible. In the United States today, some nuclear power reactors are designed with a comparably short window for restoring power. After Fukushima, this is an issue that deserves action — especially in light of our own Hurricane Katrina expe­rience, which rendered many affected areas inaccessible for days in 2005, and the August 2011 East Coast earthquake that shook the North Anna nuclear power plant in Mineral, Virginia, beyond expectations based on previous geological activity. Reducing risks To reduce these nuclear risks, we offer four related recommendations that should be adopted by the nuclear enterprise, both military and civilian, in the United States and abroad. First, the reduction of nuclear risks requires every level of the nuclear enterprise and related military and civilian organizations to embrace the importance of safety and security as an overarching operating rule. This is not as easy as it sounds. To a war fighter, more safety and control can mean less reliability and availability and greater costs. For a com­pany or utility involved in the construction or operation of a nuclear power plant, more safety and security can mean greater regulation and higher costs. The absence of a culture of safety and security is perhaps the most reliable indicator of an impending disaster. But the absence of a culture of safety and security, in which priorities and meaningful standards are set and rigorous discipline and accountability are enforced, is perhaps the most reliable indicator of an impending disaster. In August 2007, after a b-52 bomber loaded with six nuclear-tipped cruise missiles flew from North Dakota to Louisiana without anyone realizing there were live weapons on board, then Secretary of Defense Robert Gates fired both the military and civilian heads of the U.S. Air Force. His action was an example of setting the right priorities and enforcing accountability, but the reality of the incident shows that greater incorporation of a safety and security culture is needed. Second, independent regulation of the nuclear enterprise is crucial to setting and enforcing the safety and security rule. In the United States today, the nuclear regulatory system — in particular, the Nuclear Regu­latory Commission (nrc) — is credited with setting a uniquely high standard for independent regulation of the civil nuclear power sector. This is one of the keys to a successful and safe nuclear program. Effec­tive regulation is even more crucial when there are strong incentives to keep operating costs down and keep an aging nuclear reactor fleet in operation, a combination that could create conditions for a catastrophic nuclear power plant failure. Careful attention is required to protect the nrc from regulatory capture by vested interests in government and industry, the latter of which funds a high percentage of the nrc’s budget. In too many countries, strong, independent regulatory agencies are not the norm. The independent watchdog organization advising the Japanese government was working with Japanese utilities to influence public opin­ion in favor of nuclear power. Strengthening the International Atomic Energy Agency (iaea) so that it can play a greater role in civil nuclear safety and security would also help reduce risks,and will require substantially greater authorities to address both safety and security, and most importantly, more resources for an agency whose budget is only €333 million, with only one-tenth of that total devoted to nuclear safety and security. In addition, **exporting** “**best practices**” **of the U.S.** Nuclear Regulatory Commission — **that is, lessons of nuclear regulation, oversight, and safety learned over many decades — to other countries would pay a huge safety dividend.** Third, independent peer review should be incorporated into all aspects of the nuclear enterprise. On the weapons side, independent **experts in the U**nited **S**tates — from both within and outside the various concerned organizations — are relied on to review or “red team” each other, rigorously challenging and debating weapons and systems safety, and communicating these points up and down the line. The Institute of Nuclear Power Operations (inpo) provides strong peer review and oversight of the civil nuclear sector in the United States. Its global counterpart, the World Association of Nuclear Operators (wano), should give a higher priority to further strengthening its safety operations, in particular its peer review process, learning from the experiences of the United States and other nations. Strong outside peer review — combined with an enhanced capacity to arrange fines based on incidents occurring in far distant countries — would help states entering the world of high-consequence opera­tions to develop a **culture and standard needed to achieve an exemplary safety record.**

### AT: Prolif

#### Resurrecting commercial leadership solves safe global non-prolif regime

**Banks 13** [“The Decline of America’s Civil Nuclear Industry and its Impact on Our National Security”, February 9, 2013, Dave Banks, a policy advisor to Heartland and the Director of D.C. Operations for the Alliance of Wise Energy Decisions]

In reality, America’s nuclear energy industry is in rapid decline relative to its foreign competitors. With the aging of our civil nuclear fleet and the lack of new builds, America’s nuclear program has sharply contracted over the last few decades. In the 1980s, for example, 100 percent of equipment for U.S. nuclear plants was manufactured in America, compared to less than 25 percent today. Moreover, the U.S. share of global nuclear exports decreased significantly between 1994 and 2008, according to a U.S. government report. Specifically, the U.S. share of sensitive nuclear material exports declined from roughly 30 to 10 percent, and the country’s share of exports of nuclear reactors, major components, and equipment dropped from 11 to 7 percent.¶ There are a number of reasons for the demise of the sector, but chief among them are financing hurdles and cheaper forms of electricity generation, as well as the failure to find a permanent repository for high-level nuclear waste. More recently, cheap shale gas has become a threat to the continued operation of existing reactors – not just a deterrent to new construction. Duke Energy’s recent decision to shut down its nuclear plant in Florida, instead of repairing it was largely due to the economic benefits of fuel switching to natural gas. And late last year, Dominion announced its intention to shut down its nuclear plant in Wisconsin – a move that was also blamed on the abundance of shale gas.¶ Although energy market observers understand why our civil nuclear program is suffering, most of them do not appreciate its impact on U.S. national security, specifically on our ability to shape the global non-proliferation regime. And likewise, many nuclear proliferation experts do not appreciate the fact that U.S. influence in managing proliferation issues is largely dependent on the health of our civil nuclear sector. Certainly, most fail to recognize the primary reason why America possessed the power to define the nuclear proliferation agenda in the first place – the dominant role held by U.S. companies in providing civil nuclear energy technology and services throughout the world.¶ Some free market leaders would argue that the American consumer would be better off buying foreign made nuclear technologies if those goods were developed reliably at a lower cost. However, nuclear technology is not the average widget or gadget on sale at Target or Best Buy. The production of fissile material, which can be used to make weapons, is inherently linked to civil nuclear energy programs because it is a by-product that cannot be avoided with light water reactors.¶ Unfortunately, many of our elected and senior officials mistakenly assume that America will always have a significant diplomatic ability to shape global non-proliferation issues. However, Washington’s power to ensure that other governments follow non-proliferation guidelines will fall rapidly if we become an insignificant player in providing related technology and services.¶ Even now, countries that are looking to build their own nuclear programs are turning less and less to Washington for guidance. Instead, they are engaging our foreign competitors, who benefit from extensive state subsidies and can offer turn-key services and fuel take-back programs. And if nuclear-armed countries wish to help others build bombs, they can take advantage of loopholes in the Non-Proliferation Treaty (NPT) by exporting nuclear technologies and services that allow a country to develop the capacity to do so.

#### Nuclear energy doesn’t cause prolif

Joshua S. Goldstein and Staffan A. Qvist, 10-10-2018, a professor of international relations, and Staffan A. Qvist, a clean energy engineer, "If We’Re Going To Save The Planet, We’Ve Got To Use The Nuclear Option", HuffPost, https://www.huffingtonpost.com/entry/opinion-nuclear-power-climate-change\_us\_5bbe08b0e4b01470d057b4c0

Doesn’t nuclear power contribute to nuclear weapons proliferation? No. Weapons programs do not depend on civilian nuclear power, which operates under stringent international safeguards. The most problematic nuclear weapons countries, such as North Korea, do not even have civilian nuclear power. In fact, nuclear electricity has enabled disarmament, as nearly 10 percent of U.S. electricity in the last two decades came from dismantled Russian warheads.

#### Nuclear energy decreases the risk of preexisting nuclear prolif – fix tag

**Miller 17** [Nicholas L. Miller, Nicholas L. Miller is Assistant Professor in the Department of Government at Dartmouth College, 11-1-2017, accessed on 7-23-2022, "Why Nuclear Energy Programs Rarely Lead to Proliferation", https://direct.mit.edu/isec/article-abstract/42/2/40/12176/Why-Nuclear-Energy-Programs-Rarely-Lead-to?redirectedFrom=fulltext mimou]

In contrast to the conventional wisdom, this article argues that the link between nuclear energy programs and proliferation is overstated. Although such programs increase the technical capacity of a state to build nuclear weapons, they also have important countervailing political effects that limit the odds of proliferation. Speciªcally, nuclear energy programs (1) increase the likelihood that a parallel nuclear weapons program is detected and attracts outside nonproliferation pressures, and (2) increase the costliness of nonproliferation sanctions. These countervailing mechanisms are largely the product of policy interventions by actors who have worried since the beginning of the nuclear age that nuclear energy programs would lead to proliferation. In this sense, the long-standing belief that the expansion of such programs would result in an expansion in the number of nuclear weapons states might be at least partially viewed as a self-defeating prophecy, much like policymakers’ beliefs in nuclear domino effects or tipping points.7 Understanding the relationship between nuclear energy and the spread of nuclear weapons may be particularly pressing now for three reasons. First, nuclear energy has the potential to reduce carbon emissions and thereby help combat climate change, potentially making it an attractive option.8 Second, many observers have argued that the world is in the midst of a nuclear energy “renaissance,” or at least it was prior to the 2011 Tohoku tsunami, which caused nuclear meltdowns at Japanese nuclear power plants in Fukushima and dampened global enthusiasm for nuclear energy.9 Third, many countries currently developing nuclear energy programs are located in unstable security environments (e.g., Egypt, Saudi Arabia, Turkey, and the United Arab Emirates), which may provide them with incentives to seek nuclear weapons. Even though the relative costs of nuclear energy production have grown over time, particularly as natural gas has become cheaper,10 there are still dozens of countries that are at different stages of considering or developing nuclear energy programs.11 As a result, although such programs are unlikely to spread as quickly as many analysts anticipated prior to the Fukushima disaster, additional countries are still likely to pursue them over time.

#### Warming causes prolif

**Schwartz and Randall 3** (Peter – Chair Global Business Network, and Doug – Co-Head Global Business Network’s Consulting Practice, “An Abrupt Climate Change Scenario and Its Implications for United States National Security”, October 2003, http://www.mindfully.org/Air/2003/Pentagon-Climate-Change1oct03.htm)

The two most likely reactions to a sudden drop in carrying capacity due to climate change are defensive and offensive. The United States and Australia are likely to build defensive fortresses around their countries because they have the resources and reserves to achieve self-sufficiency. With diverse growing climates, wealth, technology, and abundant resources, the United States could likely survive shortened growing cycles and harsh weather conditions without catastrophic losses. Borders will be strengthened around the country to hold back unwanted starving immigrants from the Caribbean islands (an especially severe problem), Mexico, and South America. Energy supply will beshored up through expensive (economically, politically, and morally) alternatives such as nuclear, renewables, hydrogen, and Middle Eastern contracts. Pesky skirmishes over fishing rights, agricultural support, and disaster relief will be commonplace. Tension between the U.S. and Mexico rise as the U.S. reneges on the 1944 treaty that guarantees water flow from the Colorado River. Relief workers will be commissioned to respond to flooding along the southern part of the east coast and much drier conditions inland. Yet, even in this continuous state of emergency the U.S. will be positioned well compared to others. The intractable problem facing the nation will be calming the mounting military tension around the world. As famine, disease, and weather-related disasters strike due to the abrupt climate change, many countries’ needs will exceed their carrying capacity. This will create a sense of desperation, which is likely to lead to offensive aggression in order to reclaim balance. Imagine eastern European countries, struggling to feed their populations with a falling supply of food, water, and energy, eyeing Russia, whose population is already in decline, for access to its grain, minerals, and energy supply. Or, picture Japan, suffering from flooding along its coastal cities and contamination of its fresh water supply, eying Russia’s Sakhalin Island oil and gas reserves as an energy source to power desalination plants and energy-intensive agricultural processes. Envision Pakistan, India, and China – all armed with nuclear weapons – skirmishing at their borders over refugees, access to shared rivers, and arable land. Spanish and Portuguese fishermen might fight over fishing rights – leading to conflicts at sea. And, countries including the United States would be likely to better secure their borders. With over 200 river basins touching multiple nations, we can expect conflict over access to water for drinking, irrigation, and transportation. The Danube touches twelve nations, the Nile runs though nine, and the Amazon runs through seven.In this scenario, we can expect alliances of convenience. The United States and Canada may become one, simplifying border controls. Or, Canada might keep its hydropower—causing energy problems in the US. North and South Korea may align to create one technically savvy and nuclear-armed entity. Europe may act as a unified block – curbing immigration problems between European nations – and allowing for protection against aggressors. Russia, with its abundant minerals, oil, and natural gas may join Europe. In this world of warring states, nuclear arms proliferation is inevitable. As cooling drives up demand, existing hydrocarbon supplies are stretched thin. With a scarcity of energy supply – and a growing need for access -- nuclear energy will become a critical source of power, and this will accelerate nuclear proliferation as countries develop enrichment and reprocessing capabilities to ensure their national security. China, India, Pakistan, Japan, South Korea, Great Britain, France, and Germany will all have nuclear weapons capability, as will Israel, Iran, Egypt, and North Korea. Managing the military and political tension, occasional skirmishes, and threat of war will be a challenge. Countries such as Japan, that have a great deal of social cohesion (meaning the government is able to effectively engage its population in changing behavior) are most likely to fair well. Countries whose diversity already produces conflict, such as India, South Africa and Indonesia, will have trouble maintaining order. Adaptability and access to resources will be key. Perhaps the most frustrating challenge abrupt climate change will pose is that we’ll never know how far we are into the climate change scenario and how many more years – 10, 100, 1000 – remain before some kind of return to warmer conditions as the thermohaline circulation starts up again. When carrying capacity drops suddenly, civilization is faced with new challenges that today seem unimaginable.

### AT: Grid

#### Nuclear energy solves grid stability

**Motta 16** [Arthur, Professor of Nuclear Engineering and Materials Science and Engineering, Pennsylvania State University, “Nuclear Power Deserves A Level Playing Field,” ANS Nuclear Café, August 18, 2016, http://ansnuclearcafe.org/2016/08/18/28783/#sthash.VdRaXViT.dpuf]

Nuclear power provides other benefits in addition to clean air. Nuclear plants also provide stability to the electrical grid, as their output is constant and reliable. They are available at nearly all times and especially in times of need – for example, during severe winter weather when coal deliveries may be disrupted.

Additionally, nuclear power is a technology-intensive industry in which the United States has traditionally led the world. With each closure of an operating U.S. nuclear power plant, the infrastructure built over the past 50 years – including suppliers, vendors, operators, maintenance and manpower – becomes increasingly imperiled as it serves a dwindling number of plants. If the industry disappears here, it will be very difficult to rebuild as China and Russia becomes world leaders in nuclear technology.

Finally, nuclear power is also one of the rare industries that generates many high-paying jobs for engineers and technicians, as well as blue-collar jobs for plant workers – all of which must be sited in the United States. This is one reason why regulators in New York recently adopted a Clean Energy Standard that will provide significant yearly subsidies through 2029 to keep several existing reactors operating. Other states should consider taking similar steps to recognize the benefits of nuclear power and prevent premature plant closures. This would support their environmental goals.

In sum, there is a case for government intervention to improve the economic competitiveness of nuclear plants and avoid early closures. The nuclear industry does not need handouts, but a coherent U.S. energy policy should provide a level playing field in the electric markets by recognizing the essential contributions that nuclear power plants make toward reducing greenhouse gas emissions, ensuring reliable electricity and preserving grid stability. Failure to act could foreclose the nuclear power option in this country and make the road to clean air and energy independence in the future that much harder.

### AT: Nuclear Energy Bad

#### Cheap and ineffective Chinese reactors make their offense inevitable---only the plan can solve

**Tickell 15** [Oliver, science and environment journalist published in numerous magazines including New Scientist, New Statesman and The Economist, October 30, 2015, “Does China’s Nuclear Boom Threaten a Global Catastrophe?” http://www.counterpunch.org/2015/10/30/does-chinas-nuclear-boom-threaten-a-global-catastrophe/]

“China shows the way to build nuclear reactors fast and cheap.” That was the bullish headline in a Forbes magazine article last week. It went on to praise the scale of the planned nuclear investment in China’s new Five-Year Plan that runs from 2016 to 2020. Under the plan the government is to invest over US$100 billion to build seven new reactors a year until 2030. “By 2050”, James Conca wrote for Forbes, “nuclear power should exceed 350 GW in that country, include about 400 new nuclear reactors, and have resulted in over a trillion dollars in nuclear investment.” Now Conca is pretty enthusiastic about this. But the reality is a potential nuclear nightmare in the making. Experience to date shows that we should, on average, expect a major nuclear accident to take place for every 3,000 to 4,000 years of reactor operation. And with over 400 reactors running at once, it doesn’t take long to clock up those 3,000 years. In fact, you could reasonably expect a major Chernobyl or Fukushima level accident every seven to ten years – in China alone, if it pursues nuclear build on that scale. Just how safe is China anyway Now if China had a fantastic record of safety in its construction and other industries, maybe the odds should be made a bit longer. Swiss-style reactors might come in at only one big foulup every 10,000 years, for example. But that’s not China. This August past we had the massive fire and multiple explosions at the Port of Tianjin, that killed almost 200 people and devastated several square kilometres of the industrial zone. It later transpired that over 7,000 tonnes of hazardous chemicals were stored there, among them sodium cyanide, calcium carbide and ammonium and potassium nitrate, many of them kept in breach of regulations. The owners had links to the highest echelons of the Chinese state – something that may have ensured very light touch regulation. China has also experienced some recent high speed train crashes, the worst in July 2011. Two bullet trains collided head-on on a viaductin Wenzhou, Zhejiang province owing to faulty signalling, killing 40 people. The accident was blamed by the Chinese government itself on “design flaws and sloppy management”, according to the BBC. China also has a notoriously poor safety record in a range of industries from construction to coal mining. If anything we should expect China’s nuclear industry to be rather less safe that the western average, especially given the cacophony of new reactor designs and variations thereof under construction simultaneously at multiple sites with absolutely no history of operation – safe or otherwise. Another factor is the secrecy that surrounds nuclear contruction and operation in China. These matters simply are not reported on other than in glowing terms in the official press. And secrecy is all too often a cover for poor practice and cut corners. So in fact there’s a good case for thinking that Chinese reactors might pop, not one in every 3,000 to 4,000 years of operation, but rather more often. Every 2,000 years perhaps? At that rate we could expect a couple of major nuclear catastrophes every decade. Cheap? Some scepticism is in order Where Forbes celebrates the wonderfully low cost of Chinese nuclear power we must also be a little sceptical. for example, “Six Chinese-designed 1000 MW reactors at Yangjiang will be a huge nuclear power base for China General Nuclear, and will cost only US$11.5 billion for over 6000 MWe, a third of the cost in western countries.” Or at Changjang Unit 1, on Hainan Island, “The total cost of this first pair of Chinese-designed 600 MW units is only about US$3.15 billion.” While at Fangchenggang, “Six reactors are planned at this site at a total cost of about US$12 billion … It seems as though 5 years and about $2 billion per reactor has become routine for China.” How do we know what these reactors really cost? The fact is, we don’t. With China’s nuclear corporations under the control of various organs of state including the Communist Party and the Peoples Liberation Army, official statistics and accounts can simply not be relied upon. Nuclear construction in China must be cheaper than in the US and Europe due to lower labour costs. But if it really is that much cheaper it can only be at a huge safety penalty. Take the construction problems and delays at the two current EPR sites in Europe at Flamanville, France, and Olkiluoto, Finland, both now running about three times over original cost estimates. Many of the delays have been caused by safety failures. Over, for example, the flawed metallurgy of the Flamanville reactor vessel and concerns over the reliability of key valves in the cooling system. Now of course, if you simple ignore such problems and press ahead with construction to meet the targets set down a five-year plan, construction is a whole lot quicker and cheaper. But the chances of reactors popping in years to come is also considerably greater. Tsunami risk – not if but when It’s also instructive to look at the map of nuclear reactors scheduled for completion in the next decade provided by Forbes. The great bulk of them – 77 reactors in all – are built along China’s east and south coasts, for two reasons: that’s where the demand is, and that’s where the cooling water is readily available, from the sea. But of course that’s just the ones due to be completed in the next decade. If the full plan for 400 reactors by 2050 is fulfilled, probably some 300 of them would be sea-facing. There are, of course, nuclear hazards to inland reactors from flooding on the Yellow and Yangtse rivers and tributaries. But a much greater danger arises from the sea. China’s south and east coasts face out to seismically active waters. And as the Japanese discovered at Fukushima, nuclear power, earthquakes and tsunamis make a dangerous combination. Interest in the danger of tsunamis on China’s south and east coast was stimulated by the two Hengchun Earthquakes off Taiwan in December 2006, which damaged buildings and disrupted communications by severing undersea cables. One recent study put the risk of a powerful tsunami greater than 2m in height striking Hong Kong or Macau at about 10% over the coming century, mainly due to seismic activity in the Manila Trench. But head further north and east and the chances go up significantly to 13.34% at Shantou in Guangdong province. And it may be more than that, the authors note: “This probability estimate may increase with a recent rise in the earthquake activities, which started with the 1999 Chi-Chi earthquake, because the Taiwan region has a earthquake cycle time of around 80-100 years.” What is certain is that the tsunami hazard is real and substantial. Literature of historical seismic records of this region is “abundant”, the authors write. The northern Manila Trench near Taiwan is “is likely to have avery large earthquake in the future. In addition the regionis a volcanic belt. If volcano and earthquake occur in concert, a much larger tsunami disaster would develop. “Although the southern part of the Manila Trench is far away from the coast of China, the local historical records of this region have many tsunami earthquakes up to the magnitude of around 8.0. Since the oceanic portion of the South China Sea is mostly deep, tsunamic waves generated in the Manila Trench region can reach the coast of China with little loss in energy. “The wave energy can then be released in the shallow water region, and can impose a tremendous tsunami hazard to the coastal regions.” The world’s first truly global nuclear catastrophe I have done no study of the tsunami vulnerability of all the 300 nuclear reactors that could end up being built along China’s east and south coasts. But at least one – the CANDU reactor shown in the photo (above right) at Qinshan, where seven reactors are currently operational, looks vulnerable in the extreme. And the consequences of a really big earthquake and tsunami hitting China’s coastal array of 300 nuclear reactors would be catastrophic. Many dozens of reactors could be struck down, each doing their own ‘Fukushima’. This would not just bring massive radioactive contamination to China’s most developed, prosperous, productive and populated regions, but spread around the world in air and sea currents to make the world’s first truly global nuclear catastrophe.

### AT: Terror

#### No impact of a terror attack on a nuclear plant

WNA 16, World Nuclear Association, "Safety of Nuclear Power Reactors", May 2016, www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/safety-of-nuclear-power-reactors.aspx

Since the World Trade Centre attacks in New York in 2001 there has been increased concern about the consequences of a large aircraft being used to attack a nuclear facility with the purpose of releasing radioactive materials. Various studies have looked at similar attacks on nuclear power plants. They show that nuclear reactors would be more resistant to such attacks than virtually any other civil installations – see Appendix 3. A thorough study was undertaken by the US Electric Power Research Institute (EPRI) using specialist consultants and paid for by the US Dept. of Energy. It concludes that US reactor structures "are robust and (would) protect the fuel from impacts of large commercial aircraft".The analyses used a fully-fuelled Boeing 767-400 of over 200 tonnes as the basis, at 560 km/h – the maximum speed for precision flying near the ground. The wingspan is greater than the diameter of reactor containment buildings and the 4.3 tonne engines are 15 metres apart. Hence analyses focused on single engine direct impact on the centreline – since this would be the most penetrating missile – and on the impact of the entire aircraft if the fuselage hit the centreline (in which case the engines would ricochet off the sides). In each case no part of the aircraft or its fuel would penetrate the containment. Other studies have confirmed these findings. Penetrating (even relatively weak) reinforced concrete requires multiple hits by high speed artillery shells or specially-designed "bunker busting" ordnance – both of which are well beyond what terrorists are likely to deploy. Thin-walled, slow-moving, hollow aluminum aircraft, hitting containment-grade heavily-reinforced concrete disintegrate, with negligible penetration. But further (see Sept 2002 Science paper and Jan 2003 Response & Comments), realistic assessments from decades of analyses, lab work and testing, find that the consequence of even the worst realistic scenarios – core melting and containment failure – can cause few if any deaths to the public, regardless of the scenario that led to the core melt and containment failure. This conclusion was documented in a 1981 EPRI study, reported and widely circulated in many languages, by Levenson and Rahn in Nuclear Technology.In 1988 Sandia National Laboratories in USA demonstrated the unequal distribution of energy absorption that occurs when an aircraft impacts a massive, hardened target. The test involved a rocket-propelled F4 Phantom jet (about 27 tonnes, with both engines close together in the fuselage) hitting a 3.7m thick slab of concrete at 765 km/h. This was to see whether a proposed Japanese nuclear power plant could withstand the impact of a heavy aircraft. It showed how most of the collision energy goes into the destruction of the aircraft itself – about 96% of the aircraft's kinetic energy went into the its destruction and some penetration of the concrete – while the remaining 4% was dissipated in accelerating the 700-tonne slab. The maximum penetration of the concrete in this experiment was 60 mm, but comparison with fixed reactor containment needs to take account of the 4% of energy transmitted to the slab. See also video clip.As long ago as the late 1970s, the UK Central Electricity Generating Board considered the possibility of a fully-laden and fully-fuelled large passenger aircraft being hijacked and deliberately crashed into a nuclear reactor. The main conclusions were that an airliner would tend to break up as it hit various buildings such as the reactor hall, and that those pieces would have little effect on the concrete biological shield surrounding the reactor. Any kerosene fire would also have little effect on that shield. In the 1980s in the USA, at least some plants were designed to take a hit from a fully-laden large military transport aircraft and still be able to achieve and maintain cold shutdown.The study of a 1970s US power plant in a highly-populated area is assessing the possible effects of a successful terrorist attack which causes both meltdown of the core and a large breach in the containment structure – both extremely unlikely. It shows that a large fraction of the most hazardous radioactive isotopes, like those of iodine and tellurium, would never leave the site. Much of the radioactive material would stick to surfaces inside the containment or becomes soluble salts that remain in the damaged containment building. Some radioactive material would nonetheless enter the environment some hours after the attack in this extreme scenario and affect areas up to several kilometres away. The extent and timing of this means that with walking-pace evacuation inside this radius it would not be a major health risk. However it could leave areas contaminated and hence displace people in the same way as a natural disaster, giving rise to economic rather than health consequences.Looking at spent fuel storage pools, similar analyses showed no breach. Dry storage and transport casks retained their integrity. "There would be no release of radionuclides to the environment".Similarly, the massive structures mean that any terrorist attack even inside a plant (which are well defended) and causing loss of cooling, core melting and breach of containment would not result in any significant radioactive releases.However, while the main structures are robust, the 2001 attacks did lead to increased security requirements and plants were required by NRC to install barriers, bulletproof security stations and other physical modifications which in the USA are estimated by the industry association to have cost some $2 billion across the country.See also Science magazine article 2002 and Appendix 3.Switzerland's Nuclear Safety Inspectorate studied a similar scenario and reported in 2003 that the danger of any radiation release from such a crash would be low for the older plants and extremely low for the newer ones.The conservative design criteria which caused most power reactors to be shrouded by massive containment structures with biological shield has provided peace of mind in a suicide terrorist context. Ironically and as noted earlier, with better understanding of what happens in a core melt accident inside, they are now seen to be not nearly as necessary in that accident mitigation role as was originally assumed.

### AT: Waste

#### Waste can’t cause extinction---less than 1% chance it kills even one person---medical spending from nuclear industry taxes outweighs 80-fold

Bernard L. **Cohen 12** – Professor at the University of Pittsburgh, (Bernard L. Cohen, Apr. 24, 2012, "Nuclear Power Risk," accessed 1-4-2017, http://www.physics.isu.edu/radinf/np-risk.htm)

Radiation The principal risks associated with nuclear power arise from health effects of radiation. This radiation consists of subatomic particles traveling at or near the velocity of light---186,000 miles per second. They can penetrate deep inside the human body where they can damage biological cells and thereby initiate a cancer. If they strike sex cells, they can cause genetic diseases in progeny. Radiation occurs naturally in our environment; a typical person is, and always has been struck by 15,000 particles of radiation every second from natural sources, and an average medical X-ray involves being struck by 100 billion. While this may seem to be very dangerous, it is not, because the probability for a particle of radiation entering a human body to cause a cancer or a genetic disease is only one chance in 30 million billion (30 quintillion). Nuclear power technology produces materials that are active in emitting radiation and are therefore called "radioactive". These materials can come into contact with people principally through small releases during routine plant operation, accidents in nuclear power plants, accidents in transporting radioactive materials, and escape of radioactive wastes from confinement systems. We will discuss these separately, but all of them taken together, with accidents treated probabilistically, will eventually expose the average American to about 0.2% of his exposure from natural radiation. Since natural radiation is estimated to cause about 1% of all cancers, radiation due to nuclear technology should eventually increase our cancer risk by 0.002% (one part in 50,000), reducing our life expectancy by less than one hour. By comparison, our loss of life expectancy from competitive electricity generation technologies, burning coal, oil, or gas, is estimated to range from 3 to 40 days. There has been much misunderstanding on genetic diseases due to radiation. The risks are somewhat less than the cancer risks; for example, among the Japanese A-bomb survivors from Hiroshima and Nagasaki, there have been about 400 extra cancer deaths among the 100,000 people in the follow-up group, but there have been no extra genetic diseases among their progeny. Since there is no possible way for the cells in our bodies to distinguish between natural radiation and radiation from the nuclear industry, the latter cannot cause new types of genetic diseases or deformities (e.g., bionic man), or threaten the "human race". Other causes of genetic disease include delayed parenthood (children of older parents have higher incidence) and men wearing pants (this warms the gonads, increasing the frequency of spontaneous mutations). The genetic risks of nuclear power are equivalent to delaying parenthood by 2.5 days, or of men wearing pants an extra 8 hours per year. Much can be done to avert genetic diseases utilizing currently available technology; if 1% of the taxes paid by the nuclear industry were used to further implement this technology, 80 cases of genetic disease would be averted for each case caused by the nuclear industry. Reactor accidents The nuclear power plant design strategy for preventing accidents and mitigating their potential effects is "defense in depth"--- if something fails, there is a back-up system to limit the harm done, if that system should also fail there is another back-up system for it, etc., etc. Of course it is possible that each system in this series of back-ups might fail one after the other, but the probability for that is exceedingly small. The Media often publicize a failure of some particular system in some plant, implying that it was a close call" on disaster; they completely miss the point of defense in depth which easily takes care of such failures. Even in the Three Mile Island accident where at least two equipment failures were severely compounded by human errors, two lines of defense were still not breached--- essentially all of the radioactivity remained sealed in the thick steel reactor vessel, and that vessel was sealed inside the heavily reinforced concrete and steel lined "containment" building which was never even challenged. It was clearly not a close call on disaster to the surrounding population. The Soviet Chernobyl reactor, built on a much less safe design concept, did not have such a containment structure; if it did, that disaster would have been averted. Risks from reactor accidents are estimated by the rapidly developing science of "probabilistic risk analysis" (PRA). A PRA must be done separately for each power plant (at a cost of $5 million) but we give typical results here: A fuel melt-down might be expected once in 20,000 years of reactor operation. In 2 out of 3 melt-downs there would be no deaths, in 1 out of 5 there would be over 1000 deaths, and in 1 out of 100,000 there would be 50,000 deaths. The average for all meltdowns would be 400 deaths. Since air pollution from coal burning is estimated to be causing 10,000 deaths per year, there would have to be 25 melt-downs each year for nuclear power to be as dangerous as coal burning. Of course deaths from coal burning air pollution are not noticeable, but the same is true for the cancer deaths from reactor accidents. In the worst accident considered, expected once in 100,000 melt-downs (once in 2 billion years of reactor operation), the cancer deaths would be among 10 million people, increasing their cancer risk typically from 20% (the current U.S. average) to 20.5%. This is much less than the geographical variation--- 22% in New England to 17% in the Rocky Mountain states. Very high radiation doses can destroy body functions and lead to death within 60 days, but such "noticeable" deaths would be expected in only 2% of reactor melt-down accidents; there would be over 100 in 0.2% of meltdowns, and 3500 in 1 out of 100,000 melt-downs. To date, the largest number of noticeable deaths from coal burning was in an air pollution incident (London, 1952) where there were 3500 extra deaths in one week. Of course the nuclear accidents are hypothetical and there are many much worse hypothetical accidents in other electricity generation technologies; e.g., there are hydroelectric dams in California whose sudden failure could cause 200,000 deaths. Radioactive Waste The radioactive waste products from the nuclear industry must be isolated from contact with people for very long time periods. The bulk of the radioactivity is contained in the spent fuel, which is quite small in volume and therefore easily handled with great care. This "high level waste" will be converted to a rock-like form and emplaced in the natural habitat of rocks, deep underground. The average lifetime of a rock in that environment is one billion years. If the waste behaves like other rock, it is easily shown that the waste generated by one nuclear power plant will eventually, over millions of years (if there is no cure found for cancer), cause one death from 50 years of operation. By comparison, the wastes from coal burning plants that end up in the ground will eventually cause several thousand deaths from generating the same amount of electricity. The much larger volume of much less radioactive (low level) waste from nuclear plants will be buried at shallow depths (typically 20 feet) in soil. If we assume that this material immediately becomes dispersed through the soil between the surface and ground water depth (despite elaborate measures to maintain waste package integrity) and behaves like the same materials that are present naturally in soil (there is extensive evidence confirming such behavior), the death toll from this low level waste would be 5% of that from the high level waste discussed in the previous paragraph. Other Radiation Problems The effects of routine releases of radioactivity from nuclear plants depend somewhat on how the spent fuel is handled. A typical estimate is that they may reduce our life expectancy by 15 minutes. Potential problems from accidents in transport of radioactive materials are largely neutralized by elaborate packaging. A great deal of such transport has taken place over the past 50 years and there have been numerous accidents, including fatal ones. However, from all of these accidents combined, there is less than a 1% chance that even a single death will ever result from radiation exposure. Probabilistic risk analyses indicate that we can expect less than one death per century in U.S. from this source.

## AT Spark

### Space Col Good---2AC

#### Innovation solves everything---including space col

hÉigeartaigh 17 – Professor @ Cambridge, PhD in Genomics from Trinity College Dublin (Sean, “Technological Wild Cards: Existential Risk and a Changing Humanity”, <https://www.bbvaopenmind.com/en/articles/technological-wild-cards-existential-risk-and-a-changing-humanity/>, Accessed 3-7-2019)

Technological progress now offers us a vision of a remarkable future. The advances that have brought us onto an unsustainable pathway have also raised the quality of life dramatically for many, and have unlocked scientific directions that can lead us to a safer, cleaner, more sustainable world. With the right developments and applications of technology, in concert with advances in social, democratic, and distributional processes globally, progress can be made on all of the challenges discussed here. Advances in renewable energy and related technologies, and more efficient energy use—advances that are likely to be accelerated by progress in technologies such as artificial intelligence—can bring us to a point of zero-carbon emissions. New manufacturing capabilities provided by synthetic biology may provide cleaner ways of producing products and degrading waste. A greater scientific understanding of our natural world and the ecosystem services on which we rely will aid us in plotting a trajectory whereby critical environmental systems are maintained while allowing human flourishing. Even advances in education and women’s rights globally, which will play a role in achieving a stable global population, can be aided specifically by the information, coordination, and education tools that technology provides, and more generally by growing prosperity in the relevant parts of the world. There are catastrophic and existential risks that we will simply not be able to overcome without advances in science and technology. These include possible pandemic outbreaks, whether natural or engineered. The early identification of incoming asteroids, and approaches to shift their path, is a topic of active research at NASA and elsewhere. While currently there are no known techniques to prevent or mitigate a supervolcanic eruption, this may not be the case with the tools at our disposal a century from now. And in the longer run, a civilization that has spread permanently beyond the earth, enabled by advances in spaceflight, manufacturing, robotics, and terraforming, is one that is much more likely to endure. However, the breathtaking power of the tools we are developing is not to be taken lightly. We have been very lucky to muddle through the advent of nuclear weapons without a global catastrophe. And within this century, it is realistic to expect that we will be able to rewrite much of biology to our purposes, intervene deliberately and in a large-scale way in the workings of our global climate, and even develop agents with intelligence that is fundamentally alien to ours, and may vastly surpass our own in some or even most domains—a development that would have uniquely unpredictable consequences.

#### ---Extinction

Britt, 1 -- Senior Science Writer (Robert Roy, Space.com, “The Top 3 Reasons to Colonize Space” http://www.space.com/missionlaunches/colonize\_why\_011008-4.html) // DCM

It's no secret. Sooner or later, Earth's bell will be rung. A giant asteroid or comet will slam into the planet, as has happened many times before, and a deadly dark cloud will envelop the globe, killing much of whatever might have survived the initial impact. "We live on a small planet covered with the bones of extinct species, proving that such catastrophes do occur routinely," says J. Richard Gott, III, a professor of astrophysics at Princeton and author of "Time Travel in Einstein's Universe." Gott cites the presumably hardy Tyrannosaurus rex, which lasted a mere 2.5 million years and was the victim of an asteroid attack, as an example of what can happen if you don't plan ahead. But space rocks may not be the only threat. Epidemics, climatological or ecological catastrophes or even man-made disasters could do our species in, Gott says. And so, he argues, we need a life insurance policy to guarantee the survival of the human race. "Spreading out into space gives us more chances," he says. And the time is now: History instructs that technological hay should be made while the economic sun shines. "There is a danger we will end the human space program at some point, leaving us stranded on the Earth," Gott warns. "History shows that expensive technological projects are often abandoned after awhile. For example, the Ancient Egyptians quit building pyramids. So we should be colonizing space now while we have the chance.">

#### ---It’s the only shot---tech cycles ensure we’re back to where we started

#### ---Heat death inevitable but tech solves

Kaku 4(Michio, Professor of Physics at City University of New York, Discover, “How to Survive the End of the Universe (In 7 Steps): The cold, dark end is coming. We need an escape plan”, Volume 25, Number 12, December, http://www.discover.com/issues/dec-04/features/survive-end-of-universe/)

A cold, dark universe is billions, if not trillions, of years in the future. Between now and then, humans will face plenty of other calamities: wars and pestilences, ice ages, asteroid impacts, and the eventual consumption of Earth—in about 5 billion years—as our sun expands into a red giant star. To last until the very end of the universe, an advanced civilization will have to master interstellar travel, spreading far and wide throughout the galaxy and learning to cope with a slowing, cooling, darkening cosmos. Their greatest challenge will be figuring out how to not be here when the universe dies, essentially finding a way to undertake the ultimate journey of fleeing this universe for another. Such a plan may sound absurd. But there is nothing in physics that forbids such a venture. Einstein’s theory of general relativity allows for the existence of wormholes, sometimes called Einstein-Rosen bridges, that connect parallel universes. Among theoretical and experimental physicists, parallel universes are not science fiction. The notion of the multiverse—that our universe coexists with an infinite number of other universes—has gained ground among working scientists. The inflationary theory proposed by Alan Guth of MIT, to explain how the universe behaved in the first few trillionths of a second after the Big Bang, has been shown to be consistent with recent data derived from WMAP. Inflation theory postulates that the universe expanded to its current size inconceivably fast at the very beginning of time, and it neatly explains several stubborn cosmological mysteries, including why the universe is both so geometrically flat and so uniform in its distribution of matter and energy. Andrei Linde of Stanford University has taken this idea a step further and proposed that the process of inflation may not have been a singular event—that “parent universes” may bud “baby universes” in a continuous, never-ending cycle. If Linde’s theory is correct, cosmic inflations occur all the time, and new universes are forming even as you read these words. Naturally, the proposal to eventually flee this universe for another one raises practical questions. To begin with, where exactly would an advanced civilization go?

### Space Col Good---1AR

#### Getting off the rock is possible and solves inevitable extinction

Everett 16 (Sean, CEO of Prome Biological Intelligence, a global biotechnology company, editor of Medium’s news outlet dedicated to space colonialization titled “The Mission”, BS Mathematics & Actuarial Science, MBA from UChicago,“Humanity’s Extinction Event Is Coming” https://medium.com/the-mission/humanitys-extinction-event-is-coming-c0f84f1803f)

But the reality is that an asteroid impact, a change in our magnetic field, or the rising temperature of Earth’s climate are all events that we currently cannot escape. There is no back-up plan. We are, for better or worse, tied to the fate of this planet. As history has shown, that’s not a good fate to be tied to. In fact on September 7, 2016 a 30-foot asteroid flew between the Earth and the Moon. Our most powerful instruments only detected it with two days notice. Two days. If the asteroid was only 1000-foot wide, it would destroy all human life and we’d have no back-up to get out of it. Even the White House is worried about it. Five, yes five, major extinction events have occurred on our planet that we know about. We’re due for another. And when that happens, what’s our alternative? You can’t move to another house. You can’t buy survival, even with a billion dollars in the bank. The only way out, is up. We must find a way to become multi-planetary if we want to save humanity, your family, and yes, even yourself. Only this can restore the honor we seemed to have lost from the brave days of the 60s, while also ensuring our survival. It’s for the species, folks. And as a species, we have not allowed ourselves the opportunity to blast off for the stars. Only the space race in the 60s when we were afraid enough of a self-inflicted global extinction event (read: nuclear) that we put forth the funding required to launch into orbit and onto our moon. We didn’t have calculators back then, and now we have supercomputers in our pocket, but no one is allowed out of our atmosphere, save for a few communication and spy satellites. Doesn’t that make you mad? It’s not some oppressive government that tells us no. It’s us. We pay our taxes. We elect leaders. Those leaders choose Defense as the primary budget line item, but forget about defending against the forthcoming apocalypse. Funding for NASA in the United States has decreased from 4% of the national budget in the 60s to about 0.5% from 2010 onwards. That’s just the money side. But in order to move past this threshold from our home planet to space and then onto other planets, we need to do two things: Travel there. Survive. Luckily, we can simplify the problem of passing this barrier by sending machines in our place. Like TARS from Interstellar, they can go places humans cannot and explore the environment for habitability and resources, even in particularly hostile conditions. Maybe not black hole hostile, but definitely Mars hostile, as the Curiosity Rover has shown. Only now, with a few bold, private startups are we beginning to see a re-emergence of the space industry. We are about to pass a few very important tests that allow us to explore and visit the cosmos. The first is launching physical things into space. This is the catalyst that will jump start a new space race. Prices of sending cargo are falling dramatically, down to nearly $500 per pound of payload with SpaceX’s Falcon 9 heavy re-usable rocket. Note that the re-usable part is key. We can’t throw away our “space car” every time we Uber it. And once that becomes standard and cost-optimized we might be able to get that down to $10 per pound. Imagine what could happen when it costs the same amount to ship something across town as it does into space. The second, and this is just as important, is the wave of autonomous machines. Tesla has popularized the notion of self-driving cars. SpaceX lands their rocket onto a small barge in the ocean autonomously. Companies are buying startups in the space. Self-driving will be our gift, our talisman, on the quest to save the species by becoming multi-planetary. II. Shipping Ourselves to Space The graph below is from the Founders Fund manifesto, showing the decreasing cost of launching something into space. It begins with the 1960s US-versus-Russia space race and extends to the present day SpaceX-versus-Blue Origin reusable rocket race. The cheapest method we have today is SpaceX’s Falcon series rockets. With the Falcon 9 Heavy, it’s predicted launching cargo into space will be cheaper than ever before, at $750 per pound of payload delivered to low earth orbit (LOE)on an expendable rocket. You have to note here, however, that these statistics are as cheap as possible. It costs more to deliver payload on a non-reusable rocket, and on something that’s further out than LEO, like geosynchronous orbit, or to Mars. For example, based on SpaceX’s published pricing, it would be at least 4x more expensive to deliver far less cargo to Mars. So what happens when we reduce that cost to $10 per pound? Namely, an explosion of startups, much like iOS. Instead of pushing to production for your continuously deployed web and mobile app, we will see future developers push to production by deploying physical things into space. “STAGE” takes on an entirely new meaning for software developers when it means your automated regression tests fail, it could blow up a rocket and hurt people on board. That’s why SpaceX and Blue Origins exist. To make this continuous-deployment-to-space process as cheap and fast as possible. By Elon’s calculations, every 15 minutes. III. Self-Driving Space Explorers The most successful products for space, at least in the beginning, will make money by pushing this stuff into orbit. Things like science experiments and new 3D printers. A company called Made in Space creates a number of these products, including the empty box you see below used for sending things up with Blue Origin. The box shown in gray is a specialized 3D printer that works in zero gravity. Remember how most 3D printers work. It squeezes out a single layer of liquid ooze, and then another, over and over again until it builds up enough vertically that it creates an object. This can be simple plastic or more esoteroic metals. But when you’re “dripping” something, held down in place by gravity, the entire process has to be re-imagined for space. Things in zero-G would just float away. Enter these chaps. There’s also the very real need for oxygen, food, water, and shelter from the harsh elements. Funny how we will end up recreating Maslow’s Heirarchy in every new voyage or planetoid we want to colonize. And space mining is off to the races with the recent announcement of Deep Space Industry’s Prospector-1: Their vision is to extract water from asteroids and use the chemical components to hydrate us, but also as oxygen (breathing) and hydrogen (fuel). To do that, you have to identify candidate asteroids, physically get to them, land and attach, and then do surveying, prospecting, and extraction. In short, you’re going to need some level of self-driving capabilities to make this happen. And wouldn’t it be nice if it “just worked” right out of the box. Unfortunately, in space you don’t have fleets of these space craft, millions of miles of training data, maps, or an internet connection to the cloud so how the heck are deep learning algorithms going to work? I don’t think they will. And that’s what I believe we need a better approach.

#### Every second of delay is worth 10^29 potential human lives

Bostrom, ‘3 Nick Bostrom, philosopher at the University of Oxford, a Ph.D. degree in philosophy from the London School of Economics, and was a British Academy Postdoctoral Fellow at the University of Oxford, 2003, “Astronomical Waste: The Opportunity Cost of Delayed Technological Development”, Utilitas Vol. 15, No. 3, <https://nickbostrom.com/astronomical/waste.html#_edn8>, EO

As I write these words, suns are illuminating and heating empty rooms, unused energy is being flushed down black holes, and our great common endowment of negentropy is being irreversibly degraded into entropy on a cosmic scale. These are resources that an advanced civilization could have used to create value-structures, such as sentient beings living worthwhile lives. The rate of this loss boggles the mind. One recent paper speculates, using loose theoretical considerations based on the rate of increase of entropy, that the loss of potential human lives in our own galactic supercluster is at least ~10^46 per century of delayed colonization.[1] This estimate assumes that all the lost entropy could have been used for productive purposes, although no currently known technological mechanisms are even remotely capable of doing that. Since the estimate is meant to be a lower bound, this radically unconservative assumption is undesirable. We can, however, get a lower bound more straightforwardly by simply counting the number or stars in our galactic supercluster and multiplying this number with the amount of computing power that the resources of each star could be used to generate using technologies for whose feasibility a strong case has already been made. We can then divide this total with the estimated amount of computing power needed to simulate one human life. As a rough approximation, let us say the Virgo Supercluster contains 10^13 stars. One estimate of the computing power extractable from a star and with an associated planet-sized computational structure, using advanced molecular nanotechnology[2], is 10^42 operations per second.[3] A typical estimate of the human brain’s processing power is roughly 10^17 operations per second or less.[4] Not much more seems to be needed to simulate the relevant parts of the environment in sufficient detail to enable the simulated minds to have experiences indistinguishable from typical current human experiences.[5] Given these estimates, it follows that the potential for approximately 10^38 human lives is lost every century that colonization of our local supercluster is delayed; or equivalently, about 10^29 potential human lives per second. While this estimate is conservative in that it assumes only computational mechanisms whose implementation has been at least outlined in the literature, it is useful to have an even more conservative estimate that does not assume a non-biological instantiation of the potential persons. Suppose that about 10^10 biological humans could be sustained around an average star. Then the Virgo Supercluster could contain 10^23 biological humans. This corresponds to a loss of potential equal to about 10^14 potential human lives per second of delayed colonization. What matters for present purposes is not the exact numbers but the fact that they are huge. Even with the most conservative estimate, assuming a biological implementation of all persons, the potential for one hundred trillion potential human beings is lost for every second of postponement of colonization of our supercluster.[6] II. THE OPPORTUNITY COST OF DELAYED COLONIZATION From a utilitarian perspective, this huge loss of potential human lives constitutes a correspondingly huge loss of potential value. I am assuming here that the human lives that could have been created would have been worthwhile ones. Since it is commonly supposed that even current human lives are typically worthwhile, this is a weak assumption. Any civilization advanced enough to colonize the local supercluster would likely also have the ability to establish at least the minimally favorable conditions required for future lives to be worth living. The effect on total value, then, seems greater for actions that accelerate technological development than for practically any other possible action. Advancing technology (or its enabling factors, such as economic productivity) even by such a tiny amount that it leads to colonization of the local supercluster just one second earlier than would otherwise have happened amounts to bringing about more than 10^29 human lives (or 10^14 human lives if we use the most conservative lower bound) that would not otherwise have existed. Few other philanthropic causes could hope to match that level of utilitarian payoff.

### AT: No Nuclear Winter

#### Extinction---nuke winter, ag

Steven **Starr 17**. Director, University of Missouri’s Clinical Laboratory Science Program; senior scientist, Physicians for Social Responsibility. 1/9/2017. “Turning a Blind Eye Towards Armageddon — U.S. Leaders Reject Nuclear Winter Studies.” Federation of American Scientists. <https://fas.org/2017/01/turning-a-blind-eye-towards-armageddon-u-s-leaders-reject-nuclear-winter-studies/>

Now 10 years ago, several of the world’s leading climatologists and physicists chose to reinvestigate the long-term environmental impacts of nuclear war. The peer-reviewed studies they produced are considered to be the most authoritative type of scientific research, which is subjected to criticism by the international scientific community before final publication in scholarly journals. No serious errors were found in these studies and their findings remain unchallenged.

Alan Robock et al., “Nuclear winter revisited with a modern climate model and current nuclear arsenals: Still catastrophic consequences,” Journal of Geophysical Research: Atmospheres 112 (2007).

Owen Brian Toon et al., “Atmospheric effects and societal consequences of regional scale nuclear conflicts and acts of individual nuclear terrorism,” Atmospheric Chemistry and Physics 7 (2007).

Michael Mills et al., “Massive global ozone loss predicted following regional nuclear conflict,” Proceedings of the National Academy of Sciences of the United States of America 105, no. 14 (2008).

Michael Mills et al., “Multidecadal global cooling and unprecedented ozone loss following a regional nuclear conflict,” Earth’s Future 2.

Alan Robock et al., “Climatic consequences of regional nuclear conflicts,” Atmospheric Chemistry and Physics 7 (2007).

Working at the Laboratory for Atmospheric and Space Physics at the University of Colorado-Boulder, the Department of Environmental Sciences at Rutgers, and the Department of Atmospheric and Oceanic Sciences at UCLA, these scientists used state-of-the-art computer modeling to evaluate the consequences of a range of possible nuclear conflicts. They began with a hypothetical war in Southeast Asia, in which a total of 100 Hiroshima-size atomic bombs were detonated in the cities of India and Pakistan. Please consider the following images of Hiroshima, before and after the detonation of the atomic bomb, which had an explosive power of 15,000 tons of TNT.

The detonation of an atomic bomb with this explosive power will instantly ignite fires over a surface area of three to five square miles. In the recent studies, the scientists calculated that the blast, fire, and radiation from a war fought with 100 atomic bombs could produce direct fatalities comparable to all of those worldwide in World War II, or to those once estimated for a “counterforce” nuclear war between the superpowers. However, the long-term environmental effects of the war could significantly disrupt the global weather for at least a decade, which would likely result in a vast global famine.

The scientists predicted that nuclear firestorms in the burning cities would cause at least five million tons of black carbon smoke to quickly rise above cloud level into the stratosphere, where it could not be rained out. The smoke would circle the Earth in less than two weeks and would form a global stratospheric smoke layer that would remain for more than a decade. The smoke would absorb warming sunlight, which would heat the smoke to temperatures near the boiling point of water, producing ozone losses of 20 to 50 percent over populated areas. This would almost double the amount of UV-B reaching the most populated regions of the mid-latitudes, and it would create UV-B indices unprecedented in human history. In North America and Central Europe, the time required to get a painful sunburn at mid-day in June could decrease to as little as six minutes for fair-skinned individuals.

As the smoke layer blocked warming sunlight from reaching the Earth’s surface, it would produce the coldest average surface temperatures in the last 1,000 years. The scientists calculated that global food production would decrease by 20 to 40 percent during a five-year period following such a war. Medical experts have predicted that the shortening of growing seasons and corresponding decreases in agricultural production could cause up to two billion people to perish from famine.

The climatologists also investigated the effects of a nuclear war fought with the vastly more powerful modern thermonuclear weapons possessed by the United States, Russia, China, France, and England. Some of the thermonuclear weapons constructed during the 1950s and 1960s were 1,000 times more powerful than an atomic bomb.

During the last 30 years, the average size of thermonuclear or “strategic” nuclear weapons has decreased. Yet today, each of the approximately 3,540 strategic weapons deployed by the United States and Russia is seven to 80 times more powerful than the atomic bombs modeled in the India-Pakistan study. The smallest strategic nuclear weapon has an explosive power of 100,000 tons of TNT, compared to an atomic bomb with an average explosive power of 15,000 tons of TNT.

Strategic nuclear weapons produce much larger nuclear firestorms than do atomic bombs. For example, a standard Russian 800-kiloton warhead, on an average day, will ignite fires covering a surface area of 90 to 152 square miles.

A war fought with hundreds or thousands of U.S. and Russian strategic nuclear weapons would ignite immense nuclear firestorms covering land surface areas of many thousands or tens of thousands of square miles. The scientists calculated that these fires would produce up to 180 million tons of black carbon soot and smoke, which would form a dense, global stratospheric smoke layer. The smoke would remain in the stratosphere for 10 to 20 years, and it would block as much as 70 percent of sunlight from reaching the surface of the Northern Hemisphere and 35 percent from the Southern Hemisphere. So much sunlight would be blocked by the smoke that the noonday sun would resemble a full moon at midnight.

Under such conditions, it would only require a matter of days or weeks for daily minimum temperatures to fall below freezing in the largest agricultural areas of the Northern Hemisphere, where freezing temperatures would occur every day for a period of between one to more than two years. Average surface temperatures would become colder than those experienced 18,000 years ago at the height of the last Ice Age, and the prolonged cold would cause average rainfall to decrease by up to 90%. Growing seasons would be completely eliminated for more than a decade; it would be too cold and dark to grow food crops, which would doom the majority of the human population.2

#### Even if not directly existential---that spurs system collapse AND pandemics, which are

Julian Cribb 19. Author, journalist, editor and science communicator, principal of Julian Cribb & Associates who provide specialist consultancy in the communication of science, agriculture, food, mining, energy and the environment, more than thirty awards for journalism. 10/03/2019. “6 - Food as an Existential Risk.” Food or War, 1st ed., Cambridge University Press. DOI.org (Crossref), doi:10.1017/9781108690126.

Humanity is facing its greatest test in the million-year ascent of our kind. This isn’t a single challenge. It’s a constellation of huge man-made threats, now coming together to overshadow our civilisation’s stability and even, maybe, its future survival. These ten intersecting risks are: ecological collapse, resource depletion, weapons of mass destruction, climate change, global poisoning, food insecurity, population and urban failure, pandemic disease and uncontrolled new technologies (like killer robots, artificial intelligence and universal surveillance) – reinforced by a prodigious capacity for human self-delusion. But sticking our heads in the sand and trying to ignore them will not remove the danger.

These threats are known as ‘existential risks’ because they imperil our future existence, both as individuals, as a civilisation and maybe even as a species.

Their most important feature is the fact that they are not isolated from one another. They are deeply interwoven. They play into and feed one another. They cannot be addressed separately or singly, because to do so creates a situation where curbing one risk only makes other risks worse. Together they constitute a single existential emergency facing all of humanity.

An example of why they cannot be addressed piecemeal is trying to solve the global food problem by intensifying agriculture worldwide using fossil fuels, fertilisers and petrochemicals: this will only destroy the very climate, resources and ecosystem services on which agriculture, itself, depends – and is not, consequently, a viable or enduring solution. Other answers must be sought. Another example is that trying to end the Sixth Extinction of wildlife on our planet by turning half of it back to forest and grassland will not work on its own, because it would involve the sacrifice of half the current human food supply: consequently, we need a solution that achieves both aims – sustainable food for all and a sufficient haven for the Earth’s other species. So, the problem of extinction needs to be solved, in part, by solving the problem of food – and that, in turn, entails solving the problems of climate, global poisoning, resource depletion and other mega-risks. It is absolutely clear from this that the solutions we adopt must be cross-cutting. They must comprehensively address all the perils we face, not just one or a handful of them.

Take these ten great risks together and what you have is the focal issue of our time – the greatest and most profound challenge ever to confront human civilisation. The risks are all selfinflicted, a direct result of the overgrowth in human numbers and our unbridled demands on the planet – for food, resources, space and a healthy environment. By solving them together, we ensure our future. By denying them or failing to solve them all in time, we knowingly create untold misery and suffering for most of humanity and generations to come through the centuries ahead. We are gambling with the very survival of our civilisation and species. The risks are described below, along with observations about how they play into the Food or War scenario. The detail, the scientific sources and the solutions, collective and individual, to each risk are described in more detail in Surviving the 21st Century.

Extinction and Ecological Collapse

More than half of the large animals that once inhabited the Earth have been wiped from it by human action since 1970, according to the Worldwide Fund for Nature’s Living Planet Index.3 So, too, have half the fish in the sea on which humans rely for food.4 Humans are, in the words of the great biologist E. O. Wilson, ‘tearing down the biosphere’, demolishing the very home that keeps us alive.5

Extinction, it should be noted, is a part of life: 99.9 per cent of all species ever to evolve on this planet have disappeared, and new ones like ourselves have arisen to replace them. But extinction rates like today’s – a hundred to a thousand times faster than normal – are a freak occurrence that usually takes tens of millions of years, not mere decades. Animal, plant and marine species are presently vanishing so fast that scientists have dubbed our time “the Sixth Extinction” – the sixth such megadeath in the geological history of the Earth.6 By the end of the present century, Wilson says, it is possible that up to half of the eight million species thought to exist here will be gone. Furthermore, in all previous extinctions, natural events like asteroid strikes and vast volcanic outbursts have been to blame. This will be the only time in the Earth’s history when the wipe-out was caused by a single species. Us.7

The probability of humans becoming extinct during the twentyfirst century is not high – but there are scenarios, such as an all-out nuclear war, runaway climate change (+5–10 C or more), or a compound collapse in the Earth’s main life support systems, in which it must be regarded as a possibility – and the fact that it is unpleasant to contemplate is no excuse for doing nothing to stop it.

However, there are also a number of credible scenarios in which large-scale ecosystem collapse could endanger civilisation and cause very high mortality among the world’s population. These revolve around the notion of ‘environmental security’ which is, in turn, very closely tied to human security – i.e. peace or war. An ecosystem is a biological community of mutually dependent species – and the removal of one species after another can undermine it and render it dysfunctional, in the same way that pulling one brick at a time out of your home will eventually cause it to fall down. Ecosystems support all life on the planet, and maintain the quality of air, water and soil on which it depends. For humans, they provide food and clean water (provisioning services), disease and climate regulation (regulatory services), spiritual and aesthetic fulfilment (cultural services), useful chemical energy (from plants) and soil formation (support services). As ecosystems decay, the decline and loss of these services often causes significant harm to human wellbeing and can inflame the tensions that lead to conflict.

The most destructive object on the planet, as we noted in Chapter 3, is the human jawbone. The need to keep it fed is responsible, every year, for the loss of up to 75 billion tonnes of topsoil, the wasting of six trillion tonnes of water, the release of five million tonnes of pesticides, and 30 per cent of the world’s climate-wrecking carbon emissions. In addition, the contemporary food system is the chief driver of deforestation, desertification, wildlife extinctions and impaired ecosystems. Among the most striking examples of food’s impact on the wild world are the 400+ ‘dead zones’ spreading through the world’s oceans from the Arabian Sea, to the Baltic and the Mississippi delta. These are oxygenless layers in the sea, where fish cannot survive. They are caused by topsoil dislodged by land clearing, over-farming and over-grazing, the use of huge quantities of artificial fertilisers, toxic chemicals and human sewage. Along with overfishing they contribute to an ongoing collapse in world wild fisheries and are a clear example of how the activity of one part of the food system can impair another. Similarly, most inland rivers and lakes in populated regions are eutrophic and polluted – and no longer capable of producing as much food as in the past. The loss of wild fisheries increases tensions between nations and fishers over what remains and can lead to ‘fish wars’. 8

The existing global food production system is therefore a major contributor to the decline and failure of ecosystem services needed to support the human population. This in turn rebounds on the food system itself. Furthermore, the extinction of wild animals and plants deprives the food industry of many edible species that may be needed as part of a healthy, diverse global diet in future.

The solution to the extinction crisis is to cease farming and grazing on about half the currently farmed area of the planet (25 million square kilometres), transfer food production to the cities where it can take advantage of all the nutrients and water currently being wasted, and employ many of the world’s farmers and indigenous people as Stewards of the Earth to manage the rewilding and regeneration of former farmlands. Food production can continue on the remaining 24 million square kilometres using eco-agriculture. This process is further described in Surviving the 21st Century and in Chapter 9 of this book.

How the existing food system plays into the risk of war can also be viewed through the lens of environmental security: war damages environments, making it harder for humans to sustain and feed themselves – and ruined environments themselves become cauldrons of war. This is plainly to be seen in the cases of Syria, South Sudan, Yemen and the Horn of Africa. What we most need are food systems that do not cause knock-on damage to either the environment and wildlife, the climate, the oceans or to consumer health – and which ease tensions, so promoting peace, not conflict. These are described in Chapters 8 and 9.

Resource Scarcity

The average citizen of planet Earth today uses at least ten times the volume of resources used by their grandparents a century ago. Since the human population has also quadrupled over the same time, this means humanity’s gargantuan appetite for minerals, metals, timber, water, food and energy has grown fortyfold in barely a hundred years. As the Global Footprint Network explains, we are presently using enough ‘stuff’ for 1.6 Earths, not just the one we have. We now outrun the Earth’s natural ability to supply our needs in August each year.9 As with the mining of groundwater, the decline and collapse of global resources like soil, water and phosphorus, is often imperceptible to the individual: people have simply no idea they are living on borrowed time and, with that, comes enormous risk.

To make the issue of resource consumption a little more personal: you (as an average individual citizen of the planet) will in your lifetime

– use 99,720 tonnes (i.e. 40 Olympic pools) of fresh water

– displace 750 tonnes of topsoil

– consume 720 tonnes of metals and materials

– use 80 billion joules of energy

– release 288 tonnes of CO2

– release 320 kilograms of toxic chemicals

– waste 13.4 tonnes of food

– destroy 800 square metres of forest.

Because of the long, cryptic, industrial and international trade chains which hide it, most of us are unaware of the vast damage we do to the planet through our simple habit of shopping.

Yes, some of us have a notion that some of our purchases may be bad for gorillas in the Congo, orangutans in Borneo or flamingos in the Atacama – but we mostly have no true appreciation of the wider havoc we inflict on the Earth and its natural systems by the ‘innocent’ act of consumption, which business and governments try constantly to convince us is essential to ‘growth and jobs’.

It should therefore come as no surprise that the world finds itself increasingly short of key resources like fresh water, soil, phosphorus, timber and certain minerals – and that these shortages are giving rise to tensions and even to conflicts. Indeed, resource scarcity has for some time been considered by strategic experts to be one of the most likely causes of war in the twentyfirst century.10

However, people are not equally responsible for the devastation of Planet Earth. The diagram below (Figure 6.1), from [[FIGURE 6.1 OMITTED]] Oxfam, illustrates how just one tenth of humanity consumes five times as much in the way of material resources (expressed here in the form of their carbon footprint) as the poorest half of the world population. The affluent are chiefly responsible for the destruction taking place on a global scale as they seek to sustain lifestyles that the planet can no longer afford or support.

The significance of this blind spot around consumption for global food security is very great. As described in earlier chapters, the world food system depends critically on soil, water, nutrients and a stable climate, to supply humanity’s daily need for nutriment – and all of these essential resources are in increasingly short supply, chiefly because of our own mismanagement of them and our collective failure to appreciate that they are finite. On current trends, the existing food system will tend to break down, first regionally and then globally, owing to resource scarcity from the 2020s onward, and especially towards the mid century – unless there is radical change in the world diet and the means by which we feed ourselves. This will lead to increasing outbreaks of violence and war. Nobody, neither rich nor poor, will escape the consequences.

Weapons of Mass Destruction

Detonating just 50–100 out of the global arsenal of nearly 15,000 nuclear weapons would suffice to end civilisation in a nuclear winter, causing worldwide famine and economic collapse affecting even distant nations, as we saw in the previous chapter in the section dealing with South Asia. Eight nations now have the power to terminate civilisation should they desire to do so – and two have the power to extinguish the human species. According to the nuclear monitoring group Ploughshares, this arsenal is distributed as follows:

– Russia, 6600 warheads (2500 classified as ‘retired’)

– America, 6450 warheads (2550 classified as ‘retired’)

– France, 300 warheads

– China, 270 warheads

– UK, 215 warheads

– Pakistan, 130 warheads

– India, 120 warheads

– Israel, 80 warheads

– North Korea, 15–20 warheads.11

Although actual numbers of warheads have continued to fall from its peak of 70,000 weapons in the mid 1980s, scientists argue the danger of nuclear conflict in fact increased in the first two decades of the twenty-first century. This was due to the modernisation of existing stockpiles, the adoption of dangerous new technologies such as robot delivery systems, hypersonic missiles, artificial intelligence and electronic warfare, and the continuing leakage of nuclear materials and knowhow to nonnuclear nations and potential terrorist organisations.

In early 2018 the hands of the ‘Doomsday Clock’, maintained by the Bulletin of the Atomic Scientists, were re-set at two minutes to midnight, the highest risk to humanity that it has ever shown since the clock was introduced in 1953. This was due not only to the state of the world’s nuclear arsenal, but also to irresponsible language by world leaders, the growing use of social media to destabilise rival regimes, and to the rising threat of uncontrolled climate change (see below).12

In an historic moment on 17 July 2017, 122 nations voted in the UN for the first time ever in favour of a treaty banning all nuclear weapons. This called for comprehensive prohibition of “a full range of nuclear-weapon-related activities, such as undertaking to develop, test, produce, manufacture, acquire, possess or stockpile nuclear weapons or other nuclear explosive devices, as well as the use or threat of use of these weapons.”13 However, 71 other countries – including all the nuclear states – either opposed the ban, abstained or declined to vote. The Treaty vote was nonetheless interpreted by some as a promising first step towards abolishing the nuclear nightmare that hangs over the entire human species.

In contrast, 192 countries had signed up to the Chemical Weapons Convention to ban the use of chemical weapons, and 180 to the Biological Weapons Convention. As of 2018, 96 per cent of previous world stocks of chemical weapons had been destroyed – but their continued use in the Syrian conflict and in alleged assassination attempts by Russia indicated the world remains at risk.14

As things stand, the only entities that can afford to own nuclear weapons are nations – and if humanity is to be wiped out, it will most likely be as a result of an atomic conflict between nations. It follows from this that, if the world is to be made safe from such a fate it will need to get rid of nations as a structure of human self-organisation and replace them with wiser, less aggressive forms of self-governance. After all, the nation state really only began in the early nineteenth century and is by no means a permanent feature of self-governance, any more than monarchies, feudal systems or priest states. Although many people still tend to assume it is. Between them, nations have butchered more than 200 million people in the past 150 years and it is increasingly clear the world would be a far safer, more peaceable place without either nations or nationalism. The question is what to replace them with.

Although there may at first glance appear to be no close linkage between weapons of mass destruction and food, in the twentyfirst century with world resources of food, land and water under growing stress, nothing can be ruled out. Indeed, chemical weapons have frequently been deployed in the Syrian civil war, which had drought, agricultural failure and hunger among its early drivers. And nuclear conflict remains a distinct possibility in South Asia and the Middle East, especially, as these regions are already stressed in terms of food, land and water, and their nuclear firepower or access to nuclear materials is multiplying.

It remains an open question whether panicking regimes in Russia, the USA or even France would be ruthless enough to deploy atomic weapons in an attempt to quell invasion by tens of millions of desperate refugees, fleeing famine and climate chaos in their own homelands – but the possibility ought not to be ignored.

That nuclear war is at least a possible outcome of food and climate crises was first flagged in the report The Age of Consequences by Kurt Campbell and the US-based Centre for Strategic and International Studies, which stated ‘it is clear that even nuclear war cannot be excluded as a political consequence of global warming’. 15 Food insecurity is therefore a driver in the preconditions for the use of nuclear weapons, whether limited or unlimited.

A global famine is a likely outcome of limited use of nuclear weapons by any country or countries – and would be unavoidable in the event of an unlimited nuclear war between America and Russia, making it unwinnable for either. And that, as the mute hands of the ‘Doomsday Clock’ so eloquently admonish, is also the most likely scenario for the premature termination of the human species.

Such a grim scenario can be alleviated by two measures: the voluntary banning by the whole of humanity of nuclear weapons, their technology, materials and stocks – and by a global effort to secure food against future insecurity by diverting the funds now wasted on nuclear armaments into building the sustainable food and water systems of the future (see Chapters 8 and 9).

Climate Change

The effects of food and war on climate change as it is presently predicted to occur were described in Chapter 3: in brief, the stable climate in which agriculture arose over the past 6000 years is now becoming increasingly unstable as a result of the billions of tonnes of carbon that humans are injecting into the atmosphere and oceans, forming a colossal heat engine to drive more frequent, violent weather. This in turn impairs food production in regions of the world already facing severe stresses from population growth and resource depletion. Military analysts describe climate change as a ‘threat multiplier’, augmenting the tensions, conflict and instability which already exist. In reality it is a feedback loop, in which worsening climate conditions cause greater food insecurity, which is met by measures (like increased land clearing and use of fossil fuels and chemicals), which in turn worsen climate conditions, which worsen food security, which cause wars, which inflict more eco-damage...

Two degrees (2 C) of global warming – described as the danger point for humanity – are predicted to occur well before 2050 because of our collective failure to curb our carbon emissions.16 Those 2 C of warming portend bad things for any food system that depends on the weather – but just how bad cannot easily be forecast as both the climate state and the response of the global food system are governed by human behaviour, which is fairly unpredictable. Current estimates suggest crop losses of the order of 20–50 per cent at the very time we are trying to raise food output by 50–70 per cent. What can be confidently predicted, however, is that there will be an increase in both the frequency and scale of harvest failures and agricultural disease outbreaks around the world as we approach the mid century – and that beyond 2 C of warming it will become very hard indeed to maintain a stable outdoors, agriculture-based system to meet an anticipated doubling in world demand for food by the 2060s. The ‘worst case’ risk of this, as previously outlined, would be ten billion people having to subsist on enough food to feed only four billion.

That, however, is by no means the worst case of the climate story. There are ominous signs that humans have already unleashed planetary forces over which we have absolutely no control – and that these, should they become large enough, will take charge of the Earth’s climate engine and drive it into a superheated condition of +9–10 C or even higher.

Today, more people are aware that global warming may lead to complete melting of all glaciers and the polar ice-caps, thereby raising sea levels by 65 metres and inundating almost all of the world’s seaboard cities, fertile river deltas and coastal plains.17 This would clearly have a devastating effect on coastal food production. However, this process will probably take several centuries, allowing populations ample time to relocate inland. That sea levels previously rose by a similar quantum at the end of the last Ice Age, flooding part of Australia, severing Britain from Europe and America from Asia, is proof enough that such events occur as a regular part of the Earth’s warming and chilling cycles.

The great existential threat to humanity lies in vast stores of frozen methane gas (CH4) locked into the soils of the tundra regions of Canada and Siberia, in colossal deposits of frozen methane on the continental seabed surrounding the Arctic Ocean, and in massive stores of methane submerged in peat deposits and swamps in places such as the Amazon and the wet tropical forests of Southeast Asia and Africa. Methane is a gas with 20–70 times the climate-forcing power of carbon dioxide. These deposits are the accumulation of the slow decomposition of planet and animal matter in the Earth’s sediments over several hundred million years – they are identical in origin to the gas bubbles that surface when we stir the bed of a pond or lake.

The actual volume of these methane deposits is still being assessed by science. Recent estimates suggest:

• seabed deposits – between 500–2500 billion tonnes of frozen carbon;18

• tundra deposits – potentially emitting 180–420 million tonnes of carbon a year by 2100; and

• tropical peat swamps – could emit 480–870 million tonnes of carbon a year by 2100.19

That carbon released from peat swamps, tundra and possibly the oceans can have a catastrophic effect on the Earth’s climate is foreshadowed by an event known as the Palaeocene–Eocene Thermal Maximum (PETM), which took place some 55 million years ago, when Earth took a sudden fever and its temperature rocketed upwards by +5–9 C. This ‘heat spike’ caused a lesser extinction event involving widespread loss of ocean life and a smaller toll of land animals.20 However, the heating occurred over a much longer period – 100–200,000 years, compared with human-driven heating (50–100 years) – and is thought to have been mainly caused by the drying out and burning of tropical peat swamps as the climate warmed. However, the volume of carbon which caused this sharp planetary heat spike in the past is estimated to be barely a tenth of that released by humanity today.21

Today, human activity in clearing rainforests, draining swamps and burning the world’s forests to open them up for farming and food production is releasing vast amounts of methane and CO2. Explosion craters have been reported across Canada and Siberia as frozen methane deposits well up and erupt with the melting of the tundra. And scientists from Sweden, Russia, Canada and America have reported methane bubbling from the seabed of the Arctic Ocean, though not yet in massive volumes. The risk in all this is that, by warming the planet by only 1–2 C, we have set in train natural processes that we are powerless to control, setting ourselves on an inescapable trajectory to a Hothouse Earth, 5–10 C or more above today’s levels.

Although it is hard to estimate, some scientists are of the view that fewer than one billion humans would survive such an event22 – in other words, nine people out of every ten may perish in the cycle of famines, wars, heatwaves and pandemic diseases which global overheating would entail. This underlies the deadly urgency of ceasing to burn all fossil fuels, locking up as much carbon as possible and re-stabilising the Earth’s climate. In that, food production can and will play a central role.

Poisoned Planet

‘Earth, and all life on it, are being saturated with man-made chemicals in an event unlike anything which has occurred in all four billion years of our planet’s story. Each moment of our lives, from conception unto death, we are exposed to thousands of substances, some deadly in even tiny doses and most of them unknown in their effects on our health and wellbeing or upon the natural world. These enter our bodies with every breath, each meal or drink, the clothes we wear, the products with which we adorn ourselves, our homes, workplaces, cars and furniture, the things we encounter every day. There is no escaping them. Ours is a poisoned planet, its whole system infused with the substances humans deliberately or inadvertently produce in the course of extracting, making, using, burning or discarding the many marvellous products on which modern life depends. This explosion in chemical use and release has all happened so rapidly that most people are blissfully unaware of its true magnitude and extent, or of the dangers it now poses to us all as well as to future generations for centuries to come.’

This is a summation of the chemical crisis facing all of humanity, as well as all life on Earth, which I wrote in Surviving the 21st Century, and which is based on the extensive scientific research reported in Poisoned Planet.23 It is a crisis with profound impact for everyone.

According to the medical journal The Lancet, nine million people – one in six – die every year from chemical pollution of their air, water, food and living environment.24 A further 40 million die from the so-called noncommunicable or ‘lifestyle’ diseases (NCDs), cancer, heart disease, diabetes and lung disease, which are mostly diet-related.25

Food production, as we have seen, is deeply implicated in the chemical deluge. However, it is also an existential threat to human health, both in terms of infectious disease and the new ‘lifestyle’ diseases. No-one to my knowledge has compiled an accurate assessment of the total chemical effusion of humanity or presented a realistic impression of its true scale. Box 6.1 represents my own best estimate, drawn from various reliable sources.

From this it can easily be seen that the scale of humanity’s chemical assault on ourselves and on the planet is many times the scale of our climate assault – yet this issue commands nowhere near the political or scientific priority that it should. It is arguably the most under-rated, under-investigated and poorly understood of all the existential threats to humanity.

The poisoning of the Earth by human activities has grave implications for the health and safety of the global food chain and its eight billion consumers. It is not only the use of chemicals in food production that is of concern, but also the contamination of water, soils and livestock by industrial pollutants from other sources, such as mining or manufacturing. It is also the disruption of vital services such as pollination by insects of a [[BOX 6.1 OMITTED]] third of the world’s food crops and 90 per cent of wild plants.26 It is the contamination of up to three quarters of the world fish catch with microscopic plastic particles and clothing microfibres made by the petrochemical industry.27

The ending of this flood of poisons is a prerequisite for a safe, healthy and sustainable global food supply in future. And, since government regulation has largely failed to stem the worldwide flood, the task now falls to consumers – to choose foods which have been produced by safe methods and shun foods produced by unsafe methods. That is the only way that the food industry can be encouraged (and penalised) into doing the right thing by humanity and the planet: by consumers rewarding it for producing clean food and punishing it for toxic food. Otherwise it will continue to pollute as profitably as it can. It follows that the urgent global education of consumers about which foods are safe and which are toxic is also a pre-requisite.

Food Security

Our demand for food is set to double by the 2060s – potentially the decade of ‘peak people’, the moment in history when the irresistible human population surge may top out at around 10 billion. However, as we have seen, many of the resources needed to supply it agriculturally could halve and the climate for the growing of food outdoors become far more hostile.

Why food insecurity is an existential threat to humanity should, by now, be abundantly clear from the earlier chapters of this book: present systems are unsustainable and, as they fail, will pose risks both to civilization and, should these spiral into nuclear conflict, to the future of the human species.

The important thing to note in this chapter is that food insecurity plays into many, if not all, of the other existential threats facing humanity. The food sector’s role in extinction, resource scarcity, global toxicity and potential nuclear war has already been explained. Its role in the suppression of conflict is discussed in the next chapter. Its role in securing the future of the megacities, and of a largely urbanised humanity, is covered in Chapter 8. And its role in sustaining humanity through the peak in population and into a sustainable world beyond is covered in Chapter 9.

Food clearly has a pivotal role in the future of human population – both as a driver of population growth when supplies are abundant and as a potential driver of population decline, should food chains collapse. It is no exaggeration to state that the fate of civilisation depends on it.

Pandemic Disease

Disease pandemics have been a well-known existential risk to humanity since the plague of Athens in 430 BC – itself linked to a war. However, a point that escapes many people nowadays is that, as humans have become so numerous – indeed the predominant lifeform on the planet – we have also become the major food source for many microbes. We are now the ‘living compost heap’ on which they must dine and in which they must reproduce, if they are themselves to survive.

As our own population grows, pandemics are thus likely to increase, as more and more viruses and bacteria are forced to take refuge in humans following the depletion or total extinction of their natural hosts, the wild animals we are exterminating. This process is greatly assisted by our creation of megacities, tourism and air travel, schools and child-minding centres, air-conditioned offices, night clubs, sex with strangers, pet and pest animals, insects which prosper from climate change or human modification of the environment (like mosquitoes), ignorance, poor public hygiene, lack of clean water, and deficient food processing and handling.

So, while humanity is confronted with an ever-expanding array of parasites, we are simultaneously doing everything in our power to distribute them worldwide in record time – and to seed new pandemics. The World Health Organisation has identified 19 major infectious diseases with potential to become pandemic: chikungunya, cholera, Crimean-Congo haemorrhagic fever, Ebola, Hendra, influenza, Lassa fever, Marburg virus, meningitis, MERS-CoV, monkeypox, Nipah, plague, Rift Valley fever, SARS, smallpox, tularaemia, yellow fever and Zika virus disease.28 While none of these is likely to fulfil the Hollywood horror movie image of wiping out the human species – for the simple reason that viruses are usually smart enough to weaken to a sublethal state once comfortably ensconced in their new host – the apocalyptic horseman representing Pestilence and Death will nevertheless continue to play a synergetic role with his companions warfare, famine, climate change, global poisoning, ecological collapse, urbanisation and other existential threats.

Food insecurity affects the progression of pandemic diseases, often in ways that are not entirely obvious. First, new pandemics of infectious disease tend to originate in developing regions where nutritional levels are poor or agricultural practices favour the evolution of novel pathogens such as, for example, the new flu strains seen every year – which arise mainly from places where people, pigs and poultry live side-by-side and shuffle viruses between them – and also novel diseases like SARS and MERS. Second, because totally unknown diseases tend to arise first in places where rainforests are being cut down for farming and viruses hitherto confined to wild animals and birds make an enforced transition into humans. Examples of novel human diseases escaping from the rainforest and tropical savannah in recent times include HIV/AIDS, Hendra, Nipah, Ebola, Marburg, Lassa and Hanta, Lujo, Junin, Machupo, Rift Valley, Congo and Zika.29 And thirdly, because the loss of vital micronutrients from heavily farmed soils and from food itself predisposes many populations to various deficiency diseases – for example, a lack of selenium in the diet has been linked with increased risk from both HIV/AIDS and bowel cancer.30 A key synergy is the way hunger and malnourishment exacerbate the spread of disease, classic examples being the 1918 Global Flu Pandemic which spread rapidly among war-starved populations, or the more recent cholera outbreak in war-torn Yemen. In a fresh twist, Dr Melinda Beck of North Carolina University has demonstrated that obesity – itself a form of malnutrition – may cause increased deaths from influenza by both aiding the virus and suppressing the patient’s immune response.31

#### Nuclear winter is real---most recent simulations prove.

Coupe et al. 19. Joshua Coupe is with the Department of Environmental Science @ Rutgers University; Charles G. Bardeen is with the Atmospheric Chemistry Observations and Modeling Laboratory, National Center for Atmospheric Research @ Boulder, CO; Alan Robock is with the Department of Environmental Science @ Rutgers University; Owen Toon is with the Department of Atmospheric and Ocean Sciences @ University of Colorado Boulder. 08/08/2019. “Nuclear Winter Responses to Nuclear War Between the United States and Russia in the Whole Atmosphere Community Climate Model Version 4 and the Goddard Institute for Space Studies ModelE.” Journal of Geophysical Research: Atmospheres, p. 2019JD030509.

Abstract

Current nuclear arsenals used in a war between the United States and Russia could inject 150 Tg of soot from fires ignited by nuclear explosions into the upper troposphere and lower stratosphere. We simulate the climate response using the Community Earth System Model‐Whole Atmosphere Community Climate Model version 4 (WACCM4), run at 2° horizontal resolution with 66 layers from the surface to 140 km, with full stratospheric chemistry and with aerosols from the Community Aerosol and Radiation Model for Atmospheres allowing for particle growth. We compare the results to an older simulation conducted in 2007 with the Goddard Institute for Space Studies ModelE run at 4° × 5° horizontal resolution with 23 levels up to 80 km and constant specified aerosol properties and ozone. These are the only two comprehensive climate model simulations of this scenario. Despite having different features and capabilities, both models produce similar results. Nuclear winter, with below freezing temperatures over much of the Northern Hemisphere during summer, occurs because of a reduction of surface solar radiation due to smoke lofted into the stratosphere. WACCM4's more sophisticated aerosol representation removes smoke more quickly, but the magnitude of the climate response is not reduced. In fact, the higher‐resolution WACCM4 simulates larger temperature and precipitation reductions than ModelE in the first few years following a 150‐Tg soot injection. A strengthening of the northern polar vortex occurs during winter in both simulations in the first year, contributing to above normal, but still below freezing, temperatures in the Arctic and northern Eurasia.

1. Introduction

Since the proliferation of nuclear weapons in the twentieth century, considerable attention has been paid to the impact of a nuclear war on society and the environment. Crutzen and Birks (1982), following previous ideas by Lewis (1979), suggested that massive forest fires ignited by nuclear weapons would rage for weeks after a war, producing a tropospheric pall of smoke that would obscure the Sun and reduce sunlight at the surface for the duration of the fires. Turco et al. (1983) conducted the first climate modeling using a radiative‐convective climate model, showing that a nuclear winter could occur from this smoke. In a war where nuclear weapons would be used, military and industrial centers located in urban areas would be targeted, which contain fuel loading much higher than forests, thus creating an enormous amount of smoke when burned. Turco et al. (1983) found that urban fires injecting smoke into the upper troposphere could produce severe climate changes and that urban firestorms could inject smoke into the stratosphere, leading to rapid interhemispheric transport and a long‐lasting smoke pall, which has since been affirmed by coupled global climate models (Mills et al., 2008; Mills et al., 2014; Pausata et al., 2016; Robock, Oman, & Stenchikov, 2007; Robock, Oman, Stenchikov, Toon, et al., 2007). Aleksandrov and Stenchikov (1983) conducted the first three‐dimensional climate modeling for the injection scenarios of Turco et al. (1983) showing that continental temperature reductions would be large despite moderation by the oceans. Malone et al. (1985) conducted the first three‐dimensional simulations including smoke transport and removal by precipitation, showing that solar heating could cause smoke in the troposphere to rise into the stratosphere before precipitation removal, greatly prolonging the lifetime of the smoke. The effect of this smoke entering Earth's upper atmosphere would be to block out sunlight for months to years, decreasing temperatures. In 1986, The Scientific Committee on Problems of the Environment of the International Council of Scientific Unions published a report describing the immense biological, ecological, and human impacts of a nuclear war based on the literature at the time (Pittock et al., 1986). The first simulation with a modern, comprehensive coupled atmosphere‐ocean climate model by Robock, Oman, and Stenchikov (2007) showed that solar heating would loft smoke deep into the stratosphere. Robock, Oman, and Stenchikov (2007) confirmed that a nuclear winter would result from the amount of soot that could be produced by a nuclear war between Russia and the United States with current arsenals (Toon et al., 2008). Later agricultural modeling of a regional nuclear war showed an increased likelihood of crop failures and global famine due to the climate effects of smoke (Xia & Robock, 2013; Xia et al., 2015). But climate models have improved since 2007 in terms of horizontal resolution, vertical resolution, and vertical extent, which is essential for an accurate simulation of smoke lofting. We employ the much higher resolution WACCM4 model used by Mills et al. (2014) to repeat the nuclear war scenario from Robock, Oman, and Stenchikov (2007). We incorporate a more sophisticated treatment of stratospheric chemistry compared to Goddard Institute for Space Studies (GISS) ModelE, and aerosol treatment is updated from Mills et al. (2014) by treating the aerosols as fractal particles whose optical properties evolve over time. Only Pausata et al. (2016) has used a model to study the climate effect of nuclear war, using a much smaller injection than here, that allowed for the growth of aerosols in the stratosphere, but their model had a limited vertical resolution and extent (26 levels with a 3‐hPa model top), potentially limiting vertical lofting. Mixing together varying ratios of organic and black carbon, Pausata et al. (2016) found a shorter stratospheric residence time of the aerosols due to particle growth. The use of a model with a higher model top and higher vertical resolution here should help to more accurately model the lifetime of fractal smoke particles generated from mass fires, a key uncertainty in this field of study.

A significant climate response is predicated on the basis that vast amounts of smoke would reach the stratosphere, and so an accurate representation of the properties of the aerosols and the amount is crucial. The aerosols produced following the fires ignited by a nuclear explosion would contain organic compounds mixed with elemental carbon, which is also called soot or black carbon. The smoke calculations from Toon et al. (2007) excluded organic carbon, just as most historical climate simulations did, so while including it could increase particle extinction and reduce soot residence time in the stratosphere, as Pausata et al. (2016) found, we exclude it as well. Black carbon is one of the most efficient aerosols at absorbing visible light, allowing for the surrounding air to become buoyant when the aerosols are heated (Ackerman & Toon, 1981; Bond et al., 2013; Turco et al., 1983). For example, a stratospheric injection of a few tenths of a teragram of smoke, containing a few percent of black carbon, from a forest fire in British Columbia in August of 2017 heated the air by about 7 K by absorbing sunlight and lofted the smoke from an injection height of about 12 km to above 20‐km altitude within a few weeks (e.g., Khaykin et al., 2018; Peterson et al., 2018; Yu et al., 2019). In contrast, 180 Tg of black carbon (excluding organic compounds that would also be emitted) might be injected in a full scale nuclear war between the United States and Russia from convective plumes from fires (Toon et al., 2008). Self‐lofting would allow the aerosols to rise deep into the stratosphere, resulting in a long‐duration climate response (Malone et al., 1985, 1986; Robock, Oman, & Stenchikov, 2007, Robock, Oman, Stenchikov, Toon, et al., 2007). Without precipitation to act as a removal mechanism, aerosols would remain in the stratosphere for months to years depending on particle size. Robock, Oman, and Stenchikov (2007) used a model that did not include aerosol particle coagulation and growth and found an e‐folding lifetime of 4.6 years for soot particles in the stratosphere. However, simulations of massive soot injections of tens of thousands of teragram of black carbon following the impact that killed the dinosaurs showed that particle coagulation should occur, producing large soot particles with greater fall speeds (Bardeen et al., 2017; Toon et al., 2016).

Volcanic eruption clouds provide a well‐observed analog for particle lifetimes and climate effects. Sulfate aerosols generated from gases injected into the stratosphere by volcanic eruptions cause global cooling due to the reflection of incoming solar radiation back to space, which has been observed numerous times and modeled successfully (Robock, 2000). Simulations of volcanic clouds including particle growth show that large volcanic eruptions, such as that of Mt. Pinatubo with 35 Tg of sulfate aerosols, produce clouds with lifetimes of about 1 year, as observed (Barnes & Hoffman, 1997; Deshler, 2008). However, numerical simulations suggest that larger eruptions, which are not well observed, will produce large particles with shorter lifetimes (English et al., 2013; Pinto et al., 1989). Volcanic aerosols are not transported as high as black carbon aerosols as they are only weakly absorptive and do not self‐loft significantly (Robock, Oman, & Stenchikov, 2007). Wildfires pale in comparison to the Mt. Pinatubo cloud mass, but their aerosols can heat the air enough to be lofted 8 km vertically (Yu et al., 2019). An injection of 150 Tg of black carbon would be a far greater aerosol loading than wildfire contributions or any volcanic eruptions from the past 100 years (when masses can be reliably determined) but would be orders of magnitude smaller than injections of black carbon into the atmosphere 66 million years ago when an asteroid impact caused much of the biomass on Earth's surface to burn, resulting in a mass extinction event (Bardeen et al., 2017; Toon et al., 2016). Volcanic eruptions and mass fires are both effective methods of injecting aerosols into the stratosphere, but the black carbon produced by nuclear mass fires, like what is simulated here, results in far more extreme climate effects per unit mass.

Cooling at the surface is only one of many phenomena that would occur if abundant black carbon aerosols are injected into the stratosphere. Several modeling studies have shown that stratospheric temperatures would increase by more than 50 K and stratospheric ozone would undergo global destruction, even for a scenario where 5 Tg of soot is injected into the stratosphere (Mills et al., 2014; Robock, Oman, Stenchikov, Toon, et al., 2007; Toon et al., 2007). The global hydrologic cycle would become far less active, with a reduction in summer monsoon precipitation and a significantly reduced growing season (Robock, Oman, & Stenchikov, 2007; Robock, Oman, Stenchikov, Toon, et al., 2007). The impacts on human society would be devastating due to agricultural losses alone, even from the 5‐Tg scenario (Xia & Robock, 2013; Xia et al., 2015). Research on the climate impacts of volcanic eruptions has found similar, although usually less severe, consequences as a result of global cooling due to smaller stratospheric aerosol loadings (Robock, 2000).

There are many uncertainties in computing the climate after a nuclear conflict. The greatest uncertainty is how many weapons would be used, what yields would be employed, and which targets would be chosen. This uncertainty cannot be reduced, so ideally, a range of scenarios must be considered to understand the full spectrum of impacts. Using the high‐end scenario from Robock, Oman, and Stenchikov (2007), we assume a war between Russia and the United States, involving numbers of weapons allowed under current treaties. The area burned, the amount of fuel available, the amount of smoke and black carbon produced by the fires, as well as the injection altitudes of the smoke, are also uncertain. We use the approach of Toon et al. (2007) who estimated that 180 Tg of black carbon could be emitted into the upper troposphere. Following Robock, Oman, and Stenchikov (2007), we round this estimate downward to 150 Tg, which would double the 20% of black carbon rain‐out assumed by Toon et al. (2007) and used by Mills et al. (2008). The soot aerosols are emitted over the continental areas of the United States and Russia following the same idealized approach from Robock, Oman, and Stenchikov (2007). The climate response and smoke removal mechanisms may also differ between models. To date, only Robock, Oman, and Stenchikov (2007) have used a modern climate model to simulate this particular scenario of an all out nuclear war between the United States and Russia. Here we repeat the nuclear war scenario from Robock, Oman, and Stenchikov (2007) using an alternative state‐of‐the‐art modern climate model run at higher resolution and with a more explicit simulation of stratospheric chemistry and aerosols. We then compare our new results to the GISS ModelE simulations from Robock, Oman, and Stenchikov (2007) to help determine how sensitive the climate changes may be to the details of the model and to further constrain the lifetime of black carbon aerosols during this type of black carbon injection.

2. Methods

We use the Community Earth System Model with the Whole Atmosphere Community Climate Model, version 4 (WACCM4) for its atmospheric component. The model has a horizontal resolution of 1.9° × 2.5° (lat‐lon), with 66 vertical layers and a model top of 140 km (Marsh, Mills, Kinnison, Lamarque, Calvo, et al., 2013; Bardeen et al., 2017). The Community Land Model 4.0 is used as the land surface model, Parallel Ocean Program v2 is the ocean model, atmospheric CO2 is set at a constant 370 ppm (levels during the year 2000, same as GISS ModelE), tropospheric aerosols (other than black carbon) are prescribed, and ocean biogeochemistry is included. While full tropospheric chemistry is not included, the transport and removal of soot from fires is handled by the Community Aerosol and Radiation Model for Atmospheres (CARMA). CARMA is a sectional aerosol model, which in this case treats soot as fractal particles (Bardeen et al., 2008, 2017; Toon et al., 1988; Turco et al., 1979). As a result, the size of particles is not fixed and can change depending on the rate of coagulation and sedimentation. CARMA has 21 different size bins each with different optical properties, such that changing aerosol sizes also changes the amount of extinction and absorption of radiation. This is the same climate model used by Mills et al. (2014), but their simulation kept the particle size of the soot particles fixed at an effective radius of 0.05 μm. Fractal particles using CARMA have a monomer size of 0.03 μm with a fractal dimension varying between 1.5 and 3.0. Hygroscopic growth is not included, but particle coagulation is a function of relative humidity. Despite major improvements in our ability to simulate the evolution of soot particles through time in the stratosphere, photochemical processing and heterogeneous ozone chemistry on the surfaces of the soot aerosols are not represented. The aerosols themselves do not affect the photolysis rates of gas phase chemicals, similar to the models used in Mills et al. (2014) and Pausata et al. (2016). This affects our ability to report on changes in stratospheric ozone, and inclusion of these processes could potentially shorten the residence time of soot particles in the stratosphere.

Robock, Oman, and Stenchikov (2007) reported simulations of a similar war scenario with the GISS ModelE. GISS ModelE is an Earth system model, which was run with a spatial resolution of 4° × 5° (lat‐lon), with 23 vertical layers and a model top of 80 km (Schmidt et al., 2006). ModelE included a module to calculate transport and removal of aerosol particles (Koch et al., 2006). At the time, ModelE used a bulk stratospheric aerosol model, without the aerosol microphysics incorporated in WACCM4, where mass extinction and single‐scattering albedo were prescribed and sedimentation is a function of particle size. Soot in ModelE was assigned a constant unimodal radius of 0.1 μm, far different from the fractal particles in WACCM4. In ModelE it was assumed that soot could not be removed by rainfall for the first 24 hr, while in WACCM4 soot could immediately be washed out, such that in Mills et al. (2014), 28% of soot was removed before it could be lofted into the stratosphere. Three ModelE ensembles run for 10 years each with no black carbon burden were used as a climatology to compare with the perturbation case, which simulated the 10 years following the injection of soot over the United States and Russia.

As was done in previous model simulations of other nuclear war scenarios (Mills et al., 2008; Mills et al., 2014; Robock, Oman, Stenchikov, Toon, et al., 2007; Stenke et al., 2013), soot is represented as pure black carbon in WACCM4. Extinction per unit mass by soot is computed from the particle size assuming a fractal shape, and a refractive index of 1.8–0.67i, following the approach of Wolf and Toon (2010) and Bardeen et al. (2017). Consequently, the average optical properties vary throughout the simulation as the proportion of black carbon in each bin changes. The mass extinction coefficient for black carbon (for light within the 533‐nm centered wavelength band, averaged across all particle sizes) varies between 9.6 and 9.8 m2 /g in WACCM4. In an attempt to account for dust and organic carbon, Robock, Oman, and Stenchikov (2007) reduced the mass extinction coefficient of black carbon to 5.5 m2 /g for all visible light in their 150‐Tg case. ModelE also assumed a constant particle size, a constant mass absorption coefficient of 2.0 m2 /g, and a single‐scattering albedo of 0.64. However, most nuclear war soot injection estimates and simulations used pure black carbon, assuming that neither dust nor organic carbon would reduce the soot's ability to absorb radiation, while also neglecting their impact on particle size (Bond & Bergstrom, 2006; Toon et al., 2007). In contrast to ModelE, we inject 150 Tg of pure black carbon in WACCM4, where the mass extinction coefficient for particles with an effective radius of 0.1 μm at wavelengths of light at 533 nm is approximately 7 m2 /g. Not using the exact same optical properties of black carbon in WACCM4 as in ModelE sacrifices some direct comparability between the models, but it follows more closely the approach of other model simulations of mass fires as a result of nuclear war. Estimates of smoke emissions by Toon et al. (2008) and others are only for the soot component of the smoke assuming that any organics produced would be oxidized rapidly in the stratosphere. Consideration of composition other than pure black carbon in the smoke would require increasing the mass of smoke emitted in addition to changing the optical properties. Additionally, our model is not yet able to allow the ratio of black and organic carbon in fractal particles to evolve through time, which would be necessary to account for organic carbon properly. Toon et al. (2008) estimated that 180 Tg of black carbon alone could be injected into the atmosphere in the war scenario used here and in ModelE, where urban areas are targeted using 4,400 total nuclear weapons with 100‐kt yield from the Russian and United States arsenals (Toon et al., 2008). The United States and Russia each have close to 4,000 strategic weapons deployed or in storage, and the average yield is larger than 100 kt according to recent estimates (Kristensen & Norris, 2018a, 2018b). The approach by Robock, Oman, and Stenchikov (2007) effectively reduced the total black carbon injected below 150 Tg, which is no longer consistent with estimates of this war scenario (Toon et al., 2007). If Robock, Oman, and Stenchikov (2007) had wanted to consider organic or dust emissions, then the total emissions should have been increased along with changing the optical properties. Here we just consider the black carbon injection of 150 Tg, which is consistent with the emission estimates for this war scenario. We ran three ensembles of WACCM4 for 20 years each with no black carbon burden to use as a climatology to compare with a soot injection case.

The black carbon is injected into the upper troposphere (300–150 hPa) at a rate that is linearly decreasing over a 1‐week period starting on 15 May and is spread uniformly over the same areas of Russia and the United States as in ModelE. We retain this simplified approach, while in reality, soot injections would initially be focused only over areas targeted but over days to weeks would likely spread out similar to our initial injection. The year of the injection will be referred to as Year 0, which, in agreement with GISS ModelE, is the year 2000. WACCM4 was run for 20 years following this perturbation, and additional ensemble member simulations were not conducted because the magnitude of the forcing is far greater than natural variations on a global scale. Even for a 5‐Tg soot injection, the signal dominates over natural variability (Mills et al., 2014). CO2 was kept constant.

3. Results

3.1. Transport of Soot Across the Globe, Impact on Radiation, and Soot Fallout

The pattern of smoke emitted during the first week is illustrated in Figure 1, which shows the mass mixing ratio of soot at 250 hPa in the WACCM4 simulation. Intense solar heating of the aerosols generates positive buoyancy over large areas, enabling the aerosols to reach the upper levels of the stratosphere, encountering winds that quickly distribute the smoke over the Earth. After a week, soot can be found throughout most of the Northern Hemisphere (NH), and after 2 weeks it drifts into the Southern Hemisphere. Once emitted in WACCM4, the smoke is heated by sunlight and self‐lofts to pressures as low as 0.01 hPa (altitude = 80 km), as illustrated in Figure 2a, which shows the soot mass mixing ratio with height averaged over the Earth through time during the WACCM4 simulation. Because WACCM4 simulates changes in the size of soot particles, there is significant particle growth through time, shown in Figure 2b. The particles in WACCM4 grow to more than 10 times the size of the fixed radius of 0.1‐μm particles in GISS ModelE, which has consequences for soot lifetime and scattering. The presence of highly absorptive black carbon aerosols in the stratosphere results in considerably enhanced stratospheric temperatures in both WACCM4 and ModelE (see Figures 2c and 2d). WACCM4 has more vertical levels and a higher model top than GISS ModelE, allowing for more accurate handling of upper level thermodynamic and dynamic processes. Although stratospheric heating is stronger in WACCM4 due to a higher mass absorption coefficient, as evidenced by the larger area of 100 K or greater heating in Figure 2c, it persists for a longer period of time in GISS ModelE due to longer aerosol residence time, as shown by the presence of the 30 K or greater anomaly after more than 10 years.

The time evolution of the zonally averaged aerosol optical depth (AOD) anomaly in both WACCM4 and ModelE is illustrated in Figure 3, where GISS ModelE output is from Robock, Oman, and Stenchikov (2007). The WACCM4 model produces optical depths in both the Northern and Southern Hemispheres, which exceed those from ModelE by a factor of up to 2 in the initial few years. The decision to use pure black carbon in WACCM4 contributes partly to this. The second factor is WACCM4's more sophisticated microphysics scheme, which allows particles to form long chains and causes a steady increase in particle effective radius (and scattering) over time. If the mass extinction coefficient in WACCM4 was reduced by 20% across all wavelengths and particle sizes, so that aerosols with a 0.1‐μm effective radius had a mass extinction coefficient of 5.5 m2 /g (like in ModelE), growth still would have resulted in a mass extinction coefficient just larger than 7.5 m2 /g for all particles in the 533‐nm band in WACCM4. Therefore, even if the soot in WACCM4 began with the exact same size and optical properties as ModelE, the presence of larger fractal‐ shaped aerosols still would have promoted higher AOD compared to the smaller, unchanging particles assumed in ModelE. A tipping point is reached after Year 2, when the particles in WACCM4 grow too large and begin to fall out more quickly.

The time evolution of the total amount of soot in the atmospheric column, or soot burden, as simulated by WACCM4 and ModelE is illustrated in Figure 4. Additionally, the soot optical depth in the visible band, [[FIGURE 1 OMITTED]] which is calculated at 500 nm in WACCM4, is shown. The initial injection of soot is followed by a gradual decline over the course of a decade. A drop off occurs a few months after the initial injection, but then it levels off during the spring of Year 1. During the next fall, there is another quick drop in total soot burden and a leveling off in the subsequent spring. This stair‐step pattern continues for the first few years, gradually becoming less prominent as soot is removed at a more constant rate regardless of season after Year 2. Global removal of soot is enhanced during boreal winter in part because the majority of the soot [[FIGURE 2 OMITTED]] [[FIGURE 3 OMITTED]] [[FIGURE 4 OMITTED]] initially resides in the NH. Soot removal is enhanced especially near the northern polar region during this time mostly due to large‐scale descent and reduced heating of aerosols. As the soot becomes evenly spread with time, the effect is reduced. Soot is removed more slowly in ModelE compared to WACCM4, starting with the first winter after the soot injection, and this continues through to the end of the ModelE simulation, where 19 Tg of black carbon is left but less than 2 Tg remains in WACCM4 at the same time.

The mass‐weighted global average mass extinction coefficient of black carbon in WACCM4 is 9.6 m2 /g for the first month (at a wavelength of 533 nm) and increases to 9.8 m2 /g during the next few months of the model run, which is its peak value for the simulation. The change in optical depth in WACCM4 closely tracks the change in soot burden, consistent with very little change in the mass extinction coefficient after the first few months. For a wavelength of 533 nm, the mass absorption coefficient is 5.48 m2 /g. Although the size of the aerosols change, the mass absorption coefficient remains constant at 5.48 m2 /g in WACCM4 for particles with an effective radius greater than 0.036 μm (see Figure S1 in the supporting information). After 1 month, nearly 100% of the black carbon aerosols in WACCM4 grow beyond this size. As a result, the aerosols are twice as effective at absorbing shortwave radiation compared to those used in the ModelE experiment. However, variations in the mass extinction coefficient with time are primarily due to changes in scattering as opposed to absorption. The mass extinction coefficient (scattering and absorption combined) as a function of particle radius for a number of wavelengths of light in CARMA is shown in Figure 5. The properties of the particles used in ModelE are also designated in Figure 5. There is a peak in mass extinction coefficient near 10 m2 /g for aerosols with an effective radius between 0.3 and 0.56 μm for a wavelength of 533 nm. During the first few months of the simulation, the majority of black carbon aerosols in WACCM4 are within this size range. As most of the particles grow out of this optical sweet spot, they become slightly less effective. However, even when the particles in WACCM4 are at their largest sizes, they are still more effective at scattering and absorbing solar radiation than in the unchanging particles in the ModelE simulation. The growth of particles that occurs in WACCM4 (see Figure 2b) causes the aerosols to fall out more quickly than in ModelE, as the largest stratospheric particles preferentially fall into the troposphere, where they are quickly removed by rainfall and sedimentation. A fractal particle requires more mass to fall out through gravitational settling compared to spherical particles, but the aerosols in WACCM4 quickly surpass a threshold where removal becomes rapid. The growth of aerosols reduces their lifetime and alleviates the long‐term climate impact.

The smoke optical properties discussed previously are fed into the climate model's radiation codes. The ModelE and WACCM4 radiative transfer codes are not identical. WACCM4 uses the Rapid Radiative Transfer Model for GCMs code (Iacono et al., 2008; Mlawer et al., 1997), while ModelE's radiative transfer code is as described by Schmidt et al. (2006). Rapid Radiative Transfer Model for GCM uses a two‐stream scattering model for solar radiation with 14 shortwave bands and 16 longwave bands. Particles are treated as absorbers of longwave radiation. ModelE has explicit multiple‐scattering calculations for shortwave and explicit integrations over both the shortwave and longwave spectral regions. Using a k‐distribution approach, 15 noncontiguous shortwave and longwave bands are used to model overlapping cloud, aerosol, and gas absorption (Lacis & Oinas, 1991). Ultimately, we do not expect the differences between the two schemes to play a primary role in differences between climate impacts, but we cannot rule out its effect.

There are many similarities in the initial distribution of the AOD anomaly between WACCM4 and ModelE, shown in Figure 3. Unlike the case of high‐latitude volcanic eruptions, whose clouds are generally confined to latitudes poleward of 30° and disappear within less than a year (Robock, 2000), or high‐latitude forest fires injecting smoke just above the tropopause, which also seem limited to poleward of 30° (Yu et al., 2019), the emissions from midlatitude urban fires following a nuclear war spread quickly into the Southern Hemisphere. Enhanced lifetime and spread (compared to wildfires and high‐ latitude volcanic eruptions) occur because the self‐lofting of the smoke carries it from the upper troposphere to very high altitudes where it is in the overworld stratosphere, unlike volcanic and forest fire clouds that are injected into the middle world. In the middle world isentropic surfaces connect the midlatitude stratosphere and upper troposphere in the tropics, leading to rapid loss of material into the tropical troposphere (Holton et al., 1995). Once in the stratosphere, soot residence time can also be lengthened by slowing in the Brewer‐Dobson circulation due to surface cooling and reduced convection, as was found by Mills et al. (2014). [[FIGURE 5 OMITTED]]

The effect of particle growth and faster fallout in WACCM4 can be seen in Figure 3, where optical depths fall below 0.1 in Year 8 in WACCM4, while ModelE still has optical depths above 0.2 at Year 10. As particle effective radius increases in WACCM4, sedimentation is enhanced, resulting in lower optical depths after 8 years. Based on previous work, the e‐folding lifetime for stratospheric soot in ModelE was 4.6 years with an effective radius of 0.1 μm (Robock, Oman, & Stenchikov, 2007). Soot has a residence time of days to weeks in the troposphere due to precipitation washing it out, so these times reflect the stratospheric removal rates (Wang et al., 2014). In the case of simulations of a 5‐Tg soot injection in ModelE, the mass e‐folding time after initial rain‐out was longer than for the 150‐Tg case in ModelE. An 8.4 year e‐folding time was reported for the Mills et al. (2014) experiment where 5 Tg of soot with a constant radius of 0.1 μm was injected over India and Pakistan using WACCM4, while 6 years was reported by Robock, Oman, and Stenchikov (2007) using ModelE. The longer lifetime in the 5‐Tg experiments of Mills et al. (2014) than in Robock, Oman, and Stenchikov (2007), both of which fixed the soot radius at 0.1 μm, may have been due to the higher model top of WACCM4. A higher model top allowed soot to rise further above the tropopause (Figure 2), and the higher vertical resolution combined with a more accurate simulation of vertical motion resulted in the slowdown of the stratospheric residual circulation in Mills et al. (2008), enhancing soot lifetime. Here, in closer agreement with the sensitivity test in ModelE, we found using CARMA, which for the first time allowed the particles to coagulate, an e‐folding lifetime of 3.5 years for the soot from a 150‐Tg injection (as compared to 4.6 years in GISS ModelE). In the current version of WACCM4 the average effective radius of soot particles grows rapidly during the first 2 years to a size greater than 1 μm, reaching a peak of more than 1.3 μm averaged globally (see Figure 2b).

At the latitudes with the highest optical depths, surface shortwave radiation reductions of 100 W/m2 continue for 7 years in WACCM4, but for only 4–5 years in ModelE (Figure 6). Although soot fallout occurs more quickly in WACCM4, the aerosols are more effective at blocking sunlight until removal becomes significant, which is around Year 7. Greater reductions in zonal mean shortwave radiation are observed over the subtropics and tropical regions in WACCM4 compared to ModelE, and during summer in each hemisphere, WACCM4 lets in more shortwave radiation at higher latitudes than ModelE (Figure 6c). This indicates a tendency for the aerosols to linger in the tropical stratosphere more so in WACCM4 than in ModelE, related to the higher vertical resolution in WACCM4. Globally averaged, as indicated in Figure 7, both models show reductions of up to 100 W/m2 during the first year, alongside a dramatic decrease in temperature and precipitation. The total downwelling solar radiation at the surface is only 30–40% of normal (where normal is around 160 W/m2 ) during the first 6 months of the soot injection across both models. [[FIGURE 6 OMITTED]] [[FIGURE 7 OMITTED]] In WACCM4, surface light levels remain below 40% of normal for 3 years, returning to normal after about 10 years after the war starts, while ModelE shows a slower recovery, which is a direct consequence of the small, fixed size aerosols. Low‐light levels during the summer months at high latitudes may provide a challenge for organisms that depend on photosynthesis to survive. For example, the base of the photic zone in the ocean, where photosynthesis largely stops, is taken to be at 1% of surface light levels. Bardeen et al. (2017) showed that light levels were well below this limit for the smoke injections that occurred following the impact of the asteroid at the end of the Cretaceous that caused a critical mass extinction event. While parts of the polar latitudes receive less than 5% of normal light during the summer immediately after the 150‐Tg soot injection, the K‐Pg asteroid extinction event is clearly a far more extreme case.

3.2. Stratospheric Changes: Temperature, Water Vapor, Circulation

Absorption of solar radiation by soot drives extreme stratospheric temperature changes, as mentioned previously and shown in Figure 2. Positive temperature anomalies of more than 100 K occur for about 3 years in the portion of the stratosphere where the bulk of the ozone layer is located in WACCM4. ModelE has slightly less heating for the same time and location, a difference that is consistent with the higher optical depths in WACCM4 as shown in Figure 3 and the higher mass absorption coefficient. As discussed by Mills et al. (2014) and Bardeen et al. (2017), increases in temperature of this magnitude result in dramatic losses of stratospheric ozone, allowing more unfiltered UV radiation to reach the surface. WACCM4 also observed ozone loss, while ModelE did not compute changes in ozone. Heating due to soot occurs down to about 500 hPa, which pushes the tropopause down to very low altitudes, warming the tropopause. Stratospheric water vapor is typically limited by the temperature of the tropopause, so water vapor in the stratosphere increases after the nuclear conflict, as seen in the global profile of specific humidity and relative humidity anomalies after the conflict in Figure 8. Variations in water vapor in the WACCM4 control run are shown in Figure S2, along with actual specific humidity and relative humidity values for the perturbed and control run. Water vapor intrusions, also found by Mills et al. (2014) and Bardeen et al. (2017), are significant for ozone chemistry in the stratosphere, as the photolysis of water vapor exacerbates ozone destruction, which already is increased due to the stratospheric heating (Mills et al., 2014). As black carbon aerosols in WACCM4 stick together and their effective radius grows in size, they become vulnerable to removal from the stratosphere, which may be exacerbated by the intrusion of water vapor. While the lower stratosphere experiences an increase in water vapor (greater than 0.1 g/kg), the local temperature change is so great that the relative humidity is actually reduced by 10–25% for 7 years after the soot injection. Around Year 4, water vapor enters the upper stratosphere (10 to 0.01 hPa) and remains through Year 12. Around Year 9, as the black carbon aerosols are being removed from the lower stratosphere, the temperature of the stratosphere drops, while the water vapor content remains relatively constant, causing a 25–50% increase in relative humidity. A similar phenomenon in the study of the K‐Pg asteroid impact by Bardeen et al. (2017) led to the rapid removal of black carbon from the stratosphere, as local regions of the stratosphere become saturated with water and formed clouds that precipitate the black carbon. Although an increase in relative humidity is observed here, the rate of black carbon removal is mostly unchanged during this time (see Figure 4), similar to what was observed by Mills et al. (2014) in a study with a smaller soot injection.

Mills et al. (2014) also observed a slowing of the overturning circulation in the stratosphere, known as the Brewer‐Dobson circulation. Surface cooling reduced tropical tropospheric updrafts by 50% in a 5‐Tg nuclear war case, and here, using a very similar model with 150 Tg of soot, we observed a reduction in vertical velocity of greater than 80% for up to 4 years. The clear slowing of the overturning circulation of the stratosphere, the layer where most of the aerosols reside, would act to lengthen the residence time of aerosols after they are injected. However, it is apparent that aerosol growth mitigates this effect, as the aerosols fall out more quickly than in ModelE.

3.3. Surface Temperature Change

In both the GISS ModelE and WACCM4 model simulations, global mean surface temperatures drop considerably immediately following the soot injection, as seen in Figure 7. In the first year following the injection, global temperatures plunge by more than 7 K in both models, with some subtle differences. A larger negative shortwave radiation forcing is observed in WACCM4 for 8 years after the injection of soot, and yet, ModelE is 0.5 K cooler during the first summer and follows the WACCM4 temperature response very closely for 18 months after the injection of soot. This indicates that WACCM4 surface temperature is [[FIGURE 8 OMITTED]] less sensitive to a given negative shortwave radiative forcing compared to ModelE. One year after the injection of soot, global temperatures in WACCM4 have declined by 9.5 K from the climatological mean, cooler than ModelE by less than 0.2 K. From the middle of Year 1 through to the beginning of Year 6, WACCM4 remains colder than ModelE, which is also reflected in global precipitation and surface radiation. Figure 7 shows that the negative shortwave forcing reaches its maximum in Year 1, while temperatures continue to decline or remain low through Year 4. It quickly becomes clear that the temperature is not simply tracking the available sunlight, as the high thermal inertia of the oceans delays the minimum global temperature until 2 years after the injection.

Averaged globally, as shown in Figure 7, the WACCM4 simulation is 1 to 2 K colder than ModelE during Years 2 through 5 but by year 6 the WACCM4 and ModelE global temperature anomalies are both −6 K, and WACCM4 is warming up more rapidly. The speed of global temperature recovery in WACCM4 is faster than ModelE starting in Year 5. By Year 7, WACCM4 is warmer than ModelE, despite the stronger negative shortwave radiation forcing in WACCM4. WACCM4 begins to warm up more quickly, while the negative shortwave radiative forcing is still greater in WACCM4 compared to ModelE, but the gap between the two models shrinks for most of the simulation. When the effect of the larger aerosols falling out in WACCM4 is realized in the surface shortwave radiative anomaly near the end of Year 8, WACCM4 is already 1.5 K warmer than ModelE and recovering much more quickly. The quicker return to near zero radiative forcing from black carbon in WACCM4 is due to previously mentioned differences in aerosol treatment, but the response in temperature to a deficit in surface radiation is clearly different between the two models. By Year 10, there is no negative shortwave radiation anomaly in WACCM4. Global mean surface temperatures remain depressed by 0.5 to 1 K below the control climatology for up to 15 years after the soot injection due to the large heat capacity of the oceans and expansion of sea ice across the NH, which prevents it from rapidly warming back to prewar temperatures. ModelE was only run for 10 years, but a prolonged temperature response was also observed in the 5‐Tg case using WACCM4 (Mills et al., 2014).

Bardeen et al. (2017) showed that high stratospheric temperatures, similar to those observed here, can greatly increase the downwelling infrared energy at the surface. In our simulation, the globally averaged budget of downwelling longwave radiation at the surface is overwhelmingly negative in response to the cooling of the lower atmosphere. This is contrary to what was found in the K‐Pg asteroid impact case with very high aerosol loadings and near total darkness (Bardeen et al., 2017). Significantly more shortwave radiation is able to reach the surface, while more longwave radiates out to space during these nuclear war simulations. However, there is a very small increase in downward longwave radiation at higher latitudes during the winter, which is related to winter warming in this region.

Global surface temperature anomalies vary in space and in time, but similar spatial patterns are observed in both models, as shown in the December‐January‐February (DJF) Year 0–1 and June‐July‐August (JJA) Year 1 temperature anomalies in Figure 9. Regardless of season, the largest temperature change is observed over continents. A seasonal bias in the global mean surface temperature, which is obvious from the seasonal cycle from Figure 7, is observed due to the larger fraction of land mass in the NH, which allows larger temperature swings than the ocean. Negative temperature anomalies are strongest in NH summer (JJA) and weakest during NH winter (DJF) for the first 4 years. The difference in the temperature response between DJF and JJA shrinks rapidly in the ModelE simulation after Year 3 as the oceans are responding to the forcing and the forcing itself becomes smaller, reducing the amplitude of the seasonality in the response. Cooling is less significant in the Southern Ocean in both models (see JJA in Figure 9), because the Antarctic polar vortex is strengthened, causing a poleward shift in winds, which reduces the surface westerlies and vertical mixing (Robock, Oman, Stenchikov, Toon, et al., 2007). The presence of absorbing aerosols in the stratosphere alters atmospheric dynamics, similar to the mechanism behind the winter warming response observed in the NH following large tropical volcanic eruptions (Groisman, 1992; Robock & Mao, 1992; Stenchikov et al., 2002; Zambri et al., 2017).

Despite such a large aerosol loading, temperatures are warmer than the long‐term control mean across the Arctic in both model simulations during the first two winters. While temperatures are warmer, they are still below freezing on average in the Arctic. Figure 9 shows that parts of Scandinavia and areas just north of Eurasia are significantly warmer than normal in both WACCM4 and ModelE during the first full winter following the soot injection. This warming persists to a smaller degree during the second winter as well. Compared to ModelE, the WACCM4 simulation is warmer in the Antarctic and Arctic consistently after Year 1 and cooler in much of the tropics through Year 7. The high‐latitude temperature pattern is indicative of the strongly positive Arctic Oscillation in the stratosphere (250 to 10 hPa) that propagates down into the troposphere each winter. As a result, relatively warm air over the Atlantic Ocean is advected northward. This circulation pattern occurs for multiple winters, but its temperature signature is obscured by global cooling after 2 years.

There is a true nuclear winter in both of these simulations, where temperatures drop below freezing over much of the NH during the height of summer. Figure 9 shows temperature anomalies for WACCM4 and ModelE during the second NH summer after the injection (JJA Year 1), one of the coldest summers after the injection. Continental North America and Eurasia are 20 K or more below average for up to three summers after the soot injection. Temperature changes of this magnitude would lead to below freezing summer temperatures for much of the midlatitudes. The red line shown in Figure 9 represents locations, poleward of which the actual temperature is below 0 °C during JJA Year 1, which shows a shift as far south as northern Texas, Arkansas, and Missouri in the United States, imperiling important agricultural areas during that summer.

Temperatures below 0 °C in midsummer cause a near 90% reduction in the growing season in some locations, defined here and in Robock, Oman, and Stenchikov (2007) as the number of consecutive days with minimum temperatures above freezing. Figure 10 shows the length of the growing season (number of consecutive days with minimum nighttime temperatures above 0 °C) in the control run and for Years 1 to 2 in the 150‐Tg soot injection run. In the NH, the growing season is measured from 1 January to 31 December and the Southern Hemisphere is from 1 July to 30 June. The length of the growing season drops below 50 days across much of the interior United States and below 100 days for the most agriculturally productive regions in the U.S. Most of Eastern Europe's growing season is reduced below 50 days, and all parts of Russia have their growing season reduced below 25 days. Hard freezes, where temperatures drop below −4 °C, would occur through Years 2 and 3 in the summer, making it impossible to grow crops in the United States and Russia. Ukraine, Poland, and Germany would suffer similar fates, while in China, only the southeast part of the country would stay above freezing during the summer. WACCM4 produces slightly colder temperatures than ModelE, but the temperature in both simulations would be perilous for agriculture.

Robock, Oman, and Stenchikov (2007) examined the impacts of a nuclear winter at a more local level through an analysis of minimum temperatures in Iowa (42°N, 95°W) and Ukraine (50°N, 30°E) using GISS ModelE, showing that a 150‐Tg soot injection would produce below freezing temperatures in Iowa throughout the first 2 years after a full‐scale nuclear war except for a few days barely above freezing in [[FIGURE 9 OMITTED]] midsummer. In Ukraine, GISS ModelE found below freezing temperatures for two full years, with temperatures barely above freezing in the summer of the second year. The same analysis is performed here and is shown in Figure 11 for WACCM4. Temperatures drop below freezing in Iowa within 1 week following the soot injection on 15 May, and daily minimum temperatures rise above freezing only once in a span of 730 days. Minimum temperatures only consistently rise above freezing during the third summer after the initial injection of soot. In Ukraine, the first summer after the war is not as cold as Iowa, but minimum daily temperatures frequently drop below freezing. During the next summer, Ukraine minimum daily temperatures remain close to freezing but still with days at a time recording below freezing temperatures. This behavior continues through the third summer after the war, when minimum daily temperatures rise to the 5 °C range in both Ukraine and Iowa. Clearly, a nuclear war producing 150 Tg of black carbon would decimate agricultural output at midlatitudes, as even a smaller regional nuclear war led to a reduction in Chinese maize and rice production by 15% for 5 years in an agricultural modeling study (Xia et al., 2015).

3.4. Precipitation Changes

Aerosol‐forced reductions in solar heating, evaporation, and convection diminish precipitation globally, which is found in both the WACCM4 and ModelE simulations, as seen in Figure 7 and discussed by Robock, Oman, and Stenchikov (2007). Figure 7 shows the global precipitation response in both models over the course of 10 years, where there is agreement in an immediate, 30% decline in global precipitation through the first few months of the soot injection. Through Years 2–8 the WACCM4 simulation, compared to ModelE, has 10% less (−0.3 mm/day) precipitation. The maximum reduction of globally averaged precipitation in WACCM4 is 58% and in GISS ModelE is 47%, both during the end of Year 3 and beginning of Year 4. During Year 7, globally averaged precipitation increases sharply in the WACCM4 run, while the ModelE simulation recovers very slowly. The rebound in global precipitation lags the global temperature rebound by 1–2 years, but this is a similar pattern to aerosol optical depths between the two models.

Precipitation changes are heterogeneous in space, as some, primarily arid, regions experience increased precipitation despite the extreme global reduction. Figure 12 shows JJA precipitation anomalies for both WACCM4 and ModelE. Averaged globally, WACCM4 has a stronger reduction in precipitation, but there [[FIGURE 10 OMITTED]] are far more extremes in the spatial distribution of precipitation changes. Other than the reductions in precipitation across much of the continental areas in the high latitudes due to reduced evaporation, the most obvious change is the 100% and greater increase in precipitation in the eastern equatorial Pacific Ocean, especially in WACCM4. This pattern resembles the precipitation pattern of a moderate to strong El Niño in the WACCM4 control. The Southern Oscillation Index, the normalized pressure difference between Darwin and Tahiti, undergoes a rapid negative change, resulting in persistent atmospheric El Niño conditions for more than 7 years after the injection of soot. El Niño conditions are common following volcanic eruptions, which have been attributed to mechanisms ranging from land‐sea temperature contrasts to southward Intertropical Convergence Zone (ITCZ) shifts to eastward propagating Kelvin waves originating from Africa (Khodri et al., 2017; Pausata et al., 2015; Stevenson et al., 2016). Despite the rapid global cooling, a warm tongue is observed in the sea surface temperatures of the eastern equatorial Pacific from August of Year 0 to February of Year 1. Westerly trade wind anomalies up to and exceeding 14 m/s develop across much of the Pacific Ocean for almost a year, which appear to originate over the Maritime Continent and Southeast Asia. Cold air settles in across the entire eastern portion of the Asian [[FIGURE 11 OMITTED]] continent, causing anomalously high pressure to develop over the continent, producing an intense Asian winter monsoon pattern across the western Pacific for many years, regardless of the season. Intense westerly wind anomalies across the Pacific Ocean result in convection focused over the eastern equatorial Pacific, as well as moderate warming across the region. As a result of this change in circulation coupled with a reduction in evaporation, southern Asia suffers from a collapse of the summer monsoon in WACCM4, which is present in ModelE as well to a lesser degree. The weakening of the summer monsoon has been observed following volcanic eruptions, as continents cool more than the ocean, reducing the land‐ocean temperature gradient (Iles & Hegerl, 2014; Trenberth & Dai, 2007; Zambri et al., 2017). In the WACCM4 simulation, the summer Asian monsoon does not return for at least 7 years.

Both WACCM4 and ModelE agree on large precipitation reductions over southern Asia, across the western coast of central Africa, as well as in changes to the position of the ITCZ. The ITCZ, a band of clouds located where the trade winds converge, shifts southward during JJA and northward during DJF and tends to move toward the warmer hemisphere (Broccoli et al., 2006; Donohoe et al., 2012). Greater NH cooling during the summer months leads to a southward shift in the ITCZ. The 6‐month average position of the ITCZ, which was typically 3–4°N latitude during the WACCM4 control run, drops as far south as 2.5°S within months of the soot injection. Less solar heating and convection in tropical areas leads to a shift in the Hadley cell, weakening the rising branch (see Figure S3), resulting in a considerable decline in tropical rainfall in the general region of the equator to 20°N in the JJA season. The descending branch of the Hadley circulation is also diminished leading to greater precipitation generally between 20°N and 40°N during JJA, in subtropical deserts such as the Sahara, and desert regions of Australia, South America, and South Africa. In addition to temperature being unsustainable for agriculture, the lack of rainfall in the tropics could affect agriculture.

A 100% precipitation increase (+1 mm/day) over the Arctic Ocean just north of Europe during the first full NH winter after the nuclear war in both model simulations is a result of a dramatic change in the NH wintertime circulation pattern. As mentioned previously, the net energy balance is positive over the Arctic in winter due to advection of warm air from the Atlantic and thermal radiation emitted downward from the hot stratosphere. Overall, the summer monsoons weaken drastically, the average ITCZ location annually shifts southward, and precipitation increases over similar regions in both simulations. Compared to the ModelE, WACCM4 shows a stronger reduction in the Asian monsoon through Year 6, followed by faster recovery as the aerosols fall out. [[FIGURE 12 OMITTED]]

3.5. Changes in Circulation

During boreal winter, when no sunlight reaches the northern pole, soot in the midlatitudes continues to absorb sunlight, leading to warming in the midlatitudes and cooling in the polar stratosphere. A differential heating gradient develops in the stratosphere during NH winter, which increases the pole‐to‐equator temperature gradient, strengthening the stratospheric polar vortex (Mao & Robock, 1998; Robock, Oman, Stenchikov, Toon, et al., 2007; Stenchikov et al., 2002). Zonally averaged wind speeds at 10 hPa and 60°N reach more than 150 m/s each winter during the WACCM4 simulation, 250% more than even the greatest wind speed at this level during the control run. With such strong zonal winds, the vortex remains intact until the final breakdown occurs during late spring when sunlight returns to the pole and the temperature gradient is reversed. WACCM4 and ModelE are in agreement on changes in atmospheric circulation, but WACCM4's higher model top and higher vertical resolution are more adept at representing stratospheric variability, making it a better tool to analyze how changes in the stratosphere result in changes in the troposphere (Charlton‐Perez et al., 2013; Shaw et al., 2014).

Geopotential heights at 250 hPa for the first six winters after the injection from WACCM4 in Figure 13a show lower heights in the NH polar region and higher heights elsewhere, corresponding to a strong zonal circulation at this level. This height distribution translates into a highly amplified, positive mode of the Arctic Oscillation (AO) at the surface. The AO is calculated from the first empirical orthogonal function of mean sea level pressure from 20°N to 90°N and is normalized with respect to the WACCM4 control run climatology (Thompson & Wallace, 1998). The pattern from Figure 13a is not dependent on level, as a [[FIGURE 13 OMITTED]] positive AO response is present from the surface up to 10 hPa (see Figure S4). According to Stenchikov et al. (2002) in a study examining the circulation response to volcanic aerosols following the eruption of Mt. Pinatubo, a tropospheric pathway could also contribute to this pattern, where a reduction in upward propagating planetary waves due to a reduced temperature gradient between the tropics and midlatitudes allows the stratospheric polar vortex to become anomalously strong. The heating in the stratosphere for this scenario is more than 20 times greater than the heating after the Pinatubo eruption. A potential tropospheric pathway's contribution to the positive AO pattern was not examined in detail here because the strength of the stratospheric pole‐to‐equator temperature gradient is so extreme compared to changes in upward propagating planetary waves. Figure 13b shows the monthly AO index for both the WACCM4 control run and soot injection run. The AO remains amplified and positive (greater than 1.0 averaged over DJF) for 12 consecutive winters after the injection of soot during the WACCM4 simulation. The negative AO present during summer is due to enhanced heating of the aerosols at the pole. The NH winter circulation pattern in ModelE also resembles a positive AO for the 10 years of its run.

The development of a strong stratospheric polar vortex is the main contributor to warming just north of Eurasia, which only stops when the oceanic air upstream cools off after 3 years. The most amplified and positive AO winters in the WACCM4 control run, when averaged together, produce a temperature signal nearly identical to the observed warming in the first winter after the nuclear winter. The warming in these nuclear winter simulations is slightly north of the expected winter warming following volcanic eruptions and the typical positive AO temperature pattern (Zambri et al., 2017), as a stronger stratospheric pole‐to‐equator temperature gradient and stronger polar vortex shifts the advection of warm air slightly north. At high latitudes during the winter, an increase in downwelling longwave radiation at the surface is observed, but the spatial pattern, focused over Northern Europe, is more consistent with the change in circulation pattern than the distribution of aerosols. The magnitude of the positive radiative anomaly is within 10% of a composite of all strongly positive winter AO months in the WACCM4 control run, so any contribution from aerosols is minimal. Thus, the positive downwelling longwave radiation anomaly arises from a warmer than normal troposphere, which occurs due to the positive AO circulation pattern.

4. Conclusions

WACCM4, a state‐of‐the‐art climate model, and GISS ModelE, an older climate model, were used more than a decade apart to simulate the environmental aftermath of a full nuclear conflict, a near worst case scenario. The models have significant differences in particle microphysics and spatial resolution, as well as different algorithms for radiative transfer, dynamics, and other modeling approaches. Despite this, the models agree that a nuclear winter would follow a large‐scale nuclear war between the United States and Russia, a result previously found by a large number of diverse but much less sophisticated models in the 1980s. Despite differences in sensitivity to shortwave radiative anomalies, both models exhibit a peak temperature drop of near 9 K below climatological values. The massive size of the forcing explains many of the similarities in globally averaged values initially, and differences emerge as the aerosols are removed at different rates. The new model agrees not just in global averages but in spatial patterns for temperature, and precipitation changes and other climate parameters. Both models highlight the risk of a crash in global surface temperatures, but WACCM4 points to a collapse in the summer monsoon, a dramatic shift in El Niño variability, drastic changes to the Northern Hemisphere winter time circulation, and a climate state that is 0.5 to 1 K below climatological temperatures from before the war with no sign of further warming. The WACCM4 model finds that the lifetime of the smoke is greatly enhanced over 1980s models, because it extends to much higher altitudes where the smoke is more isolated from tropospheric rainfall, a result first found in ModelE by Robock, Oman, and Stenchikov (2007).

However, compared to GISS ModelE, the lifetime of soot in the WACCM4 run is shorter due to the inclusion of particle coagulation and fractal optics, despite the higher vertical resolution and model top, alleviating the duration of the most extreme climate effects. Despite this, the cooling for the first few years is more extreme in WACCM4 and temperatures at the end of the simulation suggest a new colder climate state. The inclusion of additional particle removal processes addresses a long‐standing uncertainty about the black carbon aerosols released following a nuclear war and allows us to further constrain their e‐folding lifetime. While we did not consider the effect of organic coatings on top of pure black carbon particles, future work should incorporate more direct calculations of smoke generation using high‐resolution fuel loading databases and high‐resolution fire modeling of urban landscapes to determine the distribution, type, and amount of material emitted from nuclear fires. Future work will build upon the results of Yu et al. (2019) to quantify the role of organic carbon in smoke from pyroCbs and the sensitivity tests of different ratios of organic carbon and black carbon by Pausata et al. (2016) for a regional nuclear war. Addressing the uncertainty of aerosol composition would further quantify the lifetime of these aerosols and their effects on chemistry in the stratosphere. The research conducted here supports the results of Turco et al. (1983), Sagan (1984), Pittock et al. (1986), Robock, Oman, and Stenchikov (2007), Mills et al. (2008), Robock and Toon (2012), and Mills et al. (2014) that a full‐scale nuclear attack would be suicidal for the country that decides to carry out such an attack. The use of nuclear weapons in this manner by the United States and Russia would have disastrous consequences globally. To completely remove the possibility of an environmental catastrophe as a result of a full‐scale nuclear war, decision makers must have a full understanding of the grave climatic consequences of nuclear war and act accordingly. Ultimately, the reduction of nuclear arsenals and the eventual disarmament of all nuclear capable parties are needed.

### AT: Reisner 18

#### Reisner’s wrong – 5 warrants

---simulation was done in a country club in the suburbs, fuel load was too small to be a city, omitted key factors that would allow for higher smoke rise, did not simulate until the end, only an Indo-Pak war (not global)

Bardeen et. al 19 – researcher at the National Center for Atmospheric Research, with a specialization in Atmospheric Chemistry; worked at the University of Colorado Boulder with a focus in atmospheric science (Owen Toon; Department of Atmospheric and Oceanic Sciences, Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder Colorado; Alan Robock; Department of Environmental Sciences, Rutgers University; “Comment on “Climate impact of a regional nuclear weapons exchange: An improved assessment based on detailed source calculations” by Reisner et al.”; April 2019 (Revised August 2019); <https://www.researchgate.net/publication/336673165_Comment_on_Climate_impact_of_a_regional_nuclear_weapons_exchange_An_improved_assessment_based_on_detailed_source_calculations_by_Reisner_et_al>; accessed 12/5/19) dc

In summary, Reisner et al. (2018) modeled a fire in an area with much different characteristics than considered in our studies including: 1. targeting a sparsely populated suburb surrounding a country club, not a city center, 2. having a fuel load that is more than an order of magnitude less than any of the 100 urban areas of Pakistan or India considered by Robock et al. (2007) and Mills et al. (2014), 3. omitting factors known to be important to smoke lofting (e.g., latent heat release), and 4. failing to model the full duration of the event. Because of these choices, they did not simulate firestorms, which would be expected in densely populated urban areas and are known to have high altitude smoke plumes. Critically, they have not shown that their model is capable of reproducing historic firestorms, thus making it impossible to interpret their failure to generate a classic firestorm. Reisner et al. do raise an important point that not all mass fires in a nuclear war will be firestorms; however, these mass fires cannot be assumed to be weak conflagrations, either. Accurate understanding of target locations, fuel loads, and the effects of meteorology on the fire and smoke injection heights are critical to understanding the climatic consequences of fires from a nuclear war. Fire models like HIGRAD-FIRETEC can be valuable tools for studying these issues, but the case presented by Reisner et al. is not typical of the conditions that would be expected in a nuclear war between India and Pakistan and certainly does not represent an upper bound on these effects.

### AT: Islands

#### Inbreeding

Furlan et. al, 12 (Elise, “Small population size and extremely low levels of genetic diversity in island populations of the platypus, Ornithorhynchus anatinus”, National Institutes of Health, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3399204/)>

Genetic diversity generally underpins population resilience and persistence. Reductions in population size and absence of gene flow can lead to reductions in genetic diversity, reproductive fitness, and a limited ability to adapt to environmental change increasing the risk of extinction. Island populations are typically small and isolated, and as a result, inbreeding and reduced genetic diversity elevate their extinction risk. Two island populations of the platypus, Ornithorhynchus anatinus, exist; a naturally occurring population on King Island in Bass Strait and a recently introduced population on Kangaroo Island off the coast of South Australia. Here we assessed the genetic diversity within these two island populations and contrasted these patterns with genetic diversity estimates in areas from which the populations are likely to have been founded. On Kangaroo Island, we also modeled live capture data to determine estimates of population size. Levels of genetic diversity in King Island platypuses are perilously low, with eight of 13 microsatellite loci fixed, likely reflecting their small population size and prolonged isolation. Estimates of heterozygosity detected by microsatellites (HE= 0.032) are among the lowest level of genetic diversity recorded by this method in a naturally outbreeding vertebrate population. In contrast, estimates of genetic diversity on Kangaroo Island are somewhat higher. However, estimates of small population size and the limited founders combined with genetic isolation are likely to lead to further losses of genetic diversity through time for the Kangaroo Island platypus population. Implications for the future of these and similarly isolated or genetically depauperate populations are discussed. Genetic diversity has been identified as an important factor influencing a population's long-term potential for survival (Bouzat 2010). The contribution of genetic diversity has been recognized in numerous aspects of population persistence, and is critical for long-term fitness and adaptation [see Frankham (2005) for a review]. A loss of genetic diversity has been shown to affect individual fitness with decreased sperm quality (Hedrick and Fredrickson 2010), reduced litter size (Hedrick and Fredrickson 2010), increased juvenile mortality (Ralls et al. 1988), and increased susceptibility to disease and parasites (Coltman et al. 1999). Accordingly, populations lacking genetic diversity often exhibit an increased rate of extinction (Markert et al. 2010). Inbreeding, genetic drift, restricted gene flow, and small population size all contribute to a reduction in genetic diversity. Fragmented and threatened populations are typically exposed to these conditions, which is likely to increase their risk of extinction (Saccheri et al. 1998; Madsen et al. 1999; Frankham et al. 2010). Island populations are often isolated and small in size, and therefore experience increased levels of inbreeding and a greater impact of genetic drift. As a result, these populations generally have lower levels of genetic diversity and fitness than counterparts found in mainland populations. For example, the black-footed rock-wallabies of Barrow Island, Western Australia, have extremely low levels of genetic diversity (HE= 0.053), which has led to this population suffering inbreeding depression: females experience reduced fecundity and individuals exhibit increased levels of fluctuating asymmetry (Eldridge et al. 1999). These findings are not atypical with island populations frequently identified as having reduced genetic diversity, increased levels of inbreeding, and therefore a higher extinction risk (Frankham 1997).

#### Empirics

Kriege 15 (David Kriege, 3-11-2015, "Nuclear Weapons and Possible Human Extinction: The Heroic Marshall Islanders," Nuclear Age Peace Foundation, <https://www.wagingpeace.org/nuclear-weapons-and-possible-human-extinction/)>

Here is what we know: First, nuclear weapons are capable of causing human extinction, along with the extinction of many other species. Second, nine countries continue to rely upon these weapons for their so-called “national security.” Third, these nine countries are continuing to modernize their nuclear arsenals and failing to fulfill their legal and moral obligations to achieve a Nuclear Zero world – one in which human extinction by means of nuclear weapons is not a possibility because there are no nuclear weapons. Given these knowable facts, we might ask: What kind of “national security” is it to rely upon weapons capable of causing human extinction? Or, to put it another way: How can any nation be secure when nuclear weapons threaten all humanity? Certainly, it requires massive amounts of denial to remain apathetic to the extinction dangers posed by nuclear weapons. There appears to be a kind of mass insanity – a detachment from reality. Such detachment seems possible only in societies that have made themselves subservient to the nuclear “experts” and officials who have become the high priests of nuclear strategy. Whole societies have developed a gambler’s addiction to living at the edge of the precipice of nuclear annihilation. Remember Jonathan Schell’s insight: “We prepare for our extinction in order to assure our survival.” Of course, it is nonsensical to prepare for extinction to assure survival. Just as to achieve peace, we must prepare for peace, not war, we must be assuring our survival not by preparing for our extinction, but by ridding the world of the weapons that make this threat a possibility. We must, as Albert Einstein warned, change our “modes of thinking” or face “unparalleled catastrophe.”[iv] The Victims There have been many victims of the Nuclear Age, starting with those who died and those who survived the US atomic bombings of Hiroshima and Nagasaki. This year marks the 70th anniversary of those bombings. The survivors of those bombings are growing older and more anxious to see their fervent wish, the abolition of nuclear weapons, realized. In addition to the victims in the atomic-bombed cities, there have been many other victims of nuclear weapons. These include the people at the nuclear test sites and those downwind from them. They have suffered cancers, leukemia and other illnesses. The effects of the radiation from the nuclear tests have also affected subsequent generations, causing stillbirths and many forms of birth defects. The Marshall Islanders were one group of nuclear victims. They lived on pristine Pacific islands, living simple lives close to the ocean waters that provided their bounty. But between 1946 and 1958 the US conducted 67 nuclear tests in the Marshall Islands. The tests had the equivalent power of 1.6 Hiroshima bombs being exploded daily for 12 years. Some of the islands and atolls in the Marshall Islands became too radioactive to inhabit. The people of the Republic of the Marshall Islands (RMI), who became guinea pigs for the US to study, continue to suffer. They have never received fair or adequate compensation for their injuries resulting from the US nuclear testing program.

#### Isolation

Drake 15 (Nadia Drake, 6-23-2015, "Will Humans Survive the Sixth Great Extinction?," National Geographic News, <https://www.nationalgeographic.com/news/2015/06/150623-sixth-extinction-kolbert-animals-conservation-science-world/)>

Island populations are very vulnerable to extinctions for a couple of reasons. They tend to have been isolated. One of the things we’re doing is removing the barriers that used to keep island species isolated. New Zealand had no terrestrial mammals. Species that had evolved in the absence of such predators were incredibly vulnerable. A staggering number of bird species have already been lost on New Zealand, and a lot of those that remain are in deep trouble. So, places that have been isolated for a long time. Those are very vulnerable. Species that have a very restricted range, that exist only in one spot in the world, those tend to be extremely vulnerable. They have nowhere to go and if their habitat is destroyed, say, then they’re gone.

### AT: Bunkers

#### Shelters fail

Robert Klara 17. Staff writer for the History Channel. 10-16-2017. "Nuclear Fallout Shelters Were Never Going to Work." HISTORY. https://www.history.com/news/nuclear-fallout-shelters-were-never-going-to-work

And what sorts of quarters awaited those who staggered down the stairs? Only a handful were relatively posh; Chase Manhattan Bank, for one, dropped $49,000 on “compressed” wheat biscuits in banana and chocolate flavors to stock its five-story shelter. But most citizens would find only dank, low-ceilinged basements equipped with the barest necessities: bedding, drums of potable water, medical kits and government-issue wheat crackers. And while Uncle Sam thoughtfully provided toilet paper, the toilets themselves were harder to come by. A handy tip from a government booklet advised: “Make a commode by cutting the seat out of a chair and placing the pail under it.” It’s little wonder that the medical kits also included phenobarbital to chill everybody out.

Perhaps not surprisingly, the trouble with such crude accommodations became obvious almost immediately. Mere months into the program, reports emerged of leaking water drums and shelters that had never received any supplies. In a New York Times story in June of 1963, a Harlem woman asked, “Who’d want to go down there?” referring to the fetid tenement cellar meant to serve as her shelter space. The “rats are as big as dogs,” she said. “If fallout came, I’d just run.” In fact, the untenability of the shelters was public knowledge before they had even opened. A November 1961 story on the front page of The Washington Post bemoaned that most of the designated shelters would be little more than “cold, unpleasant cellar space, with bad ventilation and even worse sanitation.”

A Long Island family sits in a ‘Kidde Kokoon,’ an underground bomb shelter manufactured by Walter Kidde Nuclear Laboratories, in Garden City, New York, c. 1955. (Credit: Underwood Archives/Getty Images)

Conditions were a serious problem, but location was a bigger one. Two-thirds of the fallout shelters in the U.S. were in “risk areas”—neighborhoods so close to strike targets that they’d likely never survive an attack in the first place. In New York, for example, most of the government shelters could be found in Manhattan and Brooklyn—despite the fact that a 20-megaton hydrogen bomb detonated over Midtown would leave a crater 20 stories deep and drive a firestorm all the way to the center of Long Island. Even out there, Life magazine said, occupants of a fallout shelter “might be barbequed.”

What were the feds thinking? According to Kenneth D. Rose, author of the book One Nation Underground, defense officials placed their faith in the counterforce doctrine, a game theory that held that atomic war would be waged with only military installations as targets. But that was wishful thinking. “It wouldn’t take much for the whole theory to totally go south,” Rose said. “If a bomber missed its target and hit a city by mistake, then of course the gloves would come off and both sides would concentrate on cities as well.”

The shelters’ dubious utility also hinged on the shaky bet that the Soviets would drop only one bomb on a city like New York, an assumption that Khrushchev himself later ridiculed in his memoirs. If he’d managed to get “one or two big ones” into Gotham, wrote the Soviet Premier, “there wouldn’t be much of New York left.”

#### 100 isn’t enough---survivors still inbreed and can’t repopulate

**Bochkov ’84**[Academician. Dir Medical Academy of Sciences at the Institute of Genetics at the USSR Academy of Sciences. The Cold and the Dark: The World After Nuclear War, 1984 Pg 141-2]

Academician Bochkov: When we talk about the ecological and biological consequences of a nuclear war, we are of course focusing on humankind. Thus, in thinking about the possibilities of human survival after a nuclear catastrophe, we should not be afraid to reach the conclusion that the conditions that would prevail would not allow the survival of human beings as a species. We should proceed from the assumption that man has adapted to his environment during a long evolutionary process and has paid the price of natural selection. Only over the past few thousand years has he adapted his environment to his needs and has created, so to speak, an artificial environment to provide food, shelter, and other necessities. Without this, modem [humankind] man cannot survive. Compared to the dramatic improvements made in the technological environment, biological nature has not changed in the recent past. In the statements of Dr. Ehrlich and Academician Bayev, we have heard about the many constraints there would be on the possibility of man's survival after a nuclear catastrophe. Because we also have to look at the more long-range future, I would like to point out that most long-term effects of a nuclear war will be genetic. If islands of humanity—or as Dr. Ehrlich has said, groups of people on islands somewhere in the ocean—should survive, what will they face in terms of genetic consequences? If the population drops sharply, the question then arises of the critical numbers of a population that would be necessary to ensure its reproduction. On the one hand there will be minimum numbers of human beings; on the other hand, because of the small numbers, there will be isolation. There will definitely be inbreeding, and lethal mutations will come to the fore as a result of this, because of fetal and neonatal exposure to radiation and because of exposure to fallout. New mutations will arise and genes and chromosomes will be damaged as a result of the radiation, so there will be an additional genetic load to bear. There will be natural aberrations and death at birth, so that the burden of hereditary illnesses will be only part of a large load. This undoubtedly will be conducive to the elimination of humanity, because humankind will not be able to reproduce itself as a species.

#### Shelters are irrelevant---long-term environment AND radiation damage is too strong.

Julius London & Gilbert F. White 19. London, an outstanding contributor to the atmospheric sciences, a former chair of the Astrophysical and Planetary Sciences (APS) Department at the University of Colorado; White was a prominent American geographer. 07/11/2019. “1. The Environmental Effects of Nuclear War—An Overview.” The Environmental Effects Of Nuclear War, Routledge.

Until recent years the evaluation of nuclear warfare effects has been chiefly in terms of the direct impacts of the blast, heat and local radioactive fallout as they destroy humans, artifacts and social structure. Much of the public debate over the notions of a winnable, limited nuclear war and of survival thereafter has focused on the enormity of demands placed upon medical assistance for those people who live through the initial blast, the rationale or absurdity of plans to carry out massive evacuations as a means of deterring or mitigating the consequences of nuclear attacks, and the complexity of reconstruction.

Now, greater attention is turning toward the environmental consequences of nuclear detonations. This is basically because of increasing recognition that regardless of the immediate impact on lives, health, buildings, public facilities and the means of production, nuclear explosions might drastically alter if not, perhaps, fatally impair the life support systems of the globe. The vision of increasing through civil defense the number of survivors from direct impacts becomes morbidly whimsical if the survivors are in environments no longer capable of providing essential water and food.

It is now generally believed that there is no tenable concept of a winnable nuclear war. Most observers agree that once a nuclear exchange is started it would most likely quickly escalate to a "total" war. Whether or not they are correct could only be proven by an initially limited nuclear exchange that might or might not trigger a broader, cataclysmic conflict. It has, however, become clear that the consequences of a mass nuclear exchange, if it were to occur, would be so catastrophic that all efforts must be exercised to prevent it. What are these consequences?

The following papers review recent efforts towards providing information on the short and long-term environmental consequences of total nuclear war. They do not deal with social or economic disruption to normal functions of society, nor with psychological trauma that may be caused by the extreme events, nor the breakdown of medical and other emergency support systems, topics which are nevertheless of profound importance in consideration of global consequences of such a calamitous event (see, for instance. Chazov and Vartanian, 1982; Laulan, 1982).

In the case of a widespread nuclear exchange as envisaged by some analysts, the intermediate and long-term effects would not necessarily be contained within any specific geographic area. In those circumstances the concept of a battlefield would no longer be applicable even if it were possible to limit the exchange to so-called tactical weapons. The use of tactical or counterforce targets would, in the view of those analysts, quickly extend to attacks on other than purely military nuclear installations.

The quality and extent of impairment to widespread life support systems from various patterns of nuclear explosions have been in controversy. Some sanguine observers have predicted that populations remote from direct bomb produced effects of light, heat and explosive blasts, and adequately protected from short-term fallout, would survive those early threats to life and health and promptly could set about the task of reconstructing their damaged physical and social systems. At the other extreme, observers have asserted that the impacts of a major exchange of nuclear warheads would wound the environment sufficiently to render the globe unable to support any substantial human population beyond a period of months or years. In between, and depending in part on assumptions made as to the number and nature of the detonations, are a variety of estimates as to the scope of environmental effects.