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## Policy Paper



### Key Points

Congress should direct DOD to conduct a study on new uses for MQ-9 Reapers that would help fill critical capability and capacity shortfalls. This should include a cost-per effect assessment and consider the indirect costs of off-loading MQ-9 tasks on high-end aircraft.

The Air Force should expand Air National Guard Ghost Reaper program in ways that would accelerate JADC2 and ABMS and reduce risk in their future operations.

DOD should fund and integrate a self-protection capability on the MQ-9 to enable it to operate in contested environments. This action will afford commanders more employment options to balance risk with requirements.

USNORTHCOM and NORAD should assess the viability of an airborne network of RPAs to fill critical gaps in homeland air defense and improve Arctic domain awareness.

Congress and the Air Force should protect the Air Force RPA community, as they will be critical players in the migration toward semi-autonomous and autonomous UAVs that will also team with manned aircraft.

The Air Force should work with the combatant commands to increase engagement with partners and allies on the potential for MQ-9s to enable a range of missions that may otherwise not be possible.

## Reimagining the MQ-9 Reaper

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### Abstract

The United States now faces an extremely broad set of threats, including peer competitors like China and Russia, nuclear ambitious adversaries North Korea and Iran, and non-state actors like ISIS and al Qaeda. All are surging. The Air Force is rightly looking to transform itself for conflict in modern, highly contested threat environments. However, the service also faces tremendous budget pressure as it looks to reset modernization delayed or canceled by past Department of Defense leadership. Given DOD's unwillingness to allocate the Air Force a greater share of the defense budget to make up for years' worth of underfunding, the Air Force now finds itself cutting legacy force structure not considered as relevant in a highly contested conflict to divert those resources to new capabilities. This is an exceedingly high-risk approach, but it is one of the few options left available to service leaders. Successfully navigating it demands careful consideration between what is truly excess and what can still prudently meet important mission requirements. That's why plans to retire the MQ-9 Reaper between 2030 and 2035 should be carefully reconsidered. The aircraft meets a broad range of requirements in a low-cost, highly effective fashion. While the Air Force has suggested acquiring a replacement for the MQ-9, this is not assured given the mountain of essential modernization programs already in play.

The Air Force must ensure it retains, sustains, and modernizes the MQ-9 inventory until a viable replacement is available in operationally suitable numbers. The MQ-9 remains in high demand by the combatant commands, and these requirements are not ebbing in the wake of the U.S. withdrawal from Afghanistan. The aircraft and its airmen remain nearly 100 percent committed to keeping watch on terrorist groups, and combatant commanders also require more awareness, decision space, and options as Russia and China continue to transform their capabilities, capacity, and posture. The MQ-9 can execute valuable missions, which in turn allows more sophisticated aircraft to focus on higher threat spaces. To this point, the Reaper can be used in many new ways to include wide-area surveillance, air and missile defense, maritime and littoral operations, Arctic domain awareness, cruise missile defense of the homeland, and even defense support of civil authorities. Considering these mission sets and the affordability of adapting the weapon system, the MQ-9 is one of the Air Force's most relevant aircraft. The Reaper must be reimagined, not prematurely retired.

## Introduction

The Air Force has reached an impasse: The age and condition of legacy weapons systems that constitute most of today's Air Force can no longer be ignored. American Airmen are expected to "Fly, Fight and Win" with a fighter force that has an unprecedented average age of 30 years and is half the size of the force that defeated Iraq's military in 1991. This includes air refueling tankers and reconnaissance aircraft that first flew in the 1950s and aging bombers that are no longer survivable against advanced enemy air defenses and cannot penetrate the battlespace. Air Force leadership recently testified that fully 44 percent of the service's aircraft exceeded their design service lives.<sup>1</sup> How has this come to pass? The answer is simple: decades of modernization deferments, serial force cuts to reduce defense spending, and a series of administrations that prioritized nation building "long wars" over keeping pace with China. The stark truth is the U.S. Air Force is the smallest and oldest it has ever been, and it is not well prepared to engage successfully in a conflict with China or Russia.

This "too small and too old" dilemma informed Air Force Chief of Staff General CQ Brown's call to accelerate the Air Force's modernization. Failing to transform the force will severely degrade our nation's ability to deter China and Russia's increasingly aggressive actions. The urgency of this task cannot be overstated. In the words of Air Force Secretary Frank Kendall, "America cannot wait to modernize the Air Force any longer, not one year, one month, or one week."<sup>2</sup> In this context, the Air Force formulated a new approach for its latest budget submission. Unlike cuts that were mostly imposed on the service in the past, the Air Force is now taking its own knife to legacy aircraft that it does not believe can survive in a high-end fight. This is a high risk approach that leaves little room for error. Replacements for older systems must be delivered on time and in quantity to ensure

capacity gaps don't emerge. There is no plan B. As it retires some aircraft that are clearly and increasingly obsolete, however, it must take care that it doesn't throw the proverbial baby out with the bath water. Specifically, the Air Force should not prematurely divest a combat-proven force that can still meet mission demand efficiently and serve as an engine for innovation and operational excellence well into the future—its fleet of MQ-9 Reapers.

Last year, Congress rebuffed the Air Force's attempt to stop all MQ-9 procurement beginning in FY 2021. Despite this clear message, the Air Force's latest budget submission again proposed to end MQ-9 production short of its previous requirements. In 2030, it also hopes to initiate retirement and send its entire Reaper inventory to the boneyard by 2035. Why? First, it's about budget. Second, some Air Force leaders do not believe MQ-9s will be as relevant in high-end, peer-on-peer fights as other capabilities they aspire to buy. There is no question that obsolescence in great power conflict is a valid metric for determining capabilities that should be on the chopping block. However, there is a pragmatic middle ground. A key principle in strategy is that existing capabilities can often be used in powerful new ways—especially in the hands of innovative warfighters. Given budget challenges, the Air Force must ensure it does not prematurely divest capabilities it already owns. This principle must be part of the Air Force's modernization calculus and applies to the Air Force's remotely piloted aircraft (RPA) enterprise, including its MQ-9s. The future of the USAF's MQ-9 force should be informed by:

- The cost for MQ-9s to perform missions and achieve desired effects in the battlespace relative to other capabilities, maximizing cost-per-effect.<sup>3</sup>
- The potential for MQ-9s and RPAs in general to help fill critical capability and

capacity gaps in an expanded array of mission areas.

- The value of using MQ-9s in ways that will preserve high-end aircraft, such as 5th generation fighters, for what they were designed to do: perform high-end missions.
- The time, cost, and risk of developing alternative weapon systems—including a next-generation MQ-9 replacement in an era where budget will remain tight and mission demand remain high.

In short, the Air Force must not overlook the potential long-term benefits of continuing its long-stated requirement of MQ-9s and enhance the survivability, command and control (C2) resiliency, autonomy, and advanced sensor capabilities of its Reaper force well beyond 2035 or until a new capability is available in operationally viable numbers. Even as Reapers continue to perform counterinsurgency and counterterrorism missions, the Air Force should take advantage of its community of airmen who created innovative RPA operating concepts in the past to develop new uses for MQ-9s in the future. These new uses could include providing needed

intelligence, surveillance, and reconnaissance (ISR) from standoff ranges in “gray zone” environments; performing as communications nodes and relays that connect sensors and shooters at the battlespace edge during high-end fights; and functioning as part of a system-of-systems that defends U.S. theater bases against air and missile attacks.

MQ-9s could also help fill gaps in domain awareness of the northern approaches to the U.S. homeland by detecting and reporting cruise missiles launched by Russian aircraft operating in the Arctic region. Such novel uses would fill critical gaps and are not merely conjecture; their potential is already emerging. Regarding standoff ISR, the Air Force demonstrated in the European theater the benefits of merging high-endurance Reapers with passive electronic support measures.

In a larger view of modernization, the Air Force seeks to substantially transform its force design. That future force will not appear instantly. There is a migration path that requires new concepts and the insertion of transformational technology into today’s force structure. Reimagining the Reaper is



Credit: U.S. Air Force Photo

Figure 1: The Air Force MQ9 Reaper is an armed, medium-altitude, long-endurance unmanned aircraft that can be remotely piloted from inside or outside a theater of operations. It can stay airborne for up to 30 hours in an extended endurance configuration without the need for refueling aircraft. It performs a range of missions including intelligence, surveillance, reconnaissance, strike, close air support, overwatch, and combat search and rescue. MQ9 Block 5 variants have upgraded communications, avionics, electrical power, and other capabilities. Within the overall Air Force flying hour program, Reaper aircraft fly 11 percent of the of the total Air Force flying hours at only 2.6 percent of the cost, and compared to other combat aircraft, the reaper inventory maintains the highest mission readiness rate. [See U.S. Air Force MQ-9 fact sheet]

an important part of that migration that can address capability gaps in situations where real-world factors will not wait for solutions a decade or two away.

## Evolving Applications

Adapting existing aircraft to perform new missions has long been a hallmark of Air Force airmen. In fact, the Air Force recently procured a half billion-dollar fleet of manned business jets to carry a communications package that relays data between airborne platforms that cannot normally share information.<sup>4</sup> Procuring mature business jets was a less expensive approach for sustaining this mission than designing a new military-specific aircraft from the ground-up. This example highlights where the use of Reapers already in the inventory would have netted the desired mission results more effectively and efficiently. From a cost-per-effect standpoint, MQ-9 Reapers modified for this mission would be substantially less expensive, post superior mission capable rates, and have multiple times the persistence during sorties as manned business jets. Using Reapers in this way would free up a squadron of these business jet pilots for other mission areas and help the Air Force fill its chronic deficit of 2,000 pilots. Commanders with this option in their toolkit could accept a higher level of risk in forward areas during periods of escalating tensions since Reapers are unmanned. Placing them in harm's way during a crisis would not risk the loss of lives or result in images of captured airmen, and, of course, combat rescue assets would not be needed should one be shot down. In addition, technically mature Reaper capabilities allow for both autonomous operations and control of multiple aircraft from a single ground station, significantly reducing the manpower usually associated with Reaper squadrons performing ISR and strike operations.

RPAs are clearly game-changing systems with enduring value to the multiple combatant



Credit: U.S. Air Force Photo

Figure 2: An MC-12 Liberty at Beale AFB in 2013. The MC-12 program began in 2008 as a way to quickly outfit Hawker Beechcraft King Air 350s with intelligence, surveillance, and reconnaissance equipment. The Air Force abruptly divested the aircraft to the National Guard and disbanded two squadrons operating in Afghanistan, resulting in a large share of its highly combat experienced pilots separating from active duty. Such lost experience is irreplaceable.

commanders who say that they cannot get enough of them to meet their operational needs today and for the foreseeable future. The Reaper's capability also benefits from the years of doctrine development, training, experience, and established culture of the airmen that operate and maintain them. The Air Force's extended RPA community—which includes civil servants and closely teamed industry talent as well as airmen—matured over the last twenty years of continuous combat operations. In combination, they are the most operationally innovative and adaptive cadre in the Air Force. Near-term moves to reduce or disperse this community would hinder achieving the future force the Air Force needs. For example, the Air Force acquired a fleet of MC-12 Liberty aircraft for counterinsurgency missions in 2009, but abruptly transferred all the aircraft to the National Guard in 2015, causing an alarming exodus of talented and experienced airmen. Prematurely sunsetting MQ-9s could likewise devastate its much larger and better-established operator community, and at the Air Force's expense.<sup>5</sup>

## Replacing the Reaper before Its Time

The Air Force has dabbled with thoughts of a Reaper replacement that can operate

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in permissive and semi-permissive threat environments, but its actual commitment to developing one might be challenged by budget realities. The Air Force has issued a Request for Information (RFI) to industry for a future unmanned aircraft family-of-systems.

This initiative, called the Next-Generation Multi-Role Unmanned Aerial System Family of Systems, could absorb the MQ-9's functionality into a broader concept that includes an MQ-Next—a direct replacement for the MQ-9—and address capability gaps for multiple missions across a range of threat environments. However, uncertainty about the program concept is reflected in recent Congressional legislation; a 2021 report by the House Committee on Appropriations

rejected the Air Force's decision to end Reaper production short of requirements as premature and noted a lack of investment toward developing a replacement aircraft. Consequently, Congress required the Air Force to submit a report detailing the requirements for an aircraft that would replace the Reaper.<sup>6</sup>

Realistically, the budget headroom needed to fund a Reaper replacement in the near term seems unlikely. The service expects, at best, flat defense budgets, and they can expect their purchasing power will be eroded by surging inflation rates. The Air Force is already struggling to find enough funding for its other big-ticket modernization programs like the B-21 bomber, KC-46 air-refueling aircraft, F-35 and F-15EX fighters, new T-7 training aircraft, a UH-1 replacement, the Ground Based Strategic Deterrent, the Advanced Battle Management Systems (ABMS), and a Next Generation Air Dominance family-of-systems. Correcting for the long-term Congressional delays on these

modernization necessities for the Air Force does not even address the additional needed investment in a myriad of low earth orbit satellite constellations to provide more resilient and capable connectivity and sensing; key enablers of the future force; and addressing other massive capability gaps in critical areas, ranging from hypersonic weapons technology to air and missile defense of air bases.

Given these competing requirements, pursuing an MQ-Next in the next decade is a higher risk choice than making a more modest investment that improves the Reaper's ability to detect and defend against air and missile threats, provide resilient communications connectivity, act as advanced communications nodes and datalink integrators, and provide much needed standoff wide area surveillance in the world's gray zones to close numerous combatant command ISR gaps. As Frank Kendall stated before the Senate Armed Services Committee in May 2021, "We have made a big investment in that platform [MQ-9] and it would be a shame to not be able to utilize it against more sophisticated threats."<sup>7</sup>

### **Preserving Capacity for the High-End**

Another important consideration is the USAF's decision to slash old inventories at higher rates than it buys high-end aircraft replacements. This practice risks repeating a hard-earned lesson of the Long War: using the Air Force's high-end aircraft for operations in the permissive airspace of the Middle East and Southwest Asia over the last twenty years aged them at an accelerated rate. If the Air Force truncates MQ-9 procurement now and prematurely retires its existing Reapers, high-end U.S. forces could be ground down further by ongoing mission requirements. The Department of Defense will likely continue its persistent requirements for keeping terrorist organizations at bay and stabilizing regions threatened by insurgencies, taxing high-end USAF aircraft used for these missions.

**The Reaper represents over \$12 billion dollars and nearly two decades of development that would continue to add value in the near term.**

In the end, the Air Force may have to choose between leveraging its massive investment in a unique weapon system and its highly experienced operator community or betting on undeveloped and unproven capabilities—the budget is that tight. The

Reaper represents over \$12 billion dollars and nearly two decades of development that would continue to add value in the near term. A new program could theoretically capitalize on the Reaper’s successes but would also bring with it a litany of added fielding and sustainment costs and would only join the force at some undefined point in the distant future. Retaining and selectively upgrading would be a more cost-effective pathway to filling known capability gaps. Rather than jettisoning Reapers, the Air Force can quickly—and more affordably—transform how they are used in both permissive and contested environments. This would better allow the Air Force to bridge to a future UAV family-of-systems that they ultimately desire. The MQ-9’s capabilities are not fully tapped; it still has the potential to meet the Air Force’s global operational requirements while saving billions of dollars needed for modernization.

**The Air Force’s Modernization Mindset —**

Great power conflict, thought for decades to be a relic of the past by many in the Department of Defense and Congress, is again the strategic question. The 2018 National Defense Strategy (2018 NDS) best expresses this strategic reawakening and exposes how long-term neglect has hollowed out the nation’s air and space power advantage. A new strategy in works by the current administration can only face and reinforce this reality. In the summer of 2020, General CQ Brown assumed

leadership over an obsolescing force worn down by the lack of modernization funding and a generation of counterterrorism operations. General Brown’s call to action was bold, direct, and immediate: if the Air Force fails to adapt, the nation risks losing in a high-end fight.<sup>8</sup>

The need to modernize, combined with the growing threat of Chinese or Russia aggression, has forced the Air Force to make major moves that will fundamentally change how America’s airmen fight in the future. Four of the Air Force’s most daring transformations involve capabilities and concepts for joint all-domain command and control, long-range strikes into contested areas, next-generation air dominance operations, and autonomous collaborative aircraft. These and other modernization initiatives are competing for a share of a defense budget that is declining in real terms after accounting for inflation. Surging public debt compounded by the economic impact of the COVID-19 virus has all but eliminated the potential for defense plus-ups in the foreseeable future. For perspective, the yearly interest penalty created by servicing the public debt is now double the size of the Air Force and Space Force’s combined budgets.<sup>9</sup> Assuming likely inflation rates, the FY 2022 defense budget reduces defense spending power by 2 percent, while domestic discretionary spending will surge 16 percent.<sup>10</sup>

Air Force leaders seem to agree there is little chance for the service to gain an increased share of the defense budget, and consequently they have remained relatively silent on its obvious need for a substantial boost in modernization funding. Their modernization approach is budget-based and does not represent what is actually necessary to meet the objectives of the 2018 NDS at a moderate level of risk. To make the budget math work, the Air Force plans

to divest older capabilities it believes cannot survive in the contested environments that would exist in a high-end fight with China, the Air Force's pacing threat.<sup>11</sup> The Air Force is also assuming the Office of the Secretary of Defense, the Office of Management and Budget, and Congress will allow it to use dollars and manpower gleaned by sending older aircraft to the boneyard for modernization programs.

This modernization approach has three risks. First, there is no assurance that resources saved by retiring force structure will remain in the Air Force's hands. Savings from USAF force cuts could be allocated to other, non-Air Force priorities as they have been in the past.<sup>12</sup> In 2010, the USAF's Air Combat Command retired older fighter aircraft to generate savings that it could use to buy new fighters. The result of this "Combat Air Forces Redux" plan was a smaller fighter force, and savings were absorbed by other programs across all the services. New jets were not bought, temporary force cuts became permanent, and the smaller fighter inventory became the Air Force's new normal.<sup>13</sup>

Second, the Air Force's modernization approach increases risk by reducing the size of its planned 5th generation fighter force over the next decade and beyond. The Air Force has requested FY 2022 funding to buy only 48 F-35s, the only 5th generation fighter now in production for the United States and its allies. Capping the F-35 buy rate well short of the USAF's originally planned 120 per year delays the fielding of a modernized force needed to defeat Chinese aggression and creates opportunities for non-Air Force decisionmakers to reallocate any savings to other programs.

The third risk is the most significant: the loss of USAF force structure in the near term increases operational risk for U.S. combatant commanders. The global threat

environment shows no evidence of taking a timeout to allow for budget-driven force cuts. The unprecedented growth in the number and density of threats means the USAF's proposed cuts will increase the gap between its operational requirements and ability to meet them.

These gaps are global in nature. Beginning at home, North America's air and missile defenses are in desperate need of new operating concepts, forces, and resources. Overseas, additional forces are needed to defend U.S. airbases against air and missile attacks. Continuing to neglect these defenses simply invites attacks that will greatly inhibit the Air Force's ability to generate combat power forward and provide logistics support to all U.S. forces. Everywhere in between, there are gaps in the USAF's capability to deter and defeat gray zone aggression by China, Russia, Iran, and other revisionist actors that seek to advance their interests while remaining below the threshold of outright conflict. The need to detect and check gray zone aggression without escalating to a major war is creating new, persistent force structure requirements. Yet, these requirements threaten to exceed

### What is the Gray Zone?

The *2018 NDS* implemented a new global operating model for projecting military power that consists of four layers of forces: contact, blunt, surge, and homeland defense. Contact layer forces conduct theater operations that fall below the threshold of armed conflict, which the Department of Defense (DOD) calls the gray zone. These include activities short of war that assure U.S. allies; augment allied defenses; and counter Chinese or Russian gray zone activities such as military incursions into allied airspace, the harassment of allied shipping in international waters, information operations, and unconventional warfare.

the capacity of an Air Force that continues to shrink its size.

Combatant commanders understand the global nature of these challenges, many of which could result in a crisis that leads to major war well before the Air Force realizes its modernization ambitions. Terrorism, extremist dogma, and instability continue to spread globally. China and Russia continue to field new capabilities that are eroding U.S. military advantages. Threats of terrorist, cruise missile, and other attacks directly on the U.S. homeland are growing. The Air Force, which will be critical to deterring and defeating these threats, is increasingly unable to meet its operational requirements.

Combatant commanders know the USAF's plan to build-down and eventually build-up will grow this capability gap. They are being asked to assume years of risk. Gen Steven Townsend, Commander of U.S. Africa Command, and Gen Ken McKenzie, Commander U.S. Central Command, are among those who are most concerned with how a shrinking Reaper force will diminish their ability to prevent insurgents and terrorists from expanding their influence across multiple regions.<sup>14</sup> Bluntly stated, there will not be enough Reapers to support their still surging operational requirements. These requirements are not likely to be reduced despite the withdrawal from Afghanistan. In fact, the withdrawal creates the need for long-endurance platforms to execute over-the-horizon ISR to keep tabs on terrorist groups within Afghanistan. MQ-9 is the only platform that can deliver persistent ISR and, if necessary, strike from long distances at no risk to aircrews.

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## Conclusion

The case for retaining, sustaining, and maintaining the MQ-9 force and adapting them for new challenges is not in conflict with General CQ Brown's modernization vision. Adapting faster does not obviate the need to adopt smarter, more cost-effective ways to fight. With modest levels of investment, the MQ-9 Reaper enterprise can expand far beyond the missions it performs so well today, and it can reduce near-uncontrolled growth in the USAF's operating and support costs as it does so. Sufficient investment in autonomy and multi-UAV control technology can add even more efficiency. Understanding the Reaper's operational potential in the future can be illustrated by examples of its adaptability in the past.

## The RPA Age: An Explosion of Innovation in Combat Operations

From its earliest inception, the Air Force's RPA enterprise was a blank canvas upon which new operational concepts could be imagined, tested, adjusted, and continually tested in actual combat operations. The act of blending new sensor technologies with long-endurance, remotely piloted, unmanned aircraft opened an entirely new vista of tactical improvisation.

On January 23, 2001, an MQ-1 Predator launched an inert Hellfire missile at a target tank located on a weapons test range in California. This event marked the first successful missile launch from a remotely piloted aircraft. In the following weeks the Predator, the precursor to the MQ-9 Reaper, carried out additional tests culminating in the first launch of a live missile. Few at the time would have imagined that just months later Predators would be among the first weapons systems deployed abroad to Afghanistan to fight Al Qaeda and the Taliban. In the months that followed those first missile tests, the



Predator would pass multiple technical and operational milestones to become a weapon that indisputably transformed the American way of war.

One immediate improvement stemmed from the Predator's ability to provide a persistent "unblinking eye" over the battlespace. The process for obtaining actionable military intelligence before the age of RPAs could be cumbersome and unresponsive to the rapidly changing needs of U.S. theater commanders. For instance, an early 1960s program called CORONA relied on returning film from reconnaissance satellites. The film was contained in parachute-deploying capsules that allowed them to be recovered after they entered the atmosphere by inflight aircraft. The film was then flown to sites for exploitation and analysis before dissemination. Professor Paul R. Baumann noted that, "it might take days or weeks after the film was exposed before a capsule was released. Some events such as the 1967 Middle East Six-Day War and the 1968 Soviet invasion of Czechoslovakia were time sensitive and ended before imagery was available."<sup>15</sup>

The use of manned airborne sensors in the 1990s was similarly challenging. To effectively attack a target, forces must find it, precisely locate or fix it, and then engage or finish it with an appropriate weapon for the desired outcome, such as destroy or render it inoperable. These find-fix-finish elements make up what is called the "kill chain." Prior to the advent of modern RPAs, separate manned aircraft had to accomplish find, fix, and finish functions, which took a relatively long period of time. Reconnaissance aircraft would take aerial pictures, then airmen would fly the exposed film to a base where others developed it, then intelligence professionals would analyze the images, then planners would develop missions to attack targets, finally

strikes would occur, and then a follow-up ISR mission would assess strike results. Technological advances helped reduce the time to complete the kill chain cycle, but the process still consumed many hours, even in the best of circumstances.

The First Gulf War in 1991 exposed the limitations of this labor-intensive find-fix-finish process, parts of which had remained largely unchanged since World War I. According to Desert Storm planner Lt Col Dave Deptula, the "most significant deficiency and/or drawback of this process was failure of the intelligence community to provide timely BDA [Bomb Damage Assessment]. BDA was not available soon enough to factor into the 'planning' day. Therefore, other means had to be established to extract best available information from which to develop a plan."<sup>16</sup> During ODS, black-and-white photographs that took hours to produce and distribute remained the primary medium for imagery intelligence. As a result, planners often lacked information they needed to develop new target lists during the highly dynamic air war and conduct BDAs to understand if airstrikes had succeeded. Iraqi "Scud" tactical ballistic missiles proved a particularly difficult challenge to find, fix, and finish as they moved frequently and were often camouflaged. The Air Force began to invest a significant number of aerial assets to find and destroy mobile Scud launchers. In a postwar analysis commissioned by the Air Force, Thomas A. Keaney and Eliot A. Cohen observed that, "By the war's end, nearly every type of strike and reconnaissance aircraft employed in the war participated in the attempt to bring this threat under control, but with scant evidence of success."<sup>17</sup> The consuming search for Iraq's Scud missiles siphoned off valuable air assets that could have been better used for other missions.

Figure 3: The image on the left is of an original General Atomics GNAT 750 UAV. The right image is an Improved GNAT - extended range (I-GNAT ER) over Iraq in 2004.

Credit: [Sandia National Labs](#) and [U.S. Air Force Photos](#)



### Learning on the Fly: Continuous Innovation in RPA Operations

DOD’s RPA enterprise was a novel experiment in military acquisition that was opposed by some in the Air Force from the start. Two years after the end of Operation Desert Storm, then-Undersecretary of Defense for Acquisition and Technology John Deutch decided it was time to overcome the Air Force’s opposition to RPAs. Deutch viewed RPAs as a “potentially lifesaving technology that would have been operational by now [1993] if the armed services weren’t so myopic or the acquisition system such a mire.”<sup>18</sup> In November that year, Deutch designated the development of an RPA as DOD’s very first Advanced Concept Technology Demonstrator (ACTD) project. The ACTD program, a version of which remains in effect today, was designed to overcome what Deutch perceived as the burdensome rigidity of the military’s traditional acquisition process. ACTDs were intended to enable field commanders to quickly evaluate new technologies in an operational setting and provide DOD acquisition authorities with real-world assessments of their performance. In January 1994, the Pentagon’s UAV Joint Program Office awarded a contract to General Atomics to adapt the Gnat 750, an early reconnaissance RPA primarily operated by the intelligence community, to meet the military’s elevated requirements.

Just six months after the contract award, the aircraft that would later become known as the Predator briefly took flight in a demonstration at a test site in southern California.<sup>19</sup>

The General Atomics MQ-1 Predator made its combat debut one year later in support of Operation Deliberate Force, a NATO air campaign against Bosnian Serb forces. Real-time, full-motion color video imagery from Predators was distributed to allied forces in Bosnia, the allied air operations center in Italy, and the European Command Joint Analysis Center in England.<sup>20</sup> This real-time imagery represented a distinct break from the era of black-and-white photographs as the basis for aerial intelligence. In September 1995, video imagery from Predators played the central role in a strategic decision by U.S. commanders to resume bombing



Credit: [U.S. Air Force Photo](#)

Figure 4: An MQ-1, armed with a Hellfire missile, over Afghanistan in 2008.

when Serbian forces did not appear to be withdrawing from areas they were occupying.<sup>21</sup> Predators continued to demonstrate their technical and operational growth in successive deployments to the Balkans throughout the late 1990s. In missions supporting Operation Allied Force in 1999, Predators worked closely with other aircraft to provide more of a target acquisition capability than purely reconnaissance. In June 1999, a Predator conducted the first “buddy lase” by an RPA for another aircraft, meaning it used a laser designator to guide a precision munition launched from an A-10 Warthog fighter to a target.<sup>22</sup>

Remotely piloted aircraft were in a period of transition at the start of the new millennium. Although Predators had proved they could find and fix targets during air campaigns in the Balkans, they did not carry weapons that could be launched by a remote controller. This restrained the Predator’s potential and allowed valuable targets to escape before other aircraft could strike them. Air Force General John Jumper, then the commander of Air Combat Command, envisioned expanding RPA roles beyond reconnaissance and surveillance.<sup>23</sup> In a May 2000 letter to the Air Force Chief of Staff, Jumper recommended the Air Force should begin exploring the potential to weaponize them. In June 2000, an Air Force technical office called Big Safari was given the responsibility for equipping Predators with an air-to-ground guided missile. This culminated in successful Predator missile launches less than a year later, and the first operational deployment of an armed RPA occurred just days after the September 2001 terrorist attacks on the United States.<sup>24</sup> The value of making the sensor also the shooter was quickly demonstrated in combat. The first strike by an RPA occurred on October 7, 2001, the opening day of Operation

Enduring Freedom combat operations, narrowly missing Taliban leader Mullah Omar.<sup>25</sup>

Operation Enduring Freedom saw other significant milestones in the Predator’s development besides marking the first armed RPA deployment. In the summer of 2001, Big Safari began developing a concept known as “remote split operations,” whereby pilots and sensor operators based in the United States could operate Predators flying thousands of miles away.<sup>26</sup> Eliminating the need to deploy dozens of RPA crewmembers overseas could yield immense savings. Under this scheme, Big Safari sought to connect Predator Ground Control Stations in the United States to the satellite communications infrastructure at Ramstein Air Base using existing cross-oceanic fiber optic networks. Although still very much a prototype, the design proved a success when the first RPA missions over Afghanistan were flown from a Ground Control Station located on the CIA’s campus in Virginia.<sup>27</sup> In November 2001, after being highlighted as a highly desirable capability by the leadership in the Combined Air Operations Center (CAOC) overseeing Predator operations, Big Safari met another milestone by developing a new system that enabled Predator operators to disseminate live full-motion video directly to other aircraft.<sup>28</sup>

RPAs allowed the Air Force to shift from using multiple aircraft over a long period of time to find, fix, and finish targets to a single platform that could accomplish all these functions in single-digit minutes. As noted by airpower historian Benjamin Lambeth, “Thanks to real-time imagery and increased communications connectivity, the kill chain was shorter than ever, and target-attack accuracy was truly phenomenal.”<sup>29</sup> That this transition occurred within a span of 12 months reflects the unique attributes

of RPAs as well as the culture of innovation inherent to the RPA community. Speaking to the 9/11 Commission, General John Jumper observed, “In the modern era, since the 1980s, I would be shocked if you found anything that went faster than this.”<sup>30</sup> In the years that followed the start of Operation Enduring Freedom, demand for multi-functional RPAs skyrocketed. Flight hours logged by the Predator family of RPAs grew from around an estimated 2,000 per month in 2004 to 14,000 hours in 2008, and to more than 50,000 hours in 2019. Amazingly, nearly 90 percent of all missions flown by the Predator family have been combat missions.<sup>31</sup>

### **The MQ-9 Reaper: The Next Step in the RPA Revolution**

The next step in the RPA revolution accelerated the rate of tactical innovation. In 1999 General Atomics began developing the Predator B—which is now known as the MQ-9 Reaper—as a larger version of the MQ-1 capable of a wider variety of missions. In the early 2000s General

Atomics partnered with what is today the NASA Armstrong Flight Research Center to develop a version of the Predator capable of high-altitude Earth science missions.<sup>32</sup> The Predator B-001 conducted its first flight in February 2001. Shortly thereafter, General Jumper made the decision to procure Predator Bs for the Air Force.

The Predator B did everything General Jumper imagined an expanded variant of the original Predator could do. Ironically, there was organizational bias against the extremely innovative concept in part due to competition for resources with other aircraft programs. Against the bureaucratic drag, Jumper became the program’s champion, forcing top-down choices. Predator Bs were designed to carry weapons, incorporate new functions and capabilities, and had greater speed without sacrificing the mission persistence of its predecessor. With a larger payload capacity and longer wingspan, the Predator B could accomplish the same mission as four MQ-1 Predators. The first Predator B prototypes were delivered to the Air Force for initial evaluation in February



Credit: [U.S. Air Force Photo](#)

Figure 5: A Senior Airman and RPA communications technician in the 432nd Aircraft Communication Maintenance Squadron at Creech AFB, NV, working at a ground control unit used to fly the MQ-9 Reaper in August of 2020.

2002.<sup>33</sup> In May 2003, the Air Force used a Predator B prototype to support Operation Safeguard, a U.S. border security operation along the U.S.–Mexico border.<sup>34</sup> Over the next three years, the highest-ranking Air Force leaders formed what was known as Task Force Arnold to oversee the Predator B’s development.<sup>35</sup> The Air Force renamed the Predator B the “Reaper” in 2006, introducing the aircraft that would become the mainstay of U.S. counterinsurgency and counterterror operations to present day.<sup>36</sup>

Since Air Combat Command stood up the first two operational Reaper combat air patrols in 2007, Reapers have been deployed to at least 12 countries to support operations in Afghanistan, Iraq, Syria, across east and west Africa, the Arabian Peninsula, and eastern Europe.<sup>37</sup> These versatile combat aircraft have killed dozens of high-value targets, including ISIS-Khorasan leader Abu Sayed, Iranian General Qassem Soleimani, and Taliban leader Mullah Mansour.<sup>38</sup> By 2016, the Reaper had accumulated over 1 million flight hours and had transformed the Air Force’s RPA enterprise from one focused primarily on ISR into a robust combat asset. In 2018, the Air Force retired the MQ-1 Predator and transitioned to an RPA enterprise of MQ-9 Reapers. The Air Force’s Reapers exceeded 2 million flight hours the following year, over 90 percent of which were flown in support of combat operations.<sup>39</sup>

### **Killing the Reaper: A Risky Way to Fund Air Force Modernization**

The growth in operational demand for RPAs since their first fielding has consistently outpaced the Air Force’s capacity to meet it. In 2005, General John Abizaid, then the Central Command commander, urgently requested more RPAs for operations in Iraq and Afghanistan, which prompted the Air Force to reprogram funds for additional aircraft.<sup>40</sup> In 2011, Air Force Gen Philip

Breedlove told lawmakers that the Air Force was struggling to meet requests for MQ-9 Reapers from Central Command, let alone the demands from other combatant commands.<sup>41</sup> In a 2012 letter to lawmakers, ADM McRaven, then the head of U.S. Special Operations Command (USSOCOM), said that upgrades to USSOCOM’s RPA fleet were an urgent unfunded priority.<sup>42</sup> In 2013, Congress added an extra \$80 million to the Air Force’s budget for MQ-9 Reapers, reasoning the service’s request was insufficient to meet the “significant unmet demand for ISR capability worldwide.”<sup>43</sup> In 2015, General Herbert Carlisle, the head of Air Combat Command, warned that the Air Force’s MQ-1 and MQ-9s were still overstretched and at the “breaking point.”<sup>44</sup> Today, U.S. military commanders continue to advocate for more Reaper capacity to support operations in nearly every region of the world. This fact and the potential new uses for Reaper have not deterred plans to begin sending the aircraft to the boneyard beginning in 2023.

The Air Force now intends to retire its Reapers as it transforms its force structure for great power conflict in contested operational environments. USAF leaders believe that Reapers will not be viable in increasingly contested areas and intends to divert savings from retiring them to develop a replacement aircraft or possibly other, higher priority programs. This stratagem is implied in the USAF’s budget documents where there is a lack of projected funding for MQ-9 improvements. Such a shutdown of funding projections typically signals the end of a program.<sup>45</sup>

The Air Force’s previous decision to cut funding in its FY 2021 budget for additional Reapers prompted an outpouring of concern from combatant commanders who even “considered joint communiques to advocate against the Air Force’s push

to reduce current Reaper capacity.<sup>46</sup> In a February 2020 letter to the House Armed Services Committee, Marine General Kenneth McKenzie, the Commander of U.S. Central Command, told lawmakers that the MQ-9 was his top unfunded priority and asked Congress to fund \$238 million for additional aircraft.<sup>47</sup> General Townsend also highlighted the value of having MQ-9 Reapers to support AFRICOM's operations while testifying to Congress, and, in a letter to lawmakers, ADM Craig Faller, head of U.S. Southern Command, included the MQ-9 Reaper as an unfunded priority and asked for \$40 million to support an RPA orbit for his area of responsibility.<sup>48</sup> "Having intelligence that can look over wide areas for long periods of time, know what's happening on the ocean, on the sea in the littorals, is really critical to us," said ADM Faller in a December 2020 roundtable with defense journalists.<sup>49</sup> U.S. lawmakers agreed with the combatant commanders. Both the Senate and House Armed Services Committees added funds to the FY 2021 National Defense Authorization Act for additional MQ-9 Reapers, rebuffing the Air Force's attempts to end its acquisition.<sup>50</sup>

### **Pushing Further into the MQ-9 Reaper Revolution: More Value**

The RPA era, led by the Predator and Reaper, allowed the USAF to conduct real-time surveillance and analysis to drive its next moves in operations. RPAs are now routinely used to surveil and analyze adversary movements, patterns of life, networks of adversary operatives; fly overwatch missions to detect threats in proximity to friendly forces; and attack targets on demand.

While these advances changed how America conducts air warfare, the MQ-9 Reaper of 2021 brings more to the battlespace than just the advantages

of remote piloting, high-endurance, and real-time sensing. RPAs in the hands of experienced airmen give the Air Force the freedom to innovate and move away from ISR-centric operational concepts for their use. Plus, the maturing of the Reaper enterprise showcases the value of using one of the Air Force's lowest cost-per-flying-hour aircraft to reduce strains on its more expensive high-end capabilities. The Air Force has yet to fully tap the potential of the Reaper for a much wider range of missions and tasks. This includes using them in operational areas and in modes where non-stealth platforms are not considered survivable. In short, the MQ-9 Reaper is a building block for the future, but this reality is not currently reflected by the Air Force's program plans to retire it prematurely.

### **New Ways to Use the Mature MQ-9 Enterprise to Meet Critical Needs**

While describing the need for expanding the mission potential of a future MQ-9 replacement beyond ISR and strike, then-Air Force Assistant Secretary of Acquisition Will Roper said that the more an MQ-Next can take on, the "less we're having to spend for those missions [that are] otherwise generating an asset bill for the Air Force."<sup>51</sup> Roper's logic is sound, and it also applies to Air Force MQ-9s. A modest level of investment could ensure MQ-9s remain viable, multi-mission platforms over the next two to three decades as a replacement is developed, acquired, and reaches full operational capability. Reapers can significantly improve the Air Force's ability to detect, warn, and defend against threats; ensure secure communications across joint force operations; and do-so within manpower and budget constraints. Some of these improvements and new functionalities have already been prototyped and demonstrated in programs involving the Air

## Sensing enables counter action before it's too late

Just as the MQ-9 is used today to establish the “pattern of life” of terrorist networks at the tactical level, the Air Force can equip Reapers with wide area surveillance sensors to provide pattern of life understanding of state activities at the operational level. In other words, the MQ-9's ability to shine a spotlight on state-sponsored activities will provide United States' decision makers detailed information needed to hold countries accountable.

This new use of the Reaper whether in combat patrols or as a greater network of aircraft becomes more important as the Air Force flags intent to reduce large, manned, and relatively expensive legacy ISR aircraft. To obtain the information needed to forestall adversarial actions, Reaper could fill the gap at a lower cost and no risk to aircrew.

National Guard, Air Combat Command, and Air Force Special Operations Command. The following sections explore the potential to use the Air Force's Reaper inventory in new and critically needed ways.

### **New Use: Wide Area Surveillance in Regions of Strategic Competition**

Russia and China are demonstrating new approaches to competing with the United States and expanding their dominance over areas along their peripheries. Their approaches exploit the time and distance challenges facing U.S. forces that must operate far from the United States. In a 2021 study aimed at informing the Biden administration's new National Defense Strategy, Mark Gunzinger and Lukas Autenried explain:

*The 2018 NDS called for the services to optimize their forces to defeat a Chinese or Russian invasion of a U.S. ally or friend before they can achieve a fait accompli. In this*

*context, a fait accompli refers to a peer adversary rapidly seizing territory before the U.S. military can effectively respond and then presenting an escalation dilemma that would coerce the United States and its allies into accepting the new status quo. Russia's rapid seizure of Crimea is a recent example of a fait accompli that, once achieved, would be extremely difficult for NATO to muster the political will and capabilities to roll back.<sup>52</sup>*

It is logical to conclude that the failure to forestall a Chinese or Russian fait accompli could have a devastating, potentially existential impact on the United States and its allies and friends. The U.S. military's challenge in this case is to sense and analyze enemy movements as early as possible and then attain a force posture needed to decisively defeat a fait accompli. The realization that the United States can detect their actions in time to forestall them is a key factor in the deterrence calculus of China, Russia, and other potential aggressors.

A related operational concept called deterrence by detection was proposed by the Center for Strategic and Budgetary Assessments (CSBA) in 2020. This concept correctly assumes an adversary must perceive clearly that its opponent has the capability and the will to inflict severe costs for an act of aggression. CSBA also asserted that effecting an adversary's decision calculus “will require an intelligence, surveillance, and reconnaissance (ISR) network composed of systems that are cost-effective, persistent, and interoperable with a broad array of allies and partners.”<sup>53</sup> This will require capabilities that can conduct long-duration surveillance operations rather than episodic monitoring missions that an enemy can predict and react to in ways that mask their actions.

Long-endurance unmanned aircraft such as MQ-9 Reapers that could host payloads of upgraded active and passive sensor technology to provide wide-area ISR data are ideal for this mission. As a non-stealthy aircraft, the Reaper is exactly what this operational concept needs to communicate the U.S. military's ability to detect force movements that are part of a gray zone operation—this could forestall a gray zone operation that is in fact a prelude to a major assault on a U.S. ally or friend. Plus, the more response time U.S. forces have, the more their time-distance disadvantage is mitigated, which may effectively deter or stall a fait accompli. Moreover, MQ-9s would have a significant cost advantage over manned ISR aircraft. Using current manned ISR aircraft to maintain a continuous ISR orbit 1,000 miles from takeoff for one year would cost 30 times more than maintaining the same orbit with MQ-9s. CSBA's analysis also shows that implementing "deterrence by detection" with multiple ISR orbits would only require 46 RPAs in the Western Pacific and another 46 RPAs in Europe.<sup>54</sup> Using modified Reapers for this mission would greatly reduce these manpower requirements and make it an even more cost-effective alternative.

Enhancing Reaper's functionality in new mission areas is not a difficult task. Podded sensor and processing capabilities are already demonstrated or at a high technology readiness level for missions such as electronic support, signals intelligence (SIGINT), and even ground and air moving target sensing (GMTI/AMTI).

### **New Use: Air and Missile Defense**

Potential adversaries across the globe noted the spectacular performance of America's airpower during Operation Desert Storm and later regional contingencies. In a 1994 RAND research brief, RADM

James A. Winnefeld Sr. asserted, "Air power had demonstrated most convincingly that—skillfully employed under the right conditions—it can neutralize, if not completely destroy, a modern army in the field."<sup>55</sup> There was no doubt that behavior anywhere on the planet that exceeded the United States' red lines could be met with a crushing response from the air within minutes or hours.

The effectiveness of U.S. networks, precision-guided munitions, stealth aircraft, and other modern weaponry during Operation Desert Storm was not ignored by China and Russia. From 1990 forward, both sought to develop capabilities and warfighting strategies that would blunt the Air Force's ability to surveil, hold at risk, or destroy targets globally. Chinese and Russian anti-access/area-denial (A2/AD) capabilities have matured over the last 30 years to the point where all the U.S. military services are now struggling to transform their thinking, forces, and overseas posture to deal with them. China continues to flex its muscles in the East and South China Seas and in proximity to Taiwan, knowing full well that most of the U.S. military's legacy fighters, bomber forces, ships, and other major weapons systems were never designed to operate under their A2/AD umbrella.

Unfortunately, DOD's strategies, plans, and programs from the early 1990s forward ignored clear evidence that China and Russia's military modernization campaigns were steadily eroding U.S. airpower advantages. This includes few efforts over the last 30 years to offset China's development of long-range strike capabilities that could severely constrain and even prevent operations from U.S. bases located throughout the Indo-Pacific region. Although DOD now acknowledges theater base defense is a major challenge and these



**Unmanned aircraft provide exactly the kind of capabilities needed to help create cost-effective defenses against these air and missile threats.**

critical nodes must be defended, progress is slow. The anemic response to this problem includes speculation that it might be better to redeploy away from some forward U.S. bases in high-risk areas rather than defend them against air and missile attacks.<sup>56</sup> The more the United States steps back, the more China projects forward. Truly restoring America's airpower advantage in the Indo-Pacific will require investment in next-generation penetrating aircraft such as the F-35 and B-21 bomber, but these aircraft must be able to operate in theater despite Chinese efforts to attack their bases and supporting logistics infrastructure.

Four events—the November 2017 North Korean ICBM missile test, the January 2018 UAV attack on Russia's Khmeimim Air Base in Syria, the September 2019 attack on the Abqaiq and Khurais oil facilities in Saudi Arabia, and the January 2020 Iranian ballistic missile attack on U.S. forces at Ain al-Asad Air Base in Iraq—were wakeup calls for the United States.<sup>57</sup> These events demonstrated the vulnerability of U.S. forward operating airbases to air and missile attacks.

This threat also stems from the global proliferation of unmanned aircraft and cruise missile technologies. These systems are often small and fly slowly and low to the ground, making them difficult to detect. Even comparatively crude UAVs and cruise missiles offer a low-cost precision strike option, making these weapons an attractive asymmetric asset for irregular proxy forces such as Hamas and the Lebanese Hezbollah, as well as other non-state actors engaged in gray zone aggression. On the opposite end of the spectrum, hypersonic glide vehicles and hypersonic cruise missiles are designed to fly at high speeds and along unpredictable,

non-ballistic flight paths to strike targets before defensive systems have a chance to react. In a March 2020 presentation in Washington, DC, Michael D. Griffin, then-undersecretary of Defense for Research and Engineering, observed that Chinese hypersonic weapons “outrun and outrange our best radars.”<sup>58</sup> For these reasons and more, the 2018 National Defense Strategy identified missile defense as a modernization priority for the U.S. defense community.<sup>59</sup>

Unmanned aircraft provide exactly the kind of capabilities needed to help create cost-effective defenses against these air and missile threats. By virtue of their long inflight dwell times, a combat patrol comprising multiple long-endurance RPAs could be a valuable means to detect and provide early warning of both low-end and high-end air and missile threats. The Missile Defense Agency (MDA) is already actively exploring using RPAs for this mission. In 2014, sensors on two MQ-9 Reapers contributed to a test of the Aegis missile defense system in which a U.S. Navy destroyer targeted a ballistic missile.<sup>60</sup> In June 2016, the MDA conducted another test where two General Atomics' Predator Bs detected and tracked a ballistic missile.<sup>61</sup> In testimony before the Senate Appropriations Committee on April 11, 2018, the director of the MDA said that the agency planned on conducting additional tests with an MQ-9 in order to understand how RPAs could contribute to boost-phase intercept tracking and “augment our existing sensor network.”<sup>62</sup>

RPAs could also serve as a first line of defense for intercepting drones and cruise missile threats. The Air Force has already conducted multiple tests in which an MQ-9 Reaper equipped with air-to-air missiles successfully downed aerial targets. In November 2017, an Air Force MQ-9 Reaper scored a direct hit on a target drone with a

heat-seeking air-to-air missile.<sup>63</sup> In a September 2020 test of the Air Force's Advanced Battle Management System (ABMS), an AIM-9X Sidewinder missile fired by an MQ-9 downed a BQM-167 Skeeter target drone that was simulating a cruise missile.<sup>64</sup> Remotely piloted aircraft equipped with medium-range high energy laser (HEL) systems could offer an additional, low-cost intercept capability. The Missile Defense Agency continues to evaluate the potential to integrate a HEL on an MQ-9 Reaper or other RPA.

A forward-operating airborne RPA combat air patrol (CAP) tasked with providing early warning and intercept capability for air and missile threats offers multiple advantages. Other capabilities include infrared search and track (IRST), signals intelligence (SIGINT), and electronic warfare (EW) jamming, as well as acting as a communications node. Compared to a similar patrol of F-35 fighters, for example, a combat air patrol (CAP) of MQ-9 Reapers equipped with sensing and shooting capabilities would be significantly more affordable in terms of their acquisition and operational costs. A study by MIT's Science Technology National Security Working Group estimated that the cost of tasking multiple F-35s to maintain a 24-hour airborne patrol against North Korean ICBM launches would be 12 to 25 times the cost of a 24-hour RPA airborne patrol.<sup>65</sup> Fuel costs alone for a single F-35 sortie would be 30 times that of an RPA sortie. Similarly, a 2018 study by CSBA found that a sortie of UAVs equipped with HELs could operate at a fraction of the cost of fighters or ground-based Patriot missile defense systems.<sup>66</sup>

Rapidly maturing directed energy technologies, along with the experimentation, demonstrations, and cost analysis discussed above, all suggest a concept of operation for a layered and integrated approach to base and area missile defense that RPAs can help enable. The MQ-9 has sufficient payload

capacity, space, and power to integrate sensors that should be components of such an airbase defense system. Long-endurance RPAs can also carry kinetic air-to-air interceptors and directed energy systems capable of killing multiple air and missile threats to our military's forward bases and forces.<sup>67</sup> The MQ-9 could and should be a key player in every one of these base defense operations.

New developments in the security environment make it clear that the ability of the U.S. military to deter threats and decisively defeat them depends on their ability to operate from forward theater bases under attack. New operating concepts and capabilities that harness the capability advantages of RPAs—including the Air Force's MQ-9 Reaper force—are needed to ensure these bases will survive an enemy's first blow to generate war-winning combat power.

### **New Use: Use in Maritime and Littoral Operations**

A U.S. joint force exercise in September 2020 offered a glimpse into a likely future scenario for the remotely piloted aircraft enterprise. During exercise "Agile Reaper" conducted at Naval Air Station Point Magu, the Air Force explored new concepts of operations for RPAs operating in a maritime or littoral environment. A group of three MQ-9 Reapers from the Air Force's 29th Attack Squadron identified targets, conducted mock airstrikes, and provided a common operating picture for air and maritime forces. By working collaboratively with elements of the Navy's Third Fleet and Marine Corps personnel, Agile Reaper demonstrated how the Air Force's RPA enterprise could also provide maritime domain awareness. In a conference with journalists after the exercise, Lt Col Brian Davis, commander of the 29th Attack Squadron, lauded the role that Reapers played in the exercise: "We've only scratched

**As the United States orients away from counterterrorism missions and toward deterring and defeating great power aggression, it will need unconventional and affordable means of detecting, identifying, tracking, exposing, and deterring aggressive gray zone activities.**

the surface of the MQ-9's capability. . . We are transitioning to an ability to generate combat airpower anywhere to include the maritime domain and we are tactically quite good at it."<sup>68</sup>

As the United States orients away from counterterrorism missions and toward deterring and defeating great power aggression, it will need unconventional and affordable means of detecting, identifying, tracking, exposing, and deterring aggressive gray zone activities. This is particularly true for gray zone activities that occur in vulnerable maritime and littoral areas. The Indo-Pacific region presents a particularly challenging environment to effectively cover due to its vastness. In the 2019 Indo-Pacific Strategy Report, the Department of Defense called for the United States to adopt a "more dynamic and distributed presence" to overcome the tyranny of distance to respond to and deter gray zone provocations.<sup>69</sup>

Although typically associated with operations over the desert and mountain terrain of the Middle East and Southwest Asia, the MQ-9 Reaper and its cadre also have a wealth of experience in maritime and littoral regions. Since the late 2000s, the U.S. Customs and Border Protection agency in partnership with the U.S. Coast Guard has flown a maritime variant of the Reaper (Predator B) along drug transit routes in the Gulf of Mexico and the Southern California coast. In 2017, General Atomics unveiled the MQ-9B SeaGuardian, a variant of the MQ-9 Reaper designed for open-water operations.<sup>70</sup> SeaGuardians can be equipped with multiple maritime surveillance sensors, including the Leonardo Sage 750 sensor

pod for locating, classifying, and tracking surface radars.<sup>71</sup>

Exercise Agile Reaper also served as a test of the Air Force's ability to rapidly deploy MQ-9s to austere locations in a maritime setting. RPAs have been deployed with minimal support personnel and infrastructure from the earliest days of Predator operations over Bosnia. For instance, in 2013 the U.S. 3rd Special Operations Squadron (SOS) deployed with the RQ-1 Predator to Niger to support France's counterterrorism operations in neighboring Mali. In a matter of weeks, the 3rd SOS established a tiny outpost consisting of a dirt foundation and plywood taxiway, enabling Predators to provide much needed ISR coverage for French forces.<sup>72</sup>

These experiences should inform future operations in maritime and littoral regions like the Indo-Pacific where U.S. forces may not always be able to count on having a large friendly air base nearby. Since the dawn of the era of airpower, central fixed airbases have been vital to the U.S. military's ability to project power, but they are becoming a limitation. In an October 2020 essay in Air Force Magazine, Lt Col Price T. Bingham argues that survivable maneuver in a near-peer conflict will require the Air Force to adopt a more flexible force posturing approach that exploits runways located throughout the world instead of centralizing its assets at a small number of massive overseas bases as it has since the Cold War.<sup>73</sup> Statements by Air Force officials suggest that this approach is correct. Speaking at the Mitchell Institute in October 2020, Gen Kenneth Wilsbach, Commander of Pacific Air Forces, observed that one of the key takeaways from the Pacific Advanced Battle Management System (ABMS) demonstration was a system that allows commanders to see detailed statistics on the status of airbases and airports in their area of operations.<sup>74</sup>

Technological enhancements that further reduce manpower forward deployed

to operate the Reaper would likewise enable operations from a more dispersed, small-footprint approach basing posture. During Agile Reaper, the Air Force tested a new deployable control system that would allow airmen to operate the MQ-9 without its standard Ground Control Station equipment.<sup>75</sup> To gain more agility, AFSOC is procuring the Portable Aircraft Control System (PACS). PACS is a suitcase-sized computer from which a ground crew can perform all preflight/postflight checks on the aircraft and start the engine. The maintenance crew can then enable the SATCOM link and hand the aircraft off for taxi and auto takeoff. This effectively eliminates the deployed ground control station. In June 2020, General Atomics Aeronautical Systems also demonstrated several enhancements to the MQ-9 Reaper's Automatic Takeoff and Landing Capability, including the ability to divert a Reaper to an airfield where a Ground Control Station is not present.<sup>76</sup> These capabilities reduce the need for brick and mortar basing infrastructure and enable a more flexible, disaggregated, and resilient approach to Reaper basing and operations.

RPAs operating in a “detect and deter” role offer multiple cost, manpower, and mission modularity advantages over manned platforms.<sup>77</sup> And, contrary to one common argument against RPAs, the fact that they are detectable and not stealthy aircraft is a benefit when they are used for the purpose of deterring malign behavior. As demonstrated in eastern Europe and Ukraine, the presence of highly visible MQ-9s signal to allies and adversaries alike that the United States is watching and is committed to a rules-based international order. Expanding the export of MQ-9s to allow true burden sharing of ISR collection is a top demand of the combatant commands.

In any future contest with China or other near peer adversary, the United States will rely on its ability to operate jointly and with foreign partners to accomplish its objectives. One of the advantages that the RPA enterprise—and the Predator and Reaper family in particular—offers is they are increasingly the aircraft of choice for America's allies and partners. Australia has already committed to acquire the MQ-9B SeaGuardian. India, Taiwan, and Japan have also expressed various interest in the MQ-9 family.<sup>78</sup> Allied continued interest in the capability, as well as the potential host of capability enhancements to the MQ-9 family, suggests the true potential for MQ-9 Reapers in the maritime and littoral domains has yet to be truly explored.

### **New Use: Communications Relays**

A communications relay is a system that connects two or more entities such as different aircraft that were not designed to communicate with each other directly—RPAs could become nodes to create relays in forward operating locations. Line of sight (LOS) communications are often a significant challenge for entities operating in locations that lack communications infrastructure like repeater towers or areas that contain natural barriers to communications like mountainous terrain. This challenge is compounded when entities are using incompatible communications systems or are operating in environments where satellite communications are inaccessible or denied by an enemy. The lack of real-time line-of-sight communications hinders the ability of commanders to communicate and direct their forces.<sup>79</sup> For example, these barriers can prevent teams of soldiers on the ground to speak to their commanders, request air support, or even communicate with supporting aircraft directly to inform them of the enemy's whereabouts. An RPA-enabled communications relay can

act like a gateway and translator for disparate entities in these situations, providing, in the words of one airman, a “Wi-Fi in the sky.”<sup>80</sup>

The U.S. Air Force and Northrop Grumman developed a system known as the Battlefield Airborne Communications Node (BACN) in response to similar communications shortfalls U.S. forces encountered in Afghanistan and Iraq in the early 2000s. The BACN is composed of a system of computer processors and communications equipment that can relay voice or data communications, provide secure communications, or convert data from one format to another.<sup>81</sup> The Air Force deployed its first E-11A aircraft equipped with a BACN system in 2009. In the following years, three other E-11As and four uninhabited EQ-4B Global Hawk RPAs were equipped with the BACN to provide essential communications to U.S. and allied forces operating in Afghanistan, Iraq, and East Africa.<sup>82</sup>

Recently the Air Force retired all of its EQ-4B Global Hawk BACN systems due to the continued underfunding of the Air Force by the DOD and the Congress.<sup>83</sup> The MQ-9 Reaper is a natural choice to host a communications relay. The Reaper’s highly modular design allows it to quickly integrate upgrades and new mission systems. This is a particularly important feature considering rapid advances in communications technologies. With long mission endurance, RPAs can provide persistent coverage over extended areas, and without an onboard crew like the E-11, the MQ-9 can be operated in areas of elevated risk without placing American airmen in jeopardy.

There are already multiple lines of effort to turn RPAs into sophisticated communications nodes adapting to networking demands at the edges of the battlespace and acting as waveform translator assets. The Air National Guard is developing a concept known as Ghost Reaper that

envisioned equipping the MQ-9 Reaper with a robust suite of intelligence and networking technologies, including the British defense contractor Ultra Electronics’ Rosetta Echo Advanced Payloads (REAP) communications relay pod.<sup>84</sup> In an August 2020 test of the REAP-1 pod, an Air National Guard MQ-9 simultaneously bridged mobile ad hoc networks (MANET) communications at extended distances and relayed full-motion video from a Raytheon Coyote UAV to command assets on the ground. Ultra Electronics is developing the REAP-2 pod that will enable 4G/LTE communications.<sup>85</sup>

In a related project, the Air Force will add a system called Stellar Relay to the MQ-9 Reaper.<sup>86</sup> An open mission system computer developed by Parry Labs, Stellar Relay is designed to turn the Reaper into an airborne data center that facilitates communications and provides high-end computing power in the form of artificial intelligence and machine learning. The Army has also tested Stellar Relay on an MQ-1C Gray Eagle RPA.<sup>87</sup>

A communications relay is one of the four primary capabilities the Marine Corps wants for its Marine Air-Ground Task Force UAS Expeditionary (MUX), a medium-altitude long-endurance UAV.<sup>88</sup> Speaking in September 2020, RADM Brian Corey, commander of the Navy’s PEO for Unmanned Aviation and Strike Weapons, emphasized the MUX must be able to provide “network data to expeditionary forces.”<sup>89</sup> The Marine Corps has already taken steps to explore how the MQ-9 can play in this scenario. A 2016 Marine Corps test demonstrated a data link could be established directly between a Predator B and ground forces.<sup>90</sup> Based on this experience and the latest advances by the Air Force in integrating a communications relay system on an MQ-9, it is little wonder that the Marine Corps acquired three MQ-9 Reapers as a bridge to the MUX.<sup>91</sup>

## **New Use: Arctic Domain Awareness**

The rise in temperatures in the Arctic in the past decade has been attended by an increase in activity as Arctic and sub-Arctic nations like Russia and China compete with the United States and its allies for trade routes, natural resources, and military access. Equipped with a small fleet of ships for Arctic missions, the U.S. Navy and

**In many ways that were perhaps unimaginable a few years ago, the Arctic encapsulates many of the unexplored applications for remotely piloted aircraft.**

Coast Guard have few ways of detecting potential threats in the polar regions. Satellite imagery of the polar regions is expensive and offers only a small window of coverage; it is too little and at too great a cost to provide sufficient warning. The combination of immense distances, low temperatures, and limited infrastructure make Arctic domain awareness missions particularly challenging.

In a lecture at a virtual conference in September 2020, former U.S. Coast Guard Commandant ADM Paul Zukunft put the issue in stark terms.<sup>92</sup> “We have significant domain awareness challenges, and that really begins in the high latitudes,” said Zukunft. “Things start to get pretty dark once you get up higher than 72 degrees north.” In one incident, Zukunft recounted, a Coast Guard cutter on patrol stumbled on a joint Russian and Chinese exercise near Kamchatka of which the U.S. intelligence community was completely unaware.

Remotely piloted aircraft are already part of the solution to improving visibility in the polar regions in ways that support military, economic, and scientific objectives. Multiple U.S. agencies including NASA, the National Oceanic Administration Agency, and the U.S. Coast Guard have explored leveraging RPAs for persistent surveillance in the Arctic. They can be equipped with measuring and detection sensors for mapping sea ice, monitoring marine traffic, evaluating infrastructure, and

surveying the impacts of a changing climate. These are vital inputs that will inform future U.S. operations in the Arctic and provide awareness of current-day activities.

Like other elements of the U.S. government, the Air Force has recently made the Arctic a priority, publishing its first Arctic Strategy document in July 2020.<sup>93</sup> The Air Force identifies multiple lines of effort in the Arctic Strategy, including improving missile defense, communications, and terrestrial weather forecasting. In many ways that were perhaps unimaginable a few years ago, the Arctic encapsulates many of the unexplored applications for remotely piloted aircraft.

Recent technological enhancements to the MQ-9 Reaper make it an attractive option for improving Arctic domain awareness. In 2016, General Atomics conducted a test of an extended-wing variant of the Reaper that increases the Reaper’s endurance from 27 to over 40 hours.<sup>94</sup> To operate in an area that is 2.5 times the size of the continental United States, this extended-range capability is essential. The MQ-9B SkyGuardian also features an Electro-expulsive Deicing System and an anti-ice heated engine inlet, two important qualities for operating in the Arctic.<sup>95</sup> Furthermore, as with dispersed basing operation in the Pacific, the Reaper’s automatic take-off and landing capability means that it can operate at more remote locations with fewer resources.

The rapidly changing dynamics in the Arctic are straining the ability of U.S. forces to keep pace with the capabilities of potential adversaries like Russia. Traditional means for improving domain awareness in the Arctic like patrol vessels and satellites are very expensive, time-consuming to produce, and cannot match the range and flexibility of air surveillance. Redirecting some of the Air Force’s Reaper capacity for this new use in the Arctic would fill a much-needed gap in Arctic domain awareness.

## **New Use: North American Air Defense Against Russian Cruise Missiles**

In March 2021 testimony before the Senate Armed Services Committee, U.S. Northern Command (USNORTHCOM) and North American Air Defense Command (NORAD) Commander Gen Glen VanHerck noted that Russia can now launch very-long-range cruise missiles from aircraft in their own airspace to strike targets in the U.S. homeland. These launches will significantly challenge the U.S. military's current missile attack warning systems. Gen VanHerck explained that the inability to detect cruise missile attacks before or at their point of launch will greatly reduce NORAD's ability to respond.<sup>96</sup>

MQ-9s can offer a radically new approach to the North American air defense mission that helps mitigate this lack of domain awareness. The Ghost

**The Ghost Reaper initiative offers a new operating concept to conduct wide area surveillance, process information at the combat edge, and warn of cruise missile attacks**

Reaper initiative offers a new operating concept to conduct wide area surveillance, process information at the combat edge, and warn of cruise missile attacks. This concept would leverage technologies and concepts within JADC2 and ABMS and accelerate their transition to address a requirement that is critical to the defense of the U.S. homeland. During periods of heightened tensions, an RPA airborne web that extends air domain awareness into the Arctic will give U.S. commanders more time to make decisions and take early actions rather than relying on the sole option of end-game missile defenses. It would also provide an airborne capability that adds resiliency to the current architecture of fixed radar sites that are more vulnerable to suppression and attacks. Ghost Reapers could also perform as a battle manager teamed with Air National Guard fighter interceptors. If armed with air-to-

air interceptors, Ghost Reapers could also bring additional firepower to the mix. From a cost-per-effect perspective, Ghost Reapers would operate at a fraction of the cost of additional manned aircraft that would be needed for these functions.

## **New Use: Defense Support of Civil Authorities**

One element of the Air Force's RPA enterprise that is often underappreciated is the role of the Air National Guard (ANG). Today, 14 Air National Guard units in 11 states conduct MQ-9 Reaper operations. Aside from contributing to a substantial number of RPA missions overseas, ANG RPA units are increasingly supporting U.S. domestic civil agencies responding to emergencies. Nowhere in the United States is this mission more apparent and urgent than in California, where the severity of the fire season grows year-by-year. Five of the largest wildfires in California's history occurred in 2020. The "August Complex" fire, the biggest in the state's history, burned over 1 million acres, twice as many as California's second largest fire.<sup>97</sup> Thousands of other wildfires throughout the state burned several million more acres and destroyed over 7,000 structures.

Remotely piloted aircraft are uniquely suited to conducting disaster response operations. The infrared sensors on the MQ-9 Reaper allow their operators to see through smoke to identify fire lines. By virtue of being uninhabited, the Reaper can fly closer and dwell for longer periods over the fires than inhabited aircraft. The Air National Guard's 163rd Attack Wing mobilized three MQ-9 Reapers in response to 2020's catastrophic wildfire season. The three aircraft flew more than 70 sorties and accumulated over 1,000 flight hours as of September 2020.<sup>98</sup> In a dramatic rescue during the Creek Fire,

an ANG-operated MQ-9 Reaper guided helicopters to safe landing spots, helping them to safely evacuate nearly 400 people.<sup>99</sup> The 163rd conducted more than twice as many operations in support of firefighting operations in 2020 than in any previous year, providing much needed situational awareness and fire mapping capabilities to firefighters on the ground.

The Air National Guard's 163rd Attack Wing was not the only RPA unit to respond. Overall, Air National Guard RPA operators from eight states volunteered to assist the 163rd Wing combat wildfires.<sup>100</sup> MQ-9 Reapers from the 432nd Wing at Creech Air Force Base in Nevada also provided imagery for firefighting efforts in the Glass, August Complex, Bear, and Zogg fires in California.<sup>101</sup> It was the first time that active-duty aircraft from the 432nd Wing contributed to a Defense Support for Civil Authorities mission.

Recent enhancements to the Reaper will make it an even more robust platform for these types of missions in the future. The Air National Guard is working with the Pentagon's Joint Artificial Intelligence Center to use artificial intelligence to reduce the amount of time it takes an MQ-9 Reaper to generate a map of the fire from six hours to 30 minutes.<sup>102</sup> In August 2020, the ANG also tested a communications relay system that could enable the Reaper to perform more command-and-control functions at fire incidents, managing data transfers and bridging communications from other firefighting aircraft and firefighters on the ground.<sup>103</sup>

In the years since the first RPA firefighting support mission in 2013, RPA operations in domestic airspace were

constrained by policies at the Department of Defense and Federal Aviation Administration.<sup>104</sup> That began to change when, in 2018, Secretary of Defense James N. Mattis delegated approval for domestic UAV missions to regional military commands.<sup>105</sup> At the same time, the ANG was making progress in developing the Ground Based Detect and Avoid Radar system to enable safe RPA operations alongside commercial air traffic in domestic airspace.<sup>106</sup> These developments—and the ANG's proven track record—helped pave the way for an expansion in MQ-9 Reaper operations in support of domestic authorities.

In terms of the scope of mission and number of sorties, the firefighting season of 2020 will be regarded as a milestone in how Air National Guard airmen and their MQ-9 Reapers can conduct disaster relief and humanitarian response missions. However, firefighting is just one area where DOD is becoming better prepared to support civil authorities. Secretary of Defense Lloyd Austin has already flagged DOD's intent to codify the nexus between climate change and the next National Defense Strategy. In a January 2021 release Austin stated, "There is little about what the Department does to defend the American people that is not affected by climate change. It is a national security issue, and we must treat it as such."<sup>107</sup> The adaptability of the Reaper will allow the Air Force and the Air National Guard to further expand the ways that it can help detect and mitigate the effects of natural disasters and other challenges that are linked to a changing climate.

## Recommendations

The Air Force planning community believes its MQ-9 Reapers will not be able to survive contested threat environments, so they must be replaced by new, more advanced systems. However, the same can be said

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for all Air Force manned ISR aircraft and 4th generation fighters. It's time for a more pragmatic assessment of budget trends and previous acquisition program track records indicates it is highly unlikely that an MQ-9 replacement will be ready in operationally viable numbers by the Air Force's proposed 2035 MQ-9 retirement target. Complications include a growing set of mission requirements, increases in the time and cost to develop clean-sheet aircraft designs, and competing demands for scarce resources. Considering the Air Force must modernize nearly every one of its other capability portfolios, the lack of budget headroom alone could see Reapers retired without a replacement. For much lower cost and less risk, the Air Force could modify its Reapers so they can perform a broader array of missions in permissive and less permissive threat environments. Variants like the Ghost Reaper are a good example. Additionally, threat environments are but one data point that should inform decisions on the Reaper force. This becomes clear after looking at how Reapers have performed the same missions as manned ISR and strike aircraft over the last 20 years for a fraction of the cost.

The following recommended actions would help inform decisions on the MQ-9 Reaper force and the potential to use it in new and innovative ways well into the future:

1. **DOD should fund and integrate a self-protection capability on the MQ-9 to enable it to operate in contested environments.** Under current operational employment tactics, techniques, and procedures, the MQ-9 is no more or less survivable than any other 4th generation aircraft. However, despite millions of hours of combat operations, the Air Force has not integrated any awareness or protective capabilities on the MQ-9A, where they have on other combat aircraft. Survivability solutions are

readily available with self-protection pods that provide MQ-9A survivability against infrared and radio frequency guided threats in contested environments. On top of being unmanned, this action will afford commanders even more risk leeway in their employment considerations as they balance collection requirements or employment options against possible loss.

2. **Congress should direct DOD to conduct a study on new uses for MQ-9 Reapers.** Before approving an end of procurement of the MQ-9 short of stated requirements, DOD should analyze the potential to use MQ-9 Reapers through 2040 in new ways that would help fill critical capability and capacity shortfalls. At the same time, the study should recommend modifications that adapt the MQ-9 to be more effective in new uses while also tailoring costs and manpower to achieve a superior cost per effect.
3. **Congress should also direct a cost-per-effect assessment.** In tandem with the previous suggestion, Congress should also direct a cost-per-effect assessment of the MQ-9 Reaper that looks at its current missions and proposed new uses through 2040 in relationship to other weapons systems. In addition to the direct cost to achieve mission effects in future battlespaces, the assessment should compare the following costs of the MQ-9 with other capability alternatives: operating and sustainment, planned product improvement capabilities, mission support resources, logistics, and personnel requirements. The assessment should also consider the increased indirect costs if the Air Force off-loads MQ-9 tasks on high-end aircraft.
4. **The Air Force should expand Air National Guard Ghost Reaper program.** The Air Force should expand the Ghost Reaper initiative to determine how it

could use its MQ-9 extended community to experiment, prototype, innovate, and otherwise bring their decades of unique RPA operational experience to bear in ways that would accelerate JADC2 and ABMS and reduce risk in their future operations. At the same time, both Congress and the National Guard should expand the inherently rapid National Guard and Reserve Equipment Appropriations funded activities to quickly integrate, test, and field innovation on the aircraft needed to adapt to new missions.

5. **USNORTHCOM and NORAD should assess the viability of an airborne network of RPAs to improve detection and engagement of Russian cruise missile attacks.** A strategic imperative exists to solve critical gaps in homeland air defense, and it begins with Arctic domain awareness. For the air domain, USNORTHCOM/NORAD should evaluate the potential of a resilient airborne network of RPAs to meet these gaps. The evaluation should leverage insights developed by the Air National Guard Ghost Reaper program.
6. **Congress and the Air Force should protect the Air Force RPA community of airmen.** Airmen, civil servants, and extended members of the MQ-9 Reaper community are critical players in the Air Force's migration toward semi-autonomous and autonomous UAVs that will also team with manned aircraft. The airmen trained and matured in the MQ-9 era are best suited to use the MQ-9 to develop and test advanced unmanned autonomy and AI technologies and capabilities, higher levels of autonomous sensing, manned-unmanned teaming, networked operations, and their associated TTPs. Congress should direct the Air Force to formulate a long-term personnel resource

plan that both cultivates and protects the Air Force RPA community from being disrupted by aircraft modernization plans and programs.

7. **The Air Force should work with the combatant commands to increase partner and ally engagement on the potential for MQ-9s to enable a range of missions that may otherwise not be possible due to budget constraints.** Each of the new uses explored in this paper have implications for increased burden sharing in critical areas of competition to include gray zone activities.

## Conclusion

Not all current MQ-9 capabilities that the Air Force considers vulnerable in contested threat environments make them obsolescent or worthy of early retirement. The Air Force's own history shows it is remarkably adept at using existing capabilities in new ways, and this often illuminates how they can accelerate leap-ahead modernization initiatives. Retiring the MQ-9 Reaper now and beginning the process to replace them in some distant future would result in a tremendous loss of capabilities that are critical to the viability of America's airpower advantage. In remarks to the Air Force's 2019 RPA Squadron of the Year presentation, Air Force Director of Operations Lt Gen Joseph Guastella asserted that the MQ-9 Reaper changed the character of warfare, and it is now time for the Reaper community of airmen to elevate their game for peer-on-peer competition. He is exactly right. The Reaper force is ready to meet the challenge if the Air Force makes the commitment and provides the resources to experiment and prototype new uses for Reaper.

Combatant commanders from the Indo-Pacific and Europe to U.S. Northern Command are asserting their critical need for more decision space as Russia and China

**The MQ-9 Reaper changed the character of warfare, and it is now time for the Reaper community of airmen to elevate their game for peer-on-peer competition.**

continue to transform their capabilities, capacity, and posture. They need capabilities that can reduce the time available to detect, analyze, and act. Persistent airborne sensing is a key component of gaining decision space to preclude a fait accompli act of aggression by China or an Arctic-based cruise missile launch from Russia. Similarly, across the gray zone competition, requirements for persistent ISR will expand U.S. decision space well ahead of a crisis-driven response.

Importantly, these requirements are not likely to be reduced due to the U.S. withdrawal from Afghanistan. Long-endurance platforms executing over-the-horizon ISR will be immediately critical to keeping watch on terrorist groups and their activities within Afghanistan. The MQ-9 is the only platform that can deliver persistent ISR and, if necessary, strike from long distances, at no risk to aircrews, with a small logistical footprint, and at the lowest cost-per-flying hour.

As the Air Force leans into an ambitious modernization flight plan for highly contested conflict, it must not forget that its RPA enterprise is much more than the aircraft it has on the ramp. After two decades of combat operations, it includes an incredibly well-trained and experienced cadre of military and civilian operators, planners, strategists, and technology experts. This community has a record of rapidly developing innovative ways to use RPAs and adapting them to meet emerging operational demands. The

Reaper community is not an obsolescing workforce. It may be the most relevant pool of warfighting talent in the Air Force. It is the human resource needed to effectively move the Air Force toward realizing its vision for manned and unmanned teaming and increasingly autonomous unmanned operations. The Air Force should take advantage of this expertise to develop new operating concepts that leverage the RPA weapon system to realize this vision. Air Force leaders must also carefully manage the RPA community to ensure its collective expertise is not lost in the rush to sacrifice old to finance new.

DOD should compare the value of fully exploiting the MQ-9 and its innovative community over the next two decades with the risks of ending its procurement short of stated requirements, eliminating the MQ-9 inventory by 2035, and choking off the weapon system's potential to do more. The facts are clear. Combatant commander demand for Reapers is growing; Reapers can help reduce the Air Force's ballooning operating costs; they can save high-end aircraft from being used up in low-end operations; and they can fill known capability shortfalls. Given these facts, the MQ-9 is not a "legacy" weapon system. Based on new missions already demonstrated and the potential of other missions explored in this study, the MQ-9 is one of the most relevant aircraft in the Air Force inventory. It must be exploited to meet ongoing and future security needs while saving billions of dollars over the next two decades—resources desperately needed for other critical and long-overdue Air Force modernization initiatives. 🌟

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