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The US Navy's use of unmanned aerial systems is increasing as the MQ-4C Triton is deployed to the fleet as its primary high-altitude, long endurance, multi-intelligence collection aircraft. In contested airspace the Triton is vulnerable to threats. This paper proposes that the US Navy implement an operating framework that enables the fleet commanders to respond to risks and protect the MQ-4C, a critical platform required in all phases of conflict.

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**TITLE:**  
**An Operating Framework to Protect US Navy Unmanned Intelligence, Surveillance, and  
Reconnaissance Platforms**

SUBMITTED IN PARTIAL FULFILLMENT  
OF THE REQUIREMENTS FOR THE DEGREE OF  
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**AUTHOR:**  
Lieutenant Commander Anthony DeJoy

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Mentor and Oral Defense Committee Member: DR. Jill Goldenziel

Approved: \_\_\_\_\_ //SIGNED//

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Oral Defense Committee Member: CDR Stephen Kelley

Approved: \_\_\_\_\_ //SIGNED//

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## Executive Summary

**Title:** An Operating Framework to Protect US Navy Unmanned Intelligence, Surveillance, and Reconnaissance Platforms

**Author:** Lieutenant Commander Anthony DeJoy, United States Navy

**Thesis:** The US Navy should implement a framework for protecting unmanned Intelligence, Surveillance, and Reconnaissance (ISR) platforms that allows the platforms to operate in threatening environments. The framework would combine the unmanned aircraft, forces for defense, and a policy that enables fleet commanders to better mitigate kinetic and non-kinetic acts against unmanned ISR aircraft in order to protect these critical, high-demand/low-density platforms during all phases of competition and conflict.

**Discussion:** The US Navy conducts intelligence, surveillance, and reconnaissance (ISR) flights to monitor potential adversaries and inform fleet commanders of the operational environment. The MQ-4C Triton is the primary unmanned aircraft that will provide US Navy fleet commanders a persistent capability to conduct ISR missions to collect multiple types of intelligence. It enables the MQ-4C ground operators the ability to fuse that intelligence in near-real-time and provide it to the fleet or units within line-of-sight of the aircraft. The US Navy requires the MQ-4C to conduct ISR missions in the geographic regions surrounding China, Russia, and Iran. In these environments, the MQ-4C is vulnerable to kinetic and non-kinetic attacks. This paper discusses why the MQ-4C is the aircraft to fulfill the maritime intelligence requirements before and during the opening phases of conflict. As a result of the characteristics of the MQ-4C, the operating environment, the threats contained within the operating environment, and critical role in enabling the preparedness of the US Navy to fight and win, the US Navy must protect this platform. This paper proposes that the US Navy implement an operating framework that enables the fleet commanders to respond to risks and protect the MQ-4C, a critical platform required in all phases of conflict. This operating framework should include three lines of effort, the first to improve the survivability of the unmanned ISR platform. The second line of effort is to integrate the MQ-4C with forces capable of decreasing the likelihood of successful kinetic and non-kinetic attacks in order to protect the aircraft. Lastly, the operating framework must include a clear policy that allows fleet commanders to protect the MQ-4C while managing operational risk.

**Conclusion:** If the US Navy implemented a framework for operating unmanned ISR platforms, it would have a much more survivable platform operating at a reduced risk of loss. The combination of a more survivable aircraft, forces for defense, and a policy that enables fleet commanders to respond to risks to unmanned ISR aircraft decrease the likelihood of a successful kinetic or non-kinetic hostile act against the MQ-4C. Persistent ISR platforms must be survivable during peacetime and in the opening phases of conflict. A clear policy enables fleet commanders to unite the unmanned platform and the forces that would provide defense, which would subsequently allow the fleet commander to respond to risks appropriately in peacetime and the early stages of a conflict.

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## *Preface*

The US Navy of the 21<sup>st</sup> Century is modernizing to meet the demands of great power competition. An unmanned aircraft, the MQ-4C Triton, will conduct the majority of intelligence, surveillance, and reconnaissance (ISR) missions for the US Navy. The US Navy requires the capabilities of the MQ-4C Triton to enable long-range, precision lethal fires to fight and win maritime conflicts in the future. In the last eight years, however, nations have shot down and jammed unmanned ISR platforms similar to the MQ-4C Triton, which demonstrate their vulnerability. The intent of this paper is not to create classified concepts of operation (CONOPS) or specific tactics, techniques, and procedures (TTP). Instead, the goal is to combine the various research related to unmanned platforms with current military guidance to inform the development and subsequent refinement of CONOPS and TTP. This paper addresses how to reduce this vulnerability through the implementation of an operating framework. The framework combines the aircraft with forces that can protect it and a policy that enables fleet commanders to respond to risks threatening the MQ-4C Triton.

This paper is the culmination of many months of research and revision. I would like to first and foremost acknowledge my wife Lindsey for the incredible support at home as I brainstormed my approach. Additionally, I would like to thank the LCSC staff for their help in reviewing my paper. Lastly, I would like to thank my mentor, Dr. Jill Goldenziel, for her guidance throughout the process, and Commander Kelley, for his help as a second reader.

## Introduction

Admiral Michael Gilday, the US Navy's Chief of Naval Operations (CNO), describes the MQ-4C Triton, and its capabilities as game-changing.<sup>1</sup> The MQ-4C Triton outperforms other US Navy unmanned intelligence, surveillance, and reconnaissance (ISR) platforms in terms of endurance, range, and multi-intelligence collection capability.<sup>2</sup> Using fused-intelligence,<sup>1</sup> MQ-4C ground operators provide targeting data that enables the employment of long-range precision weapons, which protect Sailors and Marines from fighting at a disadvantage at sea. Over the past eight years, military commanders operated unmanned ISR platforms in environments where they are vulnerable to being shot down.<sup>3</sup> In June 2019, an Iranian surface-to-air missile shot down a US Navy RQ-4 BAMS-D, the same platform on which the MQ-4C is based.<sup>4</sup>

Without targeting data from ISR platforms, the future Navy will not reach its full potential in conflicts against high-end, peer, and near-peer adversaries. The US Navy must be able to protect the MQ-4C in peacetime and the early stages of a conflict, because the conditions to assure victory on the sea are not in place during this stage of a conflict. In the geographic regions surrounding China, Russia, and Iran, where the MQ-4C is likely to operate, the platform is vulnerable to kinetic and non-kinetic hostile actions. The US Navy should implement a framework for protecting unmanned ISR platforms that allows them to operate in threatening environments. The framework would combine the unmanned aircraft, forces for defense, and a policy that enables fleet commanders to better mitigate kinetic and non-kinetic acts against unmanned ISR aircraft in order to protect these critical, high-demand/low-density platforms during all phases of competition and conflict.

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<sup>1</sup> Fused intelligence in the context of this paper, is the combination of multiple sources of intelligence, imagery, radar, signals intelligence and correlate that information to a particular ship or target of interest.

The background establishes why the US Navy requires a framework to increase the survivability of the MQ-4C and reduce risk to the platform. After establishing the high value of the MQ-4C Triton and the threats within geographic regions requiring a persistent ISR presence from the MQ-4C, this paper discusses the three components of the proposed operating framework. The three components, or lines of effort, are not sufficient individually, but together contribute to increase the survivability and reduce the risk to the MQ-4C. Combining the lines of effort creates a synergistic effect to aid in the protection of unmanned ISR platforms. All three lines of effort are required, appropriate, and feasible. Lastly, the intent of this paper is not to create concepts of operation (CONOPS) or specific tactics, techniques, and procedures (TTP) for task forces or individual units to utilize in operations. That discussion, while important, is better developed on classified systems with the key stakeholders from the relevant task forces or units informed by the framework proposed within as US Naval forces' capabilities and adversary threats change.

## Background

The MQ-4C Triton will be the most valuable unmanned ISR platform for the US Navy for several reasons. The US Navy operates several unmanned aerial systems (UAS), such as the Scan Eagle, MQ-8 Fire Scout, and RQ-21 Blackjack, but these platforms lack the range, endurance, and ability to collect multiple types of intelligence over-the-horizon within a single platform.<sup>5</sup> The aircraft's flight characteristics enable the collection of data, beyond-line-of-sight of other surface forces or fleet headquarters, which provides US Navy fleet commanders a level of situational awareness that other unmanned ISR platforms cannot provide. The MQ-4C Triton collects multiple types of intelligence and correlates those types to a single target. It collects signals intelligence and imagery intelligence, along with a multi-function active sensor (MFAS)

radar, which provides the fleet a real-time, fused, multi-intelligence maritime picture and targeting data.<sup>6</sup> The MQ-4C Triton's ability to collect intelligence at high altitude and its long endurance (more than thirty hours) gives it a range of more than twelve thousand miles, allowing it to monitor the vast maritime domain.<sup>7</sup> This unique combination of aircraft design specifications within a single platform establishes the MQ-4C Triton as the most versatile unmanned ISR platform for the US Navy. The MQ-4C can operate in the harsh maritime environment and descend through weather, withstanding lightning strikes and icing, if needed, to obtain sharp imagery of surface contacts and targets.<sup>8</sup> As a result of the game-changing capabilities of the MQ-4C, the US Navy deployed two MQ-4C to Guam to conduct missions in the western Pacific before reaching the aircraft's initial operating capability.<sup>9</sup>

In order to provide adequate targeting to support US Navy long-range fires, the Hudson Institute recommended that the US Navy vastly increase the number of MQ-4C Tritons to conduct ISR.<sup>10</sup> The cost of each aircraft is more than 180 million dollars, which constrains the US Navy's ability to purchase large quantities of the platform.<sup>11</sup> The Navy Selected Acquisition Report outlines the projected procurement by year for the MQ-4C Triton; at no time will the Navy purchase more than five MQ-4C aircraft in a single year for the life program to achieve the total amount of sixty-eight aircraft.<sup>12</sup> The aircraft's high cost, coupled with its unique capabilities, mark the MQ-4C as a high demand\low-density asset that will be highly coveted by fleet and combatant commanders. Given their limited quantity, the US Navy must protect its MQ-4C Tritons during peacetime and the early stages of conflict when fleet commanders will require persistent ISR for long-range lethal fires targeting.

The US Navy requires a persistent multi-intelligence capability for the maritime domain surrounding China, Russia, and Iran. The MQ-4C Triton provides a persistent intelligence

collection capability within a single platform designed for the maritime domain. These regions are the most challenging due to the unique geographic characteristics, the nature of targets requiring collection, and the layered threat to unmanned aircraft contained within them. The geographic regions surrounding each country stress the ability of the MQ-4C Triton to provide a persistent maritime picture to the fleets of the US Navy. China's maritime border transitions into an expansive area that contains the most significant naval force in the region.<sup>13</sup> China is capable of launching kinetic and non-kinetic weapons from multiple domains that can disrupt or destroy the MQ-4C and the means to control the aircraft as it monitors the region.<sup>14</sup> The geographic areas surrounding Russia and Iran are challenging environments as well because sovereign airspace constrains where the MQ-4C can operate in international airspace in accordance with international law. In that constrained international airspace, the MQ-4C Triton conducts ISR missions to collect difficult-to-detect targets in the vicinity of Russia and Iran within the range of kinetic and non-kinetic weapons systems.

The MQ-4C Triton operates at high-altitude to reduce its vulnerability to threats. The operating altitude of the MQ-4C is between 50,000 and 65,000 feet.<sup>15</sup> This altitude is sufficient for defense against low altitude surface-to-air missiles. However, it is insufficient for defense against most higher-altitude surface-to-air missile systems utilized by China, Russia, and Iran that can easily reach 90,000 ft.<sup>16</sup> For example, in June 2019, an Iranian surface-to-air missile shot down a US Navy RQ-4 BAMS-D, the same platform upon which the MQ-4C is based.<sup>17</sup> Many articles suggest that the shoot down demonstrates the problem with the vulnerability of unmanned aircraft like the RQ-4 and MQ-4. Political scientist Michael Horowitz states that these drones cannot defend themselves but are too costly not to defend and ineffective in contested airspace.<sup>18</sup> Chinese, Russian, and Iranian weapon systems can disrupt or destroy the MQ-4C

Triton as they have against similar unmanned ISR platforms.<sup>19</sup> Given the high cost and tremendous utility of the MQ-4C Triton and the challenging environment in which it operates, the US Navy must protect it.

### Discussion

To protect the MQ-4C Triton, the US Navy should implement an operating framework that increases its survivability and reduces the risk of loss for the unmanned ISR platform. This operating framework should comprise three lines of effort. The first line of effort is to improve the survivability of the MQ-4C Triton. An MQ-4C Triton that is more survivable is one that has increased its effectiveness and improved its operating characteristics. The second line of effort is to integrate the MQ-4C with forces capable of protecting the aircraft by denying the adversary an easy path to conduct kinetic and non-kinetic attacks. This line of effort provides forces to protect against adversary kinetic and non-kinetic actions by making them unlikely to succeed. Lastly, national command authority must clarify what actions against unmanned aerial systems by adversaries are unacceptable to the United States government in order to establish American views of predictable and acceptable behavior towards UAS. Unclassified sources indicate that current U.S. policy does not distinguish a clear difference between manned and unmanned aircraft, which then affects the actions commanders can take, consistent with the rules of engagement to protect UAS.<sup>20</sup> Any potential operating framework must include a policy that makes adversaries aware that the United States will protect its UAS against threats and potentially respond to hostile acts against unmanned platforms within a whole-of-government approach. Each line of effort individually is insufficient in aiding the protection of unmanned ISR platforms, but combined they create a synergistic effect to aid in the protection of unmanned ISR platforms.

## **Line of Effort One – Improving the Survivability of the MQ-4C Triton**

### Increase the Effectiveness of the MQ-4C

The US Navy should increase the effectiveness of the MQ-4C Triton intelligence collection capabilities to make the aircraft more survivable. In the 2014 Joint Force 2020 ISR white paper, the Chairman of the Joint Chiefs of Staff states that ISR capabilities will be survivable in a range of environments.<sup>21</sup> Survivable ISR platforms, according to the white paper, have “longer-range active and passive sensors.”<sup>22</sup> As an example, for the MQ-4C to be survivable in the geographic region surrounding China, improvements to the active and passive sensors would allow the aircraft to survey the maritime domain and detect signals more quickly while tracking targets of interest further away from the coastline and kinetic threats.

The MQ-4C capabilities are well suited to collect most military radars and communication signals. These signals emit at high levels of power to compensate for radio signal range-losses and the cluttered noise environments.<sup>23</sup> Radar and radio signal range-losses are inversely proportional to a multiple of their range and impacted by the noise environment. Typically, these factors contribute to the requirement for radar to have high power output; however, that is not always the case, if the unique signal operates at low peak power, which complicates detection at higher ranges.<sup>24</sup> More effective sensors allow the MQ-4C Triton to sense unique signals emanating from surface vessels which, typically go undetected. The next upgrade for the MQ-4C is the addition of sensors to collect specific parameters of high-interest signals.<sup>25</sup> Also, unique signals associated with surface vessels that operate in a similar frequency range of commercial navigation radars (3GHz, 5GHz, and 9GHz) can interfere with detection by the MQ-4C at longer ranges.<sup>26</sup> The US Navy should continue to improve the sensors of the MQ-4C to survey the maritime domain while minimizing the time it is in a range of threats. The US

Air Force upgraded the sensors onboard the RQ-4 Global Hawk several times to improve effectiveness in passive signal detection, and the US Navy should require the same continued improvements for the maritime domain.<sup>27</sup>

Improved passive and active sensors that increase the effectiveness of the MQ-4C by maximizing the aircraft's most valuable defensive characteristic: the altitude at which the aircraft conducts its search. While the MQ-4C Triton does have the ability to descend and ascend through cloud layers to obtain sharp imagery, there are significantly more threats to the aircraft at lower altitudes. The MQ-4C can conduct a more effective search and be more survivable if it can remain at high altitudes utilizing the MFAS radar's Inverse Synthetic Aperture Radar (ISAR), Automatic Identification System (AIS) and the AN/DAS-3 electro-optical/infrared sensor turret.<sup>28</sup> As the US Navy procures additional MQ-4Cs, improving the range of MFAS radar and utilizing the more advanced AN/DAS-4 turret would allow the MQ-4C to be more effective at higher altitudes.<sup>29</sup> A report from the Hudson Institute analyzed the time difference of conducting a broad area search of ocean visually at different altitudes.<sup>30</sup> The report conducted their analysis per the 2018 NDAA to consider distributed combat operations in a satellite denied environment.<sup>31</sup> It found that the higher altitude aircraft search reduced the required search time by more than 30%, over 12 hours.<sup>32</sup> The scenario in the report did assume ideal conditions, without the MQ-4C having an effective search plan or multiple sensors to conduct its search. However, the takeaway is clear that the higher the altitude the MQ-4C can operate and optimize its long-range sensors, the more effective and survivable it is in the environment surrounding China. Longer-range active and passive sensors do enable the MQ-4C Triton to maneuver outside of various threats surrounding China. Improved sensors on the MQ-4C Triton also allow the aircraft to survey the maritime domain of geographically constrained areas quickly. The

Arabian Gulf near Iran and the Baltic Sea near Russia are geographically constrained. Thus, the Triton can survey those areas quickly, but are unable to increase the distance from the threat, and remain in international airspace.

#### Improve the flight characteristics of the MQ-4C

The US Navy should improve the flight characteristics of the MQ-4C Triton to increase the difficulty of targeting by adversaries. The design of the MQ-4C Triton is optimal for high-altitude, long-endurance intelligence collection in the maritime domain, which is a predictable and easy-to-target platform by the air defense systems of China, Russia, and Iran. The Navy should modify the MQ-4C flight characteristics to trade some endurance for handling and performance. As referenced previously, the US Navy is slowly procuring the fleet of aircraft towards an end strength of sixty-eight aircraft.<sup>33</sup> The US Navy should seek to procure the remaining fleet of MQ-4C Tritons with the most capable airframe design and engine performance in order to frustrate adversaries with a more challenging to target platform than the current planned MQ-4C Triton. In 2016, Northrup Grumman made modifications to increase the turbine inlet temperature, resulting in an increased climb rate without sacrificing endurance of the US Air Force Block 30 and 40 upgrades to the RQ-4.<sup>34</sup> For the MQ-4C Triton, the US Navy can be proactive in minimizing the disparity between adversary weapons systems and the flight characteristics of the MQ-4C to increase the survivability of the aircraft.

#### Managing the MQ-4C Detectability

Another approach that the US Navy should implement is the managing of detectable signals emanating from the MQ-4C Triton to reduce the adversary's ability to detect the aircraft. The MQ-4C is not a stealth aircraft, nor is it camouflaged, so any adversary radar designed to locate

and track aircraft will detect the MQ-4C. Any adversary aircraft might locate the MQ-4C Triton if they are within visual range of each other. Additionally, the MQ-4C transmits several detectable signals. The MFAS radar, the GPS, and communication uplinks all are detectable to sensors but are required for the MQ-4C to be an effective maritime search platform.

The US Navy should seek continual improvement of the survivability of the current MQ-4C platform because it is the best suited unmanned ISR platform for the maritime domain and explore mitigating the ways the MQ-4C Triton is detectable to adversaries. Kelley Saylor, an associate fellow of the *Center for New American Security*, takes an alternate view and argues that, while the MQ-4C is useful in peacetime, it is too vulnerable in a war.<sup>35</sup> Saylor goes on to recommend that the United States should invest in stealthy, high-altitude, long-endurance unmanned ISR platforms for use in war.<sup>36</sup> She argues for these stealthy aircraft because they can provide an intelligence collection capability while avoiding adversary detection.<sup>37</sup> Stealth technology is a tremendous capability that allows a variety of aircraft to operate with a reduced radar cross-section. However, Saylor does not consider all of the capabilities that are required to conduct maritime ISR missions. For the MQ-4C Triton to be an effective maritime ISR platform, it must emit detectable signals to locate high-value targets of interest accurately or act as a communications relay.<sup>38</sup> This requirement to transmit negates the costly advantages that stealth capabilities provide.

The US Navy must attempt to manage all of the ways an adversary could detect and target an MQ-4C. The MQ-4C should utilize a variety of signals that frequently change and are more difficult to disrupt as well as ensuring future compatibility with NTS-3 GPS satellites that are more resistant to jamming.<sup>39</sup> If adversaries attempted to disrupt the MQ-4C GPS or primary communication links, they first would be required to devote additional resources to ascertain

what signals are in use and then attempt to disrupt those signals and their alternatives. The MQ-4C remains an aircraft vulnerable to detection and targeting. However, by modifying the aircraft with a focus on survivability as well as intelligence collection, it can manage the detection of its signals.

This line of effort improves the survivability of the MQ-4C Triton by focusing on making the aircraft more efficient, with better flight characteristics, and less detectable to adversaries for targeting. The MQ-4C Triton remains vulnerable to a certain extent regardless of efforts to make it more survivable as adversaries continue to develop technology that could threaten the MQ-4C during its 20-year lifespan.<sup>40</sup>

#### **Line of Effort Two - Operate the MQ-4C Triton with forces that can protect it**

The US Navy currently uses the MQ-4C Triton to conduct patrols individually, not integrated with other forces. The US Navy should operate the MQ-4C Triton with forces that can make it more difficult for adversaries to target and attack the unmanned ISR platform. When forces are present in an operating environment to protect the MQ-4C, adversaries become aware of the presence of protective forces. An adversary would be less inclined to take hostile action against the MQ-4C Triton in the presence of US protective forces.

An example of the United States reacting to a hostile act against a UAS with protective assets occurred in 2012. An Iranian SU-25 fighter aircraft attempted to shoot down an American UAS near the Strait of Hormuz.<sup>41</sup> In the aftermath of this attempted attack, Secretary of Defense Leon Panetta and the Commander of US Central Command, General James Mattis, had to decide whether to protect future unmanned ISR missions to ensure that Tehran did not assume it had

carte blanche to attack American assets.<sup>42</sup> In his memoir, Secretary Panetta describes the problem:

Was this a deliberate act of war by Iran or the foolish work of a rogue pilot? Without knowing the answer to that question, we also faced a second: Should we fly the routine mission again—it occurred every few days—or call it off? If we did fly, and the drone was shot down, we'd be in an explosive situation with Iran. If we didn't, we'd effectively be acquiescing to Iran's unwarranted attack. The last thing we needed was for Iran to conclude that it could shoot at us with impunity. Within hours, the matter was being hotly discussed inside the Pentagon and across the river at the White House. Some officials wanted us to fly again. Others said we should back off and reassess our rule of engagement. One underlying issue was the Predator itself. Should we regard it as the equivalent of an American airplane or ship, and thus defend it as we would any other military asset? Or, recognizing that it's an unmanned device, should we treat it as something less vital and less in need of defense?<sup>43</sup>

The decision was to protect the unmanned platform with fighter aircraft, and issue a *démarche* to Iran that the fighters will defend the unmanned aircraft.<sup>44</sup> Operating UAS with other platforms that are capable of defending them makes any attempt to attack less likely to succeed, thereby improving the survivability of the platform. This message to Iran that the United States would defend its aircraft would not have had the same desired effect if there were not forces present to reduce the likelihood of a successful Iranian attack.

The threats that can attack the MQ-4C Triton in the current and future geographic operating environments are diverse, which highlights the need for an equally diverse group of forces available and capable of operating with the aircraft in order to protect it. In the example of the Iranian Su-25, the threat was very apparent in the form of bullets caught on camera flying towards the aircraft.<sup>45</sup> A fighter aircraft, operating alongside or in the vicinity of it, is also able to discern an approaching adversary aircraft initiating hostile actions that would disrupt or destroy the unmanned platform. It was an appropriate force able to conduct the mission of defense against a conventional air threat in the Arabian Gulf.

However, in other geographic regions where the MQ-4C will operate, airbases housing fighter aircraft to conduct high-value airborne asset protection (HVAA-P) are not always available. To protect against conventional threats from the surface and air against the MQ-4C Triton, the US Navy should utilize its area air defense assets to support of ISR operations, just as a surface unit would protect any high-value target from likely subsurface, surface, or air threats. These forces could be surface action groups or independently operating surface vessels able to conduct area air defense. They can conduct surface patrols of sufficient duration to remain postured to make any potential attacks unlikely or unfeasible. A forward operating base with ground-based air defense capability could protect the MQ-4C Triton as well. A base neither has to transit off station for replenishment nor return to an aircraft carrier or airbase the way a fighter would. Whatever force or forces a fleet commander allocates to operate with the MQ-4C Triton to protect it, it must be capable of sufficiently denying the adversary an available opportunity to succeed in a conventional attack against the ISR platform.

The force, or group of forces, that would operate with the MQ-4C Triton to protect it from non-kinetic threats must also be diverse in capability, able to detect non-kinetic attacks and integrate with the MQ-4C Triton. An attack against the navigation systems onboard an MQ-4C could crash the aircraft or create confusion for the operators managing the mission. From the MQ-4C operator's perspective, he or she may be inputting the correct guidance to keep the MQ-4C on course. However, from the perspective of a ship operator, tracking the Triton navigational track via Link-16 and SPY-1 radar, or from a fighter pilot providing HVAA-P, tracking the Triton visually, via Link-16, or with an APG-77 radar, the MQ-4C may be experiencing a significant degradation in navigational control. An adversary would be legally justified to take kinetic action if the MQ-4C entered into the airspace above their territorial waters, in violation of

the Law of the Sea.<sup>46</sup> The source of the navigation error, a non-kinetic attack, may go undetected, and the adversary's actions remain non-attributable. These types of attacks add complexity to the task of protecting the MQ-4C because the forces assigned to protect the ISR platform may or may not have the entire understanding of the tactical environment. In the scenario, the fighter and ship both are unaware of such an attack. If the fighter or ship work together with the MQ-4C Triton, the aviator, or ship operator, can coordinate with the MQ-4C operator to ensure that the correct actions blunt the effects of a non-kinetic attack. The protecting forces can search for indications of jamming, locate the source, attribute the attack to the adversary, and prevent confusion to the cause of the event.

A lack of integration between forces required to protect the MQ-4C Triton from a non-kinetic attack creates confusion for the protecting force. Consider a vignette in a September 2019 issue of *United States Naval Institute Proceedings*, by Lieutenant (junior grade) Beicter that highlights the challenges protecting forces must overcome to be effective in making an adversary attack less likely to succeed:

A US Triton UAV is operating over the Black Sea while a US Navy destroyer is conducting a normal patrol. The ship is tracking a Russian frigate that has been shadowing it but never closing nearer than 25 nm. Without warning, the destroyer detects a SAM launch from the frigate, and the Triton is destroyed. The Russian ship then eases aggression, turns away, and departs the area; there is never any real danger to the ship...What if the UAV had crashed with no perceptible cause while a Russian frigate was nearby? Perhaps it was electronically attacked by the Russian, or perhaps it suffered an internal failure. How does the destroyer's commanding officer know which is the case and how to craft his or her response as a result?<sup>47</sup>

In this example, the MQ-4C Triton and the US destroyer were not operating in an integrated manner, which created confusion for the destroyer's commanding officer on the cause of the MQ-4C Triton loss. The author highlights a clear cause of an attack in one scenario and an unclear cause in the other scenario.<sup>48</sup>

If the destroyer's mission *was* integrated with the MQ-4C Triton's to protect it, the destroyer commander would understand potential threats to the MQ-4C, be able to discern the cause of an attack, and be better-postured to take measures to protect the Triton against potential threats. Were the destroyer commanding officer and the Triton mission commanders to operate together, both could plan a scheme of maneuver to mitigate potential threats and develop a communications plan to maintain an awareness of any potential internal failures. From a broad perspective, any forces protecting the MQ-4C must understand the threats to the MQ-4C and communicate to ensure that the protection provided is successful. US Navy fleet commanders must not only allocate forces to protect the MQ-4C Triton, but also ensure the ISR platform and the protecting forces can work together to achieve their objectives.

Forces that protect the MQ-4C Triton must successfully integrate by coordinating prior beforehand and ensure interoperability. Typically, US Navy fleets organize their forces by warfare specialty and coordinate together when missions require interoperability.<sup>49</sup> To successfully integrate the MQ-4C Triton missions for protection, the maritime patrol task force commander would conduct coordination with the tactical commander of whatever force or forces are protecting the MQ-4C. Coordination becomes increasingly complicated when location, service, and warfare specialty separate the commanders. Established doctrine helps alleviate the challenges of coordination because it builds a shared understanding between different forces. In the March 2019 volume of *United States Naval Institute Proceedings*, LCDR Dave Barnhill wrote an article advocating for naval doctrine on the tactical employment of maritime UAS.<sup>50</sup> He argues that the limitations of UAS and the absence of doctrine lead to selective employment of the systems.<sup>51</sup> Barnhill concludes that the gap in guidance at the operational level and lack of tactical-level doctrine prevents manned and unmanned systems from reaching their full

potential.<sup>52</sup> While Barnhill's focus is on the establishment of doctrine, fleets must ensure that manned and unmanned forces integrate to achieve their objectives to protect the MQ-4C, whether there is a doctrine or in the absence of doctrine. This line of effort unites the MQ-4C Triton with forces that can protect it. However, in order to be successful in this mission, the fleet must combine the right forces, with the right composition, and ensure they integrate with the MQ-4C Triton.

### **Line of Effort Three – A Clear policy to enable the fleet commanders**

In order to establish clearly-defined red lines, U.S. policy makers must clarify what actions against unmanned aerial systems are unacceptable. Based on unclassified research, current U.S. policy does not draw a clear distinction between manned and unmanned aircraft. Researchers John Schaus and Kaitlyn Johnson at the Center for Strategic and International Studies (CSIS), examined the issue of UAS influence on conflict escalation dynamics in August 2018.<sup>53</sup> Schaus and Johnson studied actual military incidents involving American UAS as well as plausible scenarios and discovered a discrepancy in US policy and practice.<sup>54</sup>

As Johnson and Schaus describe, current U.S. policy draws no clear distinctions between manned and unmanned aircraft. Thus, under the current policy, UAS retain the same privileges (e.g., the right to operate unfettered in international airspace) and immunities (e.g., exempt from search and inspection without the consent of the aircraft commander) as other military aircraft.<sup>55</sup> Over the course of interviews conducted by Johnson and Schaus, former high-level government civilians and retired military officers asserted that they would employ UAS in the same manner as manned aircraft. That said, these same officials also admitted that they favored UAS employment in high-risk missions, as the consequences of losing a UAS are lesser than those associated with the loss of a manned aircraft.<sup>56</sup> An example of such a high risk mission is using a

UAS to conduct ISR near disputed international airspace where a foreign power has the capability and capacity to respond. If this foreign power conducted a show of force against the unmanned system, its operators may not feel threatened by the foreign power's actions, since no American lives are at risk, and would thus continue the mission.<sup>57</sup> This limits the foreign power's response options against the UAS to potentially hostile kinetic actions.<sup>58</sup>

If the tables were turned in this scenario, and a foreign power was operating a UAS near sensitive US installations, these same former high-level government civilians and retired military officers assert that they would take similar action if threatened by a foreign UAS, but would abstain from taking action against a manned platform.<sup>59</sup> This assertion runs contrary to the US policy that UAS and manned platforms are afforded the same rights and privileges. Schaus and Johnson conclude the gap between concepts of UAS use and the practice of employment of UAS differ from manned aircraft, potentially creating uncertainty in how the United States and adversaries perceive attacks against unmanned aerial systems.<sup>60</sup> Closing this gap in policy and practice helps limit the loss of the Triton.

The United States must clearly and publicly communicate that it will protect its UAS against hostile actions. Such a declaratory policy establishes clear red lines to potential adversaries and ensures that potential adversaries possess an understanding of the consequences of aggressive action towards American UAS, such as the MQ-4C. It is important to note that these consequences need not be kinetic in nature; they could result from the targeted use of the non-military instruments of national power. This would ensure that American policy makers avoid painting themselves into a corner and retain a wide menu of responses that could be carefully tailored towards a specific adversary. By establishing a policy that clarifies the protection of UAS, the United States can develop clear rules of engagement and steps for forces

protecting UAS in the event of hostile action. The steps that forces can take in the protection of UAS would be somewhat situation-dependent based on the nature of the attack and context in which it occurred. The clarification of policy signals to adversaries what acceptable actions towards UAS are within the operating environment. When paired with forces that can protect the UAS, declaring what is acceptable/what is not acceptable behavior can deter hostile action because the forces lend credibility. The United States must declare what is acceptable and unacceptable to make adversaries and the public aware that UAS are valuable and will be protected.

The presence of UAS raises the potential for escalation because a gap in policy and practice currently exists in acceptable actions towards UAS. The Center for Naval Analysis (CNA) studied the impact of unmanned systems on escalation dynamics in 2017, to better understand how current unmanned systems affect state-on-state competition in the maritime domain during shaping and deterrence operations.<sup>61</sup> CNA's study explained that unmanned systems are distinct from manned systems in three areas: the first is the reliance on remote communications and autonomy; the second is that the lack of manning influences the acceptable level of risk during employment and willingness to protect systems.<sup>62</sup> The study argues that the third distinction is that UAS capabilities of persistence and endurance enable new missions.<sup>63</sup> The study then found that unmanned systems, like the MQ-4C Triton, can increase the potential for deliberate escalation because of the low risk to personnel.<sup>64</sup> The potential for escalation can increase inadvertently because of a lack of operating norms.<sup>65</sup> The accidental escalation between states can also occur because of a lack of experience with new technology or failure of technology.

Additionally, the study argues that operators of the UAS may not understand the theater commander's intent and inadvertently operate the system in an escalatory manner without sufficient oversight because, as in the case of the MQ-4C, the operators control it from well outside the theater.<sup>66</sup> If the unmanned system were to require recovery, the concern over the loss of unique, sensitive technology could increase the potential for escalation between nations as well.<sup>67</sup> A potential adversary might take more risks to salvage advanced technology without a requirement to recover a non-existent downed aviator. The possibility of escalation between nations as a result of a successful hostile action may increase when unmanned systems are present.

The proposed policy emphasizes protection against an attack versus the response to an attack on a UAS. The potential for escalation is present when UASs are involved, and as such, commanders must take action to prevent a successful attack. In each situation, policymakers and commanders typically consider many factors to respond to a military event with an appropriate proportional response guided by policy, which may escalate or not escalate the situation. In the case of the successful shoot down of the US Navy RQ-4 by Iran in June 2019, the United States planned a retaliatory military strike on the facilities responsible for the attack. The planned strike would have had collateral damage totaling approximately 150 people dead if the President did not cancel the strike.<sup>68</sup> In an interview, the day following the cancellation, President Donald Trump stated that the unmanned component of the aircraft was a big factor in determining his response to the attack.<sup>69</sup> President Trump prepared to conduct the strike but canceled the strike at the last minute. He stated that the cancelation was due to the retaliatory strike not being proportionate.<sup>70</sup> During the interview, the President stated that the United States' response to an attack is always going to be very strong.<sup>71</sup> This response is very good from a strategic level

because the United States is affirming a response to hostile attacks. The United States would later respond to the shoot down with a cyberattack against Iran.<sup>72</sup> It remains unclear if the President's statements affirm a clear distinction in defense of manned and unmanned systems for future UAS operations. Had the President or policymakers established a clear policy on the protection and prevention of hostile acts against UAS, the military could have allocated forces to reduce the likelihood of a successful attack against the UAS in this incident. It is also important to understand that contextually this entire event occurred amid powerful economic sanctions against Iran from the United States.<sup>73</sup> The presence of forces might not have prevented a successful attack if Iran were determined to demonstrate military strength under the weight of sanctions.

Without a clear policy establishing normal reactions to UAS, adversaries may perceive the United States' response as too strong, leading to escalation, or too weak, inviting further hostile actions. When considering preventing an attack versus responding to an attack, it is better to prevent an attack than respond to a successful attack that results in a loss of operational capability and might be escalatory. Thus, the benefits of having a clear, articulated policy outweigh the risks.

### **Implement Each Line of Effort**

To protect the MQ-4C, the Navy must implement all three lines of effort: improving the MQ-4C Triton, operating the Triton with forces that can protect it, and a policy that clarifies unacceptable actions against UAS that the United States will prevent. Each line of effort taken individually produces a negligible effect on the desired endstate to protect the MQ-4C. Improving the MQ-4C without forces defending against kinetic and non-kinetic acts does not reduce the risk to the Triton. Allocating forces for protection without addressing acceptable

behavior in UAS operations do not allow fleet commanders to manage operational risk. Lastly, establishing norms for UAS operation and protection without allocating forces causes adversaries to question the credibility of those norms. The US Navy must implement each component of the proposed operating framework for a synergistic effect.

### **Additional implications**

The approach proposed in this paper is focused on the MQ-4C Triton, but can apply, with modifications, to other non-stealth unmanned systems that the U.S. Navy is developing for the maritime domain. In 2016, China seized an unmanned underwater vehicle under the pretext of it being a hazard to navigation.<sup>74</sup> The US Navy requested 30 million dollars for two additional unmanned surface vehicles in the proposed budget for the fiscal year 2021.<sup>75</sup> Implementing the proposed framework protects this significant investment from adversary actions to disrupt or destroy these unmanned vehicles. The presence of forces that can protect the unmanned surface or underwater vehicles reduces an adversaries' inclination to attempt a hostile act. Also, declaring acceptable behavior for all unmanned systems clarifies what actions against them are also unacceptable. US Navy leadership in Europe is advocating for a variant of the MQ-25, a carrier-based UAS designed to conduct inflight refueling, also to conduct ISR.<sup>76</sup> The proposed framework adapted for the MQ-25 improves the survivability as well for this unarmed, non-stealth UAS. The framework proposed in this paper to protect the MQ-4C Triton can thus apply, with adaptations, to protecting a variety of unmanned maritime systems.

### **Counterarguments**

The US Navy might resist implementing the proposed framework entirely or partially, because the implementation diverts resources away from other operations, actions, and activities within

the US Navy. The US Navy is constrained by physical and budgetary resources to carry out its mission. The amount of money required to build the new advanced classes of ships, aircraft carriers, and submarines far exceeds the cost of the MQ-4C Triton. Allocating budgetary resources towards improving the Triton might detract from these new multi-mission platforms.

Resources are an important issue when evaluating the feasibility of the proposed framework. The US Navy does operate in a resource-constrained environment. However, the proposed framework to protect the MQ-4C does not detract from or siphon away resources. ISR platforms are a force multiplier, providing situational awareness and targeting data to the fleet. The proposed framework amplifies the resources the Navy already has. The Navy must ensure the MQ-4C Triton remains in the fleet, to maximize the capabilities of the fleet. The forces that can protect the MQ-4C are also increasing within the Navy. The surface Navy continues to pursue rapid procurement of the FFG (X) class frigate, and increase the lethality of the surface fleet.<sup>77</sup> The result is more forces available to integrate and protect the MQ-4C Triton, freeing up resources to conduct other naval missions.

The US Navy might also resist implementing the proposed framework because an attack or an attempted attack on a UAS might force the United States to have to take escalatory action. An adversary attack against the MQ-4C Triton with a manned platform might demonstrate that the approach is ineffective as a result of the protecting forces not taking action that results in loss of life.

The risk of escalation is a significant concern when protecting all naval platforms, including the MQ-4C Triton. Despite the potential for escalation when UAS are present, the United States should still pursue policies and actions to protect UAS from adversary hostilities because of the cost of the MQ-4C Triton and the valuable ISR it provides. The cost of each

aircraft is a significant investment by taxpayers. The US Navy should protect that investment from hostile action. Protecting the Triton preserves the game-changing capabilities that provide valuable ISR. The proposed framework does not compel a response even if an attack is successful. Instead, the United States retains the right to respond, thereby controlling the risk of escalation.

### **Conclusion**

The implementation of a framework for operating unmanned ISR platforms in the US Navy strengthens the operational effectiveness of the US Navy. Persistent ISR platforms must be survivable during peacetime and in the opening phases of conflict until the US Navy dominates the maritime domain. Each aspect of the operating framework requires the others to work synergistically. The platforms themselves must become less vulnerable to adversary targeting systems. The forces that provide for the defense of unmanned ISR platforms must be capable of protecting and integrating with the unmanned platform. A clear policy enables fleet commanders to unite the UAS with forces to provide defense, which would subsequently allow the fleet commander to respond to risks appropriately in peacetime and the early stages of a conflict. In the future Navy, MQ-4C Tritons will provide the predominance of intelligence to commanders. The US Navy must operate its unmanned ISR platforms like a boxer using an active defense. A boxer with an active defense is in control of what happens in the ring. Instead of waiting to be hit, the boxer is bobbing and weaving constantly. The Navy should be in control of its ring; to fail to do so would risk being hit by the adversary, a risk the future Navy can ill afford to take.

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