We affirm.

C1 is Space

Colonization is physically impossible now. Skove 25

Sam **Skove**. "The Great Astronaut-Survival Problem." POLITICO, February 26, **2025**. https://www.politico.com/newsletters/digital-future-daily/2025/02/26/astronaut-survival-mars-nasa-00206267. [Sam Skove is a space and emerging tech reporter at POLITICO, with a focus on how space policy is made across Congress, the White House, and federal agencies. He was previously an Army reporter at Defense One and before that a freelance war reporter in Ukraine. He has a master's degree in security studies from Georgetown and a bachelor's degree from Oberlin College. He speaks Russian fluently.] //arrguy

A manned mission to Mars is being discussed more seriously than ever before, thanks to the interest of President Donald Trump — who used his inaugural address to promise an American flag on the Red Planet — and the immense influence of longtime Mars enthusiast Elon Musk. Musk himself said in September that his company SpaceX will send manned missions to Mars as early as 2028. NASA's current timeline is sometime in the 2030s, after a manned mission to the moon that the agency hopes to pull off in mid-2027. Musk's priorities, though, could become NASA's priorities. The confidante of Trump plays an outsize role in government, and Trump's pick for NASA administrator Jared Isaacman has close ties to SpaceX. In a January tweet, Musk called the moon a "distraction," and wrote "we're going straight to Mars." In a separate February tweet, Musk appeared to link cancelling the International Space Station with focusing on a Mars mission. Just one problem: Humans still have to survive the trip, survive the landing, and get back. And the faster NASA tries to plow through planning, the less likely it is that anyone will be alive once they open the hatch and take their first steps on Mars. "You can send people to Mars with a whole bunch of unknowns, and that's all risk to the mission being successful, the crew surviving," Nujoud Merancy, an agency expert in exploration architectures at NASA Headquarters, told DFD in a January interview. As millennia of explorers can attest, it's sometimes easier to build a vessel than to manage the safety of the human cargo inside. **Humans going to Mars face a set of risks considerably larger than the ones they took going to the moon, a trip that took three days and never got further than a few hundred thousand miles from earth's surface.** Mars has never been closer than about 34.8 million miles from Earth in recorded history — which means astronauts will be signing onto a round trip journey of around three years, according to NASA. Figuring out what could happen to them, and how to protect them along the way, is a puzzle that space experts are just starting to sort out. **Among the hardest problems for NASA is predicting the exact impact of deep space radiation on astronauts, which has the potential to kill or sicken them both in transit and on Mars's surface.** On the journey, astronauts will face two types of radiation — solar radiation, which is easier to shield from, and galactic cosmic rays, which are harder to protect astronauts from. **NASA has worked on ways to shield from cosmic rays, but the particles, moving at near the speed of light, can pass easily through normal spacecraft.** To try to model the problem, NASA runs experiments using a galactic cosmic ray simulator at Brookhaven National Labs, which can replicate deep space radiation. It also can rely on a host of Earth-bound analogs related to historical instances of humans being exposed to radiation. One study is looking at the impact of radiation treatment on patients by looking at the effect of radiation on non-cancerous cells as an analog for the sorts of indirect radiation exposure astronauts might face, said Steven H. Platts, the chief scientist for NASA's Human Research Program. Another looks at the effect of radiation on U.S. Navy submariners, based on their long-term proximity to their submarine's reactor. Data collected on the survivors of the Hiroshima and other nuclear bombings is yet another large source of information. And Mars itself is its own wild card. "We won't really know about the radiation environment on Mars until we're on Mars," said Platts. **Pack a lunch: Astronauts will also need to eat — but rockets have limited capacity to carry the two thousands pounds of food a human typically eats in a year.** Astronauts will also need variety, both for nutrition and for their mental health. Growing crops in space could solve some supply needs, but NASA experiments to date have only had astronauts growing a maximum of five percent of their food in space, said Platts. **Crew members will also need to handle medical emergencies on their own.** NASA is exploring the use of artificial intelligence to help astronauts solve medical problems, as well as providing compact ultrasound machines that can be used to

diagnose issues, Platts said. **Some technology will need to be invented, though — astronauts won't be able lug around the large machines used on Earth to run medical tests.** Gravity, or the lack thereof, is another major issue. Thanks to research from the International Space Station, NASA knows that astronauts have trouble regulating their blood pressure when exposed to microgravity for extended periods of time. It now issues astronauts with special suits that help them adjust to Earth's gravity on their return. Other problems are still unsolved. Some astronauts experience vision problems in microgravity, a condition called Spaceflight Associated Neuro-Ocular Syndrome (SANS). NASA does not yet have a way to correct the problem. It also doesn't know if the problem gets worse over time or if it plateaus — most astronauts stay on the ISS for six months, meaning that NASA only has high quality data for space stays of that much time. Platts said he's confident that NASA will have solutions or at the very least a better understanding of the risks such that astronauts have "true informed consent" as to the risks they're taking by NASA's 2030s timeline. Speeding up the mission — as Musk appears to want — would mean astronauts won't know exactly what they're getting into, especially if NASA's pursues Musk's ambitious target of 2028. Musk may still be willing to send private astronauts on that journey. Trump, though, might not. While Trump relishes the idea of going to Mars, he also appears to be cognizant of the risk. In a 2019 National Space Council meeting with then NASA Administrator Jim Bridenstine, Trump repeatedly pressed the administrator as to why NASA couldn't go to Mars. Bridenstine explained the problems — including that NASA needs to time its launches to moments when Mars and Earth are closest in their orbit around the sun. Trump dwelled on the consequences if astronauts missed that window, and replied twice: "You don't want to be on that ship."

Swift action is key — political will is sufficient now but volatile in the future. McGrath 24

McGrath, Jenny. "Why the US Hasn't Sent Humans to Mars Yet." Business Insider, May 27, **2024**. https://www.businessinsider.com/why-havent-we-been-to-mars-yet-2024-5. [Jenny McGrath is a senior science reporter, covering archaeology, paleontology, and more.] //arrguy

Humans have long imagined life on Mars, though our understanding of the planet has changed a lot. Some of the US's earliest plans assumed humans could reach the Red Planet by the 1980s. **Over the decades, technology and funding challenges have hampered the nation's hopes of crewed flights. Earlier this month, NASA announced it was funding a revolutionary high-thrust rocket — called a Pulsed Plasma Rocket — that could make crewed missions to Mars in just two months.** That's seven months faster than it'd take with current technology and would drastically reduce the risk and cost of a crewed Mars mission, according to Howe Industries, which is developing the concept. It "holds the potential to revolutionize space exploration," NASA said in a statement. The PPR is just one of the latest developments in the US's decades-long discussion to send humans to Mars. In the early '60s, for example, nuclear-bomb-powered spaceships were proposed for the trip. Since well before NASA landed the first humans on the moon, the US has poured money and time into proposals for a crewed Mars mission, only to see its attempts never leave the ground. But technology isn't the only thing standing in the way. Politics also plays a big role. "That's kind of like a joke within the space community or the Mars community," Matthew Shindell, a curator with the National Air and Space Museum, told Business Insider. "Putting humans on Mars is always 20 years away." **It's short enough to seem tangible, he said, but long enough that the political situation will change before it can be realized.** To fully understand why the US hasn't sent humans to Mars, despite sending more robots there than any other country, it just takes a trip down memory lane. Here's a history of the US's most promising crewed Martian missions that never were.

Investment is needed — technology exists but can't be scaled up. Uppal 25

Uppal, Rajesh. "Nuclear Fusion-Powered Propulsion: A New Frontier in Space Exploration - International Defense Security & Technology." International Defense Security & Technology, **2025**. https://idstch.com/space/nuclear-fusion-powered-propulsion-a-new-frontier-in-space-exploration/. [IDST follows a unique model that monitors and analyses complete Defense and Security ecosystem, and all its interrelationships in near real time starting from world geopolitics and its military and technology implications, global natural and manmade threats and mitigating technologies, future warfare scenarios and warfare domains, International military capabilities in all domains including doctrines and strategies, their technical challenges, requirements and solutions, Homeland security and technology requirements, Horizon scan of emerging technologies, and their military impact, manufacturing technologies and Industry trends. The model monitors the present and future threat environment, performs threat assessment, identify the required technologies to mitigate that threat through system] //arrguy

Cost and Development Time Nuclear fusion technology is costly, and the timeline for achieving a space-compatible fusion reactor remains uncertain. Developing fusion propulsion requires considerable financial and institutional investment, as well as time for iterative testing and innovation. Currently, government and private sector collaborations are essential to funding research, but scaling up support could accelerate progress. The high initial costs and long lead times mean that fusion propulsion may not be viable for near-term missions, although it has great potential for future interplanetary and interstellar travel. In short, while nuclear fusion-powered propulsion holds remarkable promise, sustained progress in research, funding, and material science will be necessary to overcome these challenges and make this vision a reality for space exploration.

Affirming solves.

1 — Radiation. Lockheed 22

Lockheed Martin. "Nuclear Thermal Propulsion," **2022**. https://www.lockheedmartin.com/en-us/news/features/2022/how-nuclear-technology-will-get-us-to-mars-faster-than-ever.html. [We specialize in defense tech, solving complex challenges, advancing scientific discovery and delivering innovative solutions that help our customers keep people safe.] //arrguy

Why Nuclear Thermal Propulsion? In short: speed, efficiency and reusability. NTP will enable faster space travel than ever before. Increased speed from NTP means benefits like longer launch windows, less crew exposure to cosmic radiation in space and satellites and robotic spacecraft getting to their destinations quicker or with much higher mass. The speed of NTP comes from its high-efficiency thrust—upwards of two times more efficient than conventional propulsion systems. "It could take a hundred launches to get humans to Mars on a chemical propulsion system, but we can get it down to five with a nuclear thermal propulsion system," said Chambers. NTP's efficiency can also enable more abort options during missions. Other benefits include maximum reusability and extensibility to other missions. NTP allows the use of fewer refuelers than other systems – making it an environmentally cleaner, more efficient way to fuel. "If we want to get serious about deep space exploration, a reusable nuclear system is a cleaner, more efficient way to achieve our goals," said Bendle. "NTP will enable us to extend our exploration beyond the Moon more quickly than other alternatives might."

2 — Supplies. Mulder 20

Dr. Eben **Mulder**, Space: "X-Energy." X-energy, **2020**. https://x-energy.com/why/nuclear-and-space/nuclear-thermal-propulsion. [As X-energy's Chief Scientist, Eben Mulder, leads the development of X-energy's technology drive in expanding its high-temperature gas reactor (HTGR) technology applicability. In this executive leadership role, he serves as overall lead for considering expansion into both electrical and non-electrical deployment. His role is to charter an innovative R&D roadmap in terms of advanced fuel-cycle designs, minimizing of the Xe-100 waste profile, cyber security and proliferation resistance profile and help in providing a long-term HALEU supply strategy.] //arrguy

Going somewhere? Chemical rockets top the list of the fastest objects ever made. But if we want to open up the solar system for human exploration, they're not nearly fast enough. Today, a one-way trip to Mars takes a minimum of six months. That's a long time for an astronaut to spend in a spacecraft about the size of a one-bedroom apartment. It also creates significant operational challenges for the mission. **The longer an astronaut is in transit, the more they're exposed to high doses of dangerous cosmic radiation and the more supplies they need to carry with them for the mission.** Over the past half-century, engineers have squeezed every last drop of efficiency from conventional chemical rocket engines. If we actually want to make regular trips to Mars, we're going to need a step change in rocket engine efficiency.

That enables lateral innovation.

West 20 [Darrell M. West, Senior Fellow in Governance Studies @ Center for Technology Innovation of Brookings, 8-18-2020, Five reasons to explore Mars, Brookings, https://www.brookings.edu/articles/five-reasons-to-explore-mars/]

The recent launch of the Mars rover Perseverance is the latest U.S. space mission seeking to understand our solar system. Its expected arrival at the Red Planet in mid-February 2021 has a number of objectives linked to science and innovation. The rover is equipped with sophisticated instruments designed to search for the remains of ancient microbial life, take pictures and videos of rocks, drill for soil and rock samples, and use a small helicopter to fly around the Jezero Crater landing spot.

Mars is a valuable place for exploration because it can be reached in 6 ½ months, is a major opportunity for scientific exploration, and has been mapped and studied for several decades. The mission represents the first step in a long-term effort to bring Martian samples back to Earth, where they can be analyzed for residues of microbial life. Beyond the study of life itself, there are a number of different benefits of Mars exploration.

UNDERSTAND THE ORIGINS AND UBIQUITY OF LIFE

The site where Perseverance is expected to land is the place where experts believe 3.5 billion years ago held a lake filled with water and flowing rivers. **It is an ideal place to search for the residues of microbial life, test new technologies, and lay the groundwork for human exploration down the road.**

The mission plans to investigate whether microbial life existed on Mars billions of years ago and therefore that life is not unique to Planet Earth. As noted by Chris McKay, a research scientist at NASA's Ames Research Science Center, that would be an extraordinary discovery. "Right here in our solar system, if life started twice, that tells us some amazing things about our universe," he pointed out. "It means the universe is full of life. Life becomes a natural feature of the universe, not just a quirk of this odd little planet around this star."

The question of the origins of life and its ubiquity around the universe is central to science, religion, and philosophy. For much of our existence, humans have assumed that even primitive life was unique to Planet Earth and not present in the rest of the solar system, let alone the universe. We have constructed elaborate religious and philosophical narratives around this assumption and built our identity along the notion that life is unique to Earth.

If, as many scientists expect, future space missions cast doubt on that assumption or outright disprove it by finding remnants of microbial life on other planets, it will be both invigorating and illusion-shattering. It will force humans to confront their own myths and consider alternative narratives about the universe and the place of Earth in the overall scheme of things.

As noted in my Brookings book, Megachange, given the centrality of these issues for fundamental questions about human existence and the meaning of life, it would represent a far-reaching shift in existing human paradigms. As argued by scientist McKay, discovering evidence of ancient microbial life on Mars would lead experts to conclude that life likely is ubiquitous around the universe and not limited to Planet Earth. Humans would have to construct new theories about ourselves and our place in the universe.

DEVELOP NEW TECHNOLOGIES.

The U.S. space program has been an extraordinary catalyst for technology innovation. Everything **from Global Positioning Systems and medical diagnostic tools to wireless technology and camera phones** owe at least part of their creation to the space program. **Space exploration required the National Aeronautics and Space Administration to learn how to communicate across wide distances, develop precise navigational tools, store, transmit, and process large amounts of data, deal with health issues through digital imaging and telemedicine, and develop collaborative tools that link scientists around the world.** The space program has pioneered the miniaturization of scientific equipment and helped engineers figure out how to land and maneuver a rover from millions of miles away. Going to Mars requires similar inventiveness. Scientists have had to figure out how to search for life in ancient rocks, drill for rock samples, take high resolution videos, develop flying machines in a place with gravity that is 40 percent lower than on Earth, send detailed information back to Earth in a timely manner, and take off from another planet. In the future, we should expect large payoffs in commercial developments from Mars exploration and advances that bring new conveniences and inventions to people.

ENCOURAGE SPACE TOURISM

In the not too distant future, wealthy tourists likely will take trips around the Earth, visit space stations, orbit the Moon, and perhaps even take trips around Mars. For a substantial fee, they can experience weightlessness, take in the views of the entire planet, see the stars from outside the Earth's atmosphere, and witness the wonders of other celestial bodies.

The Mars program will help with space tourism by improving engineering expertise with space docking, launches, and reentry and providing additional experience about the impact of space travel on the human body. Figuring out how weightlessness and low gravity situations alter human performance and how space radiation affects people represent just a couple areas where there are likely to be positive by-products for future travel.

The advent of space tourism will broaden human horizons in the same way international travel has exposed people to other lands and perspectives. It will show them that the **Earth has a delicate ecosystem that deserves protecting and why it is important for people of differing countries to work together to solve global problems.** Astronauts who have had this experience say it has altered their viewpoints and had a profound impact on their way of thinking.

FACILITATE SPACE MINING

zmany objects around the solar system are made of similar minerals and chemical compounds that exist on Earth. **That means that some asteroids, moons, and planets could be rich in minerals and rare elements.** Figuring out how to harvest those materials in a safe and responsible manner and bring them back to Earth represents a possible benefit of space exploration. Elements that are rare on Earth may exist elsewhere, and that could open new avenues for manufacturing, product design, and resource distribution. This mission could help resource utilization through advances gained with its Mars Oxygen Experiment (MOXIE) equipment that converts Martian carbon dioxide into oxygen. If MOXIE works as intended, it would help humans live and work on the Red Planet.

ADVANCE SCIENCE

One of the most crucial features of humanity is our curiosity about the life, the universe, and how things operate. **Exploring space provides a means to satisfy our thirst for knowledge and improve our understanding of ourselves and our place in the universe.** Space travel already has exploded centuries-old myths and promises to continue to confront our long-held assumptions about who we are and where we come from. The next decade promises to be an exciting period as scientists mine new data from space telescopes, space travel, and robotic exploration. Ten or twenty years from now, we may have answers to basic questions that have eluded humans for centuries, such as how ubiquitous life is outside of Earth, whether it is possible for humans to survive on other planets, and how planets evolve over time.

Overall, colonization solves extinction. Bryner 23

Bryner 23 [Jeanna Bryner, Interim editor in chief of Scientific American. Previously she was editor in chief of Live Science and, prior to that, an editor at Scholastic's Science World magazine. Bryner has an English degree from Salisbury University, a master's degree in biogeochemistry and environmental sciences from the University of Maryland and a graduate science journalism degree from New York University, 3-21-2023, Will Humans Ever Go Extinct?, Scientific American, https://www.scientificamerican.com/article/will-humans-ever-go-extinct/, accessed 3-3-2025.] //aayush

It's probably **a matter of when and how, not if, we humans will meet our doom** The species Homo sapiens evolved some 300,000 years ago and has come t**o** domi**n**ate **Earth** unlike any species that came before. But how long can humans last? **Eventually humans will go extinct**. **According to the most wildly optimistic estimate, our species will last perhaps another billion years but end when the expanding envelope of the sun swells outward and heats the planet to a Venus-like state**. But a billion years is a long time. One billion years ago life on Earth consisted of microbes. Multicellular life didn't make its debut until about 600 million years ago, when sponges proliferated. **What life will look like in another billion years is anyone's guess, but one modeling study published in 2021 in Nature Geoscience suggests that Earth's atmosphere will contain very little oxygen** by then, meaning that **anaerobic microbes, rather than humans, will probably be the last living Earthlings**. If surviving to see the sun fry Earth is a long shot, when is humanity likely to meet its doom? Paleontologically, **mammalian species usually persist for about a million years**, says Henry Gee, a paleontologist and senior editor at the journal Nature, whose forthcoming book is on the extinction of humans. That would put the human species in its youth. But Gee doesn't think these rules necessarily apply for H. sapiens. "Humans are rather an exceptional species," he says. "**We could last for millions of years, or we could all drop down next week**." **Opportunities for doomsday abound**. **Humans could be wiped out by a catastrophic asteroid strike, commit self-destruction with**

worldwide nuclear war or succumb to the ravages caused by the climate emergency. But humans are a hardy bunch, so **the most likely scenario involves a combination of catastrophes that could eradicate us completely**. PICK YOUR POISON Some species killers are out of our control. In a 2021 paper in the journal Icarus, for example, researchers describe how **asteroids comparable to the one spanning 10 to 15 kilometers in diameter that killed off the nonavian dinosaurs hit Earth approximately every 250 million to 500 million years**. In a preprint paper posted on the server arXiv.org, physicists Philip Lubin and Alexander N. Cohen calculate that humanity would have the ability to save itself from a dino-killer-size asteroid, given six months' warning and an arsenal of nuclear penetrators to blow the space rock into a cloud of harmless pebbles. With less warning or a larger asteroid, Lubin and Cohen suggest, humanity should give up and "party" or "move to Mars or the Moon to party." Currently the biggest asteroid that scientists know of with the potential to strike Earth is called (29075) 1950 DA. It is a mere 1,300 meters across and has a one-in-50,000 chance of hitting our world in March 2880, according to a 2022 risk analysis by the European Space Agency. Incoming space rocks aside, **many threats to humanity are of our own making: nuclear war, the climate emergency, ecological collapse**. **We might be done in by our own tech in the form of sentient artificial intelligence that decides to snuff out its creators**, as some AI critics have suggested. An all-out nuclear war could easily destroy humanity, says François Diaz-Maurin, associate editor for nuclear affairs at the Bulletin of the Atomic Scientists. The last time humans dropped nuclear bombs on one another, only one country, the U.S., had nuclear warheads, so there was no risk of nuclear retaliation. That's not the case today—and now the bombs are a lot bigger. Those older bombs, which struck the Japanese cities of Hiroshima and Nagasaki in 1945, packed the equivalent of 15 and 21 kilotons of TNT, respectively. Together they killed an estimated 110,000 to 210,000 people. **A single modern-day, 300-kiloton nuclear weapon dropped on New York City, for example, would kill a million people in 24 hours**, Diaz-Maurin says. **A regional nuclear war, such as one between India and Pakistan, could kill 27 million people in the short term, whereas a full-scale nuclear war between the U.S. and Russia could cause an estimated 360 million direct deaths**, he adds. The threat to humanity's very existence would come after the war, when **soot from massive fires ignited by the bombings would rapidly alter the climate in a scenario known as nuclear winter**. Fears of nuclear winter may have receded since the end of the cold war, Diaz-Maurin says, but research shows that the **environmental consequences would be severe**. Even a **regional nuclear war would damage the ozone layer, block out sunlight and reduce precipitation worldwide. The result would be a global famine that might kill more than five billion people in just two years**, depending on the size and number of detonations. "That possibility of destroying humanity is still here and real," Diaz-Maurin says. **Death by ecological contamination or the climate emergency would be slower but still within the realm of possibility**. Already **humans are facing health stressors from chronic pollution** that have been **exacerbated by the additional heat brought on by climate change**, says Maureen Lichtveld, dean of the School of Public Health at the University of Pittsburgh. Hotter temperatures force people to breathe more rapidly to dispel warmth, which draws more pollution into their lungs. The climate emergency also **deepens existing problems around food security—for instance, persistent drought can devastate cropland—and infectious disease. "The interconnectedness of climate change and health inequities and inequities in general is what is impacting our global population**," Lichtveld says. THE PERFECT STORM Will these inequities eventually lead to a species-wide downfall? It's not easy to calculate the likelihood that, say, the climate emergency will kill us all, says Luke Kemp, a research affiliate at the Center for the Study of Existential Risk at the University of Cambridge. But it's probably not realistic to consider risks individually anyway, he says. "**When we look at the history of things like mass extinctions and societal collapses, it's never just one thing that happens**," Kemp says. "If you're trying to rely on a single silver bullet to kill everyone in a single event, you have to write sci-fi." **The end of humanity is far more likely to be brought about by multiple factors, Kemp says—a pileup of disasters.** Although apocalyptic movies often turn to viruses, bacteria and fungi to wipe out huge swathes of the population, **a pandemic alone probably won't drive humanity to extinction** simply because the immune system is a broad and effective defense, says Amesh Adalja, an infectious disease physician and senior scholar at the Johns Hopkins Center for Health Security. **A pandemic could be devastating and lead to severe upheaval—the Black Death killed 30 to 50 percent of Europe's population**—but **it's unlikely that a pathogen would kill all of humanity**, Adalja says. "Yes, an infectious disease could kill a lot of people," he says, "but **then you're going to have a group [of people] that are resilient to it and survive**." Humans also have tools to fight back against a pathogen, from medical treatments to vaccines to the social-distancing measures that became familiar worldwide during the COVID pandemic, Adalja says. There is one example of a mammalian species that may have been entirely eliminated by an infectious disease, he says: the Christmas Island rat (Rattus

macleari), also called Maclear's rat, an endemic island species that may have gone extinct because of the introduction of a parasite. "We are not helpless like the Christmas Island rat, which couldn't get away from that island," Adalja says. "We have the ability to change our fate." If infectious disease contributes to the downfall of humanity, it will probably be as just one piece of a larger puzzle. Imagine a planet pushed to upheaval by sea-level rise and disruption to agriculture from climate change. **The humans of this climate-ravaged world attempt a geoengineering solution that goes wrong. The situation worsens. Resources are scarce, and a bunch of countries have nuclear weapons.** Oh, by the way, the **mosquitoes that carry yellow fever range as far north as Canada in this scenario**. It's **not hard to see how the human population could decline and disappear in the face of an arsenal of challenges**, according to Kemp. **Worst-case scenarios are understudied**, Kemp says. In climate science, for example, there is a lot of research into what the world might look like at two or three degrees Celsius warmer than the preindustrial average but **very little looking at what an increase of five or six degrees C might look like**. This is partly because scientists have a hard time predicting the effects of that much warming and partly because climate scientists feel pressure from politicians not to appear alarmist, Kemp says. **Models of future worst-case scenarios also tend to do an inadequate job of predicting the cascading effects of a disaster**. "The general field of existential risk is relatively new, nascent and just understudied," Kemp says. There are questions as to how much humans should worry about something as big picture as extinction. While some see the question as pressing—controversial tech billionaires such as Elon Musk and Peter Thiel have funded organizations dedicated to studying the risks of transformative technologies—others argue that today's problems are urgent enough. Already humans are heating the globe, overexploiting and destroying nature, using land and water unsustainably, and creating chemicals that are harmful to all life, often in service to the globally well-off, says Sarah Cornell, who studies global sustainability at the Stockholm Resilience Center at Stockholm University. "Today's reality is **that some human beings are undermining or even destroying living conditions of many, many other people**," Cornell says. "From a human-scale perspective, **this is an existential crisis already**, not a risk somewhere up ahead."

Every second matters.

Beckstead 14 [Nick Beckstead, research fellow at Oxford University's Future of Humanity Institute, 2014, Will we eventually be able to colonize other stars? Notes from a preliminary review, https://www.fhi.ox.ac.uk/will-we-eventually-be-able-to-colonize-other-stars-notes-from-a-preliminary-review/, Willie T.]

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." Bostrom 2003, "Astronomical Waste."

[2] "The lion's share of the expected duration of our existence comes from the possibility that our descendants colonize planets outside our solar system. There are **many stars** that we may be able to reach with future technology (about 10^13 in our supercluster). Some of them will probably have planets that are **hospitable to life**, perhaps many of these planets could be made hospitable with appropriate technological developments. Some of these are near stars that will burn for much longer than our sun, some for as much as **100 trillion years**.(Adams, 2008, p. 39). If multiple locations were colonized, the risk of total destruction would dramatically decrease, since it would take independent global disasters, or a cosmological catastrophe, to destroy civilization. Because of this, it is possible that our descendants would survive until the very end, and that there could be extraordinarily large numbers of them." Beckstead 2013, "On the Overwhelming Importance of Shaping the Far Future," p. 57.

C2 is Upgrades

Meltdown is inevitable — it's only a matter of time. Fox 24

Fox, Audrey. “Is Nuclear Power Bad for the Environment?” Friends of the Earth, August 19, **2024**. https://foe.org/blog/is-nuclear-power-bad-for-the-environment/. [Audrey Fox is the digital communications manager at Friends of the Earth. She manages the organization’s websites, produces social content for the organization, tracks and analyzes metrics, and coordinates between the communications and campaign teams. She additionally assists with the production of multimedia content. Previously, she served as the organization’s communications intern, assisting the team with media outreach, social media, copy editing, and rapid response. Audrey holds a B.A. in Political Science and Communications with a specialization in Environmental Science from the University of California, San Diego. Outside of work, she enjoys skiing, hiking, biking, and watching Giants baseball.] //MH

Nuclear Hazards – Safety and Health Nuclear disasters serve as prescient reminders of the unimaginable dangers of nuclear power. They may be caused by human error, mechanical failures, and/or natural disasters. The Chernobyl disaster in Ukraine in 1986 remains the worst nuclear accident in history. It will take at least 3,000 years for the area surrounding the nuclear power plant to be habitable. The second worst nuclear accident occurred in 2011 after an earthquake and tsunami struck the Fukushima Daiichi Nuclear Power Station in Japan, causing all three operating reactors to melt down. The Three Mile Island Generating Station in Pennsylvania experienced a partial meltdown in 1979, leading to increases in cancer and other diseases. The worst radiation disaster in U.S. history is the Church Rock uranium spill, which occurred on the Navajo Nation a few months after Three Mile Island. Nuclear accidents pose extreme threats to life and have forced abandonment of wide swaths of land. Health impacts include increased risk of different types of cancer, immune deficiencies, infant mortality and birth defects, acute radiation syndrome (radiation poisoning), and harms to mental health. Those who mine and mill uranium and who work at nuclear power plants also face higher risk of diseases such as cancer. **The U.S. nuclear fleet is old, with an average age of 42 years. Aging infrastructure is more prone to cracks, corrosion, and other compromises in safety. Nuclear power stations are also vulnerable to military strikes and threats of terrorism.** Further, the technologies required to make nuclear energy are also the technologies required to make nuclear weapons, raising the risk of nuclear proliferation.

Affirming solves through upgrades. Tariq 24

Tariq, Ehtesham. “Costs and Benefits of Extending Aging Nuclear Power Plants | Certrec.” Certrec | Regulatory & Technology Solutions for the Energy Industry, December 2, **2024**. https://www.certrec.com/blog/costs-and-benefits-of-extending-aging-nuclear-power-plants/. [Certrec is a leading provider of regulatory compliance and digital integration solutions for the energy industry, with the mission of helping ensure a stable, reliable, bulk electric supply. Since 1988, Certrec’s innovation combined with industry expertise has helped hundreds of power-generating facilities manage their regulatory compliance with both the Nuclear Regulatory Commission (NRC) and North American Electric Reliability Corporation (NERC) and reduce their risks.] //MH

For several decades, nuclear power plants worked as a cornerstone of global energy strategies, providing reliable and carbon-free electricity to millions in the U.S. However, as many nuclear reactors approach the end of their initial design lives, questions arise about whether to decommission them or extend their operational lifespan. Aging nuclear power plants, though still a vital asset in many energy grids, face mounting challenges that require careful consideration. Extending the life of aging nuclear power plants involves a complex evaluation of costs, safety considerations, technological advancements, and socio-economic benefits. This decision-making process carries immense implications for energy security, climate goals, and financial investments. The Economic Rationale for Life Extension Projects The economics of extending the operational life of aging nuclear reactors is one of the primary drivers behind life extension projects. **Constructing new nuclear plants is a capital-intensive endeavor, often requiring billions of dollars and spanning a decade or more. In contrast, extending the life of an existing plant through life management programs, such as refurbishment and equipment upgrades, generally costs significantly less.** According to the International Atomic Energy Agency (IAEA), life extension projects can cost 25–50% of the expenses of building a new plant, making them a cost-effective solution for maintaining energy supply. Operational costs are another favorable factor. Aging nuclear plants often operate at lower marginal costs than alternative energy sources, especially fossil fuels. **With upgrades in key systems, such as steam generators, turbines,**

and safety measures, older plants can achieve higher efficiencies, further driving down costs. However, these financial benefits come with upfront investments in safety assessments, regulatory compliance, and infrastructure modernization to meet evolving industry standards. Safety Upgrades and Regulatory Challenges Safety is paramount in any discussion about extending the lifespan of nuclear power plants. **Aging infrastructure poses increased risks, necessitating comprehensive safety evaluations and enhancements. Life extension projects typically involve extensive inspections, including assessments of reactor pressure vessels, containment systems, and cooling mechanisms to identify potential vulnerabilities.** Advanced nondestructive testing methods are often employed to detect micro-cracks, corrosion, and material degradation that might compromise safety during extended operations. Meeting regulatory requirements from the Nuclear Regulatory Commission (NRC) presents additional challenges. Governments and nuclear safety agencies like the NRC require rigorous assessments to ensure that extended operations do not compromise public health or the environment. This involves implementing post-Fukushima safety measures, such as improved flood protection, enhanced seismic resilience, and backup power systems. These safety upgrades, while necessary, can significantly increase the costs and time required for life extension projects. Social and Energy Security Implications The socio-economic and energy security implications of extending the life of nuclear plants are profound. **These plants provide thousands of high-paying jobs, from engineers and technicians to plant operators and support staff.** Life extension projects, which require extensive maintenance and upgrades, often create additional employment opportunities in the local community. On the energy security front, extending nuclear plant operations reduces dependence on imported fossil fuels and mitigates price volatility in energy markets. Countries with aging nuclear fleets, such as the United States, France, and Canada, view life extension as a strategic move to maintain energy independence and secure supply chains. Conclusion The decision to extend the life of aging nuclear power plants is a multifaceted challenge involving economic, technical, environmental, and social considerations. While life extension offers significant benefits, including cost savings, enhanced energy security, and climate mitigation, it also demands substantial investments in safety upgrades, regulatory compliance, and public trust. By balancing these factors and leveraging advancements in nuclear technology, nations can ensure the safe and sustainable operation of nuclear power plants, paving the way for a cleaner and more secure energy future.

Two Subpoints - A) Accidents.

Accident risk peaks now. Dinneen 24

James **Dinneen**. “Can Aging U.S. Nuclear Power Plants Withstand More Extreme Weather?” Yale E360, **2024**. https://e360.yale.edu/digest/u.s.-nuclear-power-climate-change. [Yale Environment 360 is an online magazine offering opinion, analysis, reporting, and debate on global environmental issues. We feature original articles by scientists, journalists, environmentalists, academics, policymakers, and business people, as well as multimedia and a daily digest of major environmental news.] //MH

To reach its climate goals, the Biden administration aims to extend the lives of U.S. nuclear reactors. But a new report finds regulators have not studied whether increasingly extreme weather could threaten the safety or viability of power plants largely built in the 1970s and 1980s. On August 10, 2020 a powerful derecho windstorm blasted the Duane Arnold nuclear power plant in Iowa. Up to 130 mile-per-hour winds caused a power outage and knocked over the 50-year-old plant’s wooden cooling towers, which triggered an automatic shutdown of the reactor and a switch to backup generators to power its cooling system. The U.S. Nuclear Regulatory Commission (NRC) concluded the plant’s multiple layers of defense had avoided any risk of releasing radioactive material, but the reactor was never restarted. The plant had been slated to close, and its owner decided not to repair the damage. “A weather-related event prematurely and permanently shut down the Duane Arnold,” says Jeff Mitman, a nuclear risk consultant and a former NRC engineer now involved in a campaign to highlight safety risks at aging nuclear plants. He points to Duane Arnold as an example of how such plants can be vulnerable to extreme natural hazards that may be exacerbated by climate change. The country’s 54 nuclear power plants still in operation were designed to be resilient to numerous outside threats, including the most extreme weather-related events deemed feasible based on the historical record, and even beyond. **But most plants were built more than 40 years ago, and a new investigation finds these plants may yet be vulnerable to unprecedented hazards fueled by climate change, at a time when many experts say nuclear power is needed to keep emissions from fossil fuels in check. According to the report released earlier this month by the U.S. Government Accountability Office (GAO), the investigative arm of Congress, every nuclear plant in the country is located in an area where climate change is set to worsen flooding, heat, storms, wildfires, extreme cold, or some combination. However, it found that the NRC — which is responsible for U.S. nuclear safety — has not conducted the analyses necessary to know whether nuclear power plants are prepared for those changing conditions.** The report did not demonstrate that any plants are necessarily vulnerable to these hazards, which would require a plant-by-plant analysis. But it found the NRC has not adequately addressed whether more extreme weather could force plants to shut down or lower power output more frequently, or pose a safety risk.

Investment means improvement — solves the neg and outweighs on timeframe and scope. Rehm 23

Rehm 23 [Thomas E Rehm, American Institute of Chemical Engineers, 3-xx-2023, Advanced nuclear energy: the safest and most renewable clean energy, No Publication, https://www.sciencedirect.com/science/article/abs/pii/S2211339822000880, accessed 3-10-2025.] //aayush

Although legacy nuclear energy has been the safest form of electricity generation, it has been demonized as unsafe since the 1960s. The three well-known **nuclear accidents**, Three Mile Island, Chernobyl, and Fukushima, **were legacy nuclear designs**. **Even with the best safety record of all types of electricity generation, it is time to move away from legacy nuclear to reap the benefits of a truly renewable source of safe clean energy, advanced nuclear**. Solar and wind cannot hold a renewable candle to the vast renewable potential of advanced nuclear energy. **The transition to carbon-neutral energy can best be made with advanced nuclear, in safety, waste minimization, true renewability for thousands of years, process heat for manufacturing, and a viable means of replacing our chemical manufacturing dependence on fossil fuels**. Some of my colleagues tell me, "There are few opportunities for chemical engineers in nuclear". I disagree. **Opportunities include design and operation of high-temperature (550–750 °C) plants involving molten salts, liquid metal, and helium; application of this high-temperature capability for industrial process heating; recycling legacy nuclear 'waste' to provide fuel for advanced reactors; integration of the hydrogen economy into nuclear plant design and operation; improvement in moving pebble-bed advanced reactor technology; mining improvements for uranium and thorium, including mining uranium from seawater; molten salt storage systems for improving load following functionality and to provide process heat functionality; resolving corrosion challenges in molten salt reactors; and retrofitting existing oil-and-gas-based refineries to operate as nuclear biorefineries**.

Otherwise, meltdown causes extinction. Hodges 19

Hodges 19 [Dave Hodges—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**.

Subpoint B is Nuclear Terrorism.

Risk of nuclear terror is growing from the Middle East

Moulton 25 [Cyrus Moulton, 3-12-2025, "'Risks of nuclear terrorism are high and growing.' New tools, alliances, renewed focus needed, group led by Northeastern expert recommends.", Northeastern Global News, https://news.northeastern.edu/2024/06/18/nuclear-terrorism-risks-research/]

For roughly 80 years, the United States has managed the threat of nuclear terrorism through nonproliferation treaties, agency programs, intelligence activities, international monitoring support and more, withstanding the Cold War, the fall of the Soviet Union, and 9/11. A National Academies committee led by Northeastern University's Stephen Flynn wants to ensure the U.S. remains prepared. "The issue of **nuclear terrorism remains very** much a **real** one, there are enormous stakes involved and the risks are high, but the issue has been falling off the radar screen of the American public over the last 15 years, and the skill set of people involved in managing it is aging out," says Flynn, professor of political science and founding director of the Global Resilience Institute at Northeastern. "We really need to keep our eye on the ball. It was quite timely for Congress to call for an assessment of this risk and provide recommendations for staying on top of this issue." In the 2021 National Defense Authorization Act, Congress mandated the U.S. Department of Defense and the U.S. Department of Energy's National Nuclear Security Agency to work with the National Academy of Sciences, Engineering and Medicine to assess the current state of nuclear terrorism and nuclear weapons and materials and advise the government on how to handle such issues. Flynn, an expert on national and homeland security, was appointed chair of the committee in 2022. The committee released its final report on Tuesday. The report finds that a lot has changed since the issue of nuclear terrorism was forefront in Americans' minds following 9/11 and the buildup to the Iraq War. "We had a war on terror after 9/11, but that didn't succeed in eliminating the terrorsim threat," Flynn says. "Terrorism continues to morph," **The outbreak of the Israel-Hamas War**, which occurred as the committee finalized its report, demonstrates this morphing of terrorism. The **involvement of Hezbollah as a proxy of Iran**, and the involvement of Hamas — both groups are designated terrorist groups by the U.S. State Department — **highlight a world where non-states and nuclear-seeking states collaborate in warfare**, Flynn says. "The designation between non-state vs. state actors is blurry," Flynn says. "The assessment reveals we have to be focused on where those two things may overlap." Also "blurring" is the line between domestic terrorism and international terrorism, Flynn says. "Particularly when you look on the far right, **international terror groups are recruiting Americans** into these organizations, **and Americans are reaching out to extremist** organizations that have terrorism elements," Flynn says.

Also right wing nuclear terror.

Earnhardt et al 21 (Becca Earnhardt is a Research Associate with the Nuclear Security program at the Stimson Center. Brendan Hyatt is a nuclear security intern at the Stimson Center. Nickolas Roth serves as a senior director of Nuclear Materials Security at the Nuclear Threat Initiative, January 14, 2021, "A threat to confront: far-right extremists and nuclear terrorism", Bulletin of the Atomic Scientists, https://thebulletin.org/2021/01/a-threat-to-confront-far-right-extremists-and-nuclear-terrorism/, DOA 4/11/23) KC

Last March, neo-Nazi Timothy Wilson was killed during a shootout as he was planning to bomb a hospital treating COVID-19 patients. Like other neo-Nazis, Wilson viewed the pandemic and increased unrest among the American public as an opportunity to popularize Nazi ideas, spark further chaos, and accelerate societal collapse.[1] This past week, Ashli Babbitt was shot and killed while storming the US Capitol as part of a right-wing uprising; several years earlier, she was an employee of the Calvert Cliffs nuclear plant, exhibiting violent behavior during this period. [2] Acts of

violence by **far-right extremists** are on the rise in the United States. Until now, most of these incidents have lacked sophistication, but a critical question for national security experts is whether US far-right extremist groups that espouse violence can carry out something catastrophic. Every president serving in the last two decades has said that nuclear terrorism is a significant national security threat. Analysis of this threat has been, for good reason, mostly focused on foreign extremist groups, but recent events raise questions of whether there should be greater focus in the United States on far-right, domestic extremist threats. These extremists **represent a unique danger because of their prevalence in** federal institutions such as **the military and** the potential that they **might infiltrate nuclear facilities, where they could access sensitive information and nuclear materials.** The far-right extremist nuclear terrorism threat, which has some history, is amplified today by an ideology focused on accelerating the collapse of society and a documented interest in pursuing nuclear terrorism. Officials need to act decisively to better understand and mitigate this threat. Far-right narratives of nuclear terror. The intersection between violent far-right extremist ideology and catastrophic terrorism goes back decades. In The Turner Diaries, a 1978 novel labeled the "bible of the racist right," the protagonists use acts of nuclear terror in service of the creation of a "white world." Protagonists bomb nuclear installations, seize nuclear weapons, target missiles at New York City and Tel Aviv, and ultimately destroy the Pentagon in a suicidal nuclear attack.[3] The International Centre for Counterterrorism ties the Diaries to "at least 200 murders and at least 40 terrorist attacks/hate crimes" in the last 40 years.[4] This includes Timothy McVeigh's 1995 bombing of the Alfred P. Murrah Federal Building in Oklahoma City, resulting in the deaths of 168 people.[5] McVeigh, however, is not the only far-right terrorist to be inspired by the Diaries. In 2011, violent far-right extremist Anders Breivik's terror attacks killed 77 people in Norway. Dozens of pages in his 1,500-page "manifesto" discuss the execution of diffe**rent acts of nuclear terrorism.**[6] **An increasingly active generation of violent far-right extremist groups and actors have adopted an especially dangerous ideology that is compatible with an act of nuclear terror: accelerationism.**[7] Violent far-right extremists who adopt accelerationism view societal collapse as inevitable and seek to hasten that collapse in service of "total revolution"—the complete destruction of the existing system of governance.[8] Violent far-right extremists who adopt accelerationism hope to set off a series of violent chain events, with violence begetting more violence, destabilizing society.[9] **Indiscriminate, highly destructive acts of terror—like a nuclear attack—are therefore perfect tools to sow chaos and accelerate this societal collapse**. In Siege, one of the defining theoretical works of violent far-right accelerationism, author and accelerationist leader James Mason writes that, "[White supremacists] will be the single survivor in a war against the System, a TOTAL WAR against the System."[10] In a recent act of violent far-right extremist terrorism, Brenton Tarrant, the Australian perpetrator of the 2019 terrorist attack on Christchurch masjidain in New Zealand, wrote about accelerationism in his manifesto.[11] Groups with nuclear interests. Inspired by the ideas of accelerationism, the modern breed of violent far-right extremism is becoming more destructive, and nuclear weapons certainly fit into this profile of catastrophic violence. The intention to bring about a cataclysmic clash of civilizations bears resemblance to better known terrorist organizations like Al Qaeda and Aum Shinrikyo, both of which have pursued nuclear weapons. As director of intelligence and counterintelligence at the US Department of Energy, Rolf Mowatt-Larssen, once observed, "Osama bin Ladin has signaled a specific purpose for using WMD in al Qaeda's quest to destroy the global status quo, and to create conditions more conducive to the overthrow of apostate regimes throughout the Islamic world."[12] Like Al-Qaeda, violent far-right extremists support the creation of a new society that is in line with their own ideology. **One of the most notable and violent far-right extremist groups that have adopted accelerationism and operate in the United States is the Atomwaffen Division (AWD).**[13] **The organization's name translates from German to "the nuclear weapons division," indicating that its members have an explicit interest in nuclear terrorism.** Brandon Russel, a former Florida National Guard member and an AWD co-founder, is one case of an aspiring nuclear terrorist. A heavily armed Russel and a fellow AWD member were recently arrested while in route to the Turkey Point nuclear power plant. During the investigation officials found that Russel lived in an apartment with two AWD co-conspirators; in the apartment was a prominently placed copy of the Turner Diaries and a framed photo of Oklahoma City Bomber Timothy McVeigh. **The trio stockpiled weapons and explosives with the intent to blow up, among other targets, a nuclear power plant. In their apartment, police found pipe bomb components, traces of the explosive hexamethylene triperoxide diamine, and detonators. Police also detected two radioactive materials—thorium and americium—in his bedroom**[14] **AWD was not the first far-right extremist in America to consider using radioactive or nuclear materials in a terrorist attack. Several previously documented attempts by violent far-right extremists to commit acts of radiological terror indicate a longstanding interest among far-right actors in highly destructive, non-conventional acts of terror**.[15] In 2004, National Socialist Movement member Demetrius Van Crocker attempted to build a dirty bomb to blow up a courthouse.[16] In 2008, James Cummings, a white supremacist, obtained four 1-gallon containers of a mix of depleted uranium and thorium-232. He planned to use these materials to assemble a dirty bomb.[17] In 2013, a member of the Ku Klux Klan who worked at General Electric carried out research on radiation dispersal devices, learning what level of emission was required to kill humans.[18] Could they really pull it off? While some violent far-right extremists are clearly motivated to carry out catastrophic terrorist attacks, a question remains: Do they possess the means and opportunity to conduct an act of nuclear terrorism? There is no public evidence violent far-right extremist groups have obtained the resources or exhibited the requisite operational sophistication to carry out an act of nuclear terrorism. Many of the plots involving far-right extremists and nuclear terrorism have been poorly conceived and were unlikely to succeed. These incidents, however, likely do not provide a complete picture of the threat, because **publicly accessible information on the capability of these groups is limited, creating ambiguity about their general capabilities.** Moreover, predicting the capability of specific terrorist groups has proven to be exceptionally difficult. In January 2014, for example, Director of National Intelligence James Clapper did not list the Islamic State as a terrorist threat in his testimony to the Senate Select Committee on Intelligence. Yet, within months, the Islamic State had seized major portions of Syria and Iraq and declared a global caliphate.[19] Intelligence on potential lone-wolf actors is even more difficult to gather. **The most concerning evidence that violent far-right extremists might have access to nuclear weapons or weapons-useable material lies in their presence in the US military and other parts of the federal government. The presence of white supremacists in the military is well-known and well-documented. A 2019 poll revealed that 36 percent of active-duty military troops had witnessed evidence of white supremacist ideology in the military.**[20] **In 2020 alone, there were several recent examples of active service members being arrested for plotting far-right extremist acts of terrorism. In January 2020, Coast Guard Lt. Christopher Hasson was sentenced to 13 years in prison for planning a "mass casualty attack" in support of white nationalism**[21] **In February, former Master Sgt. Cory Reeves was discharged from the Air Force because of his ties to white supremacist organizations.**[22] **And in June 2020, Private Ethan Melzer, a neo-Nazi in the US Army, attempted to provide information about US troops abroad, "including whereabouts, movement and security details," to both white supremacist and jihadist groups. He gave this information with the intention of coordinating a suicidal, mass casualty "jihadi" attack on those troops.**[23] **There is also evidence of violent far-right extremism in other government institutions. For example, in May 2018, Matthew Gebert, a State Department employee working on Pakistani and Indian energy policy, led a double life.** He headed the Washington, D.C. chapter of the white supremacist group The Right Stuff, socialized with major white supremacist figures like Mike Peinovich and Richard Spencer, and secretly hosted a white nationalist podcast titled "The Fatherland."[24] In a May 2018 episode of "The Fatherland," Gebert announced, "We need a country founded for white people with a nuclear deterrent. And you watch how the world trembles." This pattern of insider threats raises key questions: How many violent far-right extremists are in the government? What materials or information do violent far-right extremists in government have access to? Are they sophisticated enough to steal nuclear material or sabotage a nuclear facility, or aid another actor on the outside? **To what extent have violent far-right extremists penetrated organizations like national laboratories or nuclear material production facilities, where they might be able to acquire highly-enriched uranium or plutonium—the building blocks for constructing an improvised nuclear device**? The need to screen for far-right extremists. The US government needs to develop processes that ensure violent far-right extremists do not have access to nuclear weapons, weapons-useable nuclear materials, radiological material, or sensitive information about nuclear weapons or material

Nuclear facilities are vulnerable to attacks.

Narasimha et al 7 [Roddam Narasimha, Arvind Kumar, Stephen P. Cohen, and Rita Guenther, Editors, 2007, "Science and Technology to Counter Terrorism: Proceedings of an Indo-U.S. Workshop", National Academies Press, https://nap.nationalacademies.org/catalog/11848/science-and-technology-to-counter-terrorism-proceedings-of-an-indo]

How many of the most dangerous targets are there? In the United States there are 103 operating power reactors at 65 sites. India has 14 power reactors at 6 sites, and 8 more reactors under construction. Worldwide there are 440 power reactors and 32 more under construction.35 Each reactor site has a spent-fuel storage pool containing typically several times as much long-lived radioactivity as a reactor. In addition, large civil fuel-reprocessing plants are in operation at La Hague (France), Sellafield (England), and Chelyabinsk region (Russia); similar but smaller commercial plants operate at Tokai-Mura (Japan) and Marcoule (France). How vulnerable are these targets? Reassuring statements from nuclear-industry groups and advocates are easy to find.36 However, the more balanced National Academy of Sciences study, Making the Nation Safer,37 and a range of other papers by unbiased analysts suggest that the picture is mixed. The prevalent view is that it would not be easy to attack a nuclear-energy facility in a manner that succeeds in releasing a large quantity of radioactivity. At the same time, experts agree that such an attack is not impossible and may not even be unlikely over the course of time unless additional protective measures are taken that can offset the likely increases in the capabilities of terrorists.38 What is the possibility of an attack on a nuclear reactor? Containment buildings at a few U.S. reactors located near airports were explicitly designed to survive the impact of a 707-class airliner moving at around 200 knots (representing speeds on approach to landing or shortly after take-off). The design-basis threat for containment buildings at all other nuclear reactors was not an external impact but an internal steam explosion. Despite this fact, the U.S. Nuclear Regulatory Commission (NRC), in retrospective analyses, determined that most containment buildings would be able to survive the impact of a 727-class jetliner traveling at 500 knots **It is less likely that U.S. reactor** containment**s would survive the impact of** a 767-class airliner traveling at 500 knots. Further, it is noteworthy that some reactor containments outside of the United States are less robust than those inside the country.

The impact of **a light aircraft packed with high explosives** could be problematic for many containments both in the United States and abroad. Reactors are generally protected by extra shielding inside the containment, but it is difficult to determine whether this extra protection would prove sufficient against the kinds of attacks from the air that are now plausible. Safety-related systems outside of the main containment could also lead to significant releases if they are destroyed at the same time that the containment is damaged by an attack from the air. Sabotage by intruders armed with high explosives is another scenario. If the intruders were to possess detailed National Academies of Sciences, Engineering, and Medicine. 2007. Science and Technology to Counter Terrorism: Proceedings of an Indo-U.S. Workshop. Washington, DC: The National Academies Press. https://doi.org/10.17226/11848. knowledge of reactor systems, they could likely produce a core melt event and steam explosions capable of breaching the containment, even without benefit of an aircraft impact or light-plane-as-cruise-missile attack from the outside.39 Spent-fuel pools may be more vulnerable than the reactors with which they are associated. The spent fuel in such pools can catch fire if the water is removed. Such fires can be difficult to extinguish and could release large quantities of cesium-137 and other radionuclides. An analysis published in 2003 found that spent-fuel pools in the United States currently hold an average of 400 tons of spent fuel each, containing 35 megacuries (MCi) of cesium-137.40 A 1997 Brookhaven National Laboratory study concluded that a fire at such a spent-fuel pool could release between 10 and 100 percent of the cesium-137 inventory.41 Hence, in an average case, between 3.5 and 35 MCi would be released. This amount can be compared to the approximately 2 MCi of cesium-137 that was released in the Chernobyl accident. Fuel-reprocessing plants contain many reactors' worth of radioactivity but little stored energy. For these plants, large-aircraft impact is probably a bigger risk than sabotage from within. Dry-cask spent-fuel storage, spent-fuel shipping containers, and geologic radioactive-waste repositories are far less vulnerable than are reactors and fuel-reprocessing plants. Large radioactivity releases from attacks on these targets are very unlikely. National Academies of Sciences, Engineering, and Medicine. 2007. Science and Technology to Counter Terrorism: Proceedings of an Indo-U.S. Workshop. Washington, DC: The National Academies Press. https://doi.org/10.17226/11848. Of course, the consequences of a successful terrorist attack on any nuclear-energy facility depend not only on the quantity and kinds of radioactivity released, but also on wind direction, atmospheric-mixing conditions (which govern both vertical and horizontal spreading of the radioactive plume), the distribution of population in relation to the path of the plume, and the extent to which those in the plume's path can be evacuated before it reaches them. Unlike accidents, which occur at random, terrorists carefully choose the site of their attacks. Further, they might even succeed in choosing weather conditions that would maximize the impacts of an attack.42 The 1997 Brookhaven study estimated the consequences of a spent-fuel pool fire at a pressurized water reactor to be 54,000 to 143,000 extra cancer deaths; 2,000 to 7,000 square kilometers of agricultural land condemned; and economic costs of $117 to $556 billion from evacuation **Excessive "non-cited violations" by the Nuclear** Regulatory Committee (**NRC**) **constitute a** second **sign of complacency and vulnerability.** Non-cited violations entail no penalty and no follow-up. Most of the security shortcomings that are identified in routine NRC inspections are classified as non-cited violations on the grounds "that the problems had no direct immediate adverse consequences at the time they were discovered." This appears to mean that no terrorists were attacking the plant while it was being inspected. This may seem to be a harsh judgment, but the 2003 GAO study reported that in 2000 and 2001, the NRC issued no cited violations and 72 non-cited ones. The non-cited violations included the following instances documented by NRC inspectors. A security guard slept on duty for more than half an hour The incident was treated as a non-cited violation because no attack had occurred during this period and because neither he nor any other guard at the plant had been found sleeping more than twice during the previous year. A security officer falsified logs to show that he had checked vital area doors and locks when he was actually in another part of the plant In this case the officer was solely responsible for the security of the particular area because a security upgrade project was under way that had disabled or diverted all the other security for the area. Guards failed to physically search individuals for metal objects after the walk-through detectors and hand scanners indicated that something was present. These **individuals were** then **allowed unescorted access through** the plant's **protected area**. This was treated as a non-cited violation because a similar breach had been observed fewer than two times at that plant in the preceding year. Moreover, the NRC does not systematically collect, analyze, and disseminate 43 General Accounting Office. 2003. Nuclear Regulatory Commission Oversight of Security at Commercial Nuclear Power Plants Needs to Be Strengthened. GAO-03-752. Washington D.C. Page 67 Suggested Citation:"7 Threats to Civil Nuclear-energy Facilities." National Academy of Sciences. 2007. Science and Technology to Counter Terrorism: Proceedings of an Indo-U.S. Workshop. Washington, DC: The National Academies Press. doi: 10.17226/11848.× Save Cancel information relevant to improving plant security. The 2003 GAO report on the security of U.S. nuclear-reactor sites found that the NRC does not have a routine, centralized process for collecting, analyzing, and disseminating security inspections to identify problems that may be common to other plants or to identify lessons learned in resolving a security problem that may be helpful to plants in other regions. NRC headquarters receives inspection reports only when a licensee challenges the findings from security inspections. NRC headquarter officials do not routinely obtain copies of all security inspection reports because headquarters files and computer databases are insufficient to hold all inspection reports.44 National Academies of Sciences, Engineering, and Medicine. 2007. Science and Technology to Counter Terrorism: Proceedings of an Indo-U.S. Workshop. Washington, DC: The National Academies Press. https://doi.org/10.17226/11848. Another sign of complacency and vulnerability is that, in the United States, state laws often constrain the types of weapons that can be used by guard forces, virtually ensuring that they will be less well armed than their attackers. Specifically, state law often forbids the use of automatic weapons by nonfederal guard forces at nuclear power plants. Since attackers will probably be armed with automatic weapons, this asymmetry in weaponry hurts the prospects for the successful defense of nuclear power plants. The existing laws of several states call into question the legality of the use of deadly force to protect private property. Many of the guards at these installations have expressed concern in interviews that were they to use deadly force against intruders, they might be subjected to legal action or punishment. The NRC has recommended that state legislatures and the U.S. Congress pass legislation to remedy this situation, but this has not yet occurred. Many prominent members of the nuclear energy profession appear to be underestimating the terrorism problem, especially in statements prepared for policy makers and the general public. Claims such as, "nuclear power plants are the best protected industrial facilities in the United States" and "attacks on nuclear reactors cannot cause significant harm to the public" are common. The first claim is misleading because, although it might be accurate, it says nothing about whether or not the degree of protection is adequate relative to the threat. The second claim is wrong: the harm that could result from successful attacks on nuclear reactors has been established by many independent studies. Nor is the threat purely hypothetical: actual threats against, or attacks upon, nuclear power reactors have already been reported in Argentina, Lithuania, Russia, South Africa, South Korea, and western Europe.

Upgrades boost security. Maness 25

Maness 25 [Coleman Maness, Director of sales and marketing at ARES Security Corporation, 2-24-2025, "Enhancing Nuclear Security in an Era of Rising Threats", ARES Security, https://aressecuritycorp.com/2025/02/24/enhancing-nuclear-security-in-an-era-of-rising-threats/, accessed 4-4-2025.] //aayush

As global tensions and cybersecurity threats escalate, **nuclear security remains a top priority for governments** and energy providers. This blog explores recent updates in nuclear security regulations, advancements in security technology, and **best practices for protecting nuclear facilities against physical and cyber threats**. Current Threat Landscape in Nuclear Security **With evolving geopolitical threats, nuclear facilities face increasing risks from cyberattacks, insider threats, and unauthorized drone surveillance**. **Recent attempts to breach nuclear plants have emphasized the need for robust perimeter security and advanced monitoring** systems. The **increasing threat of state-sponsored cyberattacks targeting nuclear reactors** highlights the necessity of multi-layered cybersecurity protocols. **The NRC's latest assessments emphasize the need for real-time monitoring, automated threat detection, and rapid response capabilities** to prevent security breaches. Regulatory Developments and Compliance Requirements The Nuclear Regulatory Commission (**NRC**) **has introduced new cybersecurity frameworks for nuclear facilities, emphasizing compliance with regulations** such as 10 CFR Part 73. **Facilities must implement multi-layered security systems and continuous risk assessment protocols**. The Department of

Energy (**DOE**) has **also increased funding for cybersecurity enhancements in nuclear energy facilities**, further reinforcing national security priorities. **Strengthening Nuclear Security Through Innovation** and Vigilance **Ensuring nuclear security requires continuous innovation and adherence to regulatory requirements**. **By integrating advanced security solutions and staying ahead of emerging threats, nuclear facilities can maintain operational resilience and public safety**. As the nuclear industry expands, **proactive security frameworks will remain essential** in mitigating evolving threats and ensuring long-term sustainability.

Even one attack escalates---turns every impact.

Buis 18 [Irma Arguello and Emiliano J. Buis, * founder and chair of the NPSGlobal Foundation, and head of the secretariat of the Latin American and Caribbean Leadership Network. She holds a degree in physics, a Master's in business administration, and completed graduate studies in defense and security, ** lawyer specializing in international law. He holds a PhD from the University of Buenos Aires (UBA), a Master's in Human and Social Sciences from the University of Paris/Panthéon-Sorbonne, and a postgraduate diploma in national defense from the National Defense School, "The global impacts of a terrorist nuclear attack: What would happen? What should we do?," 2018, *Bulletin of the Atomic Scientists*, Vol. 74, Issue 2, pp. 114-119, https://doi.org/10.1080/00963402.2018.1436812, Recut EA]

The consequences of **a terrorist nuclear attack** .A small and primitive 1-kiloton fission bomb (with a yield of about one-fifteenth of the one dropped on Hiroshima, and certainly much less sophisticated; cf. Figure 1), detonated in any large capital city of the developed world, **would cause** an **unprecedented catastrophi**c scenario. .[FIGURE 1 OMITTED] An estimate of direct effects in the attack's location includes a death toll of 7,300-to-23,000 people and 12,600-to-57,000 people injured, depending on the target's geography and population density. Total physical destruction of the city's infrastructure, due to the blast (shock wave) and thermal radiation, would cover a radius of about 500 meters from the point of detonation (also known as ground zero), while ionizing radiation greater than 5 Sieverts – compatible with the deadly acute radiation syndrome – would expand within an 850-meter radius. From the environmental point of view, such an area would be unusable for years. In addition, radioactive fallout would expand in an area of about 300 square kilometers, depending on meteorological conditions (cf. Figure 2). [FIGURE 2 OMITTED] But the **consequences** would **go** far beyond the effects in the target country, however, and **promptly** propagate **worldwide**. Global and national security, economy and finance, international governance and its framework, national political systems, and the behavior of governments and individuals would all be put under severe trial. The severity of the effects at a national level, however, would depend on the countries' level of development, geopolitical location, and resilience. Global security and regional/national defense schemes would be strongly affected. An increase in **global distrust** would **spark** rising **tensions** among countries **and** blocs, that could even lead to the brink of **nuclear** weapons **use** by states (if, for instance, a sponsor country is identified). The consequences of such a shocking scenario would include a **decrease** in states' **self-control**, an **escalat**ion of **present conflicts** and the emergence of new ones, accompanied by an increase in military unilateralism and military expenditures. Regarding the economic and financial impacts, a severe global economic depression would rise from the attack, likely lasting for years. Its duration would be strongly dependent on the course of the crisis. The main results of such a crisis would include a 2 percent fall of growth in global Gross Domestic Product, and a 4 percent decline of international trade in the two years following the attack (cf. Figure 3). In the case of developing and less-developed countries, the economic impacts would also include a shortage of high-technology products such as medicines, as well as a fall in foreign direct investment and a severe decline of international humanitarian aid toward low-income countries. We expect an increase of unemployment and poverty in all countries. Global poverty would raise about 4 percent after the attack, which implies that at least 30 million more people would be living in extreme poverty, in addition to the current estimated 767 million. [FIGURE 3 OMITTED] In the area of international relations, we would expect a breakdown of key doctrines involving politics, security, and relations among states. These international tensions could

lead to a collapse of the nuclear order as we know it today, with a consequent setback of nuclear disarmament and nonproliferation commitments. In other words, the whole system based on the Nuclear Non- Proliferation Treaty would be put under severe trial. After the attack, there would be a reassessment of existing security doctrines, and a deep review of concepts such as nuclear deterrence, no-first-use, proportionality, and negative security assurances. Finally, the behavior of governments and individuals would also change radically. Internal chaos fueled by the media and social networks would threaten governance at all levels, with greater impact on those countries with weak institutional frameworks. Social turbulence would emerge in most countries, with consequent attempts by governments to impose restrictions on personal freedoms to preserve order – possibly by declaring a state of siege or state of emergency – and legislation would surely become tougher on human rights. There would also be a significant increase in social fragmentation – with a deepening of antagonistic views, mistrust, and intolerance, both within countries and towards others – and a resurgence of large-scale social movements fostered by ideological interests and easily mobilized through social media. Prevention, preparedness, response Given the severity of the impacts, no country in possession of nuclear weapons or weapons-usable materials can guarantee its full protection against nuclear terrorism or nuclear smuggling for proliferation purposes. Nor is it realistic to conceive of full compensation to others in the international community, if a catastrophic event happens because of any country's acts or omissions. Therefore, we consider that prevention is the only acceptable way forward to preserve global stability.