THE FIGHT ON THE HOMEFRONT: THE U.S. NAVY'S UNMANNED SYSTEMS AND HOMELAND DEFENSE

Arlowe, Thomas B.

Monterey, CA; Naval Postgraduate School

NAVAL POSTGRADUATE SCHOOL

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THE FIGHT ON THE HOMEFRONT: THE U.S. NAVY'S UNMANNED SYSTEMS AND HOMELAND DEFENSE

by

Thomas B. Arlowe

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Thesis Advisor: Erik J. Dahl
Second Reader: James A. Russell

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The U.S. Navy is a force that provides deterrence with a forward presence around the globe. The advancement of technology and the rise of strategic competitors have shifted the dynamics of military operations, which can challenge the forward presence of the U.S. Navy. This challenge can threaten the U.S. homeland, while the focus of military strategy is to maintain forces abroad. To secure the homeland, this thesis argues that the U.S. Navy can innovate and make greater use of unmanned systems. Unmanned systems will be an aspect of the fleet's force design soon, and their integration is critical for the future of naval operations. The Navy is currently developing and testing unmanned aerial vehicles (UAV), unmanned surface vehicles (USV), and unmanned underwater vehicles (UUV) to augment the fleet and increase its capabilities. These systems can enhance the U.S. Navy's ability to defend the homeland through the following mission areas: intelligence, surveillance, and reconnaissance (ISR), maritime security, anti-surface warfare (ASuW), anti-submarine warfare (ASW), and mine countermeasures (MCM).

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THE FIGHT ON THE HOMEFRONT: THE U.S. NAVY'S UNMANNED SYSTEMS AND HOMELAND DEFENSE

Thomas B. Arlowe
Lieutenant, United States Navy
BS, Ball State University, 2015

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Approved by: Erik J. Dahl
Advisor

James A. Russell
Second Reader

Afshon P. Ostovar
Associate Chair for Research
Department of National Security Affairs

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ABSTRACT

The U.S. Navy is a force that provides deterrence with a forward presence around the globe. The advancement of technology and the rise of strategic competitors have shifted the dynamics of military operations, which can challenge the forward presence of the U.S. Navy. This challenge can threaten the U.S. homeland, while the focus of military strategy is to maintain forces abroad. To secure the homeland, this thesis argues that the U.S. Navy can innovate and make greater use of unmanned systems. Unmanned systems will be an aspect of the fleet's force design soon, and their integration is critical for the future of naval operations. The Navy is currently developing and testing unmanned aerial vehicles (UAV), unmanned surface vehicles (USV), and unmanned underwater vehicles (UUV) to augment the fleet and increase its capabilities. These systems can enhance the U.S. Navy's ability to defend the homeland through the following mission areas: intelligence, surveillance, and reconnaissance (ISR), maritime security, anti-surface warfare (ASuW), anti-submarine warfare (ASW), and mine countermeasures (MCM).

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LIST OF ACRONYMS AND ABBREVIATIONS

AOA	amphibious objective area
ARG	amphibious ready group
ASCM	anti-ship cruise missile
ASuW	anti-surface warfare
ASW	anti-submarine warfare
CNO	Chief of Naval Operations
COBRA	coastal battlefield reconnaissance
COLREG	Convention on the International Regulations for Prevention of Collisions at Sea
CONOP	concept of operation
CONUS	continental United States
COP	common operating picture
CRS	congressional research service
CS21R	Cooperative Strategy for the 21st Century Seapower
CSG	carrier strike group
DARPA	Defense Advanced Research Projects Agency
DHS	Department of Homeland Security
DLCIN	detect, localize, classify, identify, and neutralize
DOD	Department of Defense
DON	Department of the Navy
ExMCM	Expeditionary Mine Countermeasures
FLIR	forward-looking infrared radar
IPOE	intelligence preparation of the operational environment
ISR	intelligence, surveillance, and reconnaissance
JP	joint publication
LCS	Littoral Combat Ship

LUSV	large unmanned surface vehicle
MCM	mine countermeasure
MEMUUV	maritime expeditionary mine countermeasure unmanned undersea vehicle
MUSV	medium unmanned surface vehicle
NDS	National Defense Strategy
NORAD	North American Aerospace Defense Command
NSS	National Security Strategy
ONR	Office of Naval Research
RDT&E	research, development, test, and evaluation
SAG	surface action group
SMCM UUV	surface mine countermeasure unmanned undersea vehicle
SS/SSP	diesel-powered/air-independent powered attack submarine
SSBN	nuclear-powered ballistic missile submarine
SSN	nuclear-powered attack submarines
STUAS	small tactical unmanned aerial system
SURFDEVRON	Surface Development Squadron
UAS	unmanned aerial system
UAV	unmanned aerial vehicle
USDIV	Unmanned Surface Vessel Division
USNORTHCOM	United States Northern Command
USV	unmanned surface vehicle
UUV	unmanned underwater vehicle
UUVRON	unmanned undersea vehicles squadron
UX-24	Air Test & Evaluation Squadron Two Four
VLS	vertical launch system
VSW	very shallow water
VTUAV	vertical takeoff/landing tactical UAV

EXECUTIVE SUMMARY

The United States is a maritime power that deters its adversaries through a distributed naval force around the globe to ensure security. The U.S. Navy defends the homeland by operating in forward regions of the world and through the use of an active, layered defense strategy. The objective of this strategy is to deter threats before they can strike the U.S. homeland. However, the emergence of advanced technologies and the rise of strategic competitors have challenged the U.S. Navy's ability to rely on its forward presence to deter its adversaries. With these challenges, the homeland has become a credible target against threats from these competitors. To secure the homeland, the U.S. Navy needs to innovate and adapt to the emerging technology of unmanned systems. This thesis examines how the Navy can incorporate the emerging technology of UAVs, USVs, and UUVs into its mission to defend the homeland.

The innovation and integration of unmanned systems has become a top priority for senior naval leaders. The U.S. Navy's Force Design 2045 outlines that the fleet will become a hybrid fleet, augmented by the integration of unmanned systems into its maritime operations. These systems are being developed and tested to increase the fleet's overall capabilities and deterrence. To continue the U.S. Navy's ability to maintain a global presence for security, this thesis examines high-priority mission areas outlined in the U.S. Navy's roadmaps within their master plans for these systems based on their capabilities and performance. Within these high-priority mission areas, this thesis incorporated mission areas that can be conducted to defend the homeland. These mission areas include intelligence, surveillance, and reconnaissance (ISR), mine countermeasures (MCM), anti-submarine warfare (ASW), maritime security, and anti-surface warfare (ASuW).

The U.S. Navy has a robust arsenal for these systems within the air, surface, and subsurface communities. The primary UAVs within the fleet include the MQ-8C Fire Scout, MQ-4C Triton, ScanEagle, and the MQ-4A Reaper. On the other hand, the Navy is developing large and medium unmanned surface vehicles for the surface fleet with the Lionfish, Kingfish, and Knifefish for the subsurface community. The U.S. Navy has also

established developmental squadrons for the experimentation of these to enhance their integration into the fleet. These developmental squadrons are expertly testing the capabilities of these systems and what they can provide to the fleet.

By examining potential mission areas and the current systems in the Navy, this thesis outlines potential operations these systems can provide to defend the homeland. The primary mission these systems can conduct for the homeland is ISR through the operation of coastal reconnaissance and coastal surveillance. ISR can be a proactive tool conducted to enhance the U.S. Navy's maritime domain awareness while expertly detecting and locating potential threats. One of the primary functions of the U.S. Navy is maritime security, and unmanned systems can aid in this function through the operation of port security and ASuW/ASW coordination with the fleet. UUVs can provide anti-terrorism support through the operation of inspecting a ship's hull for potential underwater explosives. USVs can enhance an AsuW engagement with MUSVs, providing the surface fleet with ISR capabilities, while LUSVs are being developed to augment the lethality of the fleet with ASCMs. UAVs, especially the Triton, can provide real-time intelligence to the Navy's P-8A maritime aircraft for increased coordination for ASW deterrence. Finally, UUVs are the primary tool for underwater object detection, localization, and bottom mapping for the MCM mission.

The current strategic environment has become a new threat to the U.S. Navy and the homeland. The Navy needs to continue its deterrence through an active, layered defense from abroad. This strategy can stretch the force thin, but the integration of unmanned systems can be the solution the Navy needs to remain a formidable maritime presence and successfully defend the homeland.

I. INTRODUCTION

The use of unmanned systems has become a common occurrence in the U.S. military, and these systems are being incorporated into all aspects of military operations. The U.S. Navy has been developing and testing these advanced systems in order to successfully integrate them into the fleet. Senior naval leaders are calling for the future of the U.S. Navy to be a "hybrid fleet" and these systems will be a critical asset for maintaining security around the globe.[1] But although these systems can augment naval assets, can they ensure security for the homeland? This thesis examines the potential utilization of unmanned systems into the U.S. Navy's homeland defense strategy.

This introductory chapter will provide the basis for the potential use of unmanned systems into homeland defense. First, this chapter explains the difficulty of homeland defense due the rise of strategic competitors which has made homeland defense a top priority for U.S. leaders. Second, this chapter outlines literature that provides an overview of the current systems, the integration of these systems, and current or potential missions they can provide for the U.S. Navy. Lastly, this chapter provides two hypotheses for the integration into the homeland defense mission and an overview for the succeeding chapters.

A. RESEARCH QUESTION

Considering the increasing application of advanced technology and the emergence of naval competitors, the United States Navy has incorporated the use of unmanned systems into its operations. The Navy has incorporated unmanned aerial vehicles (UAV), unmanned surface vehicles (USV), and unmanned underwater vehicles (UUV) to strengthen its mission readiness and capabilities. However, the focus of unmanned systems has been on operations abroad and away from homeland defense. The growing capabilities of adversaries have increased the need for the Navy to play a pivotal role in homeland defense, and unmanned systems may provide that ability while other naval

[1] Department of the Navy, *Unmanned Campaign Framework*, (Washington, DC: Department of the Navy, 2021), 2.

assets are forward deployed. To elucidate this role, this thesis examines the following question: How can unmanned systems be effectively used in the United States Navy's strategy and operations for homeland defense?

B. PROBLEM STATEMENT

The U.S. Navy's common strategy for maritime security throughout the globe has been the use of forward-deployed assets. These assets have provided freedom of the seas, ensured the free flow of commerce, and provided regional support to various allies globally. However, the military technology of the U.S.'s adversaries has developed rapidly in the 21st century and will continue to do so. According to the Congressional Research Service (CRS) report, *China Naval Modernization*, the "Department of Defense (DOD) states that China's navy is the largest navy in the world with a battle force of approximately 340 platforms, including major surface combatants, submarines, ocean-going amphibious ships, mine warfare ships, aircraft carriers, and fleet auxiliaries."[2] In the face of this rapidly growing threat, with most of the Navy's strategies and capabilities focused abroad, is the U.S. Navy prepared for a scenario in which a naval power can threaten the continental U.S. (CONUS)?

Not only have our naval adversaries grown in size, but they have benefited from a significant advancement in technology, specifically unmanned systems.[3] Meanwhile, interest in these unmanned systems on the part of U.S. naval leaders has been increasing. Former Acting Secretary of the Navy Thomas W. Harker, in *Department of the Navy's (DON) Unmanned Campaign Framework Report*, stated, "To compete and win in an era of great power competition, the Department is committed to investing in advanced autonomy, robust networks, and unmanned systems to create true integrated human-machine teaming that is ubiquitous across the fleet."[4] In the same report, Chief of Naval Operations M. M. Gilday recognized that a "hybrid fleet" of unmanned and manned

[2] Ronald O'Rourke, *China Naval Modernization: Background and Issues for Congress*, CRS Report No. RL33153 (Washington, DC: Congressional Research Service, 2022), Summary, ProQuest.

[3] Department of Defense, *Annual Report to Congress: Military and Security Developments Involving the People's Republic of China*, (Washington, DC: Department of Defense, 2019), 41–42.

[4] Department of the Navy, *Unmanned Campaign Framework*, 1.

systems will be needed to maintain security around the globe.[5] With this growing technology, can the U.S. Navy incorporate unmanned systems into their homeland defense strategy to maintain a forward presence around the globe while also maintaining an effective homeland defense strategy?

C. LITERATURE REVIEW

This literature review will examine various aspects pertaining to this thesis question. The first portion of the literature review will focus on the DOD and DON official publications about homeland defense and the current priority for an integrated fleet of manned and unmanned systems for the future. The second portion will pertain to debates about the use of unmanned systems for homeland defense. Some argue that unmanned systems can play an integral role in homeland defense, whereas others argue that the current U.S. Navy's plans are too vague and may not be feasible. The last portion of this review provides an overview of the current UAV, USV, and UUV systems within the Navy and the capabilities and missions that they can achieve.

1. DOD and DON Official Publications

The United States military has many important priorities that dictate specific policies and strategies geared toward those priorities. Each priority has its own publication outlining how to conduct and achieve those goals. One of the important priorities for all branches of the military is the defense of the homeland. Recent sources describing homeland defense as a vital priority include the 2022 *National Defense Strategy* (NDS) and the Chief of Naval Operations (CNO) Navigation Plan for 2022.[6] Homeland defense is not only a strategic priority for the U.S. Navy but also the entire DOD.

With the rise of enemy capabilities, homeland defense strategy has become a top priority for the military and will play a pivotal role in keeping the United States safe. The

[5] Department of the Navy, *Unmanned Campaign Framework*, 2.

[6] Department of Defense, *National Defense Strategy of the United States of America* (Washington, DC: Department of Defense, 2022), 7, https://cle.nps.edu/access/content/group/2cc28e47-8688-4f7b-8c64-63db863c4e91/Readings/Session%209/2022%20National%20Defense%20Strategy.pdf.

NDS and CNO Navigation Plan outline the concept of integrated deterrence to counter enemy capabilities.[7] Integrated deterrence entails using all aspects of the military and all available tools to ensure security.[8] The CNO Navigation Plan outlines a force design plan that can support the NDS and its homeland defense strategy. The force design plan states that the Navy needs to become a hybrid fleet with the integration of unmanned systems. These unmanned systems aim to increase the Navy's intelligence, surveillance, and reconnaissance (ISR) capability and reduce the need and risk of manpower for certain missions.[9] Unmanned systems can provide homeland defense capabilities for the U.S. Navy.

Defending the homeland requires a broad range of strategies, missions, and priorities for multiple service branches and agencies. To provide the U.S. Navy with clear guidance for homeland defense, the *Naval Operations Concept* provides direct information on how U.S. naval forces will operate in various missions to enhance national security and maritime strategy.[10] Additionally, A *Cooperative Strategy for the 21st Century Seapower (CS21R)* outlines the U.S. maritime strategy for all U.S. Sea Services, including the U.S. Navy, U.S. Marine Corps, and the U.S. Coast Guard.[11] The Joint Publication (JP) 3–27 *Homeland Defense* provides a vision of the U.S. Navy's role in homeland defense. This publication details the operational framework, fundamentals, and layered defense for homeland defense.[12]

Navy leadership, cognizant of the importance of a hybrid fleet (combining manned and unmanned systems), released the DON's *Unmanned Campaign Framework*

[7] Chief of Naval Operations, *Navigation Plan 2022* (Washington DC: Department of the Navy, 2022) 6, https://cle.nps.edu/access/content/group/2cc28e47-8688-4f7b-8c64-63db863c4e91/Readings/Session%207/CNO%20Navigation%20Plan%202022; Department of Defense, *National Defense Strategy,* 8.

[8] Department of Defense, *National Defense Strategy,* 8.

[9] Chief of Naval Operations, *Navigation Plan 2022*, 9-10.

[10] Department of the Navy, *Naval Operations Concept 2010: Implementing the Maritime Strategy* (Washington, DC: Department of the Navy, 2010), 1, https://apps.dtic.mil/sti/pdfs/ADA522268.pdf.

[11] Department of the Navy, *A Cooperative Strategy for 21st Century Seapower* (Washington, DC: Department of the Navy, 2015), iii.

[12] Joint Chiefs of Staff, *Homeland Defense Joint Publication (JP) 3- 27*, (Washington, DC: Joint Chief of Staff, 2018).

in 2022. This campaign framework outlines the Navy's plan to integrate unmanned systems into the fleet. It examines the Navy's mission, the importance of unmanned systems, and the current and future portfolio for unmanned systems. This unmanned framework aligns the Navy's mission with the NDS to increase warfighting capabilities, lethality, operational readiness, and deterrence to ensure a secure homeland.[13] Current unmanned systems within this framework include UAVs, USVs, and UUVs, such as the MQ-8C Fire Scout, MQ-4C Triton, Medium and Large Unmanned Surface Vessels (M/LUSVs), the Mk-18 UUVs. These vehicles can provide ISR, mine countermeasures (MCM), and homeland defense capabilities within the fleet.[14]

In December 2020, the DON released an additional strategic outline, *Advantage at Sea: Prevailing with Integrated All-Domain Naval Power.* This strategic outline corroborates the need for an integrated fleet of manned and unmanned systems to provide deterrence in the current security environment. Within this strategy, naval assets "must be able to protect the homeland" through integration.[15] The integration of unmanned systems can increase ISR capabilities to increase the successful surveillance and targeting for Air and Surface warfare missions. This integration allows U.S. assets to continue power projection, sea control, and sea denial by increasing the capability to distribute forces and maintain a forward presence globally.[16]

2. Arguments and Debates

Naval experts and leaders have proposed and debated the different uses for unmanned systems. For example, to ensure sea denial to the adversary—a key mission for the U.S. Navy—successful defense of the coast is vital. Accordingly, Milan Vego argues that UAVs, USVs, and UUVs can be skillfully deployed for coastal defense,[17]

[13] Department of the Navy, *Unmanned Campaign Framework*, 2–6.

[14] Department of the Navy, *Unmanned Campaign Framework*, 14–16.

[15] Department of the Navy, *Advantage at Sea: Prevailing with Integrated All-Domain Naval Power* (Washington, DC: Department of the Navy, 2020), 15.

[16] Department of the Navy, *Advantage at Sea*, 28.

[17] Milan Vego, *Maritime Strategy and Sea Denial: Theory and Practice*, (New York, NY: Routledge, 2019), 266–269.

including through "coastal surveillance," which aims to detect and locate any potential enemy aircraft, submarines, and ships.[18] According to Vego, these unmanned systems can ensure the safety of naval assets such as personnel, facilities/installations, commercial shipping, and traffic lanes by preventing any large-scale attacks along the coast.[19]

To increase the feasibility and use of unmanned systems, the Naval Studies Board of the National Research Council conducted a study on the use of unmanned systems through various operating environments and potential threats. One of the findings in the report is that unmanned systems can be deployed to counter mines, submarines, and surface craft threats. This report argues that UUVs can map out and surveil littoral regions for any mine threats while also being deployed for reconnaissance and the monitoring of any potential enemy submarines. UAVs and USVs can be deployed to counter any small surface crafts swarming the littoral regions. They can provide early detection through ISR, targeting sensors, and potential offensive capabilities from unmanned systems.[20]

One of the most visible and widespread communities within the Navy is the surface community. The surface community has also shifted its focus toward the use of unmanned vehicles. Erich D. Grome's article "Spectres of the Sea: The United States Navy's Autonomous Ghost Fleet" provides an in-depth window into the use and integration of unmanned vehicles in the surface community. This article describes the use of unmanned vehicles in ensuring the safety of navigation and current manned operations, such as scouting or patrolling, and examines the cost effectiveness of unmanned vehicles and their ability to reduce the stress of manning associated with surface crews.[21] As Grome states, the Ghost fleet "offers the United States a more

[18] Vego, *Maritime Strategy and Sea Denial*, 269.

[19] Vego, *Maritime Strategy and Sea Denial*, 269.

[20] National Research Council, *Autonomous Vehicles in Support of Naval Operations* (Washington, DC: National Academies Press, 2005), 29–32, https://doi.org/10.17226/11379.

[21] Erich D. Grome, "Spectres of the Sea: The United States Navy's Autonomous Ghost Fleet, Its Capabilities and Impacts, and the Legal Ethical Issues That Surround," *Journal of Maritime Law and Commerce* 49, no. 1 (January 2018): 31–69. ProQuest.

efficient, more effective, less expensive, and less life-endangering alternative through its autonomous capabilities."[22] According to experts such as Grome, the capabilities and impacts of unmanned vehicles can greatly increase the capabilities of surface fleets.

There is debate, however, about the Navy's current outline for the integration of unmanned systems into the fleet. The Navy has been developing, innovating, and testing various systems for many years, and autonomous systems are no exception. However, Congress has been skeptical about autonomous systems, specifically offshore autonomous systems.[23] With recent failures in the development of new warships, Congress has insisted to the DON that successful land-based testing is needed before shifting the testing to offshore testing. On the other hand, CNO Gilday recently called for more unmanned systems within the next five years, suggesting that the U.S. may need to look toward off-the-shelf unmanned systems.[24]

Not only has there been skepticism concerning the development of these systems; this skepticism has also extended to their use. The Navy has called for these systems to be integrated into the fleet, but the planning for the use of these systems seems vague to some.[25] There have been unanswered questions about how the Navy will sustain, repair, refuel, or deploy these unmanned systems. Further, there is debate over whether these systems are expendable or if there is any future in retrieving these systems for multiple missions.[26]

[22] Grome, "Spectres of the Sea," 67.

[23] Justin Katz, "Show, Don't Tell: Navy Changes Strategy to Sell Unmanned Systems to Skeptical Congress," *Breaking Defense* (blog), March 10, 2022, https://breakingdefense.sites.breakingmedia.com/2022/03/show-dont-tell-navy-changes-strategy-to-sell-unmanned-systems-to-skeptical-congress/.

[24] Justin Katz, "Show, Don't Tell: Navy Changes Strategy to Sell Unmanned Systems to Skeptical Congress."

[25] Justin Katz, "Show, Don't Tell: Navy Changes Strategy to Sell Unmanned Systems to Skeptical Congress."

[26] Gregory V. Cox, "The U.S. Navy's Plans for Unmanned and Autonomous Systems Leave Too Much Unexplained," *War on the Rocks* (blog), December 10, 2021, https://warontherocks.com/2021/12/the-u-s-navys-plans-for-unmanned-and-autonomous-systems-leave-too-much-unexplained/; Jonathan Panter and Johnathan Falcone, "The Unplanned Costs of an Unmanned Fleet," *War on the Rocks* (blog), December 28, 2021, https://warontherocks.com/2021/12/the-unplanned-costs-of-an-unmanned-fleet/.

3. Current and Potential Missions

Publications within the federal government, DOD and Navy provide valuable insight into potential unmanned systems, and one of the most authoritative sources of such insight is the Congressional Research Service. Regarding UAVs, an important CRS report is *Unmanned Aircraft Systems: Current and Potential Programs.* This report provides an overview of the capabilities of Unmanned Aerial Systems (UAS) throughout each branch of the military.[27] One aspect this CRS report examines is the advantages of unmanned over manned aircraft systems. An important advantage of unmanned systems is their higher projected flight hours, such as the RQ-4 Global Hawk, which is projected to fly 356 hours more than the manned P-8 aircraft.[28]

Another vital CRS report regarding unmanned systems is the *Navy Large Unmanned Surface and Undersea Vehicles: Background and Issues for Congress.* This CRS report outlines the Navy's plans, such as the Unmanned System Campaign Framework, as well as the construction, funds, and visions for USVs and UUVs. The LUSVs intend to incorporate the capacity for anti-surface warfare (ASuW) and strike warfare capabilities, whereas the MUSV configurations incorporate ISR. This CRS report also discusses issues raised by Congress. Concerns include the concept of operations (CONOPS) for these large UVs and the analytical approach for the fleet architecture to integrate these systems into the fleet.[29]

The CRS reports provide an overview of current and potential missions for incorporating unmanned systems into the fleet but do not offer in-depth insights into potential missions for these systems. For this, master plans for USVs and UUVs were developed to elucidate potential missions for these systems. These plans identified high-

[27] John R. Hoehn and Paul K. Kerr, *Unmanned Aircraft Systems: Current and Potential Programs*, CRS Report No. R47067 (Washington, DC: Congressional Research Service, 2022), 1–12. https://crsreports.congress.gov/product/pdf/R/R47067.

[28] John R. Hoehn and Paul K. Kerr, *Unmanned Aircraft Systems: Current and Potential Programs*, CRS Report No. R47067 (Washington, DC: Congressional Research Service, 2022), 15. https://crsreports.congress.gov/product/pdf/R/R47067.

[29] Ronald O'Rourke, *Navy Large Unmanned Surface and Undersea Vehicles: Background and Issues for Congress*, CRS Report No. R45757 (Washington, DC: Congressional Research Service, 2023), 1.

priority missions that can be conducted based on the capabilities, technology, and level of performance of the systems.[30]

D. POTENTIAL EXPLANATIONS AND HYPOTHESIS

In recent decades, homeland defense has become a top priority for naval leaders, who also remain committed to maintaining a forward presence around the globe. This thesis argues that the U.S. Navy should deploy unmanned systems for homeland defense to sustain its forward presence; but how can this be done effectively? The integration of manned and unmanned systems throughout the fleet has been an essential element of the current strategies of the DON, but how can these systems be integrated for homeland defense?

One hypothesis about how the U.S. Navy can effectively deploy unmanned systems for homeland defense is through ISR missions. For any area in which the U.S. naval forces operate, including the homeland, battle space awareness and the ability to create a cohesive common operating picture (COP) are critical. UAVs have been successfully deployed overseas to increase battlespace awareness and ensure naval forces understand their operating environment. These UAVs can also be deployed to increase awareness and the detection range for any potential threats to the homeland. On the other hand, USVs and UUVs can also provide ISR capabilities through their patrolling and surveillance capabilities. These unmanned systems can use their patrol missions to counter any surface craft, submarines, aircraft, or any other potential threat. They can increase battlespace awareness for homeland defense by increasing ISR missions. Therefore, these unmanned systems could prevent any large-scale military attack and protect critical naval bases or facilities.

The deployment of manned naval forces can be a strenuous and dangerous endeavor in any mission. Ensuring the safety of the sailors is of the utmost importance. Another hypothesis for the use of unmanned systems is alleviating the stress of manned

[30] Department of the Navy, *The Navy Unmanned Surface Vehicle (USV) Master Plan* (Washington, DC: Department of the Navy, 2007), https://apps.dtic.mil/sti/pdfs/ADA504867.pdf.; Department of the Navy, *The Navy Unmanned Undersea Vehicle (UUV) Master Plan* (Washington, DC: Department of the Navy, 2004), https://apps.dtic.mil/sti/pdfs/ADA511748.pdf.

crews and their safety. If there is any potential threat along the U.S. coast, unmanned systems can be deployed instead of manned systems. USVs and UUVs can be deployed to counter threats such as mines, submarines, or surface ships. The danger against these threats can be significant, but unmanned systems can be a deterrent while also protecting U.S. lives.

E. RESEARCH DESIGN

Unmanned systems have been used for many decades but have recently become a priority for policy and strategy. In this thesis, my intent is to first research the current missions and strategies of the U.S. Navy for homeland defense. The U.S. Navy is a maritime nation that executes a forward presence mission abroad. However, homeland defense has become a top priority for the current administration and top naval leaders. To understand how unmanned systems can play a crucial role in homeland defense, this thesis investigates what missions the Navy can execute within homeland defense.

Second, this thesis researches current and future unmanned systems within the U.S. Navy. This thesis examines the current state of unmanned systems; what capabilities they provide to the fleet; what payloads they carry, such as sensors and radars; and how integration with other naval assets can be accomplished. The Janes database provides crucial information on current unmanned systems. Information within this database includes current equipment, intelligence, data, analysis, and news on U.S. unmanned systems.[31] By understanding their capabilities, this thesis examines what these emerging technologies can offer for homeland defense.

Finally, this thesis investigates how to match homeland defense missions with unmanned systems capabilities. This research will examine how those capabilities can be effectively leveraged in mission areas for homeland defense. To understand their capabilities for those missions, this thesis researches the Navy's strategies for homeland defense and planned mission areas for unmanned systems. The master plans for unmanned systems outline high-priority mission areas deemed feasible for unmanned systems based on their capabilities and performance. The master plans for unmanned

[31] Janes Database (accessed February 9, 2023), https://customer.janes.com/janes/search?q=uavs&pg=1.

systems examine how these unmanned systems can be deployed in various mission areas, such as MCM, maritime security, anti-submarine warfare (ASW), ASuW, and ISR, among others.[32] This thesis examines how the U.S. Navy can effectively deploy unmanned systems in different mission areas to ensure the U.S. homeland is secure.

F. CHAPTER OVERVIEW

This thesis comprises four chapters. Chapter I provides the background on the thesis question, literature review, and research design. Chapter II examines the U.S. Navy's current strategy for homeland defense. This includes the basics of homeland defense and the framework for the U.S. Navy's homeland defense strategy as well as different mission areas associated with homeland defense. Chapter III provides background on current and future unmanned systems, along with their capabilities and primary mission areas in the U.S. Navy. This chapter covers current equipment, intelligence, data, and analysis of U.S. unmanned systems. Chapter IV examines how these homeland defense missions can be accomplished more effectively through the use of unmanned systems, both presently and in the future.

G. CONCLUSION

The U.S. Navy is a maritime power that provides national and global security by maintaining a forward presence. However, the rise of strategic competitors and emerging technologies threaten the homeland. To counter the risks, the U.S. Navy can adapt its operations to the rise of advanced technologies and incorporate unmanned systems into its operations. These unmanned systems can be the answer to the U.S. Navy's needs for securing the homeland while maintaining a forward presence throughout the globe.

The next chapter examines the basics of homeland defense, which includes the definition and framework of how the U.S. conducts homeland defense through the concept of layered defense. This chapter also outlines the mission areas where unmanned systems can be used to provide defense for the homeland.

[32] Department of the Navy, *The Navy Unmanned Surface Vehicle (USV) Master Plan*, xi; Department of the Navy, *The Navy Unmanned Undersea Vehicle (UUV) Master Plan*, xvi.

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II. WHAT IS HOMELAND DEFENSE?

Defending the homeland has always been a top priority for senior naval leaders, and in the age of advanced technology, unmanned systems can play a critical role in such defense. Currently, however, the U.S. Navy has not established a concept of operations (CONOPs) for unmanned systems for homeland defense. To provide potential mission areas for homeland defense, this chapter examines the unmanned surface vehicle (USV) and unmanned undersea vehicle (UUV) roadmaps released by the U.S. Navy. These roadmaps provide an analysis of mission areas identified by the U.S. Navy as top-priority mission areas across which these unmanned systems can act. Regarding unmanned aerial vehicles (UAV), this chapter examines current mission areas where UAVs have already been used and any potential mission capabilities being developed or tested. These mission areas include intelligence, surveillance, and reconnaissance (ISR), mine countermeasures (MCM), anti-submarine warfare (ASW), maritime security, and anti-surface warfare (ASuW). Conducting these missions could provide the U.S. Navy with the necessary tools to defend the homeland while also furthering its mission of retaining a forward presence around the globe.

This chapter first explains the definitions of the U.S. homeland and homeland defense while also discussing why homeland defense is vital. Second, the chapter outlines how unmanned systems can aid the U.S. Navy's current maritime security strategy. Unmanned systems can assist in three main functions of the maritime security strategy: power projection, sea control, and all-domain access. Lastly, the chapter outlines mission areas that are relevant to homeland defense.

A. THE HOMELAND

The definition of the U.S. homeland clearly outlines which areas, territories, waters, and airspaces are incorporated into homeland defense. The Joint Chiefs of Staff *Homeland Defense Joint Publication (JP) 3–27* describes the United States' homeland as the "physical region that includes the Continental United States (CONUS), Alaska,

Hawaii, U.S. territories, and surrounding territorial waters and airspace."[33] This definition includes not only CONUS but also territories outside CONUS that are equally important and need to be defended by U.S. assets. The physical dimensions of the homeland encompass a vast number of territories and waters that add to the complexity of defending the homeland.

B. HOMELAND DEFENSE

As a top priority, homeland defense is clearly defined and under the direction of the DOD. Homeland defense, as defined in the JP 3-27, is "the protection of United States sovereignty, territory, domestic population, and critical infrastructure against external threats and aggression or other threats as directed by the President."[34] However, homeland defense was distinctly defined during the aftermath of the 9/11 terrorist attacks. In this aftermath, the United States introduced the term homeland defense to differentiate itself from the newly created Department of Homeland Security (DHS) and its primary mission of homeland security.[35] Distinguishing between homeland defense and homeland security singled out the DOD as the leading authority for homeland defense.[36] Although homeland defense incorporates numerous organizations and agencies, the DOD takes the lead in ensuring it is properly conducted.

The DOD's homeland defense mission is conducted through the Homeland Defense Operational Framework, which contains objectives for how the DOD can defend the homeland. Two primary objectives in the framework are to "deny a threat's access to the nation's sovereign airspace, territory, and territorial seas" and "deter aggression and coercion by conducting global operations."[37] The DOD needs to accomplish these objectives to ensure the successful defense of U.S. territories, its domestic population,

[33] Joint Chiefs of Staff, *Homeland Defense Joint Publication (JP) 3- 27*, 1-1.

[34] Joint Chiefs of Staff, *Homeland Defense Joint Publication (JP) 3- 27*, GL-8.

[35] James J. Carafano, "Homeland Security and Homeland Defense: Distinctions and Differences," in *Introduction to Homeland Defense and Defense Support of Civil Authorities (DSCA): the U.S. military's role to support and defend*, ed. Robert McCreight and Bert B. Tussing (CRC Press, 2014), 6.

[36] Carafano, "Homeland Security and Homeland Defense: Distinctions and Differences," 7.

[37] Joint Chiefs of Staff, *Homeland Defense Joint Publication (JP) 3- 27*, 1-10.

and any another critical asset.[38] This framework provides the DOD with the ability to deter threats to the homeland by incorporating global operations in its strategy.

The objective of global operations is to deny and deter potential threats outside the borders of the homeland using an active, layered defense. The active, layered defense concept describes homeland defense not only within U.S. borders but globally as well. According to JP 3-27, the active, layered defense is "a global defense that aims to deter and defeat aggression abroad and simultaneously protect the homeland."[39] DOD forces are deployed in forward regions to engage in active, layered defense to create a defense-in-depth strategy for deterrence.[40] Deploying forces in forward regions enhances the ability to successfully deter external threats before they become a serious threat to the U.S. homeland. According to this concept, homeland defense is not only engaging threats on the home front but also being a proactive, global force.

The innovation of unmanned systems can grant the DOD and the U.S. Navy the ability to protect the U.S. homeland while also maintaining security throughout the globe. The U.S. Navy is already a global force, and being a forward presence asset is an inherent part of the U.S. Navy's national defense strategy.[41] JP 3-27, *A Cooperative Strategy for 21st Century Seapower (CS21R),* and the *Advantage at Sea* reaffirm the vital importance of continuing a forward presence in forward areas of operations to defend the homeland.[42] Being a forward presence and retaining the ability to defend the homeland is an enormous feat that incorporates vast resources and manpower. To accomplish homeland defense, the DOD will need to ensure that the correct assets, including unmanned systems, are in place to counter threats against the U.S. and its homeland.

[38] Joint Chiefs of Staff, *Homeland Defense Joint Publication (JP) 3- 27*, 1-10.

[39] Joint Chiefs of Staff, *Homeland Defense Joint Publication (JP) 3- 27*, 1-9.

[40] Joint Chiefs of Staff, *Homeland Defense Joint Publication (JP) 3- 27*, 1-9.

[41] Department of the Navy, *Advantage at Sea: Prevailing with Integrated All-Domain Naval Power* , 9.

[42] Joint Chiefs of Staff, *Homeland Defense Joint Publication (JP) 3- 27*, 1-9; Department of the Navy, *A Cooperative Strategy for 21st Century Seapower*, 2; Department of the Navy, *Advantage at Sea: Prevailing with Integrated All-Domain Naval Power* , 6.

C. AIDING THE MARITIME STRATEGY

Defending the homeland is a robust mission that needs more than simply manned crews to accomplish its objectives and continue the U.S. Navy's maritime strategy. To implement a successful and continuous maritime strategy, homeland defense requires several missions that demand a wide range of personnel, equipment, and resources. The *CS21R* publication, revised in 2015, describes the overall maritime strategy of the U.S. Sea Services. *CS21R* outlines five functions that are critical to the Sea Services in ensuring global and national security. These functions are all-domain access, deterrence, sea control, power projection, and maritime security.[43] These five functions are vital to how the U.S. Navy conducts its operations, deploys its forces, and enhances security globally and in the homeland. However, these functions may expend numerous conventional naval forces, and unmanned systems can increase these resources.

1. Functions of Maritime Strategy

Unmanned systems have the ability to project power, which is critical for ensuring global security and incorporates the homeland. As stated earlier in the chapter, the homeland not only incorporates CONUS but also U.S. territories globally. Critical areas that are vital to U.S. national security are located in contested areas around the globe. The ability of U.S. assets to maintain a forward presence is crucial for ensuring global security.[44] An inability to defend these areas will provide competitors the strategic advantage to increase their capabilities against U.S. forces and its allies. These forward regions are crucial to the national security strategy of a stable and secure Pacific region while also providing a defense-in depth strategy for homeland defense.

Unmanned systems can play a role in coast defense operation for establishing sea control. Sea control is a critical function that ensures the Navy's ability to conduct its function as a forward presence and project power. When the U.S. Navy is unable to gain sea control, its ability to conduct its operations as a forward presence and secure the homeland is hindered. To establish sea control, the U.S. Navy needs to defend its coast.

[43] Department of the Navy, *A Cooperative Strategy for 21st Century Seapower*, 19.

[44] Department of the Navy, *A Cooperative Strategy for 21st Century Seapower*, 19.

While the defense of the coast is critical in sea denial, it is essential to ensure that an adversary is not successful in gaining sea control.[45] Sea control is a requisite for the U.S. Navy to conduct global operations; defending the coast is critical for sea control, and unmanned systems can play a role in the same.

Unmanned systems can aid in the seaward defense zone within coast defense operations. The seaward defense zone is defined as "one's coastline to several dozen or even hundreds of nautical miles outward" with the primary objective being to "prevent surprise attack and ensure the safety of one's naval forces, commercial shipping, naval/air bases/ports, and coastal facilities/installations."[46] Vego states that unmanned systems can aid the seaward defense zone by conducting coastal reconnaissance, and USVs, UUVs, and UAVs, can provide this ability.[47] By using unmanned systems within this operation, the U.S. Navy can enhance its ability to defend the coast and establish sea control in the maritime strategy. Establishing sea control allows the U.S. Navy to continue its strategy of deploying manned assets to forward regions without the need to exclusively use manned assets for coastal defense.

While unmanned systems can play a primary role in costal surveillance in support of sea control, these systems can also assist in all-domain access. Successful all-domain access provides U.S. assets the ability to maneuver freely in their operating area or contested areas. One aspect of all-domain access is battlespace awareness.[48] Battlespace awareness involves the "persistent surveillance of the maritime domain" and "an understanding of when, where, and how adversaries operate."[49] These systems can perform their surveillance capabilities in forward-deployed regions to allow U.S. assets the freedom of maneuver while understanding their environment and any potential threats in those environments.

[45] Vego, *Maritime Strategy and Sea Denial*, 266.

[46] Vego, *Maritime Strategy and Sea Denial*, 269.

[47] Vego, *Maritime Strategy and Sea Denial*, 269.

[48] Department of the Navy, *A Cooperative Strategy for 21st Century Seapower*, 19–20.

[49] Department of the Navy, *A Cooperative Strategy for 21st Century Seapower*, 21.

2. Hybrid Fleet

The integration of unmanned systems into the U.S. Navy has become a top priority for senior naval leaders. According to the CNO's Navigation Plan, to defend the homeland the "Navy must become a hybrid fleet. Manned, multi-mission platforms will remain at the core of our future fleet but augmented with new platforms and new capabilities."[50] The 2022 *National Security Strategy (NSS)* released by the Biden administration outlined the current security environment and the priorities within this strategy. One of the priorities for the U.S. military will be to be prepared, modernized, and ready in a world of strategic competitors.[51] The U.S. homeland has always been a strategic target for competitors or terrorist organizations. With the advancement of technology and the shift in the global security environment, a threat against the U.S. homeland is potential and credible. The U.S. Navy is no longer the largest in the world, but it can maintain maritime dominance via the integration of a hybrid fleet. A hybrid fleet can continue to achieve naval strategies, especially homeland defense. Unmanned systems are ideal for the U.S. Navy to modernize its force, advance its naval warfare through technology, and be prepared for the next fight in any part of the world.

D. UNMANNED MISSIONS ASSOCIATED WITH HOMELAND DEFENSE

The Navy has established roadmaps for USVs and UUVs that contain mission areas in which unmanned systems could potentially act, but it still has not established specific CONOPs associated with these systems. These roadmaps outline the development, employment, and analysis of mission areas for unmanned systems. In addition, these roadmaps provide top-priority mission areas where USVs and UUVs can be integrated to achieve U.S. Navy fleet objectives.[52] On the other hand, UAVs have already been developed, tested, and deployed in certain missions to assist in meeting

[50] Chief of Naval Operations, *Navigation Plan 2022*, 9.

[51] White House, *National Security Strategy of the United States of America* (Washington, DC: White House, 2022), 11, https://cle.nps.edu/access/content/group/2cc28e47-8688-4f7b-8c64-63db863c4e91/Readings/Session%202/2022%20National%20Security%20Strategy.pdf.

[52] Department of the Navy, *The Navy Unmanned Surface Vehicle (USV) Master Plan,* x-xi; Department of the Navy, *The Navy Unmanned Undersea Vehicle (UUV) Master Plan*, xvii-xix.

naval objectives, and potential missions are in development for future UAV programs.[53] These mission areas within the roadmaps can be the foundation for creating unmanned systems CONOPs within the homeland defense mission.

This thesis attempts to connect the potential missions analyzed by the U.S. Navy that can achieve the operational objective of defending the homeland from a defense-in-depth and forward presence perspective. The following mission areas are critical to the continuation of distributing U.S. naval forces, maintaining a forward presence around the globe, and defending the homeland from afar: ISR, MCM, ASW, maritime security, and ASUW. These mission areas will provide unmanned systems with the ability to play a pivotal role in the naval objectives of defending the homeland in the era of strategic competition.

1. Intelligence, Surveillance, and Reconnaissance

ISR is a fundamental mission that always has been and always will be conducted within any military strategy. Conducting an ISR mission is critical for the success of any military operation. With the growth of capabilities from other nations, it is vital to know the movement and location of the adversary before they locate yours. ISR missions are critical for increasing situational awareness, and improved unmanned systems can provide that increased situational awareness to naval assets. ISR performs the collection of all forms of intelligence for the military, detection or localization of any adversarial forces, and layout of any area of responsibility.[54] UAVs have proven to be perfect unmanned ISR assets that have provided the U.S. military advantages as seen in past conflicts, such as Iraq and Afghanistan.[55] ISR is a capable asset that can be successfully integrated while enhancing the overall operating picture for U.S. naval leaders.

The ISR mission area opens the door for the employment of other critical mission areas for the active, layered defense concept. Unmanned systems can contribute to the

[53] John R. Hoehn, Kelley M. Sayer, and Michael E. Devine, *Unmanned Aircraft Systems: Roles, Missions and Future Concepts*, CRS Report No. R47188 (Washington, DC: Congressional Research Service, 2022), 1-5, https://crsreports.congress.gov/product/pdf/R/R47188.

[54] Department of the Navy, *The Navy Unmanned Undersea Vehicle (UUV) Master Plan*, 9.;

[55] Hoehn, Sayer, and Devine, *Unmanned Aircraft Systems: Roles, Missions and Future Concepts, 1.*

ISR mission area by furthering battlespace awareness, increasing sensor capabilities within an operating environment, and operating in areas that manned crews may not be able to operate in.[56] Specifically, UUVs can operate in contested areas that could potentially be difficult for the adversary to detect.[57] The primary objective of ISR is to aid manned crews in maintaining accurate battlespace awareness to understand their operational environment. However, operating in areas that manned crews are unable to reach will hinder the manned crew's ability to obtain an accurate operational picture and decrease their overall battlespace awareness within the environment they are operating. Unmanned systems have proven capable of conducting ISR missions throughout the world but can also significantly contribute to homeland defense.

2. Mine Countermeasures

Mine warfare has not played a primary role in current strategies, but it has serious consequences for U.S. assets if used against the United States. The importance of MCM operations is the ability to establish transit routes (also known as Q-routes), lanes, and safe operating areas for areas such as littoral penetration areas, offshore fleet operating areas, and amphibious objective areas (AOAs).[58] The goal of unmanned MCM operations is to detect, localize, classify, identify, and neutralize (DLCIN) mine threats to establish safe operating areas and ensure the security of manned U.S. crews.[59] While the U.S. Navy mine warfare fleet consists of MCM Avenger class ships that are manned, human error and the safety of these manned crews can be critical in establishing either safe operating areas or vital transit routes. The goal is to prevent the mining of critical operating areas and provide other assets the ability to conduct their own missions against any threats.

The two best methods within MCM missions for homeland defense are the MCM Search and MCM Neutralization concept of operations. The MCM Search method

[56] Department of the Navy, *The Navy Unmanned Undersea Vehicle (UUV) Master Plan*, 9.

[57] Department of the Navy, *The Navy Unmanned Undersea Vehicle (UUV) Master Plan*, 9.

[58] Department of the Navy, *The Navy Unmanned Surface Vehicle (USV) Master Plan,* 11; Department of the Navy, *The Navy Unmanned Undersea Vehicle (UUV) Master Plan*, 10.

[59] Department of the Navy, *The Navy Unmanned Surface Vehicle (USV) Master Plan,* 12-13.

consists of using sensors to positively detect, classify, and identify mines.[60] The MCM Neutralization method consists of "rendering a mine incapable of firing on a passing target."[61] MCM operations have been integrated into the fleet for many decades with the MCM Avenger class MCM ships, but some of these ships have already been decommissioned or will be in the near future. Their ability to continue critical MCM operations may be in jeopardy, and unmanned systems could be the solution.

3. Anti-Submarine Warfare

Adversarial submarines have an increased lethality against U.S. forces, due to their stealth and payload capabilities. Unmanned systems can conduct two categories of ASW operations, such as "Maritime Shield" and "Protected Passage." Maritime Shield involves establishing a safe Carrier or Expeditionary Strike Group AOR. Protected Passage involves establishing a clear lane for naval forces to transit between clear operating areas.[62] UUVs and USVs can counter adversaries during homeland defense. Unmanned systems could also enhance other mission areas during their ASW operations by furthering the establishment of safe operating areas and extending the operating environment.

Advanced technologies have provided submarines the ability to avoid detection for increased durations, significantly increasing the threat level to U.S. Navy assets. Therefore, ASW covers a difficult mission area for U.S. Navy manned crews and will continue to do so. According to the DOD's report *Military and Security Developments Involving the People's Republic of China*, the PLAN "operates six nuclear-powered ballistic missile submarines (SSBN), six nuclear-powered attack submarines (SSN), and

[60] Program Executive Officer for Littoral and Mine Warfare, *Unmanned Surface Vehicle (USV) Master Plan* (Washington, DC, 2007), 15.

[61] Program Executive Officer for Littoral and Mine Warfare, *Unmanned Surface Vehicle (USV) Master Plan* (Washington, DC, 2007), 18.

[62] Department of the Navy, *The Navy Unmanned Surface Vehicle (USV) Master Plan,* 23; Department of the Navy, *The Navy Unmanned Undersea Vehicle (UUV) Master Plan*, 12.

44 diesel-powered/air-independent powered attack submarines (SS/SSP)."[63] The report predicts that the PLAN submarine force will reach a maximum of 70 submarines.[64] The PLAN maintains a formidable submarine force in the future and continues to be a serious threat to naval assets. As with the ISR mission area, unmanned systems can provide increased situational awareness, a clear understanding of the operational picture, and the ability to counter this formidable threat.

4. Maritime Security

Ensuring the protection of U.S. domestic naval ports, maritime infrastructure, and other critical infrastructure provides the U.S. Navy the ability to continue its mission of homeland defense. This protection rests with the mission area of maritime security. The USV Master Plan describes the objectives of maritime security as the ability to collect intelligence below and above the ocean, deter against U.S. assets, and prevent all threats against manned assets.[65] To complete these objectives, maritime security for unmanned systems provides ISR, port monitoring, and maritime domain awareness.[66] These operations within maritime security can prevent the destruction of critical infrastructure and maintain maritime dominance around the U.S. homeland. The U.S. is a maritime nation, and credible maritime security is an integral part of homeland defense. Without maritime security, the U.S. homeland and critical assets would be threatened by credible threats in its ports.

5. Anti-Surface Warfare

The ASuW mission incorporates a variety of operations within its mission area. These operations include coastal patrol, port security, and maritime domain awareness. The USV unmanned systems can engage surface threats using lethal and non-lethal

[63] Department of Defense, *Military and Security Developments involving the People's Republic of China* (Washington, DC: Department of Defense, 2022), 52, https://media.defense.gov/2022/Nov/29/2003122279/-1/-1/1/2022.pdf.

[64] Department of Defense, *Military and Security Developments involving the People's Republic of China*, 52.

[65] Department of the Navy, *The Navy Unmanned Surface Vehicle (USV) Master Plan,* 33.

[66] Department of the Navy, *The Navy Unmanned Surface Vehicle (USV) Master Plan,* 33; Department of the Navy, *Naval Operations Concept 2010: Implementing the Maritime Strategy*), 41.

means. ASuW also entails the incorporation of live fire engagement with potential adversaries. According to the USV Master Plan, the objective is "to provide the ability to engage targets through the use of lethal and/or non-lethal weapons while protecting or keeping manned platforms out of harm's way."[67] The Congressional Research Service Report regarding the Navy's Large Unmanned Surface Vehicles (LUSVs), described in detail later in Chapter III, explains that the Navy intends for LUSVs to be equipped with a vertical launch system (VLS) that is capable of firing anti-ship cruise missiles (ACSMs) within its payload.[68] These USVs would have the payload capability to engage potential threats in the open ocean and littoral areas for homeland defense.

These systems would also be able of providing engagements coverage and supporting manned crews during high-risk situations. When not deployed for live engagements, unmanned systems can provide coastal patrol and port security while naval assets are being deployed for ASuW duties.[69] If manned assets are deployed or engaged in certain operations, unmanned systems can respond to critical situations that require a quick response that the manned crews cannot provide. These systems can protect engaged manned assets while also providing real-time situational awareness and quicker responses to threats than manned crews.

E. CONCLUSION

Defending the homeland is a dynamic mission that involves a host of personnel, equipment, resources, and operations, including unmanned systems. This chapter examined the basics of homeland defenses: the definition of the homeland and homeland defense as well as the importance of defending the homeland to the U.S. Navy. Defending the homeland is a top priority for national strategies, including the U.S. Navy's overall maritime strategy. Unmanned systems can support the U.S. Navy's maritime strategy, including through power projection, sea control, and all-domain access. The integration of more advanced technology, such as unmanned systems, can

[67] Department of the Navy, *The Navy Unmanned Surface Vehicle (USV) Master Plan,* 38–39.

[68] O'Rourke, Ronald. *Navy Large Unmanned Surface and Undersea Vehicles,* 5.

[69] Department of the Navy, *The Navy Unmanned Surface Vehicle (USV) Master Plan,* 38–39.

provide the U.S. with a strategic advantage. These unmanned systems can critically aid in mission areas, such as ISR, MCM, ASW, maritime security, and ASuW toward the homeland defense mission.

Homeland defense not only incorporates defending the homeland but also maintaining a forward presence to deter adversaries. This forward presence incorporates an active, layered defense designed to curb any potential threat before it can threaten the homeland. The U.S. Navy has provided that deterrence since its existence, but the emergence of advanced technology and changes in strategic competitors could jeopardize that deterrence if a solution is not found. The integration of unmanned systems into the U.S. Navy's tactical, operational, and even strategic strategies can provide the ideal solution for deterrence. The next chapter examines the current state of unmanned systems with the U.S. Navy and what capabilities they provide for homeland defense.

III. STATE OF THE U.S. NAVY'S UNMANNED SYSTEMS

Unmanned systems have been a part of U.S. military innovation for some time and have played a significant role in the technological advances of the military. Unmanned aerial vehicles (UAV) have been a critical asset for the military and have been incorporated into military operations. As with UAVs, the U.S. Navy is currently seeking to improve the capabilities of unmanned systems associated with unmanned surface vehicles (USV) and unmanned underwater vehicles (UUV). The development and testing of these systems are crucial to their successful integration into the fleet. These systems will become critical assets within the U.S. Navy's future force design and military operations.

This chapter first examines the future force design outlined by the Chief of Naval Operations' (CNO) Navigational Plan that incorporates unmanned systems into the fleet. Second, this chapter explores the current state of UAVs, USVs, and UUVs developed by the U.S. Navy. This section examines their current capabilities, primary missions, and/or payloads. Lastly, this chapter discusses the developmental squadrons that have been established to develop, experiment with, and test the capabilities of these systems for future integration into the fleet.

A. FORCE DESIGN

The future force design of naval forces and its assets are currently in a critical environment, in which senior naval leaders believe the next course of action is to commence expansion. Within the CNO's 2045 force design plan, the expansion of its force includes the integration of approximately 150 unmanned surface and subsurface platforms.[70] This expansion of the fleet is designed to reinforce the size of the manned surface fleet. The U.S. Navy generally ranges between 270 and 300 ships within its fleet and currently consists of 299 ships.[71] This number does not include the expansion of

[70] Chief of Naval Operations, *Navigation Plan 2022*, 10.

[71] Ronald O' Rourke, *Defense Primer: Naval Forces*, CRS Report IF10486 (Washington, DC: Congressional Research Service, 2023), 2.

UAVs, which would further increase the number of unmanned platforms within the force design. These unmanned systems can augment the fleet with increased capabilities and assets to fulfill the goal of the force design.

With the integration of unmanned systems, these systems will also maintain the CNO's force design imperative of increased distribution. The U.S. Navy needs to maintain its ability to distribute its forces geographically and be a forward presence.[72] Unmanned systems will contribute to the distribution force design imperative by not only expanding the force but also allowing the critical manned assets to continue that forward presence while unmanned systems can contribute to homeland defense. Integrating the surface fleet with unmanned platforms will contribute to increasing force lethality while simultaneously being a global presence and defending the homeland.

B. UAVS

UAVs have played a critical role in U.S. military operations over the past two decades and will continue to do so for the foreseeable future. UAVs currently provide a wide range of capabilities and missions to support various naval assets and their operations. These UAVs can enhance maritime domain awareness through increased intelligence, surveillance, and reconnaissance (ISR) capabilities; target acquisition data collection; anti-surface warfare (ASuW); and anti-submarine warfare (ASW). The U.S. Navy has a robust UAV program to support the force design of future and critical missions that include the MQ-8C Fire Scout, MQ-4C Triton, and MQ-9A Reaper.

1. MQ-8C Fire Scout

The MQ-8C Fire Scout UAV was recently developed and can provide critical mission capabilities for the U.S. Navy. The MQ-8C Fire Scout is a vertical takeoff/ landing tactical UAV (VTUAV) that has a maximum altitude 17,000 ft with an endurance duration of around 12 hours.[73] The Fire Scout is based on the airframe of the Bell 407

[72] Chief of Naval Operations, *Navigation Plan 2022*, 8.

[73] "Northrop Grumman MQ-8C Fire Scout," Janes, July 26, 2023, https://customer.janes.com/.

helicopter, which is a four-bladed rotor that is designed as a utility helicopter.[74] Being based on a utility helicopter, the Fire Scout is a multi-purpose UAV capable of providing the Navy with a variety of capabilities.

The Fire Scout can perform critical missions such as ISR and MCM operations. It is equipped with a Forward-Looking Infrared Radar (FLIR) and an active electronically scanned radar for ISR and detecting, classifying, and tracking multiple targets.[75] Another possible payload for the Fire Scout is the AN/DVS-1 Coastal Battlefield Reconnaissance and Analysis (COBRA) system. This system is designed for UAVs to conduct "tactical reconnaissance in the littoral battlespace for detection and localization of minefields and obstacles in the surf zone."[76] With these sensors, the Fire Scout can not only be utilized for ISR missions but also use that ISR capability for detecting and localizing potential threats in the littorals for Mine Countermeasures (MCM) operations.

The Fire Scout can provide similar operational capabilities as the primary helicopter for naval warships, the MH-60R. The Fire Scout completed an ASW mission by deploying sonobuoys and a sonobuoy receiver to enhance its ASW mission potential.[77] Since the Fire Scout is a VTUAV, it can land and takeoff on suitable warships to create a permanent asset on those warships. Its primary warship is the Littoral Combat Ship (LCS), but it also has the capability to land on different platforms and extend its capabilities to those platforms.[78] The Fire Scout can also reduce the use and stress of the MH-60R helicopters and their crew while deployed. The Fire Scout can provide deployed warships the ability to continue these critical mission areas while their

[74] "Bell 407,"Janes, February 14, 2023, https://customer.janes.com/.

[75] Janes, "Northrop Grumman MQ-8C Fire Scout."

[76] "AN/DVS-1 Coastal Battlefield Reconnaissance and Analysis - (COBRA)," United States Navy, December 28, 2018, https://www.navy.mil/Resources/Fact-Files/Display-FactFiles/Article/2167953/andvs-1-coastal-battlefield-reconnaissance-and-analysis-cobra/ https%3A%2F%2Fwww.navy.mil%2FResources%2FFact-Files%2FDisplay-FactFiles%2FArticle%2F2167953%2Fandvs-1-coastal-battlefield-reconnaissance-and-analysis-cobra%2F.

[77] "Flight testing demonstration MQ-8C Fire Scout ASW potential," Janes, February 3, 2021, https://customer.janes.com/.

[78] Janes, "Northrop Grumman MQ-8C Fire Scout."

embarked helicopter pilots and air crew are conducting any repairs, maintenance, or resting.

2. MQ-4C Triton

The MQ-4C Triton is a land-based, autonomous system primarily used for ISR over open oceans and coastal regions. The MQ-4C is capable of on operational range of 8,200 nautical miles with an endurance of over 24 hours at an altitude of around 50,000 ft.[79] The Triton enhances previous UAV ISR capabilities that can positively detect, track, and classify any maritime vessels. The Triton system enhancements include an anti-icing system, anti-lightning protection, and a more robust wing and fuselage structure.[80] Former Chief of Naval Operations Admiral John Richardson stated in 2018 that one of the key platforms required and needed for the future of the Navy is the MQ-4C Triton UAV.[81] Triton not only improves the U.S. Navy's ISR capability but also improves the positive identification of surface targets that may pose a threat to naval assets around the globe.

Triton is also an effective UAV that is capable of mission integration with manned systems, specifically its ISR sensors. In 2016, the Triton UAV was able to successfully pass its full motion, 360° video feed to the P-8 multi-mission aircraft.[82] The P-8 Poseidon aircraft is a U.S. Navy aircraft that is capable of ISR, maritime patrol, ASW, and ASuW missions.[83] This capability greatly enhanced the P-8 mission capabilities and readiness. It allows the manned aircraft to expand its tracking and detecting ranges while strengthening the crew's situational awareness. This capability also provides a redundancy for the P-8 crew during any mission. If the Triton and P-8 are

[79] "MQ-4C Triton: Making the World's Oceans Smaller," Northrop Grumman, accessed August 29, 2023, https://northrop-grumman-7pdlqe7lt-agencyq-ngc.vercel.app/.

[80] Ernest Snowden and Robert F. Wood Jr., *Maritime Unmanned: From Global Hawk to Triton,* (Annapolis, MD: Naval Institute Press, 2021), 234–235.

[81] Snowden and Wood Jr., *Maritime Unmanned,* 227.

[82] Otto Kreisher, "Triton UAV Passes Full-Motion Video To P-8 During Flight Test," *USNI News* (blog), June 22, 2016, https://news.usni.org/2016/06/22/triton-uav-passes-full-motion-video-p-8-flight-test.

[83] "Boeing P-8A Poseidon," Janes, August 25, 2022, https://customer.janes.com/.

conducting flights together, the P-8 can use the Triton's video feed if the P-8 crew experiences any technical issues from their organic sensors.

3. ScanEagle

ScanEagle is a small tactical UAS (STUAS) that has been deployed by the U.S. Navy and the Marine Corps in critical operating environments such as Iraq and Afghanistan. This ISR UAV has the capability to operate for over 20 hours to increase the battlespace awareness for a Carrier Strike Group (CSG) or independent deployers.[84] ScanEagle provides naval assets the ability to extend their non-organic sensors for their operations. The organic sensors of naval assets may not be able to extend as far out as the UAVs, which would significantly decrease the awareness and readiness of the naval assets.

4. MQ-4A Reaper

The MQ-9A Reaper is a newly developed UAV for USMC and naval assets to further increase their ISR, ASuW, and battlespace awareness abilities for a strike force. The MQ-9A Reaper drone has been a staple within the USAF's drone program but has recently become a critical asset within the USN's and USMC's UAV program. The MQ-9A Reaper is a multi-mission capable drone that can enhance ISR and support long-range missile strikes. The Reaper has a maximum altitude of 50,000 ft, a maximum endurance of 27 hours, and a maximum radius of 2,250 nautical miles.[85] The Reaper has successfully demonstrated the ability to support long-range missile strikes. The Reaper has the capability to acquire specific targets and pass those coordinates to the airborne early warning aircraft, E-2D Hawkeye, which can pass those coordinates to the force. The sensors onboard the Reaper can also provide positive pre- and post-battle damage

[84] Brien Alkire, James G. Kallimani, Peter A. Wilson, and Louis R. Moore, *Applications for Navy Unmanned Aircraft Systems*, (Santa Monica, CA: RAND, 2010), xiii, https://www.rand.org/pubs/monographs/MG957.html.

[85] "MQ-9A Reaper," Naval Air Systems Command (NAVAIR), accessed July 20, 2023, https://www.navair.navy.mil/product/MQ-9A-Reaper; Joe Saballa, "US Navy MQ-9 Drone, E-2D Aircraft Team Up for Long-Range Missile Strike," The Defense Post, March 21, 2023, https://www.thedefensepost.com/2023/03/21/us-navy-drone-missile-strike/.

assessment pertaining to the force's operations.[86] The MQ-9A Reaper is an effective UAV capable of enhancing lethal and non-lethal tasks for naval assets.

C. USVS

While UAVs have proved successful in the fleet, USVs are recently developed unmanned systems that can be vital for future operations. The U.S. Navy's Office of Naval Research (ONR) has created several programs to continue the innovation and integration of unmanned surface vehicles in the fleet.[87] The Navy has currently developed Medium Unmanned Surface Vehicles (MUSVs) and Large Unmanned Surface Vehicles (LUSVs) to expand the surface fleet. These USVs will be able to support distributed maritime operations, enhance maritime domain awareness, and conduct ASuW and ASW mission areas.[88]

Military warfare currently consists of emerging technologies that push the evolution of warfare dynamics, and these unmanned vehicles are an aspect of those emerging technologies. These vehicles can provide senior leaders with new capabilities. These vehicles are equipped with sensors, payloads, and/or weapons that can increase their lethality.[89] These systems will support and assist the surface fleet, increase mission durations, and decrease the high-intensity stress on manned crews during their operations.

1. LUSVs

The Navy has outlined the physical dimensions and future capabilities of the USVs, specifically the LUSVs and MUSVs. Regarding LUSVs, these surface vehicles are 200 feet–300 feet in length, are cheaper than current ships in the fleet, and are capable of conducting high endurance operations. These unmanned vehicles have the capacity to carry anti-ship cruise missiles and are equipped with 16–32 missile-launching tubes to

[86] Saballa, "US Navy MQ-9 Drone, E-2D Aircraft Team Up for Long-Range Missile Strike."

[87] Greg Leatherman, "Unmanned Surface Vehicles and the Future of the U.S. Navy," *Ocean News & Technology* (May 2019), 10.

[88] Department of the Navy, *Unmanned Campaign Framework*, 15.

[89] O'Rourke, *Navy Large Unmanned Surface and Undersea Vehicles: Background and Issues for Congress,* 1–2.

house the anti-ship cruise missiles.[90] The LUSVs are also capable of operating for 30–90 days without any manned assistance and capable of a range of up to 4500 NM.[91] Due to their range, LUSVs will operate with and support CSGs, Surface Action Groups (SAGs), Amphibious Ready Groups (ARGS), and any independent deployers.[92]

2. MUSVs

MUSVs are smaller unmanned systems capable of conducting similar operations as LUSVs, but these vehicles are primarily intended to support naval assets with ISR, targeting, and awareness of their operating environment. MUSVs range from 45 to 90 feet in overall length with a high endurance capacity for certain payloads. The primary payloads in MUSVs are ISR capabilities specifically intended to enhance battlespace awareness for naval assets. MUSVs will be capable of autonomous and semi-autonomous operations to support CSGs, SAGs, and independent deployers using their high-endurance capability and payloads.[93]

a. Sea Hunter

Sea Hunter, a newly created MUSV prototype, has completed various tests and proven to be a capable unmanned vehicle for naval operations. Developed by the Defense Advanced Research Projects Agency (DARPA), Sea Hunter is a 132 foot-long unmanned vessel with two diesel engines capable of reaching 27 knots and sustaining fuel for a mission spanning approximately 70 days.[94] Sea Hunter is designed for navigation autonomy with the capability of following the International Regulations for Prevention of Collisions at Sea (COLREGS). This vehicle can safely navigate, avoid obstacles, and

[90] O'Rourke, *Navy Large Unmanned Surface and Undersea Vehicles: Background and Issues for Congress,* 5.

[91] Department of Defense, *Unmanned Sea Vehicles: US Department of Defense FY 2024 Budget In-depth Analysis,* (Washington, DC: Department of Defense, 2023), 11.

[92] O'Rourke, *Navy Large Unmanned Surface and Undersea Vehicles: Background and Issues for Congress,* 8.

[93] O'Rourke, *Navy Large Unmanned Surface and Undersea Vehicles: Background and Issues for Congress,* 12–13.

[94] Stephen J. Mraz, "Enter the Sea Hunter: The Next Step in Unmanned Weapons Platforms," *Machine Design* 90, no. 3 (March 2018): 6, ProQuest.

conduct operations semi-autonomously or autonomously.[95] In January 2019, Sea Hunter became the "first ship to autonomously navigate from San Diego to Pearl Harbor, Hawaii, and back."[96] Sea Hunter provides a great opportunity for the U.S. Navy to continue the innovation of using unmanned vehicles that are capable of safe navigation and long, oceanic transits.

With its long endurance capacity and ability to transit bodies of water, Sea Hunter can further enhance the ASW, maritime security, and ASuW mission areas. Its primary operation within these mission areas would be the ability for long-range surveillance. Sea Hunter would be capable of tracking, detecting, and localizing either surface or subsurface targets for a substantial duration.[97] One of the initial capabilities of Sea Hunter has been to track submarines for long periods without any support, and it can use that tracking ability to also locate surface targets to support maritime security and ASuW operations.

D. SMUU/MUUV

While the air and surface communities have invested in unmanned systems to strengthen their mission readiness and capabilities, the sub-surface community has also shifted its focus to unmanned systems. The UUV systems include various small and medium UUVs (S/MUUV), such as the LionFish SUUV, the MK 18 Mod 2 Kingfish MUUV, and the Knifefish MUUV. These undersea vehicles focus on operations such as ISR, mine warfare, and intelligence preparation of the operational environment (IPOE).[98] These vehicles provide valuable information associated with the area of responsibility (AOR) of surface fleets or even potentially hostile environments.

[95] The Royal Institute of Naval Architects, "US Navy Develops Vision for Unmanned Capabilities as Part of Future Surface Combatant Force," *Warship Technology* (2019): 28, https://www.jstor.org/stable/48601565.

[96] The Royal Institute of Naval Architects, "US Navy Develops Vision for Unmanned Capabilities as Part of Future Surface Combatant Force," 28.

[97] "Sea Hunter," Janes, June 22, 2023, https://customer.janes.com/.

[98] Department of the Navy, *Unmanned Campaign Framework,* 35.

1. LionFish SUUV

The Lionfish UUV program is the next generation of the SUUV program. Lionfish is the upgraded version of the previous MK 18 Mod 1 Swordfish UUV with enhanced capabilities. The MK18 family of UUVs has been the most successful UUV program within the U.S. Navy according to the Navy's Unmanned Framework Campaign.[99] Its primary missions consist of ISR, object localization, bottom mapping and survey, mine countermeasures, and IPOE.[100] This UUV gained the capability to provide MCM search operations in low-visibility very shallow water (VSW) zones. This allows the UUV to further enhance its search capability in shallower water ranging from 10 to 40 feet.[101] The upgraded Lionfish has been developed to increase the unmanned vehicles' endurance capability to around 18 hours while retaining the capability of operating at a depth of approximately 305 meters.[102] The Lionfish SUUV will continue the success of the MK 18 Mod 1 UUV program and further increase its capabilities.

2. MK18 Mod 2 Kingfish

The MK 18 Mod 2 Kingfish is a medium-sized UUV within the fleet. The Kingfish UUVs are operated by the U.S. Navy's Expeditionary Mine Countermeasures (ExMCM) division, and approximately 90 Kingfish UUVs have been developed and distributed throughout the fleet. This UUV is capable of an endurance of 70 hours and a maximum operating depth of 600 meters.[103] However, the U.S. Navy is currently developing another UUV that will become an upgrade to the MK 18 Mod 2 Kingfish UUV. The upgraded UUV is known as Viperfish, which is a Maritime Expeditionary Mine Countermeasure Unmanned Undersea Vehicle (MEMUUV). This new MEUUV is being developed to enhance the Navy's ExMCM division. The operational Kingfish and

[99] Department of the Navy, *Unmanned Campaign Framework,* 16.

[100] Department of the Navy, *Unmanned Campaign Framework,* 35.

[101] "Clearing the Way: UUVs Evolve to Meet Front-Line MCM Requirements," Janes, February 12, 2008, https://customer.janes.com/.

[102] "REMUS 300 UUV as next-generation SUUV programme of record," Janes, April 1, 2022, https://customer.janes.com/.

[103] "REMUS 600," Janes, July 14, 2023, https://customer.janes.com/.

developing Viperfish UUV upgraded will enhance battlespace awareness and mine warfare capabilities while enhancing expeditionary mine countermeasures for joint operations throughout the fleet.

3. Knifefish MUUV

The Knifefish MUUV is a surface mine countermeasure unmanned undersea vehicle (SMCM UUV) that is a vital aspect of the Navy's mine detection, and identification capability against various mines throughout various operating environments. Knifefish can operate with the LCS and other surface ships if necessary.[104] Knifefish has been a successful mine countermeasure UUV during its development trials and varying exercises. These trials included mine test targets in various clutter environments, simulated minefields, and multiple depths.[105] Knifefish has become a capable and effective countermeasure UUV that is expected to be invaluable to naval assets in future operating environments.

E. UNMANNED SYSTEMS SQUADRONS

The CNO's Navigation Plan describes priorities needed to accomplish the Navy's mission of creating a larger and more lethal force. Two of these priorities relevant to unmanned systems are readiness and capabilities. The Navigational Plan needs naval assets to be mission ready to deter threats and ensure national and global security. To achieve this, it prioritizes the capabilities of modernizing the force, developing advanced platforms, and ultimately producing an effective fighting force.[106] The U.S. Navy's force design outlines the increase in unmanned systems that will modernize the force with advanced platforms, but developing these systems is only the beginning of the process. To effectively achieve the integration of unmanned systems, personnel need to understand their capabilities and how to operate these systems to effectively integrate

[104] "U.S. Navy's UUV countermine Knifefish reaches milestone C," Janes, August 27, 2019 , https://customer.janes.com/.; Department of Defense, *Unmanned Sea Vehicles: US Department of Defense FY 2024 Budget In-depth Analysis,* 5.

[105] "Knifefish Unmanned Undersea Vehicle (UUV)," *Naval Technology*, January 13, 2022, https://www.naval-technology.com/projects/knifefish-unmanned-undersea-vehicle-uuv/.

[106] Chief of Naval Operations, *Navigation Plan 2022*, 12.

these assets into the fleet. The U.S. Navy has specifically established developmental squadrons designed to develop, test, and integrate these unmanned systems.

1. UUVRON and SURFDEVRON

Regarding UUVs and USVs, the U.S. Navy has established the Unmanned Undersea Vehicles Squadron (UUVRON) and Surface Development Squadrons (SURFDEVRON). These development squadrons are designed to incorporate unmanned systems into the fleet by testing their various capabilities.[107] Within SURFDEVRON, the U.S. Navy established Unmanned Surface Vessel Division (USDIV) One. The primary objectives of USDIV One are to experiment with medium and large USVs, test their capabilities, and provide the training and knowledge for sailors to operate and sustain these complex systems.[108] Former Commander, Naval Surface Forces/Naval Surface Force U.S. Pacific Fleet Vice Admiral Kitchener stated that "USVDIV One will be a catalyst for innovation as we employ unmanned surface capabilities in the Pacific Fleet."[109] These squadrons and the personnel within will commence the on-the-ground experimentation that can lead the development and integration of these systems into the manned surface fleet.

To ensure the feasibility of integrating unmanned systems into the surface fleet, the U.S. Navy needs to create viable CONOPs. Both UUVRON and SURDEVRON are currently developing feasible CONOPs for the UUVs and USVs that could be incorporated into the surface fleet objectives.[110] These squadrons include technology developers, fleet operators, relevant enlisted personnel, and surface warfare qualified

[107] Chief of Naval Operations, *Navigation Plan 2022*, 25.

[108] Ensign Ronan Williams, "Navy Increases Unmanned Capabilities with Newly Established Unmanned Surface Division," *United States Navy*, May 13, 2022, https://www.surfpac.navy.mil/Media/News/Article/3033092/navy-increases-unmanned-capabilities-with-newly-established-unmanned-surface-di/http%3A%2F%2Fwww.surfpac.navy.mil%2FMedia%2FNews%2FArticle%2F3033092%2Fnavy-increases-unmanned-capabilities-with-newly-established-unmanned-surface-di%2F.

[109] ENS Williams, "Navy Increases Unmanned Capabilities with Newly Established Unmanned Surface Division."

[110] Megan Eckstein, "USV, UUV Squadrons Testing Out Concepts Ahead of Delivery of their Vehicles," *USNI News*, September 9, 2020, https://news.usni.org/2020/09/09/usv-uuv-squadrons-testing-out-concepts-ahead-of-delivery-of-their-vehicles

officers trained in COLREGS to assist in the development of these CONOPs.[111] These CONOPs are vital to fully understand the capabilities and mission these systems can provide for the fleet.

2. UX-24

The U.S. Navy has also established the Air Test & Evaluation Squadron Two Four (UX-24) for UAVs. Squadron UX-24's primary mission is to "conduct research, development, testing, and evaluation (RDT&E) of Unmanned Aircraft Systems (UAS)."[112] This squadron consists of various experts, engineers, and naval test pilots to provide accurate assessments of these systems and their capabilities.[113] As with UUVs and USVs, this squadron provides an accurate assessment of current and future systems capabilities. Senior naval leaders need a clear understanding of the current state of these systems, and these test squadrons provide just that. UAVs have proven to be successful in various military operations, but this squadron can continue the successful development and testing of advanced UAVs.

F. CONCLUSION

Unmanned systems are emerging technologies that will be the future of the fleet and naval assets. The future force design outlines that the fleet will be expanded, and unmanned systems will be a part of that future expansion. Not only will these systems expand the fleet, but they will also enhance the fleet's capabilities. These systems can provide a variety of payloads that have the capacity to perform certain missions and objectives. Currently, the U.S. Navy is developing and testing a wide variety of systems that will benefit the entire fleet. UAVs have already been proven for the fleet, but other systems are being developed to benefit the surface and sub-surface communities. These systems will be the future of the fleet and be incorporated into future tactics, strategies, and operations.

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[111] Eckstein, "USV, UUV Squadrons Testing Out Concepts Ahead of Delivery of their Vehicles."

[112] "Air Test and Evaluation Squadron Two Four (UX-24)," Naval Air Warfare Center Aircraft Division (NAWCAD), accessed September 8, 2023, https://www.navair.navy.mil/nawcad/ux24/.

[113] NAWCAD, "Air Test and Evaluation Squadron Two Four (UX-24)."

The next chapter will analyze how these systems can aid the U.S. Navy in its homeland defense mission, while it maintains a distributed naval force to operate in forward regions of the world. The chapter will examine how the current payloads and capabilities of these systems can support homeland defense missions, and it will also investigate any gaps within these homeland defense missions that unmanned systems can fill. The U.S. Navy needs to continue its distributed maritime operations, and unmanned systems can be the systems to protect the home front.

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IV. FIGHTING ON THE HOMEFRONT

In the present-day era of strategic competition, the United States needs to continue deploying a formidable force around the globe to execute a full spectrum of military operations. These military operations can range from combat operations to providing humanitarian assistance to various countries to enhance security and maintain stability globally. The U.S. military is a force for peace and security around the world, but for the United States to operate globally, it must be secure at home. Defending the homeland has always and will always be a top priority for senior U.S. military leaders, and unmanned systems can play a critical role in homeland defense.

This concluding chapter will examine how the current unmanned systems within the U.S. Navy provide the ability to effectively execute the mission of defending the homeland. These systems will incorporate their capabilities to become critical assets for each of the homeland defense missions outlined in Chapter II: intelligence, surveillance, and reconnaissance (ISR), maritime security, anti-surface warfare (ASuW), anti-submarine warfare (ASW), and mine countermeasures (MCM).

A. ISR

One critical aspect of defending the homeland is the need to be proactive to prevent any acts of aggression or activities that can harm the homeland. To be proactive, U.S. assets need to conduct effective ISR operations, of which unmanned systems are an essential asset. UAVs have already been an effective tool for ISR operations and can continue this mission to ensure security for the homeland. For example, the newly developed MQ-4C Triton UAV consists of an upgraded sensor suite that is capable of 360-degree coverage of its operating environment during its ISR operations or maritime patrols.[114] These sensors are critical in the UAVs' ability to actively and successfully detect and classify contacts during its ISR operations. UAVs can be an effective, proactive tool for the U.S. Navy to deploy to counter any specific threats and enhance security.

[114] Northrop Grumman, "MQ-4C Triton: Making the World's Oceans Smaller."

Manned air crews can be deployed to conduct ISR operations, but UAVs can enhance these operations with their capabilities. The U.S. Navy's maritime patrol aircraft, the P8-A Poseidon, can receive valuable surveillance information from Triton's video feed to increase its surveillance area range.[115] Triton can reach a range of over 8,000 nautical miles and significantly increase the surveillance area.[116] This coverage allows Triton to obtain accurate, real-time intelligence over a vast amount of the ocean or littoral waters, which helps ensure situational awareness.[117] In addition, Triton includes a reinforced airframe with de-icing, anti-lightning, and gust load protection systems to operate in harsh weather conditions without damaging its vital sensors.[118] These upgrades provide Triton the capability to conduct surveillance operations and maintain an accurate picture of the operational environment. Ultimately, Triton represents an advanced UAV within the U.S. Navy's arsenal that can support manned patrols while also continuing its mission in adverse climates that could potentially restrict manned operations.

Even though UAVs can significantly enhance situational awareness, ISR issues exist within the home front that need to be addressed. The recent Chinese "research" balloon over the United States indicated the potential threat of undetected objects. The United States initially detected the aerial object over U.S. airspace above Alaska and deemed the object to pose no security or intelligence risk to the United States. However, the aerial object was later determined to be a surveillance balloon due to its equipment related to intelligence gathering.[119] The U.S. State Department released a public statement stating that the balloon was not equipped with standard weather equipment, but equipped with multiple antennas and sensors specifically designed for intelligence

[115] Kreisher, "Triton UAV Passes Full-Motion Video To P-8 During Flight Test."

[116] Northrop Grumman, "MQ-4C Triton: Making the World's Oceans Smaller."

[117] Northrop Grumman, "MQ-4C Triton: Making the World's Oceans Smaller."

[118] Snowden and Wood Jr., *Maritime Unmanned,* 234–235; Northrop Grumman, "MQ-4C Triton: Making the World's Oceans Smaller."

[119] Lara Seligman and Sam Stein, "Timeline: A Chinese Spy Balloon's Trip across the United States," *Politico*, February 5, 2023, https://www.politico.com/news/2023/02/05/timeline-a-chinese-spy-balloons-7-day-trip-across-the-united-states-00081222.

surveillance.[120] Several officials within North American Aerospace Defense Command (NORAD) and the U.S. government stated that there were significant gaps within the United States' "domain awareness" capability.[121] This aerial object was equipped with its own surveillance equipment capable of gathering vital information against the United States.

While the high-altitude balloon was destroyed without any major risks, the incident still proved alarming. Even though the balloon was shot down, the duration of the balloon's flight could have potentially provided China with valuable information about U.S. homeland defense, sensitive sites, or defensive measures in place. The spy balloon traveled over Montana, which is home to the U.S. nuclear missile silos.[122] In recent years, there have been numerous aerial objects that have traveled over U.S. airspace that could be a threat to the United States.[123] The rate and increase of these aerial surveillance objects can become a serious threat to U.S. national security.

Due to recent incidents, unmanned systems can provide a solution to enhance the detection of unknown aerial objects over U.S. airspace or waters. These systems have capable surveillance sensors to assist in the successful detection and identification of unknown objects. The number of unknown aerial objects has significantly increased over the last few years and has demonstrated a weakness in the United States' ability to effectively detect and identify these objects.[124] To curb the domain awareness gap, unmanned systems can enhance the effectiveness of detection of unknown objects or contacts by conducting coastal reconnaissance.

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[120] Emily Feng and Lexie Schapitl, "How a Chinese 'spy Balloon' Prompted the U.S. to Scour the Skies," *NPR*, February 14, 2023, World, https://www.npr.org/2023/02/14/1156731462/china-spy-balloon-timeline-key-dates/.

[121] Erin Banco, "What the Biden Administration Isn't Telling Congress about Spy Balloons," *Politico*, March 21, 2023, https://www.politico.com/news/2023/03/21/congress-chinese-spy-balloon-00087980.

[122] Tara Coop and Lolita C. Baldor, "Pentagon: Chinese Spy Balloon Spotted over Western US," *AP News*, February 3, 2023, https://apnews.com/article/chinese-surveillance-balloon-united-states-montana-47248b0ef2b085620fcd866c105054be.

[123] Seligman and Stein, "Timeline: A Chinese Spy Balloon's Trip across the United States."; "What the Biden Administration Isn't Telling Congress about Spy Balloons," *Politico*, March 21, 2023, https://www.politico.com/news/2023/03/21/congress-chinese-spy-balloon-00087980.

[124] Banco, "What the Biden Administration Isn't Telling Congress about Spy Balloons. "

1. Coastal Reconnaissance and Coastal Surveillance

UAVs and USVs are highly capable unmanned systems that can cover a large amount of the maritime environment for ISR operations and defending the homeland through coastal reconnaissance operations. Vego outlines that an "effective employment of local sea defense forces is reliable, and continuous coastal reconnaissance should be conducted both in peacetime and in time of war."[125] The purpose of coastal reconnaissance is to detect and identify any potential hostile or enemy combatant from the coastline extending hundreds of nautical miles outward.[126] Unmanned systems are being developed with the ability to enhance the ISR mission and increase situational awareness for security. Smaller USVs, specifically Sea Hunter, have demonstrated the ability to conduct oceanic transits, which can be effective within the confines of the U.S. coast for ISR operations. The systems are being developed to have an endurance range of 4,500 nautical miles, which is vital for ISR coverage.[127] Coastal reconnaissance can be another method within the ISR mission area for unmanned systems. Deploying these systems can be a tool to gain an accurate assessment of the maritime domain before adversary contacts can reach or engage the U.S. coastline.

The high-endurance capabilities of these systems can augment the domain awareness gaps observed by the high volume of unknown objects penetrating U.S. airspace. Advanced Triton can effectively operate over 24 hours, allowing for a high endurance range during operation.[128] The high endurance capability can fill the domain awareness gap by having an advanced ISR system continuously monitor the airspace with real-time intelligence gathering,[129] which is critical in obtaining an accurate representation of the environment and gaining situational updates as they happen. Triton

[125] Vego, *Maritime Strategy and Sea Denial*, 269.

[126] Vego, *Maritime Strategy and Sea Denial*, 269.

[127] "USN issues RFI for Medium Unmanned Surface Vehicle, Janes," October 23, 2018, https://customer.janes.com/.

[128] Jonathan Snyder, "Navy Receives Triton Drone with Enhanced Surveillance Abilities Ahead of Schedule," *Stars and Stripes,* June 22, 2023, https://www.stripes.com/branches/navy/2023-06-22/navy-triton-drones-northrop-alaska-10512545.html.

[129] Snyder, "Navy Receives Triton Drone with Enhanced Surveillance Abilities Ahead of Schedule."

can be a viable option for senior leaders to incorporate unmanned systems to augment the current issues of proactively detecting unknown contacts within or outside the U.S. homeland.

Once located, coastal reconnaissance can shift to coastal surveillance, and unmanned systems can effectively conduct this specific operation. Coastal surveillance occurs once a potential hostile or enemy combatant is detected and located. The primary purpose of coastal surveillance is to actively monitor and track the activities of the specific platform.[130] UAVs and USVs can actively monitor air and surface contacts, whereas UUVs can monitor any subsurface contacts that could become a potential threat. These systems can actively monitor these contacts while waiting for manned crews to provide additional support or conduct further operations against the contacts. These systems will provide the U.S. Navy with the advantage of active surveillance and monitoring of unknown contacts for homeland defense.

B. MARITIME SECURITY

As the previous section has shown, unmanned systems can provide crucial intelligence and reconnaissance to help keep the maritime approaches to the U.S. homeland secure. However, detecting threats is not enough; capabilities to respond to those threats are needed, and here, too, unmanned systems can be very useful. Providing security for the maritime domain is an essential role in defending the homeland. Maritime security is critical in maintaining a secure maritime environment, countering terrorism and transnational crime, protecting the exclusive economic zone (EEZ), and combating any unlawful activity within the maritime domain.[131] Maritime security means enforcing the rules and regulations regarding the governance of maritime activities and protecting the maritime domain within the U.S. homeland.[132] Without maritime security, the U.S. would be vulnerable to acts of aggression or unlawful activity detrimental to vital U.S. assets.

[130] Vego, *Maritime Strategy and Sea Denial*, 269.

[131] Department of the Navy, *A Cooperative Strategy for 21st Century Seapower*, 26.

[132] Department of the Navy, *A Cooperative Strategy for 21st Century Seapower*, 26.

1. Port Security

Acts of terrorism against U.S. naval ports, facilities, or any critical infrastructure pose a credible and dangerous threat within the maritime domain. One of the biggest threats is the possibility of non-state actors conducting acts of terrorism against these facilities. The U.S. *National Strategy for Maritime Security* outlines the various methods and tools non-state terrorist groups can employ to strike the U.S. in the maritime environment. These methods and tools include suicide boats, commercial vessels launching missiles at vessels or port facilities, UUVs deploying underwater explosives, and terrorists deploying various mines in unknown locations.[133] These pose a credible threat to the United States due to maritime vulnerabilities, as examined in the *National Strategy for Maritime Security.* This strategy described naval ports as robust, multi-functioning infrastructure, compounded by a wide range of individuals, organizations, and networks that add to the complexity of port security. Port security suffers from vulnerability due to easy accessibility by either water or land, and adversaries can tamper with the facilities, ships, and/or barges.[134] The operations and assets within naval facilities are complex, involving a multitude of organizations, and these organizations can become a target for terrorists.

One of the most tragic incidents in U.S. history regarding a mishap in port security was the bombing of the *USS Cole* in late 2000. During a routine in port refueling in Aden, Yemen, two suicide pilots detonated a bomb-laden boat alongside the *USS Cole* that caused a 40-foot-wide hole in its hull, killed 17 crew members and injured 37 others.[135] The security mishap occurred when the crew onboard the *USS Cole* believed that the approaching boat was a part of the assistance crew in their refueling operations.[136] The *USS Cole* incident exhibited the ability of non-state actors to exploit

[133] George W. Bush, *National Strategy for Maritime Security*, (Washington, DC: White House, 2005), https://www.maritime-cybersecurity.com/National_Strategy_for_Maritime_Security.html.

[134] Bush, *National Strategy for Maritime Security*.

[135] "USS Cole Bombing," Federal Bureau of Investigation, accessed October 24, 2023, https://www.fbi.gov/history/famous-cases/uss-cole-bombing; Lisa Otto, Suzanne Graham, and Adrienne Horn, "Maritime Terrorism," in *Global Challenges in Maritime Security: An Introduction*, ed. Lisa Otto (Switzerland: Springer, 2020), 155.

[136] Otto, Graham, and Horn, "Maritime Terrorism," 156.

gaps in security measures and threaten the U.S. Navy.[137] While this incident occurred over two decades ago, the U.S. Navy can still be threatened by maritime terrorism today if terrorists exploit further gaps.

Port Security is a robust, complex mission within the larger mission of maritime security which needs to adapt and innovate through the use of unmanned systems. There are many challenges within maritime security, and one of these challenges is the advances in technology. Anja Menzel and Lisa Otto, in *Global Challenges in Maritime Security*, introduced solutions to the challenges of maritime security, namely innovation as key to addressing these challenges.[138] Without adapting and innovating, disastrous incidents, such as the *USS Cole*, can occur in a U.S. port or facility. Unmanned systems will become a critical asset to improve the security measures within naval facilities.

Unmanned systems can be proactive within port security to ensure the security of the assets at home. UUVs can be at the forefront of conducting inspection/identification operations. In addition to the maritime security mission, inspection/identification can protect and secure critical naval assets, such as warships, maritime infrastructure, and naval ports. These include performing area searches, object identification, and localization of underwater threats in and around areas such as ship hulls, port areas, or any other underwater areas.[139] One risk within port security is adversaries damaging assets using underwater explosives. To detect these explosives, the Lionfish UUV can be deployed to survey and conduct an inspection of U.S. ships in port. This smaller UUV can be deployed in shallow waters to detect and locate any potential threats undetected by U.S. personnel onboard the ships.[140] Using unmanned vehicles for the inspection of ship hulls could keep U.S. naval warships deployable and ready for sea at a moment's notice,

[137] Otto, Graham, and Horn, "Maritime Terrorism," 156–157.

[138] Anja Menzel and Lisa Otto, "Connecting the Dots: Implications of the Intertwined Global Challenges to Maritime Security," in *Global Challenges in Maritime Security: An Introduction*, ed. Lisa Otto (Switzerland: Springer, 2020), 239.

[139] Department of the Navy, *The Navy Unmanned Undersea Vehicle (UUV) Master Plan*, 33.

[140] Janes, "Clearing the Way: UUVs Evolve to Meet Front-Line MCM Requirements."

while not risking sailors' lives.[141] Inspection and identification are vital in ensuring the protection and security of our naval assets within homeland naval ports. If this mission is not successful, U.S. naval assets could potentially be threatened and prevented from conducting valuable missions even before commencing. UUVs can be a critical tool for the U.S. Navy to enhance anti-terrorism operations and ensure port security. Keeping warships deployable is paramount for the U.S. Navy's strategy of continuing a forward presence globally. As such, inspecting ship hulls is vital to maintaining the ship's mission readiness, hull integrity, and port security.

2. ASuW/ASW Coordination and Engagement

Adversaries deploying surveillance objects can pose a threat to the U.S., in addition to sending their powerful fleets to the homeland. Adversarial submarines are a powerful force that can reach the United States without being detected. These submarines can reach both the Pacific and the Atlantic coasts of the United States if there are gaps in the United States' ISR operations. Army General Chris Cavoli, the top commander of NATO, said that Russian submarines patrol in the Atlantic have been more numerous than in previous years.[142] General Glen VanHerck, Commander of NORAD and United States Northern Command (USNORTHCOM) stated that Russian submarines are being deployed more frequently, specifically, the Russian Yasen-class nuclear cruise missile attack submarine, which could be a concern for the U.S.[143] Gen. Van Herck stated, "Now not only the Atlantic [sic], but we also have them in the Pacific, and it's just a matter of time—probably a year or two—before that's a persistent threat, 24 hours a day."[144] The

[141] Robert W. Button, John Kamp, Thomas B. Curtin, and James Dryden, *A Survey of Missions for Unmanned Undersea Vehicles*, (Santa Monica, CA: RAND, 2009), 90.

[142] Paul D. Shinkman, "U.S.: Russian Subs in Atlantic 'More Active Than We've Seen Them in Years,'" *U.S. News,* April 26, 2023, https://www.usnews.com/news/national-news/articles/2023-04-26/u-s-russian-subs-in-atlantic-more-active-than-weve-seen-them-in-years.

[143] Sam LaGrone, "NORTHCOM: Russia Close to Persistent Nuclear Cruise Missile Attack Sub Presence off U.S. Coasts," *USNI News* (blog), March 23, 2023, https://news.usni.org/2023/03/23/northcom-russia-close-to-persistent-nuclear-cruise-missile-attack-sub-presence-off-u-s-coasts.

[144] LaGrone, "NORTHCOM: Russia Close to Persistent Nuclear Cruise Missile Attack Sub Presence off U.S. Coasts."

location and frequent movements of other navies can potentially reach the homeland if undetected.

Time plays a critical operational factor in the ability to successfully monitor and engage potential threats in any environment, and unmanned systems can assist here. As was noted earlier, all unmanned systems have the capability to effectively monitor and assist in a potential engagement situation. For example, if a UAV or USV is conducting coastal reconnaissance and detects a contact that may be hostile, they can provide continued monitoring until manned surface assets arrive. The unmanned systems being deployed to track and monitor these contacts can augment a Surface Action Group (SAG) or an independent deployer to deter the detected threats. The U.S. Navy can deploy various surface assets to counter specific threats, which also takes considerable time. While waiting for these units to reach the contacts, the unmanned systems will continuously monitor and provide intelligence to the SAG, or independent deployer.

Once these contacts are detected and tracked, there is still the possibility of an engagement. In the case of an engagement, the USVs can increase the battlespace awareness of the environment or augment the surface assets with increased ASCM capability. MUSVs can continuously track the contact while the LUSVs can provide enhanced ASuW capability with possible ASCMs onboard.[145] A SAG or independent deployer has the capability to engage surface contacts, when necessary, but those assets can be limited or hindered. However, these assets can be deployed with LUSVs to augment their ASuW capabilities for a possible engagement. The SAG or independent deployer would need a human operator to remotely initiate the engagement sequence with the C2 structure.[146] Both the LUSVs and MUSVs could be deployed with surface assets to enhance their battlespace awareness of adversaries and support a potential ASuW engagement.

[145] O'Rourke, *Navy Large Unmanned Surface and Undersea Vehicles: Background and Issues for Congress,* 5.

[146] O'Rourke, *Navy Large Unmanned Surface and Undersea Vehicles: Background and Issues for Congress,* 7.

Not only is coordination between manned and unmanned systems essential for ASuW, but it is also imperative for ASW. Subsurface contacts are extremely difficult to find, monitor, and/or classify as a potential threat. To increase the probability of detecting subsurface contacts, coordination is needed between unmanned and manned systems. As seen with the Triton, this UAV can pass real-time intelligence to the maritime patrol P-8. The P-8 is employed with ASuW capabilities, such as ASW sensors and torpedoes to counter threats.[147] However, the P-8 crew can also support ASW capabilities by relaying the information they received from the Triton to a DDG and/or MH-60 helicopter within the SAG.[148] With that valuable intelligence, the DDG or MH-60 can deploy their ASW suite capabilities, such as their torpedoes, sonobuoys, and sonar to either monitor or engage the contacts if necessary.[149] This coordination is essential to detect these difficult targets in any operating environment that can target U.S. assets while conducting routine operations.

C. MCM

The United States has an extensive coast that significantly increases the difficulty of effectively monitoring the maritime domain and provides an adversary with more opportunities to strike the homeland. Unmanned systems can conduct ISR operations to ensure adversarial contacts are effectively tracked and monitored; however, these systems can also miss contacts because of the distance being covered, and adversaries can use this to their advantage. One of the potential failures in the ISR operations is the non-detection of adversaries laying mines close to the U.S. coast. Retired Naval Officer, LCDR Jack Rowley, wrote that "Sea mines are perhaps the most lethal form of these weapons, as they are hard to find, difficult to neutralize, and can present a deadly hazard to any vessel—even those ships specifically designed to hunt them."[150] Even though the

[147] United States Naval War College, *Joint Maritime Operations: Forces/Capabilities Handbook*, (Newport, R.I. U.S Navy War College, 2020), 29.

[148] Naval War College, *Joint Maritime Operations Forces/Capabilities Handbook*, 29.

[149] Naval War College, *Joint Maritime Operations Reference Guide, Forces/Capabilities Handbook*, 30.

[150] Jack Rowley, "Dealing with the Threat of Adversary Sea Mines," *Naval News*, November 11, 2020, https://www.navalnews.com/naval-news/2020/11/dealing-with-the-threat-of-adversary-sea-mines/.

potential threat of mines against U.S. forces is primarily from abroad, there is still the possibility that an adversary could exploit gaps within the maritime domain to position mines around the U.S. coast.

When the threat of mines around the U.S. has been exploited, the U.S. Navy can deploy its capable UUVs to detect and classify these threats. The sensors onboard UUVs are intended to achieve the main objective of MCM operations: DLCIN (detect, localize, classify, identify, and neutralize).[151] Regarding MK18 UUVs, the current development and testing of their sensors at the Naval Oceanography Mine Warfare Center (NOMWC) aim to create an efficient sensor that can accurately assess the ocean bottom and contacts with imagery.[152] LTJG Michael Barnhall of NOMWC describes the main sensor onboard the MK18 UUVs as being developed to "take imagery" of the ocean bottom to "physically look at on a computer" and provide real-time data to the force.[153] A potential upgrade to the UUV family would be using the synthetic aperture sonar (SAS) instead of the conventional side scanner sensor. This radar provides an enhanced payload for ocean mapping and object detection with a higher resolution, increased search rates, and enhanced classification performance.[154] The sensors onboard UUVs are used to provide an accurate assessment of the ocean bottom to effectively ascertain the detection and classification of potential mines, even those potentially around the U.S. coast.

If there is a credible threat, the UUVs will be utilized alongside an ExMCM company to neutralize the detected and classified threat. The ExMCM company consists of an EOD MCM platoon and an unmanned systems platoon.[155] The unmanned systems platoon begins the MCM operation with the deployment of MK18 UUVs, such as

[151] Department of the Navy, *The Navy Unmanned Surface Vehicle (USV) Master Plan,* 12–13.

[152] Brandi Vincent, "Surveys and stickers: A day on the water with the Navy's MK-18 drones," *Defensescoop,* October 11, 2023, https://defensescoop.com/2023/10/11/surveys-and-stickers-a-day-on-the-water-with-the-navys-mk-18-drones/?utm_source=sailthru&utm_medium=email&utm_campaign=mil-ebb&STOverlay=342f5a58-c37b-4142-b049-1f737335b507.

[153] Vincent, "Surveys and stickers: A Day on the water with the Navy's MK-18 drones."

[154] "Diving in: UUV technologies mature to take on new naval missions," May 5, 2021, https://customer.janes.com/.

[155] Jeff Atherton, "Expeditionary Mine Countermeasures Company Uses UUVs to Complete Certification Exercise," United States Navy, April 26, 2021, https://www.navy.mil/DesktopModules/ArticleCS/Print.aspx?PortalId=1&ModuleId=523&Article=258453.

Kingfish, for mine detection and classification. Once detected, the data are analyzed by an element of the ExMCM company to assess what has been collected by the UUV and if the detected object is a threat. After a threat is detected, the ExMCM company will then deploy the EOD element to neutralize the threat.[156] This unit has successfully augmented the ExMCM company with unmanned systems to effectively complete the detect-to-engage sequence of countering mines.

D. CONCLUSION

Ensuring the United States is secure and safe from acts of aggression is a complex and robust objective that entails a wide range of resources, personnel, and challenges. Any gaps or errors in defending the homeland can be critical in affording any threat the opportunity to strike the homeland. The United States main operation to defend the homeland is through an active, layered defense framework to deter adversaries and defend against threats. This active, layered defense strategy allows the U.S. Navy to be a forward presence around the globe to enhance global security while also deterring any adversary well before they have the opportunity to strike the homeland of the United States. However, the strategy of being a forward presence can also create a dilemma in which critical assets may be absent at home to secure the homeland.

The integration of unmanned systems can be a solution for the U.S. Navy to enhance security for the homeland by being incorporated into their active, layered defense doctrine. Senior U.S. naval leaders understand that advanced technology, such as unmanned systems, will become a critical asset not only to bolster the number of assets but also to augment the fleet's capabilities and lethality. The U.S. Navy is currently developing unmanned systems to bolster the fleet through UAVs, USVs, and UUVs. These systems are currently being developed and experimented with to understand the exact capabilities they can offer the fleet. They are also being experimented with to enhance their integration into the fleet through the establishment of development squadrons that provide concrete CONOPs for these systems.

[156] Atherton, "Expeditionary Mine Countermeasures Company Uses UUVs to Complete Certification Exercise."

This thesis has examined the current state of unmanned systems being developed within the U.S. Navy and how they can provide security for the maritime domain at home. As a global force, the U.S. The Navy generally conducts its deterrence through the use of forward deployments. As a result, homeland defense is not a common mission of the bulk of the U.S. Navy. To assist the U.S. Navy in its homeland defense, this thesis examined mission areas that are relevant to homeland defense and incorporated these missions with the U.S. Navy's unmanned arsenal. The high-priority mission areas for homeland defense included ISR, ASuW, ASW, Maritime Security, and MCM.

These advanced systems can ultimately augment the U.S. naval forces by not only increasing the number of assets in the fleet but also enhancing the lethality of the fleet. Unmanned systems can conduct extensive surveillance operations for the entirety of the U.S. coast. Whether from the air or the depths of the sea, unmanned systems can detect and monitor any contact before it becomes a potential threat to the U.S. These systems have significant capabilities that can drastically enhance the ability to track unknown contacts while also augmenting the fleet's capabilities. These systems can integrate with the fleet to engage credible air, surface, or subsurface threats. Even in port, unmanned systems can still deter threats by thoroughly inspecting and identifying them to counter terrorist threats.

The innovation of unmanned systems provides the U.S. Navy with the perfect opportunity to adapt to the rise of strategic competitors. The current strategic environment has pressured the U.S. Navy to continue its strategy of projecting its forces abroad to maintain global stability. The successful integration of unmanned systems into the U.S. Navy will allow it to continue its forward presence while simultaneously defending the homeland. Without unmanned systems, the U.S. Navy may lose its advantage of deterring adversaries from afar. Unmanned systems may be the solution the U.S. Navy needs to remain the most formidable naval force in the world.

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