

MITCHELL INSTITUTE

Policy Paper



Key Points

Exporting U.S. unmanned aerial vehicles (UAV) to allies and security partners is essential to enhance the interoperability necessary for effective coalition military operations.

U.S. export policy, guided by the nuclear non-proliferation Missile Technology Control Regime (MTCR), treats UAVs as if they were nuclear/WMD cruise or ballistic missiles, thereby restricting foreign sales.

The marketplace for UAVs is surging, and China is exploiting U.S. adherence to the MTCR for commercial and political gain.

U.S. adherence to the MTCR Guidelines fractures key relationships, blunts coalition warfighting capability and capacity, and raises operational security risks to the United States as partner nations turn to China.

To enable the export of critical UAVs to U.S. allies and partners, the Congress should craft language in the 2021 NDAA that explicitly defines UAVs as aircraft and not synonymous with or a subset of cruise missiles. This statutory change would supersede the MTCR, effectively removing U.S. UAV export decisions from the MTCR Guidelines.

Modernizing Unmanned Aerial Vehicle Export Policy for Effective Coalition Forces

By Heather R. Penney

Senior Resident Fellow, The Mitchell Institute for Aerospace Studies

Abstract

Since 1987, the United States has voluntarily adhered to international nuclear non-proliferation export Guidelines set by the Missile Technology Control Regime (MTCR), which classifies unmanned aerial vehicles (UAV) as nuclear-capable cruise or ballistic missiles. As a result, UAVs are subject to specific export restrictions, and key U.S. allies and security partners cannot access these UAVs from U.S. defense manufacturers. For larger military UAVs, U.S. export policy starts at “no” because the MTCR imposes a “strong presumption of denial.”

Exporting larger U.S. UAVs is vital to building and sustaining coalition operations. When allies and partners own and operate these highly capable aircraft, they provide a forward presence of intelligence collection and deterrence. They signal enduring U.S. commitment that reassures allies and deters adversaries, especially important when U.S. forces are spread thinly.

Despite recent efforts to create a more rational UAV export policy, the United States remains hampered by the export guidelines and restrictions of the MTCR. These limitations fracture important partnerships, blunt warfighting capability and capacity, and raise operational security risks as partners turn to China. Not a member of the MTCR, China is using this market vacuum to expand its influence, gain an intelligence advantage, and compromise U.S. security partnerships. Conflating UAVs with nuclear-capable missiles is detrimental to U.S. and allied security interests. The United States should no longer seek to modify the MTCR’s UAV definitions and instead remove U.S. UAVs from the MTCR Guidelines by defining—via congressional statute—UAVs as combat aircraft.

Executive Summary

Unmanned aerial vehicles (UAV) are crucial technologies in modern military operations. The role of these aircraft is evolving to include missions such as manned-unmanned teaming, aerial refueling, electronic warfare, and more. As the United States positions to compete against high-end peer threats, it must leverage the value of UAVs across the spectrum of combat.

Demand for UAV capabilities by U.S. allies and security partners is growing dramatically. Whereas it is in the interest of the United States to provide key partners access to the same UAVs it uses, the U.S. defense industry is restricted from exporting these aircraft by the nuclear non-proliferation Missile Technology Control Regime (MTCR) of the 1980s. These export restrictions are driving America's security partners into the arms of China, which uses its sale of UAVs to expand its influence, gain an intelligence advantage, and compromise partner integration with U.S. forces.

Since 1987, the United States has voluntarily adhered to MTCR Guidelines, which classify UAVs as nuclear-capable cruise or ballistic missiles. The Guidelines define large UAVs capable of carrying a 500 kg (or greater) payload more than 300 km one way as "Category I" systems, and they are subject to significant restrictions. Export policy for such UAVs is driven by a "strong presumption of denial." Importantly, the MTCR acknowledges that "the decision to transfer remains the sole and sovereign judgment of the government," and national statutes take precedence over the MTCR Guidelines.¹ Manned aircraft are specifically excluded from this regime.

The harmful consequences of these restrictive export policies only increase as UAVs proliferate and become more important to U.S. security operations. Allies

and partners are essential force multipliers, and effective coalition operations require seamless integration of capabilities. Operating the same UAVs as the U.S. Air Force means that partners can burden-share with the United States. Partners can provide a forward presence of intelligence collection and deterrence in critical regions, freeing U.S. assets for other global commitments. Establishing long-term relationships through the sale of U.S. UAVs is a clear signal of enduring U.S. commitment that both reassures allies and deters adversaries. When allies operate Chinese-made UAVs, the United States loses strategic advantages; it also enables the Chinese to disrupt/manipulate coalition operations.

China is exploiting a market vacuum to enter regions that are of critical interest to the United States and forge new security relationships with historically solid U.S. partners. Jordan is one high-profile example; Iraq, Saudi Arabia, and the UAE are other U.S. security partners that have procured Chinese UAVs; and Algeria, Egypt, Nigeria, Uzbekistan, Kazakhstan, and Serbia have followed suit. The decades-long lifecycles of these UAVs mean that the Chinese market "entry" could turn into a strategic advantage for China, especially when integrating indigenous industry.

The United States should not cede any more market share—or key partner relationships—to the Chinese. Continuing to include UAVs within the Guidelines of the MTCR harms critical U.S. relationships, U.S. industry, and coalition operations. The increasing divergence between export policy, military requirements, and reality in the global marketplace is a dangerous impediment to current and future U.S.-led coalitions. The United States cannot fully realize the potential of UAVs in coalition operations without a fundamental shift in export policy.

The United States must continue to act as a global leader in support of non-proliferation efforts, but subjecting UAVs to the MTCR controls is harmful to both U.S. national interests and the objectives of the regime. Attempts to adjust the MTCR measures to broaden UAV exports have not only failed but may have emboldened China to pursue global influence via UAVs. As unmanned technologies advance, MTCR constraints will become more archaic,

inducing further export of unmanned technologies by irresponsible actors. U.S. legislation must define UAVs as aircraft to align U.S. export policy more appropriately. UAV exports should be regulated as any other combat aircraft. Changing U.S. export policy such that UAVs are treated as aircraft and no longer subject to the Guidelines of the MTCR will not be a panacea, but given the growing importance of UAVs to future warfare, it is an imperative.

Recommendations:

1. When the next plenary session of the MTCR meets, the United States should not propose additional airspeed thresholds to delineate Category I or II systems to resolve dysfunctions involving Guidelines for UAVs.
2. The U.S. Congress should craft language in the 2021 NDAA that affirms the U.S. commitment to non-proliferation and defines UAVs as aircraft—not as a subset of cruise missiles, and therefore not subject to the MTCR Guidelines, Annex, or any U.S. policy driven by the MTCR. This language should further direct that UAVs be subject to the same export considerations as other military aircraft without application of any previous MTCR scrutiny or application of additional preview or review.
3. The U.S. should review all other policies that restrict export of UAVs by categorizing them separately from manned aircraft and adjust to treating them as manned aircraft.
4. Congressional language in the 2021 NDAA should direct for UAVs to have the same co-development, co-production, and any other privilege or consideration afforded to military aircraft for the purposes of direct commercial sale or foreign military sale.
5. The Administration should capitalize on a limited window of opportunity to re-engage with key partners wavering in their Chinese UAV partnerships. Of key symbolic and strategic priority is a deliberate goal of exporting American UAV capabilities to Jordan on a rapid timeline.
6. The 2021 NDAA should direct the Department of Defense to develop standing UAV requirements and configurations for security partners and allies in each of the geographic combatant commands and report to Congress the consolidation of such requirements.

Introduction

Unmanned aerial vehicles (UAV) are crucial technologies for modern military operations. During their first appearance in the Balkans over 25 years ago, the USAF pioneered the use of MQ-1 Predator UAVs in combat. The United States has since prototyped and fully fielded a range of unmanned aircraft for conducting persistent ISR and integrated overwatch and strike operations. As the nation now prepares to compete against high-end peer threats, the success of future warfare depends upon

UAVs should not be treated as if they were nuclear missiles: they simply are not. They should instead be regulated for export as combat aircraft.

leveraging the value of UAVs across the spectrum of combat. Yet the Missile Technology Control Regime (MTCR), an international political agreement established for nuclear non-proliferation, defines UAVs as nuclear missiles for the purpose of export control. The United States cannot fully realize the potential of UAVs among its friends and allies without a fundamental shift in policy. UAVs should not be treated as if they were nuclear missiles: they simply are not. They should instead be regulated for export as combat aircraft.

The value of UAVs is expanding in the global marketplace, precipitating an explosion in UAV technology and industry. Today, at least 101 nations operate these aircraft in a military capacity. These platforms range from hand-launched, line-of-sight vehicles that weigh less than 3 kilograms (kg) to high-altitude, long-endurance surveillance-strike aircraft that rival the size of airliners. Research and procurement of military UAVs in 2018 was marked at over \$9 billion globally and forecasted to grow significantly. The Teal Group “2019–2020 World Military Unmanned Aerial Systems Market Profile

& Forecast” projected global military UAV research and procurement to exceed \$13 billion by 2027, producing over 5,000 aircraft.² By 2029, the international market will account for over 50 percent of this UAV procurement.³

Whether remotely piloted, loyal wingmen, or fully autonomous, UAVs are clearly part of future warfare, and the United States will not be engaging in future operations alone. Allies and security partners have been, and will continue to be, critical to the political legitimacy and combat effectiveness of military operations. However, the MTCR guidelines require that any request for large UAVs be subject to a “strong presumption of denial.” The U.S. State Department follows the Guidelines, and consequently, the response to export requests for large UAVs begin with “no.” Key allies and partners are prevented from importing and operating UAVs supplied by the United States as a direct result of U.S. participation in the MTCR.

U.S. export policy governing UAVs is stuck in a Cold War mindset and an anti-proliferation framework. U.S. policy in line with the MTCR treats UAVs anachronistically, entangling them with export restrictions covering cruise and ballistic missiles capable of delivering nuclear payloads. UAVs produced in the United States are consequently subject to stringent export limitations. Key U.S. allies and security partners cannot access these valuable capabilities from U.S. defense manufacturers.

There is now an increasing divergence between U.S. national security strategy and MTCR-constrained U.S. export policy. That gap invites competitors to capitalize on U.S. policy to undermine U.S. security. As the strongest case study, U.S. policy constraints driven by the MTCR are pushing key U.S. security partners into

Rather than creating stability and decreasing risk for the United States and its allies, the current U.S. UAV policy is not only misguided but also leads U.S. friends and allies to establish arms sales agreements with our adversaries to obtain needed military capability.

the arms of China, which is exploiting this market vacuum to expand its influence, gain an intelligence advantage, and restrict the ability of potential partners to integrate with U.S. forces.

Despite directives from the Trump administration to create UAV export policy more closely aligned with U.S. national security strategy and interests, the United States policy remains severely hampered by MTCR export guidelines and restrictions. UAV technology outpaced this policy a long time ago, and the latest revision does

nothing to alter the gap. So long as the controls imposed by the MTCR are applied to UAVs, the United States will continue to be inhibited from responsibly exporting these important capabilities to secure and stabilize key regions of the world. Strategic relationships will erode as partners are forced to procure UAVs from China or other hostile states, and it will come at a cost to U.S. security interests as well as those of American industry.

The future of warfare will depend increasingly on UAV technology; the consequences to U.S. security interests of conflating UAVs with nuclear missiles will be increasingly untenable. Rather than creating stability and decreasing risk for the United States and its allies, the current U.S. UAV policy is not only misguided but also leads U.S. friends and allies to establish arms sales agreements with our adversaries to obtain needed military capability. This inhibits U.S. ability to conduct integrated operations and provides crucial intelligence to China while stimulating innovation within the Chinese UAV industry. An immediate and significant change in U.S. policy must occur before more damage is done.

The Royal Jordanian Air Force Case Study— No Choice but Chinese

When the Royal Jordanian Air Force first displayed their Chinese-built remotely piloted aircraft (RPA) at the Special Operations Forces Exhibition and Conference (SOFEX) held in Amman, Jordan from May 7–10, 2018, it was hardly a surprise to U.S. military officials.⁴ The United States gave Jordan no other option for safeguarding their security interests than to look eastward for a suitable solution. Jordan had requested remotely piloted aircraft of U.S. origin for years but were repeatedly denied. Given their requirements for long-endurance surveillance and reconnaissance, the purchase of the Chinese aircraft by the crucial U.S. security partner was quite rational—it was the only avenue left open.

Many American stakeholders, handcuffed by outmoded policy, wholly perceived the lack of wisdom in withholding U.S. military drones from a lynchpin partner in the Middle East. A strong, stable, moderate Jordan was, and continues to be, pivotal to U.S. policy in the region. Jordan's quiet cooperation with Israel for their mutual security concerns was equally served by adding U.S. surveillance capabilities to the Jordanian security apparatus. The Jordanians have emulated U.S. defense models and remain close to their U.S. Air Force partners, having one of the most capable and professional air forces in the region. That the restrictions rooted in the MTCR's non-proliferation mission were poorly applied in this case is blatant.

At the time, Representative Duncan Hunter (R-California) strenuously objected to the Obama administration's reluctance to approve the Jordanian requests and expressed his concern in a letter to the president: "Allowing Jordan to obtain Chinese assets ... is a serious mistake. Not

only will a new market exist for China to export its technology, any incorporation of Chinese assets will directly harm U.S. interoperability.”⁵ As a critical partner to the United States in the Middle East, Jordan’s procurement of Chinese drones signaled a serious setback in the relationship and presents significant new security concerns regarding cooperative military operations with the United States.

Chinese military analyst Song Zhongping acknowledges that China is actively exploiting the export vacuum created by the MTCR: “The Chinese product now doesn’t lack technology ... and the United States restricting its arms exports

is precisely what gives China a great opportunity.”⁶ Whereas Jordan is not the only nation to purchase Chinese UAVs, it is perhaps the best example of a U.S. failure to fulfill requirements as a security partner because of the high-profile nature of the acquisition. At the same time, other U.S. security partners in the region, including Iraq, Saudi Arabia, and the UAE, have notably procured Chinese drones, and Algeria, Egypt, Nigeria, Uzbekistan, and Kazakhstan have

followed suit.⁷ This growing list shows the Chinese desire to capture market share in regions of U.S. interest and with historically solid U.S. security partners.

The Value of UAV Export: Strengthening Partnerships and Operations

The proliferation of Chinese military hardware fielded by traditional U.S. allies and partners signals an erosion of key security relationships and the growing influence of China globally. U.S. partners now rely on China for training, control stations, sustainment, and intelligence processing, and command and control

systems. Furthermore, Chinese drones flown by U.S. partner nations pose serious security risks to coalition and U.S. forces. Although they operate as friendly forces, they provide China the opportunity to invade coalition networks to exploit U.S. technologies and operations, even when Chinese UAVs are flown by partner nations. Not only do these security risks effectively bar partners from participating in coalition operations, they also limit the ability of partners to share intelligence. As a result, U.S. relationships with these nations are weakened, and a greater burden is placed on U.S. forces. Given the long lifespan of many of these UAVs, the purchase of Chinese drones could cause a long-term rift in these critical partnerships.

The ability to export larger U.S. UAVs is critical to building and sustaining successful coalition operations. Real-time sharing of data and intelligence, as well as complete and secure integration across all partners, creates synergies of effort in coalition operations while also increasing capacity. Africa presents a clear example of developing and maintaining partner capability to combat terrorism, insurgencies, and illicit trade. The purchase and deployment of Chinese UAVs by these partners increases the potential for security compromises and could scuttle regional security objectives favorable to U.S. interests.

Allies and partners owning and operating these highly capable vehicles can provide forward presence, intelligence collection capability, and deterrence in critical regions of the world when U.S. forces may have limited access. At the same time, the presence of partner-operated U.S. vehicles reassures allies and deters adversaries as a clear signal of America’s enduring commitment to that partner nation and associated region. Therefore, to achieve desired outcomes for coalition

The proliferation of Chinese military hardware fielded by traditional U.S. allies and partners signals an erosion of key security relationships and the growing influence of China globally.

operations, U.S. security partners and allies should operate the same UAVs as the United States. The most capable U.S. UAVs offer greater range and duration, better multi-sensor packages, and a deeper weapons magazine than comparable Chinese systems. Equipped with these systems, allies can more effectively integrate with U.S. operations, creating more concentration, mass, and flexibility.

Operating the same UAVs means that partners can burden-share with the United States, freeing U.S. assets for other global commitments or increasing force density where required. When allies operate U.S. UAVs, including MQ-1s, MQ-9s, or future UAVs, machine-to-machine data transfer is seamless, intelligence processing sharing is enhanced, and operational flexibility is dramatically increased.

Interoperability with allies and security partners is full integration at all levels: the air tasking order, mission objectives, the sharing of intelligence, and collaborative targeting and tactics.

When allies operate Chinese-made UAVs, these strategic advantages are lost.

Illustrating this loss, one remotely piloted aircraft operator recalled a mission in which the U.S. allies operated incompatible UAVs. The operator was tasked to take over an orbit from an allied UAV, but the handoff of the target was exceedingly difficult and nearly failed. Because the ally's system was not interoperable with the U.S. MQ-9, crews had to transfer tracking of the target—an individual in a truck—using manual coordinates over the phone, a time-consuming and imprecise methodology. Such a hand-off involving an unpredictably moving vehicle proved “almost pointless.... [The] probability of success goes way down.”⁸ The time-consuming and laborious process occurred because the two different UAV types could not share information across a common

system design that allows machine-to-machine situational awareness or visual handoff through a shared video feed:

*We couldn't data-share. As a result, [the allied operator is] passing the coordinates—over the phone—for a vehicle with a last known heading, going this direction, an approximate miles per hour, and a description. But the target was in a city with such traffic density that we just couldn't find it.*⁹

In other words, the incompatible UAV types could not share information across a common system design that allows machine-to-machine situational awareness or visual handoff through a shared video feed, and the result was a time-consuming, laborious, and imprecise methodology with a low-probability of success.

This same operator contrasted this experience to another operational handoff with a partner that had a system that was interoperable with the MQ-9:

*With real-time data-sharing, I literally could pull up on my computer screen his exact sensor and double click on it with my mouse to slew my sensor to exactly where they're looking. It's instantaneous and they're looking exactly where my crosshairs are and confirm—in a dynamic, dense, and often confusing environment—that we are on the exact car.*¹⁰

This real-time sharing of information was crucial to maintaining positive custody of the target through the winding streets of the city. The interoperability of the two UAVs enabled a quick, precise handoff and positive confirmation of an elusive target in a challenging, complicated, and dynamic environment.

Interoperability is not just about real-time data sharing and compatible datalinks and networks. Interoperability with allies and security partners is full integration at all levels: the air tasking order, mission objectives, the sharing of intelligence, and collaborative targeting and tactics. Because of the need for operational security, the United States cannot integrate partners with Chinese UAVs into coalition operations—and not simply because of technical incompatibilities like datalinks. While China takes what some would call a *laissez faire* approach to the modification, sustainment, employment, and end-use of their UAVs, industry experts state that the

The MTCR was created to strengthen nuclear non-proliferation efforts by addressing the “most destabilizing delivery systems for such weapons:” ballistic and cruise missiles.

Chinese maintain a strong hold on the command and control (C2) elements of their drones. These C2 elements, including the datalinks, ground station software and computers, and other controls, allow China to potentially monitor activity and even collect intelligence from these drones to learn about coalition operations, discern potential high-value targets, assess status of forces, and many other surreptitious activities.

The worry is not that coalition partners would in any way deliberately allow China to collect intelligence, but that they would do so unknowingly and involuntarily. Virtually undetectable cyber espionage techniques are one reason why the U.S. government barred the use of Huawei manufactured equipment in the United States for use in the next generation 5G wireless network. The danger of the close ties between Huawei and the Chinese government was spotlighted at the Munich Security Conference in February 2020 by a bi-partisan delegation of top U.S. government leaders. Secretary of State Mike Pompeo was quoted as describing

companies like Huawei as “Trojan horses for Chinese intelligence.”¹¹

When U.S. allies and security partners acquire Chinese UAVs, American bilateral and military relations are weakened, coalition operations are significantly hampered, and interoperability and true operational integration are set back by decades. If U.S. UAV export policy remains unchanged from the restrictions imposed by the MTCR, China will likely continue to expand their market—and sphere of influence—into regions that are critical to the economic and national security interests of the United States.

MTCR Approach: Equating Unmanned Aerial Vehicles with Nuclear Missiles

Current UAV export policy is dominated by the MTCR—a nuclear non-proliferation regime. Unlike treaties, where signatories are then bound by international law, the MTCR is wholly voluntary and not enforceable. Established in 1987 by the G-7 industrialized nations (Canada, France, Germany, Italy, Japan, the UK, and the United States), the MTCR was created to strengthen nuclear non-proliferation efforts by addressing the “most destabilizing delivery systems for such weapons:” ballistic and cruise missiles.¹² Although the 1970 Treaty on the Non-Proliferation of Nuclear Weapons has long been the foundation of global non-proliferation efforts, the premise of the regime was that limiting the transfer of missiles and missile technologies would pose an additional barrier to rogue actors obtaining nuclear capability.¹³ Manned aircraft were specifically excluded.

The regime changed their charter in 1992 to combat the proliferation of any weapon of mass destruction (WMD), not just nuclear weapons.¹⁴ This change of scope to include biological and chemical agents was significant, because it

expanded potential delivery mechanisms. Consequently, the regime members included UAVs.¹⁵ The capability of target drones to deliver these more compact threats meant that they could be used like a cruise missile. As described by then-Chair of the MTCR, Ambassador Piet de Klerk, “In 1992 it was decided to enlarge the scope to not only missiles but *all* unmanned delivery vehicles, for *all* weapons of mass destruction, including chemical and biological weapons [emphasis original].”¹⁶ This means that after a technology revolution unforeseen in 1992, the MTCR’s ongoing effort to constrain the export of unmanned WMD delivery systems and associated technologies now includes optionally manned aircraft, remotely piloted aircraft, and autonomous aircraft.

The MTCR has no jurisdiction over the actions of any partner and does not have the power to provide oversight or enforcement.

The MTCR has grown from the original seven members to 35 today, including Russia, added in 1995, and Turkey, added in 1997.¹⁷ All changes to the existing MTCR Guidelines and its equipment and technology Annex are accomplished through full consensus of all partners. China is not a signatory nor a formal adherent, but it has “voluntarily pledged” to adhere to the MTCR export restrictions.¹⁸ This kind of unilateral adherence is encouraged by the regime; membership is not necessary to enforce the principles and guidelines. This enables nations to formally notify the regime of their intent to follow the Guidelines and Annex of the regime even if they have not been provided membership through a full consensus vote of the MTCR partners. Membership in the MTCR, however, is not intended to confer any special status or more lenient consideration regarding the export decisions of other members. Members are supposed to apply the same stringent evaluation criteria

to all export requests, regardless of whether the interested nation is also a partner in the regime. U.S. policy considers membership in the regime an important criteria in overcoming the strong presumption of denial.

As an informal political understanding, the MTCR is not a treaty. Its Guidelines and Annex are not binding in any statutory or legal manner—the MTCR has no jurisdiction over the actions of any partner and does not have the power to provide oversight or enforcement.¹⁹ According to the Office of the Secretary of Defense, Defense Technology Security Administration, “[t]he Guidelines and Annex are implemented by each Partner in accordance with its national laws and legislation.”²⁰ Partners to the regime comply with the export restrictions on a wholly voluntary basis.²¹ While compliance may be voluntary, many members treat the Guidelines and the associated Annex as almost definitive. For them, deviation from the Guidelines or Annex requires extenuating circumstances.

Technologies in the MTCR Annex

The Equipment and Technology Annex lists items controlled or governed by the MTCR. Many of these items, meant to restrict transfer of missile technologies related to the delivery of WMD, are indistinguishable from conventional combat aircraft systems. A few examples covered by the MTCR Annex include:

- Turbojet and turbofan engines
- Radial ball bearings
- Composite structures
- Various alloys
- Accelerometers or gyros
- Integrated navigation systems
- Flight control equipment
- Receiving equipment for navigation satellite systems
- Stealth, or materials for reduced observables

Partners of the MTCR are expected to unilaterally adhere to a common set of export controls on WMD delivery systems defined by the MTCR Guidelines and Annex.²² U.S. export policy, based on these restrictions, applies to controlled items which cover “virtually all key equipment and technology needed for missile development, production, and operation.”²³ The Annex is the regime’s “list of controlled items including virtually all key equipment, materials, software, and technology needed for missile development, production, and operation....”²⁴ The Annex lists subsystems and technologies, and even goes into some detail about the types of technologies that fall under its purview. Importantly, the Annex retains enough ambiguity to reasonably encompass emerging technologies and vehicles based on its payload weight and one-way range.

Categories of Delivery Systems Governed by the MTCR

The MTCR Annex divides missiles and UAVs into two sections: Category I and Category II. The level of export control an item is subject to depends upon the delivery vehicle’s payload and range: if it is capable of carrying a 500 kg (or greater) payload more than 300 km one way, it is defined as a Category I item.²⁵ The Guidelines place special emphasis on limiting transfers of Category I items, as the regime deems these systems as the most threatening. The Guidelines’ language is indicative of how the regime conflates UAVs with cruise missiles, as well as its continued emphasis on ballistic missiles. The Guidelines explicitly cover “complete rocket systems” and also encompass “unmanned air vehicle systems (including cruise missile systems, target and reconnaissance drones).”²⁶ Interestingly, the Guidelines’ language continues to focus on rockets. Category I items include the complete system, production facilities for

the system, and all major sub-systems. In the Annex, these subsystems include UAV turbine engines, datalinks, or flight control systems. But the summary of the Guidelines continues to focus on “rocket stages, re-entry vehicles, rocket engines, guidance systems, and warhead mechanisms.”²⁷

UAVs and F-35s: *Common Technology but Different Export Controls*

U.S. UAVs and F-35s share many similar technologies but are controlled in dramatically different ways. The F-35, for example, is the most technologically advanced aircraft in the world and is possessed by 13 nations, a number that continues to grow. Yet items that have been approved for export on the F-35—like stealth, composites, engine components, sensors, datalinks, and flight controls—would be restricted by the MTCR Annex if they were on a UAV. In this way, similar or even the same technologies are treated differently simply by virtue of being on a manned or unmanned aircraft. It should also be noted that F-35 partners have production and industrial participation, activities that are prohibited by the MTCR Guidelines.

Complete systems that fall beneath the 300 km range threshold also have control restrictions, but the regime is more lenient about these Category II items. These definitions, still in place in the 2019 Annex, clearly focus on missile technologies despite the inclusion of UAVs nearly 30 years ago. The significance of this nuance is that it points to what has long been an uneven accommodation: treating UAVs as if they were nuclear ballistic missiles instead of what they are—aircraft.

Further complicating the issue, Category I items and their subsystems are considered highly sensitive. Nations agree to exercise restraint, starting with the “unconditional **strong presumption of denial** [emphasis original] regardless of the purpose of the export.”²⁸ Although

the language of the regime strongly discourages any consideration of Category I exports for any reason, the Guidelines also acknowledge that “the decision to transfer remains the sole and sovereign judgment of the government.”²⁹ This retained authority is significant, and was reiterated in 2016 by the MTCR Chair, Ambassador Piet de Klerk: “In the end, export control decisions are national decisions. All MTCR members weigh the different factors involved and seek the right balance between national economic and global security interests.”³⁰ While export of any Category I system remains firmly discouraged, the MTCR ultimately recognizes the prerogative of each member to make their own export decisions, even for these sensitive systems.

The international community strongly encourages “great restraint” with these sensitive Category I items.³¹ Specifically, the Guidelines require a member nation to

The Guidelines require a member nation to obtain “assurances from the government of the recipient state” that the system will be used for the stated purpose and not modified, replicated, or transferred.

obtain “assurances from the government of the recipient state” that the system will be used for the stated purpose and not modified, replicated, or transferred.³² Furthermore, the “transport” of production facilities of Category I items is strictly not authorized. Even when a country exports a full Category I system or items, it cannot set up licensing for co-production or workshare in the receiving nation. This restriction exists to tightly control the technology and prevent the intangible transfer of intellectual property or skills that the receiving nation could independently apply to missile production.

Systems whose performance falls below the 500 kg/300 km performance threshold are considered Category II. As such, they are not subject to as stringent export

controls. Partners are still meant to consider the MTCR Guidelines when making an export decision and strongly encouraged to take the appropriate precautions regarding technology transfer, alteration, and end use. They are not, however, required to notify the regime of export, nor are they prohibited by the “no undercut” rule, which prevents states from exporting items to nations that have previously been denied by another MTCR partner.

Items covered in the Annex include those that are “dual-use:” technologies, materials, software, and subsystems that can be used for both military and civil or commercial application. Items that are part of a Category I system are considered sensitive technologies and are treated with the same strong presumption of denial as UAVs, even when they are a component on a Category II or civil/commercial system. Other listed items in the Annex are to be treated as Category II for the purposes of export, even when for civil or commercial use.³³

U.S. Efforts to Address the Policy Friction between UAVs and the MTCR

In 2015, the United States provided additional guidance to its UAV export policy. Hailed as a move to “allow the more widespread export of armed drones for the first time,” this policy imposed stringent criteria on requested transfers.³⁴ In addition to MTCR Guidelines, evaluation criteria emphasized enhanced end-use monitoring, humanitarian considerations, reducing collateral damage, and complying with international norms.³⁵ While this new policy did allow for exports of armed UAVs on “rare occasions,” it maintained the long-standing U.S. commitment to the MTCR and the strong presumption of denial.³⁶

In 2018, as part of the Conventional Arms Transfer policy reforms, the Department of State further revised its

UAV export policy. This new revision acknowledged the importance of other considerations in meeting American national security needs. In addition to allowing the direct commercial sales of UAVs to U.S. partners, the new policy articulates five primary objectives regarding the evaluation of UAV transfers:

1. Increasing trade opportunities for U.S. companies
2. Bolstering partner security and counter-terrorism capabilities
3. Strengthening bilateral relationships
4. Preserving U.S. military advantage
5. Preventing the proliferation of WMD delivery systems³⁷

This shift was simultaneously significant and unremarkable. It signaled the burgeoning recognition that the limitations on UAV exports is eroding America's security

and influence in crucial regions while empowering America's most significant global adversaries. At the same time, none of these revisions altered the strong presumption to deny requests for Category

I systems such as the MQ-1, RQ-4, or the MQ-9. Nations interested in U.S. UAVs must still complete a Defense Security Cooperation Agency (DSCA) assessment from a 2011 memorandum that clearly articulates the U.S. policy to adhere to the MTCR Guidelines and reaffirms the U.S. commitment to the "strong presumption to deny."³⁸

A key question in this DSCA questionnaire is number eight: "Explain why an MTCR Category I ISR UAV or UCAV would fulfill the requirements and a manned aircraft or non-MTCR Category I ISR UAV or UCAV cannot."³⁹ What is confounding

about this question is the implicit suggestion that a Category I UAV is equivalent to a manned aircraft. And in many respects, this is correct; UAVs are truly aircraft, even if there is no cockpit. Technologically, there is no difference. A RAND study found that "the basic technologies are similar to aircraft technologies, and manned aircraft are specifically exempted from MTCR controls."⁴⁰ This begs the question as to why UAVs are treated as ballistic or cruise missiles and not aircraft for the purposes of export policy.

The problems posed by continuing to include UAVs within MTCR missile controls are becoming more widely recognized within the Trump administration. Dr. Christopher Ashley Ford, Assistant Secretary of the Bureau of International Security and Nonproliferation at the Department of State stated, "In technological and economic terms, in other words, the environment in which the MTCR's technological parameters were established was an entirely different universe from the one we inhabit today."⁴¹

A 2018 national security memorandum recognized the need "to align our unmanned aerial systems (UAS) export policy more closely with our national and economic security interests," and directed that U.S. delegates should "address the status of, and recommend next steps for, MTCR adoption of revised controls for MTCR Category I UAS."⁴²

According to industry experts, proposed changes were not to the controls but to the definitions. Consistent with previous categorization, the U.S. recommendations focused on vehicle performance, providing Category II treatment for a certain subset of UAVs with a maximum speed value.⁴³ An additional 800-kph speed threshold—roughly 430 nmph—was proposed for distinguishing between Category I and II vehicles. The

None of these revisions altered the strong presumption to deny requests for Category I systems such as the MQ-1, RQ-4, or the MQ-9.

MTCR members at the 2019 plenary rejected this airspeed as too high; it is expected that the United States will propose a 600 kph—or a 320 nmph—threshold at the next meeting. As with the current definitions, a system would have to meet or exceed all three thresholds to be controlled as Category I. In other words, Category I vehicles would have the ability to carry a 500 kg payload 300 km at a speed of 600 kph. UAVs that are Category I today, such as MQ-1s or MQ-9s, would fall below the speed threshold and be reclassified as a Category II. An RQ-4 Global Hawk, however, with a top speed of 630 kph (340 nmph) would remain Category I.

“[The MTCR] has managed to thwart the missile programs in more than a handful of states...In particular, it can be noted that developments in the DPRK and Iran have gone slower than in other cases.”⁴⁴ While the MTCR may, indeed, share a claim to this success, this does not recognize role of other factors. In the decades of the 1980s and 1990s, missile technology was indeed “rocket science.” The sophistication of missile delivery systems effectively limited their possession to the G-7 industrialized nations and the Soviet Union. And today, although commercial space efforts are growing, launch technology remains difficult, expensive, and requires extensive research and development programs.

UAV	Speed	Range	Payload	Altitude	MTCR Category
MQ1-B Predator	120 nmph	675 nm	2 x Hellfire (450 lb)	25,000 ft	Cat I (could move to Cat II)
MQ-9 Reaper	200 nmph	1,000 nm	4 x Hellfire (900 lb); 2 x 500 lb bombs	50,000 ft	Cat I (could move to Cat II)
RQ-4A/B Global Hawk	340 nmph	14,000 nm	3,000 lb SIGINT/ELINT	60,000 ft	Cat I

Figure 1: Speed thresholds may reduce restrictions on some USAF UAVs, but future UAVs operating with manned teams will remain Category 1 and subject to the strong presumption of denial.

Source: U.S. Air Force Fact Sheets

Any aviator understands how using airspeed as such a threshold is problematic, as indicated airspeed changes with atmospheric conditions and altitude. If this change is adopted, it will give the false impression of a positive reform of export policy. In fact, it will continue a trend of policy severely lagging the pace of UAV technology and hamper smart UAV export considerations and controls. More troubling, though, is that airspeed is an inappropriate means to differentiate UAVs from cruise missiles. The issue is not a matter of finding the right definition of aerodynamic performance. UAVs are aircraft, not cruise missiles, and should be treated as aircraft for the purposes of export.

MTCR: A Policy Unable to Keep Pace with Changing Technology

Ambassador Piet de Klerk has touted the MTCR as being successful in curbing the proliferation of missile delivery systems:

Developing ballistic missiles requires high levels of engineering expertise and a skilled manufacturing base. Only a handful of nations have been able to produce missiles with truly intercontinental ranges and ensure successful reentry, demonstrating the continuing challenge of organically developing strategic nuclear delivery systems.⁴⁵

Regarding the issue of ballistic missile nonproliferation, the MTCR has remained a somewhat effective means to restrict the export, transfer, and development of missiles and their technologies. The multi-nation joint effort to develop the Condor II ballistic missile was abandoned, and Syrian and Libyan missile programs have faced delays and challenges. Some eastern European nations destroyed their ballistic missiles, and four other nations—Brazil, South Africa, South Korea, and Taiwan—have shelved their missile and space launch programs.⁴⁶ However, while they were

driven to do so indigenously without the benefit of importing systems under the purview of MTCR. India, Pakistan, North Korea, and Iran have all continued to develop missile programs to varying degrees of success. North Korea has even accelerated its programs despite additional sanctions and trade blocks.

Furthermore, what may be true for ballistic missile technology does not apply to UAVs. Whereas the MTCR has generally slowed the proliferation of ballistic weapons technologies, more than 50 countries are developing indigenous UAVs, and more than 70 have already acquired them.⁴⁷ And

The pace of UAV technological development and global manufacturing is accelerating, and the sheer number of unmanned vehicles—and the nations operating them—are growing.

the pace of UAV technology is only accelerating. A study by the Danish Technological Institute showed that, “80 percent of the patents associated with UAV technologies have been published since 2016.”⁴⁸ While most of these patents are likely commercially focused, it is reasonable to assume that these patents have relevance to military UAV applications. The pace of UAV technological development and global manufacturing is accelerating, and the sheer number of unmanned vehicles—and the nations operating them—are growing.

The commercial market demand for UAVs far exceeds that for missiles. One major market research firm estimates that the global unmanned aerial vehicle market will reach \$48.8 billion dollars annually by 2026.⁴⁹ Defense applications account for a large portion of this revenue, but the share of civil applications is growing, spotlighting the market losses that current export restrictions could impose on U.S. companies. The Teal Group found that the annual market for civil UAVs will nearly triple from 2019 to 2028, creating

a “total market value of approximately \$96.7 billion over the 10-year period.”⁵⁰ According to Goldman Sachs, the fastest growth opportunities in UAVs comes from industrial, business, and civil governments.⁵¹ These applications can range from drug delivery on hospital campuses, agricultural observations, pipeline or powerline inspections, construction, geological assessments, and more.

Most of the technologies and subsystems on commercial and civil drones fall under at least the Category II Annex list. Thus far, the MTCR has sought to address dual-use technologies through categorizing the perceived sensitivity of the final system: range and payload. The expanding use of drones for civil and commercial use, however, is making it more and more difficult to differentiate systems used for commercial or military applications.⁵² The growth of Category I commercial/civil UAVs in the international market only further complicates navigating the restrictions of the MTCR.

The MTCR was crafted for ballistic missile technology, and the inclusion of UAVs has long been a poor fit. The diverse utility of UAVs, the demand for them around the globe, the pace of technological advancement, and the blurred lines of dual use have transformed the context in which the MTCR was established. Consequently, the MTCR is increasingly outmoded and ineffective at curbing the proliferation of UAVs around the world.

Category II/I Thresholds: Missing the Mark on Scale, Technology, and Mission Effects

Part of the failure of the MTCR to limit the spread of UAVs is due to the seemingly arbitrary definition between Category I and II systems. The 500 kg payload threshold was originally selected

because it represented the state-of-the-art for WMD warhead miniaturization and effectiveness in 1987.⁵³ This limit is somewhat meaningless with respect to what is relevant to UAV technology today. Unlike ballistic or even cruise missiles, the size of the vehicle is not the primary technical challenge for UAVs. A nation that can develop or acquire a UAV just below Category I can scale the core of the system to a larger vehicle.

A case in point is the evolution of the Navy Fire Scout. The RQ-8A/MQ-8B is a relatively small, Category II unmanned helicopter designed for employment from the Navy's Littoral Combat Ships.⁵⁴ In 2010, Special Operations Command issued a requirement for ship-based intelligence, surveillance, and reconnaissance (ISR) with a range of 300 nm and a 700-lb payload, with eight hours of time on station—a Category I capability. Northrop Grumman, developer and manufacturer of the Fire Scout, responded to the requirement by integrating the core of the Fire Scout's software and control logic into a Bell 407 commercial helicopter.⁵⁵ Although the airframe changed, the heart of the system—the flight control software, datalinks, and ground station—stayed the same.

For nations that do not have access to Category I UAVs, vehicles with performance metrics just under the Guideline threshold provide the only viable alternative. Jordan, UAE, Iraq, and Saudi Arabia all made the decision to use Chinese Category II systems when the United States denied their export requests for U.S. UAVs. Long endurance (or equally range, for the purposes of the MTCR) can be coupled with a payload just shy of 500 kg, making Category II systems sufficient to achieve mission effectiveness.

In a report directed by Section 1276 of the 2017 National Defense Authorization Act, RAND recommended an additional MTCR category to address this very dynamic: Near-Category I. Their reasoning behind this subtle parsing was that:

1. Near-Category I UAVs are capable of performing many of the lethal and non-lethal missions that Category I systems do.
2. Companies and nations are deliberately skirting the Category I limitations to avoid the onerous “strong presumption of denial.”
3. At this upper limit, the ability to trade fuel for payload makes the delineation of Category I thresholds irrelevant.⁵⁶

In other words, advancing technology enables manufacturers to skirt the lower limits of the MTCR Category I while still providing similar mission effects. The miniaturization of processing and sensor technology increases additional payload for weapons within the existing airframe. Weapons themselves are becoming smaller, making these Near-Category I systems viable choices for achieving mission effects. Both the AGM-79 Joint Air-to-Ground Missile and the AGM-114 Hellfire weigh roughly 50 kg, providing a reasonable weapons load-out while remaining below MTCR Category I limits. Alternately, users may make operational choices that transform a Category II into a Category I simply by trading fuel for payload.

The effectiveness of these Near-Category I systems is demonstrated by the success of Chinese exports. Just capable enough, these systems are typically less expensive and are acquired much more easily than Category I systems. The Chinese Wing Loong II has an endurance of over 20 hours and can carry up to 480 kg, just under the 500 kg payload threshold for Category I.⁵⁷

Advancing technology enables manufacturers to skirt the lower limits of the MTCR Category I while still providing similar mission effects.

China gives the appearance of adhering to MTCR Guidelines while aggressively exporting these systems. Although China is the largest exporter of these Near-Category I UAVs, it is not alone in this tactic.⁵⁸ Israel, Italy, the UAE, Germany, and Qatar are marketing these types of drones internationally.⁵⁹ Others are emerging in the rapidly advancing marketplace for UAVs. Turkey is on the verge of becoming a major UAV exporter with demonstrated UAV combat performance.⁶⁰

The reality of many nations essentially circumventing the intent of the MTCR while complying with its terms is not an argument for U.S. industry to do the same and develop Near-Category I systems. Instead, the growing export of Near-Category I systems is an indication of how ineffectual the MTCR is with respect to controlling the proliferation of UAVs, while simultaneously weakening the ability of the United States and

its partners to achieve their broader security objectives. As capable as these smaller UAVs may be, the attributes of a system must be matched to the demands of the mission. The operational challenges that the United States and its coalition partners face require more payload, more range, and more speed—not less. Near-Category I drones may provide the minimally acceptable capability needed for states seeking to patrol their borders, but many of the operational challenges that face the United States and its coalition partners require more capability. Near-Category I systems simply cannot address current and future security requirements.

Treat UAVs like Conventional Combat Aircraft

While many nations are using Near-Category I vehicles to skirt MTCR trade restrictions, Category I systems are often the

clear and best choice for a security partner. Greater size and fuel load confer longer persistence, greater area coverage, and more mission flexibility. The larger sensor packages and payload capacity of a Category I UAV can provide better quality data, and with a larger weapon load-out, these systems can enable weapon employment options through the duration of a sortie. Ensuring that the nation's allies and security partners share the same systems creates more seamless coalition operations that can meet the physical and operational challenges of the 21st century.

MTCR restrictions on the export of Category I systems, sub-systems, and other items thus fracture important partnerships, blunt warfighting capability and capacity, raise operational security risks, and significantly reduce the effectiveness of coalition operations. Ironically, the serious damage to U.S. national security caused by compliance with the outmoded MTCR continues even though the MTCR has not been successful in inhibiting the development and proliferation of UAVs globally. The regime's strong presumption of denial regarding the export of Category I systems merely enables hostile actors to exclusively export these larger systems, while smaller yet scalable Category II systems and sub systems are quickly proliferating across the global marketplace.

In terms of trade policy, instead of treating UAVs as missiles, it would be more effective to treat them as what they actually are: aircraft. And, a logical approach to controlling UAV technology into the future is to subject UAVs to standard conventional arms export policy—the same that governs other combat aircraft. This is the only enduring means to ensure that these capabilities support the national security interests of the United States and its allies, as well as protect critical technologies from misuse or exploitation.

The attributes of a system must be matched to the demands of the mission.

MTCR: Enabling the Proliferation of Irresponsible Exporters

Contrary to the intent of the regime, continuing to include UAVs within the MTCR Guidelines—treating UAVs as if they were missiles—creates a market vacuum for hostile actors to fill; it allows bad actors to export UAV technology without appropriate controls. The challenge that this situation poses to non-proliferation efforts is the inability of responsible actors to monitor, influence, and control the transfer and use of these technologies. Five of eight nations that are developing weaponized Category I systems—“those systems of greatest concern from a proliferation standpoint”—do not adhere to the MTCR.⁶¹ Then-Assistant Secretary of Defense for Indo-Pacific Affairs Randall Schriver explained the risk of Chinese export: “China is less disciplined, and so there’s a proliferation risk as well to regimes that we would regard as not necessarily responsible.”⁶² Despite some reporting that China has voluntarily pledged to follow MTCR guidance, China is not recognized as a formal adherent to the regime, and its behavior indicates that is not complying with the spirit of the restrictions.⁶³

It is well known that China does not expect, demand, or enforce any limitations on the employment or end-use of its weapons. This may well be why some nations find China a more attractive supplier than the United States. International military markets analyst Daniel Darling states that China’s “lack of political restrictions on the sale and delivery of Chinese hardware to interested parties and the broader trade packages presented to recipient countries by the Chinese government serve to further entice potential buyers.”⁶⁴ More

interested in how it can use its exports to extract concessions from recipient countries, China uses what Daniels calls a “no-strings-attached export policy,” to become “the world’s leading exporter of armed drones, with sales of 153 to 13 countries since 2014.”⁶⁵

The restrictions of the MTCR have created a vacuum that serves to expand China’s global influence. In 2017, the China Aerospace Science and Technology Corporation (CASC), producer of the CH-4 Rainbow, signed a partnership agreement with King Abdulaziz City for Science and Technology (KACST) in Saudi Arabia to build a UAV and associated equipment. While the CH-4 is technically a Category II aircraft, the production facilities can easily be adapted to future larger UAV designs. Pakistan and Myanmar also operate Chinese production facilities.⁶⁶ According to open source reports, exporting drone production facilities is relatively “small business.” China’s broader purpose is to create strategic partnerships and industrial cooperation that support President Xi Jinping’s Belt and Road Initiative. As an example, the Saudi facility also serves to increase China’s access to oil. According to Zhou Chenming, a defense executive associated with CASC, “The real aims behind the deals are an oil-hungry China being able to get more oil from the kingdom to sustain its domestic economic development, and Saudi Arabia improving its infrastructure with China’s technological aid.”⁶⁷ The strings that come with Chinese drones have nothing to do with adherence to international norms or the responsible employment of the technology.

History proves this out. In 1988, just one year after the MTCR was created, Beijing used the opportunity to sell more than three dozen of its advanced, nuclear-capable, intermediate-range DF-3A ballistic

China uses what Daniels calls a “no-strings-attached export policy,” to become “the world’s leading exporter of armed drones, with sales of 153 to 13 countries since 2014.”

The void created by MTCR restrictions also enables China to export to nations that are or would be natural security partners for the United States.

missiles to Saudi Arabia. The sale provided a valuable cash infusion to China, as the \$3.5 billion amounted to more than half of China's defense budget at the time. Perhaps more importantly, China used the sale to influence the kingdom to "cut-off diplomatic ties with self-ruled Taiwan and formally recognize Beijing in 1990."⁶⁸ Sales of arms and technology that are prohibited by the regime allow China to establish relationships and extract concessions that clearly undermine the global security interests of the United States and its allies.

The Chinese have been able to advance the quality and capabilities of their UAVs, making them a more lucrative partner for traditionally U.S.-dominated markets. As a technological second-mover that leverages stolen intellectual property, China has an advantage in developing attractive systems for affordable prices because they can avoid costly ground-up research and development expenses. Importantly, Chinese companies use these sales to conduct what is effectively operational test and evaluation, spiraling improvements into its next generation of UAVs. Song Zhongping, a Chinese military analyst, acknowledges that China is aggressively pursuing market share. Furthermore, the resistance of the United States to export is, "precisely what gives China a great opportunity. The sales are helping expand Chinese influence across a region vital to American security interests."⁶⁹ American administration officials agree. In an interview, Assistant Secretary of Defense for Indo-Pacific Affairs Randall Schriver said that opening markets with military sales is "a tool for [China] to develop closer defense and military ties, particularly for future access."⁷⁰

The void created by MTCR restrictions also enables China to export to nations that are or would be natural security partners for the United States. This is exactly the opportunity that China exploited when key U.S. partners in the Middle East were denied their requests for UAVs. Despite policy assertions to the contrary, use and end-use restrictions of the MTCR inhibit the United States from using UAV exports to strengthen bilateral relationships, shape and influence behavior, and enforce adherence to international norms. By maintaining a strong bias towards denial, MTCR sacrifices the ability to more strictly monitor and control UAV technology, determine the appropriate configuration, ensure anti-tamper measures, and control end-use disposal. The proliferation of Near-Category I systems is increasing, and China is now openly marketing the Category I CH-5. Not only is the MTCR's "effectiveness in limiting global proliferation of these UAVs being seriously compromised," it is also preventing responsible nations from influencing the employment and end-use of UAVs.⁷¹

Non-proliferation efforts can only be effective when the targeted technology is difficult to develop and states desiring to acquire the technology are denied transfer. Thus, non-proliferation also depends upon the willingness of nations to refrain from exporting the technology, weapon, or resource. While these conditions generally remain true for missile technology—meaning that the MTCR continues to be an effective barrier to developing missile delivery systems that can be used for WMD—UAV technology is increasingly accessible through indigenous development, export, and technology transfer. It should be clear that non-proliferation dynamics no longer apply to UAVs. While MTCR forces states to talk about their potential transfers,

The MTCR has distorted natural market and security dynamics to provide an artificial opportunity and advantage to China.

it is from a basis of “no.” As a result, the MTCR obstructs the ability of responsible states to engage and influence others during export discussions and post-sale, while enabling hostile state behavior that significantly increases risk to U.S. security interests.

Deleterious Impacts of MTCR Restrictions on the U.S. Defense Industrial Base

Both commercial and military trend analyses show that the demand for UAVs will continue to increase across the globe. The unmanned aerial vehicle market is assessed to be worth \$48.8 billion by 2026, and the MTCR restrictions, which also apply to commercial and industrial technologies, threatens U.S. competitiveness in this market.⁷² Across all applications, the “Asia-

Pacific is expected to register the fastest growth over the estimated period from 2019 to 2026,” with the military and defense segment continuing to dominate the market share.⁷³

The MTCR has distorted natural market and security dynamics to provide an artificial opportunity and advantage to China. According to Teal Group analyst Steven Zaloga, “The Chinese rightly think this gives them an opportunity to break into markets that otherwise they would never had any chance to break into.”⁷⁴ Importantly, these initial sales may close certain markets to the United States for decades. The lifecycle of “some unmanned vehicles exceed 20–30 years, fostering a long-term relationship centered around logistics and sustainment.”⁷⁵ Once a nation has paid for the Chinese infrastructure and logistics, they would likely be unable or unwilling to pay the bill again to operate a U.S. system that would operate in parallel. Alarming, this “foot in the door” with Category II UAVs may provide follow-on product opportunities for China.

In their 2017 congressionally mandated study, RAND found that the “increasing UAV development and manufacturing capabilities in China and other nations can be partly attributed to U.S. export controls.”⁷⁶ The MTCR restrictions harm the U.S. industrial base at the same time that they invigorate Chinese industry. Chinese systems once were obvious imitations of U.S. drones, but market demand has resulted in the rapid development and sophistication of Chinese systems.⁷⁷ The market demand has also spurred a growing number of joint ventures or co-development efforts.

A sample of these co-development efforts indicate the MTCR member nations are collaborating with each other, as well as states that are not MTCR partners. The EuroMALE UAV, an initiative between France, Italy, Germany, and Spain, is working to develop a large UAV that will likely be Category I.⁷⁸ Companies in Turkey and Ukraine recently signed a “strategic cooperation deal” with the intention “to boost drone capabilities.”⁷⁹ An Israeli/Indian joint venture, Adani Elbit Advanced Systems, is manufacturing the Hermes 900, a Near-Category I UAV, and has been marketing it internationally.⁸⁰ Israel has had discussions with Japan to develop both drones and unmanned fighters, and Japanese company Aeronext recently formed a strategic alliance with major Chinese UAV manufacturer MMC.⁸¹ Although the focus of this alliance is industrial drones, the transfer of Japanese “4D GRAVITY” technology will provide significant intellectual property advances to China.

Innovation is moving offshore from American defense companies. This was the only practical choice for Boeing when presented the requirements for an advanced unmanned combat aerial vehicle for Australia. Boeing could not use their U.S.

Such a move by an American defense company to offshore the research and development of a major new technology was a wake-up call.

workforce or company to do the work, given the MTCR export restrictions. Instead, Boeing Defense Australia, a wholly owned subsidiary, developed the Airpower Teaming System “Loyal Wingman” in partnership with the Royal Australian Air Force. According to the Boeing Chief Technical Officer Greg Hyslop, the Loyal Wingman program “represents the largest investment in the development of unmanned programs outside the United States.”⁸² Capable of fighter-like performance, Boeing Defense Australia and the Australian government intend to export the Loyal Wingman to trusted allies, like the “Five Eyes” partners (the United States, the United Kingdom, Canada, Australia, and New Zealand).

When Boeing Australia revealed the Loyal Wingman at the Avalon Airshow in 2019, one U.S. Air Force official called it “a significant emotional event.” Such a move by an American defense company to offshore the research and development of a major new technology was a wake-up call. MTCR restrictions would make it very difficult (if not prohibitive) for Boeing to export a domestically developed Category I UAV, even in response to Australian requirements. Deliberately using its international subsidiaries to enable innovation by offshore research and development was the best and most viable option for Boeing. In this light, the negative consequences to U.S. security of the MTCR Guidelines become more concerning than simply ceding market share. Instead, they may be causing more of a “brain drain,” pressuring industry to move talent, intellectual property, and production completely offshore.

Developing such an advanced UAV overseas raises serious issues for U.S. defense officials. As a member of the MTCR,

will Australia take a strong presumption of denial to this advanced Category I system? What, if any, technologies can be imported for use in the development of domestic variants or other UAVs? Will the U.S. military be able to access and modify any technologies in the Loyal Wingman UAV? Will Boeing Defense be licensed for production in the United States? Will this compete with U.S.-made UAVs and further diminish U.S. market competitiveness?

Another U.S. Air Force official, however, was grateful for the Boeing Australia move. “We totally support them, and we want them to run. Australia can innovate faster with new technologies, experiment with those technologies and develop new tactics. We can learn from them.”⁸³ This official noted that the combination of U.S. defense acquisition regulations and MTCR restrictions create a perfect storm that rapidly impedes innovation in UAVs.

The DoD system takes too long to get from requirements to fielding, even with rapid development. These bureaucratic processes significantly slow down the ability of the industrial base to innovate new platforms and capabilities writ large, and UAVs are not immune. Furthermore, despite the growing reliance on UAVs, other recapitalization and modernization priorities are squeezing out defense budgets. The tightening will accelerate as enormous federal expenditures mount to address the COVID-19 pandemic. As a result, U.S. defense budgets will come under increasing pressure, limiting bandwidth to invest in advanced UAVs. Because the MTCR effectively prohibits co-development and co-production of UAVs, the nation must rely upon its allies and partners to develop advanced UAVs offshore, hoping that the United States will have access to import those technologies. UAVs are essential

to today's military operations and will only become more so in the future. The restrictions and prohibitions that the MTCR imposes against export, co-development, and co-production of UAVs present an unacceptable barrier to safeguarding America's national security interests.

The Future Force Requires Unmanned Aerial Vehicles

The MTCR is the incorrect rubric to control UAV proliferation today, and the developmental path of UAVs will only diverge even further from MTCR relevance over time. The system pilot and sensor operator are often cited as a potential means to distinguish UAVs from cruise missiles.

While the presence of a pilot may seem like a reasonable way to define UAV export categories, this will not remain a sufficient threshold in future operations. UAVs have become indispensable to modern military operations, but the vehicles will not be nearly so manpower intensive.

There is nothing "unmanned" in the system required to operate MQ-9s, RQ-4s, and other UAVs, especially conducting the analysis of the information that these aircraft provide. The MQ-1 and MQ-9 have a much higher manpower ratio than traditional fighter aircraft do. Increased manning is required to conduct in-country take-offs and landings, as well as maintain 24/7 operations. To provide 24/7 coverage requires over 40 people for flight and sensor operations; over 50 for launch, recovery, and maintenance; and over 60 personnel for dedicated intelligence analysis. Because of these personnel requirements, the term "remotely piloted aircraft" was instituted by the Air Force in 2009 as a far more accurate description than unmanned aircraft systems (UAS), as there is nothing unmanned about UAVs except the vehicle itself. Why should the presence of a pilot or operator not be used as an additional distinguishing factor to determine which

UAVs should be covered by the MTCR and how they should be governed?

While the presence of a pilot may seem like a reasonable way to define UAV export categories, this will not remain a sufficient threshold in future operations. UAVs have become indispensable to modern military operations, but the vehicles will not be nearly so manpower intensive. UAVs should not depend on a human piloting the system to avoid being subject to the MTCR. The RQ-4, for example, was designed to fly autonomously—with a man "on-the-loop," not "in-the-loop." Capable of taking off and landing by itself without any human control, it follows a pre-planned mission flight path. While current employment methods require its operations to be monitored by human operators with the frequent manual control, the RQ-4 concept was to prioritize available and assigned manpower for intelligence processing—not manual stick and rudder skills. In the future, autonomous intelligence gathering systems will not have to rely on pre-planned routing that resembles autopilot-driven flight management. Instead, these aircraft will scour areas of responsibility with unpredictable but rational maneuvering. They will avoid threats and seek out optimized "looks" at targets sets or other entities of interest, autonomously collaborating and deconflicting with each other.⁸⁴

For weaponized systems, humans will continue to be involved in the kill chain, but their roles and responsibilities will evolve. Much of the value a pilot or operator now provide are associated with positively identifying the target, complying with rules of engagement, refining weapon aim points, and/or maneuvering the vehicle into a position of launch acceptability to optimize target effects.⁸⁵ In the future, unmanned aircraft will be capable of autonomous and collaborative, dynamic maneuvering. These aircraft will be capable

The definitions and controls imposed by the MTCR are clearly mismatched to the reality of today's UAVs and their trends for future development. These UAVs are not cruise missiles. They are specialized aircraft with innovative yet conventional missions—not kamikaze delivery vehicles of WMD.

of acting as “loyal wingmen,” flying in formation with a manned aircraft where a pilot acts as a mission commander of its autonomous flight.⁸⁶

These technologies are already being developed. The MQ-25, a Category I UAV and the Navy's first operational carrier-based unmanned aircraft, will have a range of over 900 km and carry 6,800 kg of fuel in order to provide “much-needed refueling capability” to the F/A-18 Super Hornet, the EA-18G Growler, and the F-35C Lightning.⁸⁷ Boeing is developing its loyal wingman concept to operate between four and six vehicles in conjunction with a manned aircraft.⁸⁸ The Air Force Research Laboratory is developing a similar platform, the XQ-58A Valkyrie, another loyal wingman intended to carry weapons and jam radars.⁸⁹ DARPA is also pursuing the ability of UAVs to autonomously fly in formation with dynamically maneuvering jets. The air combat evolution (ACE) program is using artificial intelligence to autonomously fly an F-16 in a dogfight. The purpose of the

technology challenge is not so much about the dogfight, but to increase warfighter trust in autonomous combat technology and aerial maneuvering in a dynamic environment.⁹⁰ DARPA's Gremlins X-61A is another variation on future unmanned concepts; they are developing technology to enable unmanned aircraft to fly in a swarm and autonomously collaborate to accomplish pre-assigned missions, like gathering different kinds of intelligence in the battlespace.

Given the geographic challenges and mission demands of future warfare,

any of these unmanned aircraft will easily exceed MTCR Category I thresholds; near-Category I systems will be insufficient to meet requirements. The definitions and controls imposed by the MTCR are clearly mismatched to the reality of today's UAVs and their trends for future development. These UAVs are not cruise missiles. They are specialized aircraft with innovative yet conventional missions—not kamikaze delivery vehicles of WMD.

A recent RAND study on armed UAVs found that the concerns that generated the inclusion of UAVs into the Guidelines are largely unfounded. UAVs are not the best method of delivery. Conventional and improvised technologies are more easily attainable, simpler, more lethal, and more difficult to defend against than UAVs.⁹¹ Smaller UAVs may be more likely used in these kinds of improvised one-way attacks, not the Category I UAVs that the MTCR restricts. Regardless, there is significant value in enabling the export of all UAVs, regardless of their category. Export facilitates strong relationships, influence, and responsible end-use. Chris Ford, the Assistant Secretary of State for International Security and Non-Proliferation, recognizes the benefits of engagement:

But MTCR Partners are to an important extent shut out of much of this exploding market, unable to participate fully in the commercial benefits of this booming sector—because of the high hurdle imposed by the MTCR's reflexive presumption of denial for all Category I systems—and with their governments unable to reap the full benefits of the relationships that UAS engagement can bring as countries around the world seek to expand their capabilities into these diverse new, non-WMD-related areas.⁹²

Instead of applying incremental adjustments to an MTCR that lags the path of technological innovation, UAVs should simply be recognized as what they are: aircraft—unmanned or autonomous—not missiles.

While the non-proliferation intent of the MTCR is admirable, it is ineffective when applied to UAVs; furthermore, it provides a self-limiting dynamic that non-adherents of the regime are exploiting. UAVs are not ideal WMD delivery mechanisms. As unmanned systems continue to advance, the gap between ideal WMD delivery technologies and the reality of UAVs will only widen. The assumptions behind treating UAVs as missiles has always been unfounded. This mismatch is now doing far more harm than good, even threatening the non-proliferation purpose. Speaking to the impediment created by non-WMD related UAVs, Ford asserts, “This situation harms

not just the competitiveness of MTCR Partners, but also the MTCR itself—and the cause of nonproliferation. It puts needless pressure upon the MTCR and could threaten its long-term integrity.”⁹³

As the United States and its allies develop more advanced and autonomous UAVs, the export, co-development, and even co-production of these capabilities will be essential to interoperability, sharing intelligence, integrating combat operations, and deterring conflict with great power adversaries—or winning if conflict occurs. Real-time data sharing, for example, will be more crucial in contested battlespace than it has been in counter-terrorism operations in the Middle East. Imagine if a swarm of unmanned sensors cannot share with allied forces. What if the various F-35 countries each have different and incompatible loyal wingmen? This is not to argue against diverse fleets, but those decisions should be intentional and not driven by an outdated and inappropriate non-proliferation policy. Only through

technology sharing and co-development will the United States and its allies be able to execute seamless and effective coalition operations.

If the MTCR prohibits the export of these crucial systems, it will be setting the United States, its allies, and its security partners up for failure. Instead of applying incremental adjustments to an MTCR that lags the path of technological innovation, UAVs should simply be recognized as what they are: aircraft—unmanned or autonomous—not missiles.

Recommendations

The Royal Jordanian Air Force recently sold its six armed, Chinese-built CH-4 UAVs to the Libyan National Army.⁹⁴ Led by Khalifa Haftar, the Libyan National Army controls most of eastern Libya and is fighting against the U.N. recognized unity government in Tripoli.⁹⁵ While Jordan supports Haftar, without end-use controls, the international community lacked any mechanism to obstruct the sale by the kingdom.

It was somewhat of a surprise when Jordan announced its desire to sell the drones in the summer of 2019, as the fleet has at least another decade or more of life. Yet reports indicate that the Jordanians were unhappy that the drones had “heavy maintenance requirements and limited capacity.”⁹⁶ Other reporting suggests that the maintenance of the CH-4Bs may have been problematic. Of the ten Chinese drones procured by Iraq, only one was fully mission capable.⁹⁷ Officials in the U.S. Air Force noted that unlike U.S. foreign military sales, which come with robust training, sustainment, and support packages, the much cheaper Chinese systems likely do not. Without the knowledgeable support from a dedicated security partner like the United States, these countries may have been either

As unmanned technologies continue to advance, the constraints of the MTCR will only become more divergent and archaic, inducing further export of unmanned technologies by irresponsible actors.

unprepared, ill-equipped, untrained, or without the needed spare parts to maintain a healthy, robust fleet. Other sources indicate more general reliability and performance issues regarding command links and operational altitudes.⁹⁸ With the sale of their CH-4Bs, Jordan has again expressed interest in procuring U.S. UAVs, even as the Chinese ready a more capable set of competing systems. At the same time, U.S. allies and partners want to buy American, despite the entrenched predisposition of “no” to U.S. UAV export.

This window for the United States to re-engage valued security partners through the deliberate export of UAVs may not be open for long. China is learning from the operational lessons of their unmanned systems and it is developing new UAVs. The CASC CH-5 is a visual knock-off of the RQ-4 Global Hawk, while its stealthy CH-7 high altitude, long endurance drone resembles the U.S. Navy’s X-47B unmanned combat aerial vehicle (UCAV). The GJ-11 Sharp Sword drone is also a stealthy flying wing airframe that is touted as a combat drone already in active Chinese service.⁹⁹ China’s export intentions regarding these new systems is not yet clear. What is certain is the United States should not cede any more valued market share to the Chinese. Continuing to include UAVs within the Guidelines of the MTCR harms critical U.S. relationships, U.S. industry, and coalition operations.

This is not to say that the United States should be cavalier about the export of UAVs or weaken its support for nuclear or WMD non-proliferation efforts. The United States must continue to act as a global leader in support of non-proliferation efforts. It must also recognize that continuing to

subject UAVs to the MTCR controls is both counter-productive to the objectives of the regime and harmful to U.S. national interests. As unmanned technologies continue to advance, the constraints of the MTCR will only become more divergent and archaic, inducing further export of unmanned technologies by irresponsible actors. The most effective approach to modernizing UAV export policy is to remove them from a regime that was not intended for the size and number of aircraft, proliferated technologies, and broader strategic environment of UAVs today.

The next meeting of the regime was scheduled to occur late spring of 2020. This was not a meeting of the principals during a plenary, but a reinforced point of contact meeting, where crucial and sometimes contentious issues are discussed. Due to the COVID-19 pandemic, this meeting has now been delayed. It is expected, however, that when the regime meets again that the U.S. representatives will propose an additional airspeed threshold (delineating Category II or I systems) to resolve the debate surrounding UAVs in the Guidelines. The United States should not propose an additional airspeed threshold. An airspeed proposal—regardless of the kilometers per hour—is simply a band-aid that is already behind the pace and trend of the unmanned aircraft technology. If passed, it will only continue to interfere with the ability of responsible actors to export UAVs, distorting the dynamics of military sales in a way that weakens important alliances and disadvantages the strategic interests of United States and its friends.

Instead, the United States should work with the other members of the regime to create a consensus around removing UAVs from the MTCR altogether. UAVs are fundamentally aircraft, not missiles, and should be treated as aircraft for the purposes

**The U.S. Congress
should craft language
in the 2021 NDAA
that affirms the U.S.
commitment to non-
proliferation *and* defines
UAVs as aircraft—not
cruise missiles.**

of export consideration. Military aircraft are subject to export control, and these controls are rigorous, responsible, and without the presumption of denial, which facilitates both U.S. diplomatic and national security interests. Including unmanned aircraft with military aircraft controls—whether remotely piloted, semi-autonomous, or fully autonomous—will only enhance the U.S. ability to bolster allied defenses, enhance the effectiveness of coalition forces, and increase interoperability.

This does, however, beg the question of how one differentiates an unmanned aerial vehicle from a nuclear cruise missile. UAVs are best defined as unmanned aircraft. This implies the common-sense notion that unmanned aircraft are aircraft intended for recovery and reuse, even though they may not have their pilots on board.

These aircraft may be armed, carry cargo for airdrop, or simply be collecting intelligence, but they are aircraft. As such, they should be controlled as manned aircraft used for similar purposes—not through an arbitrary range and payload threshold, but through a rational examination of the mission need, technology transfer, anti-tamper measures, and use and end-use.

The U.S. Congress should craft language in the 2021 NDAA that affirms the U.S. commitment to non-proliferation *and* defines UAVs as aircraft—not cruise missiles. As aircraft, whether “manned” or “unmanned,” these systems will not be subject to the MTCR export controls. This language should allow for co-development and co-production with allies and partners, as well as any other privilege or consideration afforded to military aircraft for the purposes of direct commercial sale or foreign military sale export considerations. The Guidelines of the regime are, as a political agreement,

non-binding and subject to the statutes and legislation of each member nation. Because any change to the MTCR can only be accomplished through a total consensus of the plenary, it is unlikely that the proposal to remove unmanned aircraft from the Guidelines will be approved. While this effort is important as an act of good faith and diplomacy with member nations, it is important the United States draws a line that clearly and definitively crafts sovereign national legislation defining UAVs as aircraft and removes U.S. UAVs from being governed by the MTCR. This statute should be clear that UAVs should be subject to the same export considerations as other military aircraft.

Finally, combatant commanders should develop standing UAV requirements and configurations for security partners and allies. Because there has been such a long-standing strong presumption of denial, this work has not been done. As a result, when requests for UAVs have been approved, the coordination and determination regarding configuration can take years. The Honorable Heather Wilson, the 24th Secretary of the Air Force, sought to address the larger issue of configuration determination through encouraging a “commodity” concept, where allies could purchase systems currently on the production line. There is some merit in this approach, as it maintains a standard configuration for all consumers and is least disruptive to the manufacturer. This commodity approach, however, risks denying partners the entire system because one item or sub-system may not be approved for export. Each partner nation has unique mission requirements and may need a custom configuration. It is in the nation’s interest to analyze, coordinate, and pre-determine to the maximum extent possible what these configuration options might be to expedite the entire process.

In summary, the Trump administration and Congress should modernize export policy pertaining to UAVs as follows:

1. When the next plenary session of the MTCR meets, the United States should not propose additional airspeed thresholds to delineate Category I or II systems to resolve dysfunctions involving Guidelines for UAVs.
2. The U.S. Congress should craft language in the 2021 NDAA that affirms the U.S. commitment to non-proliferation and defines UAVs as aircraft—not as a subset of cruise missiles, and therefore not subject to the MTCR Guidelines, Annex, or any U.S. policy driven by the MTCR. This language should further direct that UAVs be subject to the same export considerations as other military aircraft without application of any previous MTCR scrutiny or application of additional preview or review.
3. The United States should review all other policies that restrict export of UAVs categorizing them separately from manned aircraft and adjust to treating them as manned aircraft.
4. Congressional language in the 2021 NDAA should direct for UAVs to have the same co-development, co-production, and any other privilege or consideration afforded to military aircraft for the purposes of direct commercial sale or foreign military sale.
5. The Administration should capitalize on a limited window of opportunity to re-engage with key partners wavering in their Chinese UAV partnerships. Of key symbolic and strategic priority is a

deliberate goal of exporting American UAV capabilities to Jordan on a rapid timeline.

6. The 2021 NDAA should direct the Department of Defense to develop standing UAV requirements and configurations for security partners and allies in each of the geographic combatant commands and report to Congress the consolidation of such requirements.

The United States should work to create a consensus to remove UAVs from the MTCR and place UAVs under export restrictions structured for combat aircraft, whether the UAVs are remotely piloted, semi-autonomous, or autonomous.

These actions will begin the process of normalizing unmanned aerial vehicle export policy. UAVs are aircraft, not missiles, and for too long the MTCR has distorted the normal balance of national security and economic interests against the fear of nuclear and WMD proliferation. The cost of this well-intended but increasingly dysfunctional agreement has been low, given the relative era of peace and stability since the fall of the Soviet Union in 1991. However, the rise of China as a great power competitor is raising the stakes and potential consequences. Thus far, China has been exploiting the market vacuum of U.S. exports in the demand for unmanned aircraft vehicles. As a result, American security interests have been weakened. Removing unmanned aerial vehicles from the MTCR will not be a panacea, but given their growing importance to future warfare, it is an imperative. ★

Endnotes

- 1 “MTCR Guidelines and the Equipment, Software, and Technology Annex,” Missile Technology Control Regime, <https://mtcr.info/mtcr-guidelines/>.
- 2 Dee Ann Divis, “Military UAV Market to Top \$83B,” *Inside Unmanned Systems*, April 24, 2018.
- 3 “Teal Group Predicts Worldwide Military UAV Production of Almost \$99 Billion Over the Next Decade in Its 2019/2020 Market Profile and Forecast,” The Teal Group Corporation, November 11, 2019, <https://www.tealgroup.com/index.php/pages/press-releases/64-teal-group-predicts-worldwide-military-uav-production-of-almost-99-billion-over-the-next-decade-in-its-2019-2020-uav-market-profile-and-forecast>.
- 4 Amman Najib and Jeremy Binnie, “SOFEX 2018: Jordan unveils CH-4 UAV—Janes,” *Pakistan Defence Forum*, May 11, 2018, <https://defence.pk/pdf/threads/sofex-2018-jordan-unveils-ch-4-uav-janes.558319/>.
- 5 Martin Matishak, “China is selling drones to Jordan, lawmaker says,” *The Hill*, May 5, 2015, <https://thehill.com/policy/defense/242210-china-is-selling-drones-to-jordan-lawmaker-says>.
- 6 Jon Gambrell and Gerry Shih, “Chinese armed drones now flying across Mideast battlefields,” *AP News*, October 3, 2018, <https://apnews.com/1da29d68e3cc47b58631768c1dcfa445>.
- 7 George Nacouzi et al., *Assessment of the Proliferation of Certain Remotely Piloted Aircraft Systems: Response to Section 1276 of the National Defense Authorization Act for Fiscal Year 2017* (Santa Monica, CA: RAND, 2018), 15, https://www.rand.org/pubs/research_reports/RR2369.html. This list may not be exhaustive, given the lack of information from the Chinese government.
- 8 Author interview, Lt Col John Duray, January 4, 2020.
- 9 Ibid.
- 10 Ibid.
- 11 Michelle Myers, “Pelosi, Pompeo turn up the heat on China’s Huawei at security conference,” *CNET*, February 16, 2020, <https://www.cnet.com/news/pelosi-pompeo-turn-up-the-heat-on-chinas-huawei-at-security-conference/>.
- 12 “Frequently Asked Questions (FAQS),” MTCR, <https://mtcr.info/frequently-asked-questions-faqs/>.
- 13 “Nuclear Non-Proliferation Treaty,” Bureau of International Security and Nonproliferation, U.S. Department of State, <https://www.state.gov/nuclear-nonproliferation-treaty/>.
- 14 “Frequently Asked Questions (FAQS),” MTCR.
- 15 Ibid.
- 16 Piet de Klerk, “The MTCR: Successful international co-operation, with limits,” The 23rd Asian Export Control Seminar, Tokyo, 23-25 February 2016, <https://mtcr.info/wordpress/wp-content/uploads/2016/07/160228-Presentation-MTCR-for-AECS2016.pdf>.
- 17 “MTCR Partners,” MTCR, <https://mtcr.info/partners/>.
- 18 Lynn E. Davis et al., *Armed and Dangerous? UAVs and U.S. Security* (Santa Monica, CA: RAND, 2014), 3, https://www.rand.org/pubs/research_reports/RR449.html.
- 19 “Frequently Asked Questions (FAQS),” MTCR.
- 20 “Multilateral Export Control and Non-Proliferation Regimes,” Office of the Secretary of Defense (OSD), Defense Technology Security Administration, accessed January 10, 2020, <https://www.dtsa.mil/SitePages/promoting-engagement/multilateral-non-proliferation-regimes.aspx>.
- 21 “Frequently Asked Questions (FAQS),” MTCR.
- 22 “MTCR Guidelines and the Equipment, Software, and Technology Annex,” MTCR, <https://mtcr.info/mtcr-guidelines/>.
- 23 “Multilateral Export Control and Non-Proliferation Regimes,” OSD.
- 24 “Frequently Asked Questions (FAQS),” MTCR.
- 25 MTCR, *Equipment, Software and Technology Annex* (Auckland, New Zealand: October 11, 2019), [https://www.un.org/ga/search/view_doc.asp?symbol=S/RES/1540%20\(2004\)](https://www.un.org/ga/search/view_doc.asp?symbol=S/RES/1540%20(2004)).
- 26 “MTCR Guidelines and the Equipment, Software, and Technology Annex,” MTCR.
- 27 Ibid.
- 28 “Frequently Asked Questions (FAQS),” MTCR.
- 29 “MTCR Guidelines and the Equipment, Software, and Technology Annex,” MTCR.
- 30 de Klerk, “The Missile Technology Control Regime: Successful international co-operation, with limits.”
- 31 MTCR, *Equipment, Software and Technology Annex*.
- 32 “Guidelines for Sensitive Missile-Relevant Transfers,” MTCR, <https://mtcr.info/guidelines-for-sensitive-missile-relevant-transfers/>.
- 33 Deborah A. Ozga, “A Chronology of the Missile Technology Control Regime,” *The Nonproliferation Review*, Winter 1994, 67, <https://www.nonproliferation.org/wp-content/uploads/npr/ozga12.pdf>.
- 34 Ajay Kuntamukkala and Robert D. Kyle, “State Department Issues New Export Policy for Military UAS,” *Focus on Regulation*, February 20, 2015, <https://www.hoganlovells.com/en/blogs/focus-on-regulation/state-department-issues-new-export-policy-for-military-uas>.
- 35 “U.S. Export Policy for Military Unmanned Aerial Systems,” Office of the Spokesperson, U.S. Department of State, February 17, 2015, <https://2009-2017.state.gov/r/pa/prs/ps/2015/02/237541.htm>.

- 36 "U.S. Export Policy for Military Unmanned Aerial Systems," Office of the Spokesperson, U.S. Department of State.
- 37 "U.S. Policy on the Export of Unmanned Aerial Systems," Office of the Spokesperson, U.S. Department of State reported by *GlobalSecurity.org*, April 19, 2018, <https://www.globalsecurity.org/military/library/news/2018/04/mil-180419-state01.htm>.
- 38 "Pre-Letter of Request (LOR) Requirements for Missile Technology Control Regime (MTCR) Category I Intelligence, Surveillance, and Reconnaissance (ISR) Unmanned Aerial Vehicles (UAVs), DSCA Policy 11-11," official memorandum, Washington, DC, Defense Security Cooperation Agency, 2011, <https://samm.dsca.mil/sites/default/files/DSCA%2011-11.pdf>.
- 39 "Pre-Letter of Request (LOR) Requirements for Missile Technology Control Regime (MTCR) Category I Intelligence, Surveillance, and Reconnaissance (ISR) Unmanned Aerial Vehicles (UAVs), DSCA Policy 11-1."
- 40 Davis et al., *Armed and Dangerous?* 24.
- 41 Christopher Ashley Ford, "The Case for Reforming the Missile Technology Control Regime," remarks, Hudson Institute, February 12, 2019, <https://www.state.gov/the-case-for-reforming-the-missile-technology-control-regime/>.
- 42 "National Security Presidential Memorandum Regarding U.S. Conventional Arms Transfer Policy," official memorandum, Washington, DC, Office of the White House, 2018, <https://www.whitehouse.gov/presidential-actions/national-security-presidential-memorandum-regarding-u-s-conventional-arms-transfer-policy/>.
- 43 Paul K. Kerr, *U.S.-Proposed Missile Technology Control Regime Changes*, CRS In Focus (Washington, DC: Congressional Research Service, May 7, 2020), <https://fas.org/sgp/crs/nuke/IF11069.pdf>.
- 44 de Klerk, "The Missile Technology Control Regime: Successful international co-operation, with limits," 2.
- 45 Kelsey Davenport, "Worldwide Ballistic Missile Inventories: Fact Sheets & Briefs," Arms Control Association, December 2017, <https://www.armscontrol.org/factsheets/missiles>. Nations that possess both nuclear and ballistic missile capability are China, France, India, Israel, North Korea, Pakistan, Russia, the United Kingdom, and the United States. There are several unique technical problems that strategic ballistic missiles pose: the relationship between range and fuel; logarithmic demands of payload weight to fuel; thermal reentry; and precision navigation.
- 46 Kelsey Davenport, "The Missile Technology Control Regime at a Glance," The Arms Control Association, July 2017, <https://www.armscontrol.org/factsheets/mtcr>.
- 47 Davis et al., *Armed and Dangerous?* 9.
- 48 Patrick C. Miller, "Report: UAS industry shows exponential growth since 2016," *UAS Magazine*, March 26, 2019, <http://UASmagazine.com/articles/2006/report-UAS-industry-shows-exponential-growth-since-2016>.
- 49 "Unmanned Aerial Vehicle (UAV) Market Size Worth Around US\$48.8 Bn by 2026," *MarketsInsider*, January 29, 2020, <https://markets.businessinsider.com/news/stocks/unmanned-aerial-vehicle-uav-market-size-worth-around-us-48-8-bn-by-2026-1028855734>.
- 50 Charles Alcock, "Teal Report Sees Civil UAS Market Tripling in Size by 2028," *AINonline*, July 18, 2019, <https://www.ainonline.com/aviation-news/business-aviation/2019-07-18/teal-report-sees-civil-UAS-market-tripling-size-2028>.
- 51 John Walker, "Industrial Uses of Drones – 5 Current Business Applications," *emerj*, January 30, 2019, <https://emerj.com/ai-sector-overviews/industrial-uses-of-drones-applications/>.
- 52 Mary Beth Nikitin, Steven A. Hildreth, Paul K. Kerr, *Proliferation Control Regimes: Background and Status* (Washington, DC: Congressional Research Service, 2012), 39, <https://crsreports.congress.gov/product/pdf/RL/RL31559/15>.
- 53 Nacouzi et al., *Assessment of the Proliferation of Certain Remotely Piloted Aircraft Systems*, 6.
- 54 "RQ-8A and MQ-8B Fire Scout Unmanned Aerial Vehicle (UAV)," United States Navy Fact File, United States Navy, February 18, 2009, https://www.navy.mil/navydata/fact_display.asp?cid=1100&tid=2150&ct=1.
- 55 Bill Gabbert, "U.S. Navy acquires MQ-8C Fire Scout drones based on the Bell 407," *Fire Aviation*, July 13, 2019, <https://fireaviation.com/2019/07/13/u-s-navy-acquires-mq-8c-fire-scout-drones-based-on-the-bell-407/>.
- 56 Nacouzi et al., *Assessment of the Proliferation of Certain Remotely Piloted Aircraft Systems*, 6.
- 57 "Wing Loong Lethal UAS," *Global Security*, accessed January 7, 2020, <https://www.globalsecurity.org/military/world/china/wing-loong.htm>.
- 58 Nacouzi et al., *Assessment of the Proliferation of Certain Remotely Piloted Aircraft Systems*, 15.
- 59 Ibid, 15-19.
- 60 Kelsey D. Atherton, "Turkey drones are battle tested and ready for export," March 4, 2020, *C4ISRNET*, <https://www.c4isrnet.com/unmanned/2020/03/04/turkeys-drones-are-battle-tested-and-ready-for-export/>.
- 61 Davis et al., *Armed and Dangerous?* 10.
- 62 David Axe, "One Nation Is Selling Off Its Chinese Combat Drones," June 5, 2019, *The National Interest*, <https://nationalinterest.org/blog/buzz/one-nation-selling-its-chinese-combat-drones-61092>.
- 63 "MTCR Partners," MTCR.
- 64 Daniel Darling, "China's Arms Exports: Up, Up and Away," *Defense & Security Monitor*, May 9, 2019, <https://dsm.forecastinternational.com/wordpress/2019/05/09/chinas-arms-exports-up-up-and-away/>.

- 65 Ibid.
- 66 Minnie Chan, "Chinese drone factory in Saudi Arabia first in Middle East: Deal part of US\$65b package sealed during visit of King Salman," *South China Morning Post*, March 26, 2017, <https://www.scmp.com/news/china/diplomacy-defence/article/2081869/chinese-drone-factory-saudi-arabia-first-middle-east>.
- 67 Ibid.
- 68 Ibid.
- 69 Jon Gambrell and Gerry Shih, "Chinese armed drones now flying across Mideast battlefields," *AP News*, October 3, 2018, <https://apnews.com/1da29d68e3cc47b58631768c1dcfa445>.
- 70 Axe, "One Nation Is Selling Off Its Chinese Combat Drones."
- 71 Nacouzi et al., *Assessment of the Proliferation of Certain Remotely Piloted Aircraft Systems*, 49.
- 72 "Unmanned Aerial Vehicle (UAV) Market Size Worth Around US\$48.8 Bn by 2026," *MarketsInsider*.
- 73 Ibid.
- 74 Steven Zaloga, quoted in Dee Ann Divis, "Military UAV Market to Top \$83B," *Inside Unmanned Systems*, April 24, 2018, <https://insideunmannedsystems.com/military-uav-market-to-top-83b/>.
- 75 Divis, "Military UAV Market to Top \$83B."
- 76 Nacouzi et al., *Assessment of the Proliferation of Certain Remotely Piloted Aircraft Systems*, 48.
- 77 Divis, "Military UAV Market to Top \$83B."
- 78 "Airbus-Dassault-Leonardo EuroMALE," *Military Factory*, November 8, 2019, https://www.militaryfactory.com/aircraft/detail.asp?aircraft_id=1969.
- 79 Burak Ege Bekdil, "Turkey, Ukraine seek to jointly produce 'sensitive' defense technology," *Defense News*, September 16, 2019, <https://www.defensenews.com/unmanned/2019/09/16/turkey-ukraine-seek-to-jointly-produce-sensitive-defense-technology/>.
- 80 "Indo-Israel UAV Joint Venture In \$180 Million Export Deal with Philippines," *Defense World.net*, June 15, 2019, https://www.defenseworld.net/news/24957/Indo_Israeli_UAV_Joint_Venture_in_180_Million_Export_Deal_with_Philippines#.XjbfEXdFxQw.
- 81 "Japan, Israel defense officials eye joint research on drones, unmanned fighters: sources," *The Japan Times*, July 1, 2016, <https://www.japantimes.co.jp/news/2016/07/01/national/japan-israel-defense-officials-eye-joint-research-drones-unmanned-fighters-sources/#.Xjbf13dFxQw>; and "Aeronext and Major Chinese Industrial Drone Manufacturer MMC Strategic Alliance Start of 4D® Drones in the Chinese Market," *Business-Wire*, June 20, 2019, <https://www.businesswire.com/news/home/20190620005366/en/Aeronext-Major-Chinese-Industrial-Drone-Manufacturer-MMC>.
- 82 Nigel Pittaway, "Boeing unveils 'loyal wingman' drone," *Defense News*, February 27, 2019, <https://www.defensenews.com/digital-show-dailies/avalon/2019/02/27/boeing-unveils-loyal-wingman-drone/>.
- 83 Author interview, Kenneth Bray, January 16, 2020.
- 84 For more on this future vision, see David Deptula, Heather Penney, Lawrence Stutzriem, and Mark Gunzinger, *Restoring America's Military Competitiveness: Mosaic Warfare* (Arlington, VA: The Mitchell Institute for Aerospace Studies, 2019), <http://www.mitchellaerospacepower.org/single-post/2019/09/10/Restoring-Americas-Military-Competitiveness-Mosaic-Warfare>.
- 85 Author interview, Lt Col John Duray, January 4, 2020.
- 86 For a deeper discussion on the vision for and technological imperatives of manned-unmanned teaming, see Douglas Birkey and David Deptula, *Manned-Unmanned Aircraft Teaming: Taking Combat Airpower to the Next Level* (Arlington, VA: The Mitchell Institute for Aerospace Studies, 2018), <http://www.mitchellaerospacepower.org/single-post/2018/07/10/Manned-Unmanned-Aircraft-Teaming-Taking-Combat-Airpower-to-the-Next-Level>.
- 87 Sam Lagrone, "MQ-25 Stingray Unmanned Aerial Tanker Could Almost Double Strike Range of U.S. Carrier Air Wing," *USNI News*, August 31, 2017, <https://news.usni.org/2017/08/31/mq-25-stingray-unmanned-aerial-tanker-almost-double-strike-range-u-s-carrier-air-wing>; "MQ-25," Boeing, accessed February 1, 2020, <https://www.boeing.com/defense/mq25/>.
- 88 Pittaway, "Boeing unveils 'loyal wingman' drone."
- 89 Colin Clark, "US 'Loyal Wingman' Takes Flight: AFRL & Kratos XQ-58A Valkyrie," *Breaking Defense*, March 7, 2019, <https://breakingdefense.com/2019/03/us-loyal-wingman-takes-flight-afrl-kratos-xq-58a-valkyrie/>.
- 90 "Training AI to Win a Dogfight," Defense Advanced Research Projects Agency, May 8, 2019, <https://www.darpa.mil/news-events/2019-05-08>.
- 91 Davis et al., *Armed and Dangerous?* 6–7.
- 92 Christopher Ford, "Transcript: A New Strategic Approach to Civil Nuclear Cooperation: A Conversation with Christopher Ford," The Hudson Institute, February 26, 2019, <https://www.hudson.org/research/14905-transcript-a-new-strategic-approach-to-civil-nuclear-cooperation-a-conversation-with-christopher-ford>.
- 93 Christopher Ashley Ford, "The Case for Reforming the Missile Technology Control Regime."
- 94 "Libya's Haftar receives 6 Chinese drones from Jordan," *Middle East Monitor*, February 6, 2020, <https://www.middleeastmonitor.com/20200206-libyas-haftar-receives-6-chinese-drones-from-jordan/>.
- 95 Emily Tamkin, "Who is Libyan National Army leader Khalifa Hifter?" *The Washington Post*, April 6, 2019, <https://www.washingtonpost.com/world/2019/04/06/who-is-libyan-national-army-leader-khalifa-hifter/>.

96 Abdulkader Assad, "Haftar gets Jordan's Chinese drones, Intelligence Online says," *The Libya Observer*, February 3, 2020, <https://www.libyaobserver.ly/news/haftar-gets-jordans-chinese-drones-in-intelligence-online-says>.

97 Sebastian Roblin, "Chinese Drones Are Going to War All Over the Middle East and Africa," *The National Interest*, September 29, 2019, <https://nationalinterest.org/blog/buzz/chinese-drones-are-going-war-all-over-middle-east-and-africa-74246>.

98 Roblin, "Chinese Drones Are Going to War All Over the Middle East and Africa."

99 Stephen Chen, "China unveils its answer to US Reaper drone – how does it compare?" *South China Morning Post*, <https://www.scmp.com/news/china/diplomacy-defence/article/2103005/new-chinese-drone-overseas-buyers-rival-us-reaper>; "China unveils stealth combat drone under development," CBS News, November 7, 2018, <https://www.cbsnews.com/news/china-stealth-combat-drone-ch-7-under-development-middle-east/>; and "New GJ-11 Stealth Combat Drone With Flying Wing Design Takes Part In China's National Day Parade," *Defense World*, October 1, 2019, https://www.defenseworld.net/news/25593/New_GJ_11_Stealth_Combat_Drone_with_Flying_Wing_Design_takes_part_in_China_s_National_Day_Parade#.XkCDR3dFxQw.

About The Mitchell Institute

The Mitchell Institute educates about aerospace power's contribution to America's global interests, informs policy and budget deliberations, and cultivates the next generation of thought leaders to exploit the advantages of operating in air, space, and cyberspace.

About the Series

The Mitchell Institute Policy Papers is a series of occasional papers presenting new thinking and policy proposals to respond to the emerging security and aerospace power challenges of the 21st century. These papers are written for lawmakers and their staffs, policy professionals, business and industry, academics, journalists, and the informed public. The series aims to provide in-depth policy insights and perspectives based on the experiences of the authors, along with studious supporting research.

About the Author

Heather Penney is a senior resident fellow at the Mitchell Institute for Aerospace Studies, where she conducts extensive research on defense policy with a focus on leveraging the decisive advantage of aerospace power. Prior to joining Mitchell Institute, Penney worked over a decade in the defense industry focused on defense budgets, supporting program execution and campaign management. She served in the Washington, DC Air National Guard flying F-16s and G-100s and as a member of the Air Force Reserve in the National Military Command Center. She lectures to a number of organizations, universities, and military institutions on subjects related to future defense force design, Air Force capabilities and force structure, organizational command and control, reform of the defense personnel system, and other defense policy issues. Penney received her undergraduate degree from Purdue University, majoring in English with a minor in Philosophy, and earned a Master of Arts degree in American Studies from Purdue University. She continues to fly vintage aircraft, has raced jets, and has flown with the Collings Foundation.

