UNITED STATES COAST GUARD

DEPUTY COMMANDANT FOR OPERATIONS

UNMANNED SYSTEMS STRATEGIC PLAN

MARCH 2023

WASHINGTON, D.C.


U. S. COAST GUARD
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DEPUTY COMMANDANT FOR OPERATIONS

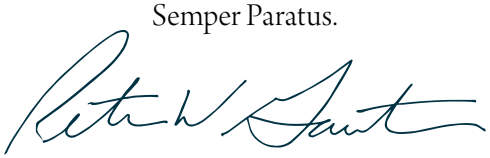
The Coast Guard is on the front lines of our Nation's efforts to protect the American people, our homeland, and our values. As our Nation's only multi-mission, military, maritime service, we are a law enforcement organization, a regulatory agency, humanitarian first responders, and a member of the intelligence community. We advance national security, economic prosperity, and global maritime norms. Our unique position in the Department of Homeland Security (DHS) and our enduring role with the Department of Defense (DoD) allows our service to effectively address complex challenges facing the Nation. These challenges will require our very best – the best people, best tools, and best performance.

In order to meet the challenges of an increasingly dynamic operational environment, we must adapt to the rapid pace of technological development. Unmanned systems (UxS) play a key role and hold great promise to improve Coast Guard mission excellence. UxS can help us find mariners in distress. They can increase our capacity to detect illicit drug and migrant trafficking at sea so we can most effectively allocate finite boats, ships, and aircraft. UxS can be a powerful tool in the monitoring of Illegal, Unreported, and Unregulated (IUU) fishing around the world. In a changing Arctic, UxS can aid in the navigation of icebreakers, track icebergs and increased vessel traffic, and monitor the growth of other commercial activities. Our future will employ UxS in an interconnected spectrum of interoperable systems and enable effective integration of artificial intelligence to deliver actionable data to Coast Guard operators in situations like these and many more. UxS that enable optimal human-machine teaming provide game-changing opportunities for the Coast Guard.

The Coast Guard will also move with purpose to defend against and regulate unmanned systems in the complex maritime environment. We will employ counter-UxS capability appropriate to the Coast Guard's maritime security role across all domains to help assure the security of the Marine Transportation System (MTS). Further, the adoption of automation, autonomy, and unmanned systems promises to transform the maritime industry. We will exercise our authority and responsibility to ensure the continued safe and secure operations and movement of goods throughout the MTS upon which our nation depends.

While the key to Coast Guard success has always been our people, UxS offer the prospect of improving the performance and efficiency of our workforce and acting as a true force multiplier. The Coast Guard will seek to align our requirements, procurements, acquisitions, and funding to ensure UxS can be delivered at the speed of need and integrated with our workforce and existing assets. Embracing and integrating UxS will allow us to more effectively safeguard the American people and promote maritime safety and security in a complex and evolving environment.

Semper Paratus.



VADM Peter W. Gautier

The Coast Guard effectively employs, defends against, and regulates unmanned systems in a complex maritime environment advancing maritime safety, security, and prosperity for the American public.

I. CHANGE, THREATS, AND OPPORTUNITIES FROM UNMANNED SYSTEMS

INTRODUCTION

The Coast Guard's broad set of missions demand the very best from Coast Guard men and women and our cutters, boats, aircraft, and shore stations. Yet, the maritime domain continues to change rapidly and present new challenges. "The pace of change in today's world is accelerating. Geopolitical strategic competition, economic volatility, climate change impacts, shifting workforce expectations, evolving technologies, and emerging maritime uses are converging and driving change for our service."[1] IUU fishing has replaced piracy as one of the greatest global maritime threats. Illicit trafficking of drugs and migrants is moving farther offshore and persists as a threat to the public. Maritime activity in the Arctic is growing. Natural disasters continue to threaten those on and near our oceans. The demands for Coast Guard services is strong and continues to grow.

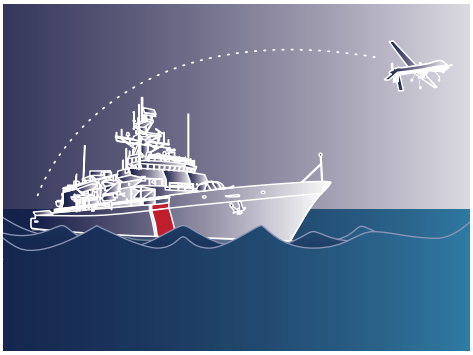
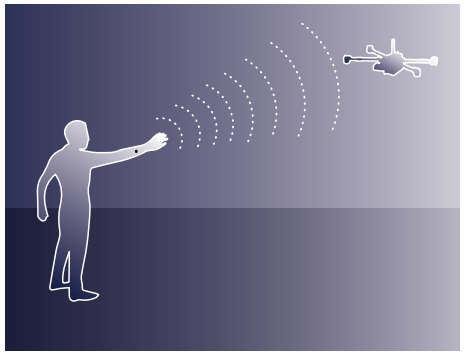
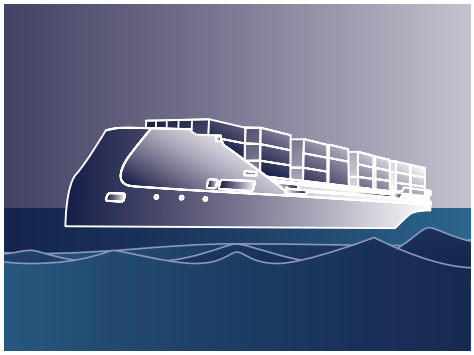
Maintaining awareness and enforcing governance in a changing maritime domain remains central to nearly every Coast Guard mission. Domestically, "Emerging uses of the maritime environment – including offshore energy production, unmanned vessel and aerial systems employment, and commercial space activities – are rapidly expanding, challenging existing regulatory and operational frameworks."[2] More broadly, "National competitors, violent extremists, and increasingly powerful and capable transnational criminal organization (TCOs) all continue their attempts to exploit weak governance at sea, corruption ashore, and gaps in maritime domain awareness to gain economic and political advantage."[3] These changes present both threats and opportunities to Coast Guard mission execution while increasing the demand for Coast Guard maritime domain awareness in support of U.S. and global interests.

Technology is advancing, offering new tools and capabilities that can help execute Coast Guard missions. "The rapid evolution of technology, the ever-growing demand for Coast Guard Services, an increasingly dynamic operating environment, and global strategic competition strain our current ways of conducting missions. We must sharpen our competitive edge to match the pace of change affecting the maritime domain. This is a call to action." [4]

UxS create opportunities to unite people, assets, systems, and data in new ways to create a more agile force. UxS can fill coverage gaps and improve situational awareness. UxS can also provide new capability to augment crewed missions. UxS can remove human beings from the often dirty, occasionally dull, and potentially dangerous work of some missions. UxS cannot perform missions alone, but they can help preserve our personnel readiness until exactly the moment when a Coast Guardsman is needed.

The Coast Guard already employs some UxS, but we do so in a mostly separated and platform-centric manner. The Coast Guard has already experienced the successes of programs such as medium-range unmanned aerial system (UAS) onboard

1 United States Coast Guard Strategy, October 2022, pg 1, https://media.defense.gov/2022/Oct/12/2003094294/-1/-1/0/USCG-STRATEGY-2022.PDF
2 Ibid, pg 7
3 Ibid
4 Commandant's Intent, June 2022

National Security Cutters and short-range UAS in use at various Coast Guard afloat and ashore units. When seamlessly integrated with other technologies, UxS can become a force multiplier as part of a technology ecosystem linking sensors to operational decision-makers across assets, networks, data systems, advanced analytics, and information sharing platforms with greater speed and efficiency. We must remain agile and adaptive to pursue this transformative change.

While UxS present opportunities for Coast Guard employment, they are already being used by all types of actors in the maritime environment, and we should expect their presence to grow significantly. Curious citizens using unmanned systems are inadvertently impacting the routine operations of government and commercial vessels and coastal facilities. Commercial space companies are using unmanned barges for their operations, and shipping companies are incorporating autonomous systems and even fully autonomous vehicles into their fleets. Narcotics traffickers have built small, homemade unmanned submarines to covertly move drugs illegally across maritime borders. We should expect that UxS will become ubiquitous in the maritime environment, and we must be prepared for the impacts.

Understanding the changes, opportunities, and risks to Coast Guard missions allows us to construct a vision that sets the course for our strategy.

VISION STATEMENT:

The Coast Guard effectively employs, defends against, and regulates unmanned systems in a complex maritime environment advancing maritime safety, security, and prosperity for the American public.

The Coast Guard will employ unmanned systems to improve our mission execution. Coast Guard mission execution often begins with awareness of what is happening in the maritime domain. Surveillance, detection, classification, identification, and prosecution (SDCIP) are enduring, high-level capabilities that the Coast Guard needs in order to execute its statutory missions.[5] Unmanned systems can augment or supplant manned systems in these capability areas to greatly improve maritime domain awareness, allow more proactive employment of Coast Guard personnel and assets, and enable faster and more efficient search and rescue, drug and migrant interdiction, and marine environmental response. Employment of UxS will preserve the readiness of our manned assets and enhance the performance of our workforce.

5 Coast Guard Mission Needs Statement, January 2016, https://www.dhs.gov/sites/default/files/publications/United%20States%20Coast%20Guard%20-%20Mission%20Needs%20Statement%20FY%202015.pdf

The Coast Guard must be ready to defend against threats from unlawful use of unmanned systems. The widespread growth and low cost of unmanned systems means these tools are also available to both the general public and enterprises seeking to do harm to the United States, our environment, resources, and marine transportation system. Unwitting citizens could adversely impact the safety and security of the marine transportation system. Worse, nefarious actors may see opportunities to use unmanned systems in order to disrupt Coast Guard operations, conduct illicit activities, or jeopardize the flow of commerce while avoiding detection or attribution. The Coast Guard will deploy counter-unmanned systems capabilities to minimize these risks.

The Coast Guard must establish and enforce a regulatory framework for the safe and lawful use of unmanned systems in the Marine Transportation System. The opportunities that unmanned systems present for commerce can be transformative. The commercial industry is already developing, testing and integrating greater autonomous operations into their marine systems and vessels. The Coast Guard must ensure the safe and responsible incorporation of these technologies into remotely operated and autonomous systems and vehicles. We will do this working closely with technology developers, maritime industries, and standards bodies as is our tradition.

Meeting these challenges will require the Coast Guard to be agile, adaptive, and anticipatory by ensuring the innovative delivery and integration of UxS into operations. We will continue to explore new capabilities including unmanned surface, underwater, ground, air, and space vehicles. We will also build an efficient and agile requirements, procurement and acquisitions process with a focus on contracting services rather than buying systems. We will adopt a philosophy to collaborate, test small, learn, and scale smart. An agile requirements and acquisitions program that supports both contracting services and acquiring systems, coupled with a sound testing and scaling program, will allow the Coast Guard to adopt, integrate, and employ technology at the pace of market maturity and ensure continued decision advantage in the maritime domain.

The Coast Guard will explore opportunities to partner with government and industry to pursue this strategy quickly and responsibly. We will seek to partner with other DHS components, validating joint requirements for both UxS and counter-UxS that can be leveraged across the Department. As a military service guided by the National Defense Strategy (NDS) and the Tri-Service Maritime Strategy, we will seek expertise and lessons learned from the Department of Defense to identify maturing technologies and to remain interoperable with DoD combatant commands. We will engage actively with other government agencies to share knowledge and data on the development of UxS. Perhaps most importantly, we will seek input from and partner with the commercial sector to stay informed of existing and emerging technologies and data sources needed to intelligently and responsibly deploy and regulate these evolving technologies.

UxS alone are not the only answer. Continued incorporation of key enablers and core technologies will be crucial in advancing toward the vision. Developments in autonomy, including beyond visual line of sight (BVLOS) operations for UAS and autonomous surface and underwater vehicles, offer the ability to extend human potential and allow us to execute dangerous or difficult tasks safely and efficiently, saving time, saving money, and most importantly, saving lives.

Beyond the vehicles and sensors, we must pursue complementary systems in coordination with UxS to ensure full integration into Coast Guard operations. The Coast Guard must expand its tactical communications and network capabilities where UxS will operate at the "edge" of existing terrestrial networks enabling their safe operation and data transfer. Data storage and management infrastructure is needed for secure access and analysis of UxS collected data. Artificial intelligence and machine

learning (AI/ML) will be force multipliers to UxS and operators, facilitating analysis across asset and domain data streams, automating detection of objects, and preserving human attention for crucial operational actions. Finally, next-generation command and control and information dissemination platforms are crucial to connect these technologies to our Coast Guard workforce, cueing up information for operational decision-makers. This updated technology ecosystem, incorporating UxS, can create new ways for the Coast Guard to execute its broad set of missions.

The Coast Guard will embrace this transformational change with strategic goals that advance toward our vision.

STRATEGIC GOALS

1. Adopt a capability-centric approach that allows for delivery of multi-mission unmanned systems (UxS) and counter-unmanned systems (C-UxS) designed to integrate with and enhance existing capabilities.
2. Establish a prevention and response framework essential to facilitate the safe use of remotely operated and autonomous vehicles and systems in the Marine Transportation System.
3. Align research and development, requirements, procurement, acquisitions, and funding to fuel innovation through a "test small, learn, and scale smart" approach to deliver unmanned systems at the speed of need.
4. Build and sustain partnerships across DHS, DoD, and other stakeholders to leverage parallel efforts, ensure interoperability, and realize efficiencies for deployment of UxS and C-UxS capabilities.
5. Ensure UxS interface and integrate with key enablers and core technologies in order to support, integrate, and adapt to the evolution of unmanned systems and capabilities at speed and scale.

CHALLENGES AND OPPORTUNITIES

Rapid advancements in the design and use of UxS will present challenges while offering valuable opportunities to improve mission execution.

Adoption of UxS will introduce transformational change within the Coast Guard force structure, requiring new personnel skills and training to augment the mix of manned assets. Further, we must modify policy, doctrine, tactics, techniques, and procedures to incorporate the use of UxS. We will identify those changes early and determine the best ways to integrate UxS for optimal manned-unmanned teaming.

UxS will require investments in strategic planning, research and development, acquisitions, operational testing, systems engineering, and sustainment to fully leverage these capabilities. We will look for opportunities to procure services, test and evaluate and modify where appropriate, and deploy multi-mission platforms to allow widest use of UxS assets from multiple host units, within and external to the Coast Guard, across all mission sets.

Commercial research and development in this rapidly evolving field of technology outpaces traditional government processes for requirements and acquisitions. We will continue to evaluate all means of delivering capabilities including government-owned and operated, contractor-owned and operated, and data-as-a-service. We will pursue efficiencies in the requirements development process and leverage all acquisition authorities to accelerate the pace of introducing these innovative technologies into the Coast Guard.

UxS will require a spectrum of core technologies and key enablers to yield their full potential. The Coast Guard will simultaneously pursue communications networks, data management systems, artificial intelligence, and information dissemination platforms to deploy UxS and maximize the utility of the data they collect. The synergies of a technology ecosystem operating in concert will transition the Coast Guard to a more proactive force.

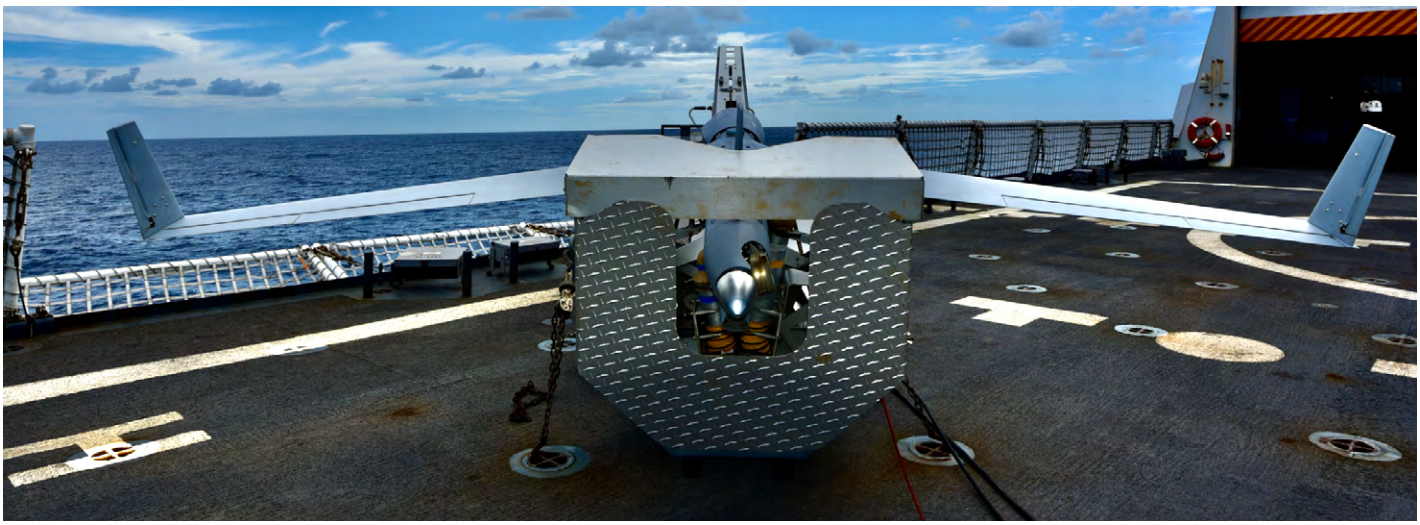
The UxS marketplace is extremely competitive with many providers and acquirers moving quickly to develop and deploy UxS. The Coast Guard will build and grow partnerships across government to share technical information, partner on research and development, and pursue common requirements to lower barriers to deploying UxS and increase opportunities for interoperability and interchangeability.

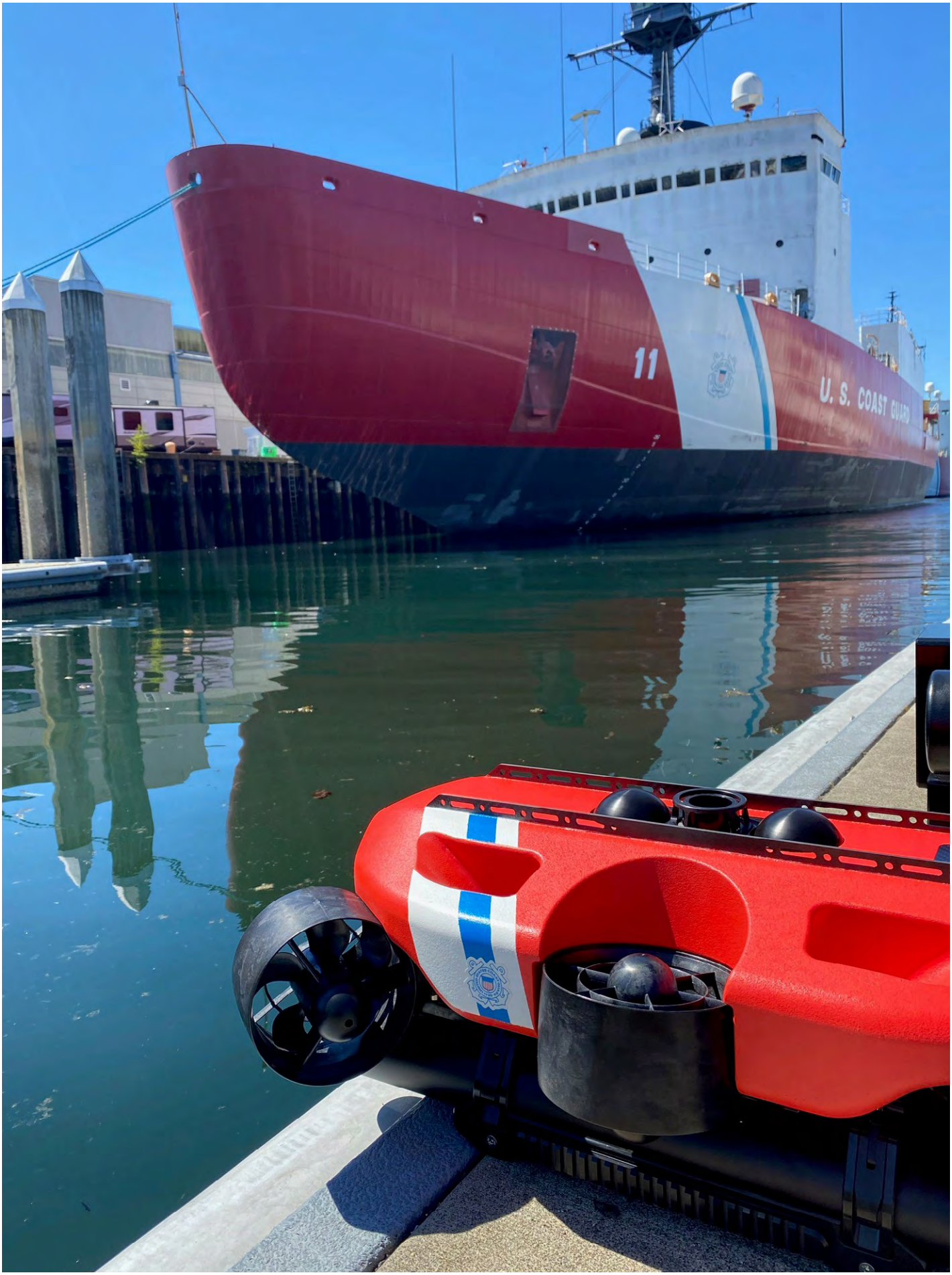
While rapid growth in the availability of UxS presents opportunities for increased effectiveness by government agencies and new markets for industry partners, it also presents new threats as adversaries seek to exploit UxS for maligned purposes and citizens misuse the new technologies. In keeping with our maritime safety and security missions and in collaboration with our partners, the Coast Guard will deploy counter-UxS (C-UxS) capabilities to protect our forces and the homeland against this emerging threat.

UxS and fully autonomous systems present unique regulatory challenges to ensure safe operation in congested spaces. The Coast Guard will be a leader in government, working in concert with other national and international regulatory agencies to develop a risk-based framework, seeking safe and responsible operation of UxS in the maritime domain for all.

While UxS can be controlled by either remote operators or autonomy, they can be vulnerable to a growing number of increasingly complex cybersecurity threats. The Coast Guard will leverage industry and government partners to identify, test, deploy, and maintain resilient systems that are trusted, reliable, and safe for operations.

In pursuing this UxS vision, the Coast Guard will take advantage of opportunities to leverage technologies for improved mission effectiveness. Many of the opportunities lie in the pursuit of key enablers and core enabling technologies necessary for UxS operations.

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KEY ENABLERS AND CORE TECHNOLOGIES

Adoption of UxS will necessitate the introduction of other new technologies within the Coast Guard so that UxS can be fully leveraged as a force multiplier. These key enablers and core enabling technologies should be pursued in concert with UxS to deliver a new information ecosystem.

- ***Doctrine, Organization, Training, non-Material Solutions, Leadership, Personnel, and Facilities (DOTmLPF):*** Vehicles and sensors alone cannot deliver the full capabilities of UxS. Doctrine, organization, training, personnel, and facilities must enable UxS to be seamlessly integrated into Coast Guard force structure and packages.
- ***Data Interfaces and Standards:*** For a cross-domain, capability-centric, interoperable vision to be realized in the fast-changing technological environment of UxS, the Coast Guard will adopt and manage interface requirements between UxS, communications platforms, data centers, analysis tools, and human operators in order to allow deployment of new platforms and technologies driven by both planned recapitalization and unplanned obsolescence.
- ***Automation and Autonomy:*** The growing fields of automation and autonomy in engineering systems will enable UxS to be operated farther offshore and demand less human control and interaction. Autonomous operations can expand further the utility of UxS for greater persistence and broader maritime domain awareness. When responsibly developed and deployed, UxS can operate fully and safely autonomously, expanding the potential operational uses while rapidly decreasing the number of, and risk to, Coast Guard personnel needed for routine operations.

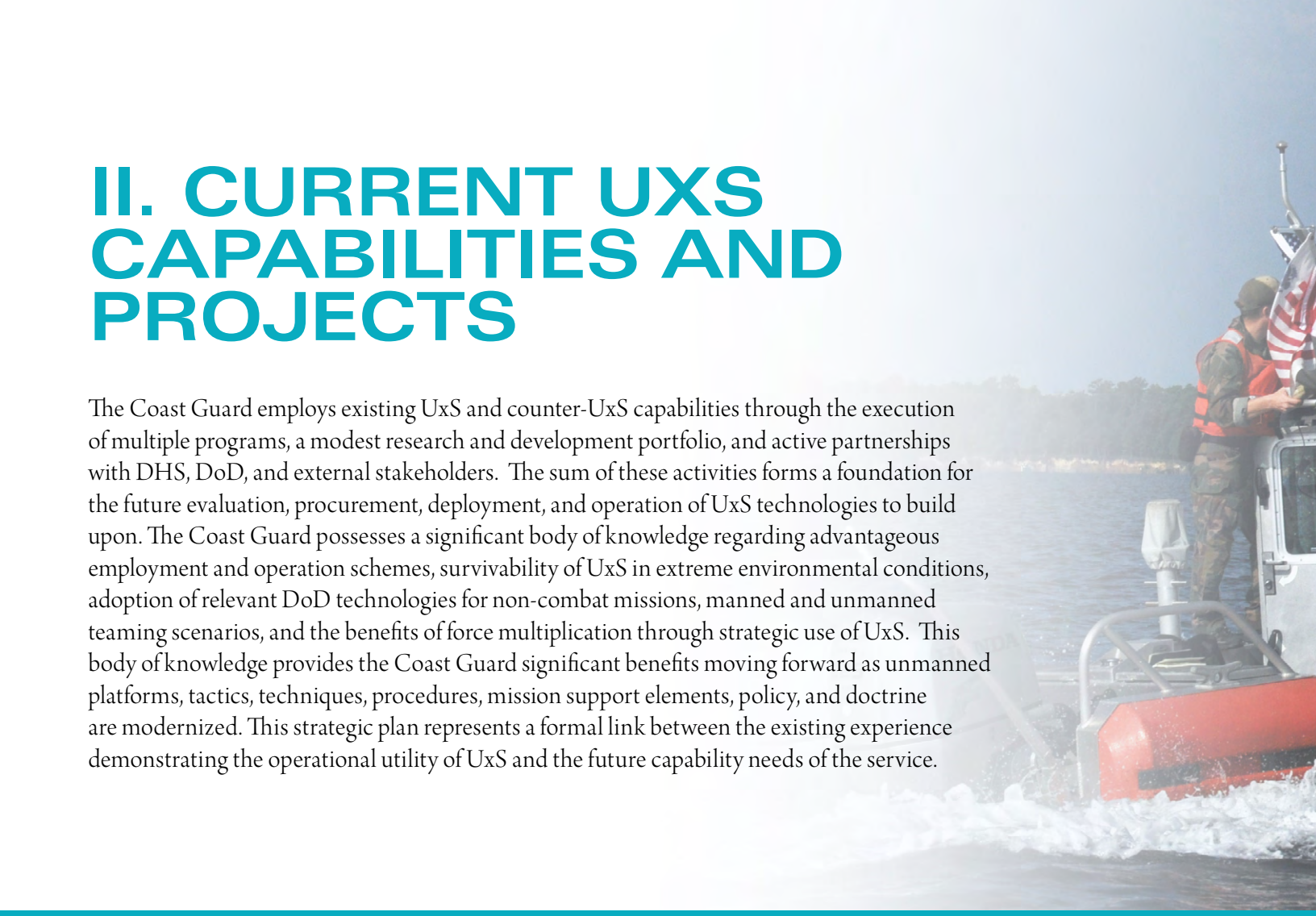
Perhaps the greatest enabler will be to incorporate UxS into an operational data ecosystem that can fundamentally transform Coast Guard operations. This ecosystem would capitalize on data as a strategic asset by connecting manned, unmanned, and fixed sensors, transferring and converting data into information and knowledge, and cueing decisions by human analysts and operators. Figure 1 illustrates how UxS must be integrated with other technologies and enabled by Coast Guard authorities to form this mission-focused ecosystem. The interdependent components of this operational data ecosystem include:

- ***Tactical Networks:*** Currently, manned platforms use onboard operators to analyze and make decisions from data that is rarely sent back to shore. UxS, however, cannot be effective without reliable communications back to the operational decision-maker. Whether integrated into legacy systems or via separate communications networks, UxS will require both command and control interface and the ability to transfer digital data from onboard sensors.
- ***Data Management:*** When operational data from UxS reaches shore, it needs to be organized, stored, and managed so it can be accessed and analyzed quickly and efficiently and adhere to evidence chain of custody standards. Data storage practices should be structured to ensure the right information is accessible to the right people at the right time for immediate decision-making and to identify long-term trends and patterns of life in the maritime domain.
- ***Artificial Intelligence and Machine Learning (AI/ML):*** Given the quantity of operational data expected to be generated by UxS, employing humans to analyze it would be inefficient and ineffective. Rather, we will leverage AI/ML tools to detect objects in still or video imagery, transcribe and analyze voice calls by radio, and assess anomalous behavior to reduce raw data into actionable information.
- ***Command and Control:*** Ultimately, the data ecosystem's interface with human operators and decision makers will rely on effective command and control platforms enabling them to visualize the information, make timely decisions, and deploy manned or unmanned systems in response.

While the Coast Guard looks ahead to these new capabilities, we have already employed UxS with operational success and conducted extensive research and development projects. A look at existing capabilities and projects demonstrates the Coast Guard's commitment to improving mission execution through UxS.

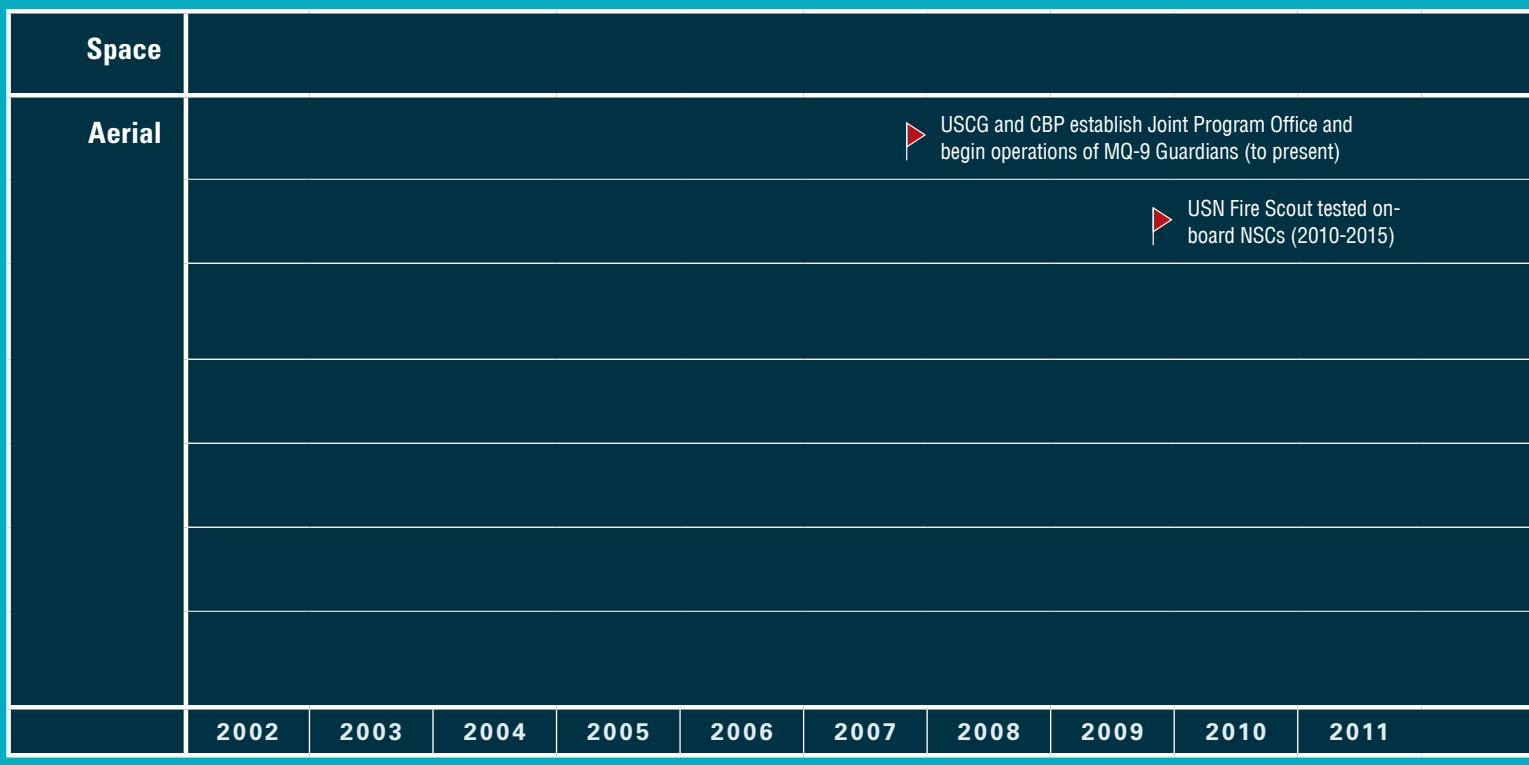
FIGURE 1:
Concept of an operational data ecosystem incorporating UxS

II. CURRENT UXS CAPABILITIES AND PROJECTS



The Coast Guard employs existing UxS and counter-UxS capabilities through the execution of multiple programs, a modest research and development portfolio, and active partnerships with DHS, DoD, and external stakeholders. The sum of these activities forms a foundation for the future evaluation, procurement, deployment, and operation of UxS technologies to build upon. The Coast Guard possesses a significant body of knowledge regarding advantageous employment and operation schemes, survivability of UxS in extreme environmental conditions, adoption of relevant DoD technologies for non-combat missions, manned and unmanned teaming scenarios, and the benefits of force multiplication through strategic use of UxS. This body of knowledge provides the Coast Guard significant benefits moving forward as unmanned platforms, tactics, techniques, procedures, mission support elements, policy, and doctrine are modernized. This strategic plan represents a formal link between the existing experience demonstrating the operational utility of UxS and the future capability needs of the service.

TIMELINE OF RESEARCH AND DEVELOPMENT AND CAPABILITIES



R&D Study: Use of CubeSats for Coast Guard Missions

R&D: Space Based Radio Frequency Systems

Boeing/Insitu ScanEagle operated on the National Security Cutter under the sUAS for NSC program (to present)

R&D: Analysis of short range UAS in a maritime environment under RAMPS (2013-2019)

Group One UAS Prototype Project Initiative (GUPPI) utilizes commercial off the shelf systems for limited missions. (2018-2021).

GUPPI program transitions to US made BlueUAS.

R&D: Arctic Search and Rescue project using ScanEagle and Puma AE deployed on HEALY (2015)

R&D: Advanced sUAS Sensor Investigations of ViDAR, IMSAR, and Hood Tech payloads (2015-2017)

R&D: Long Range/Ultra Long Endurance LR/U-LE to examining feasibility, costs, and benefits for ISR (2017-2019)

R&D: Evaluations of detect-and-avoid technologies for beyond visual line of sight (BVLOS) and Vertical Takeoff and Landing (VTOL) UAS operations (2019-2023)

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023

CURRENT UXS RESEARCH, DEVELOPMENT, TEST & EVALUATION PROJECTS

AIR

- Vertical Takeoff and Landing (VTOL) UAS
- Beyond Visual Line of Sight (BVLOS) Flight Authorization

SURFACE

- Sensor Fusion for Collision Avoidance
- Autonomous Mission Programming and Execution

SUBSURFACE

- Oil Detection and Mitigation Under Ice
- Hull and Infrastructure Inspection

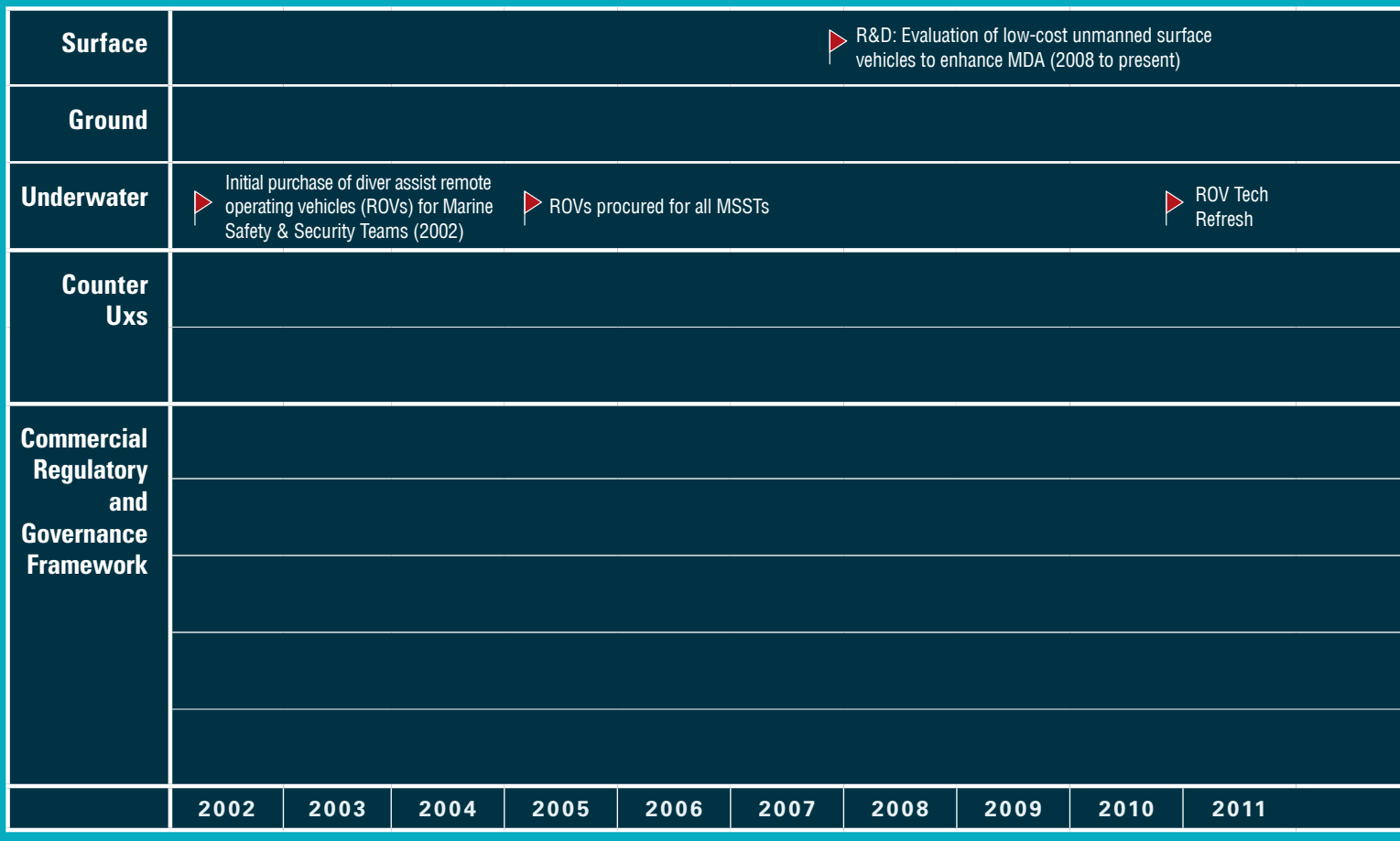
GROUND

- Confined and Hazardous Space Inspection
- Remotely Operated Brush Cutting for Inland Rivers Aids to Navigation

COUNTER

- Advanced System Interoperability for Cutter-based C-UAS
- Rapidly Deployable C-UUV/USV for Ports, Waterways and Coastal Security (PWCS)

TIMELINE OF RESEARCH AND DEVELOPMENT AND CAPABILITIES



SPACE

- High Latitude Connectivity
- Space-based RF Detection and Geolocation

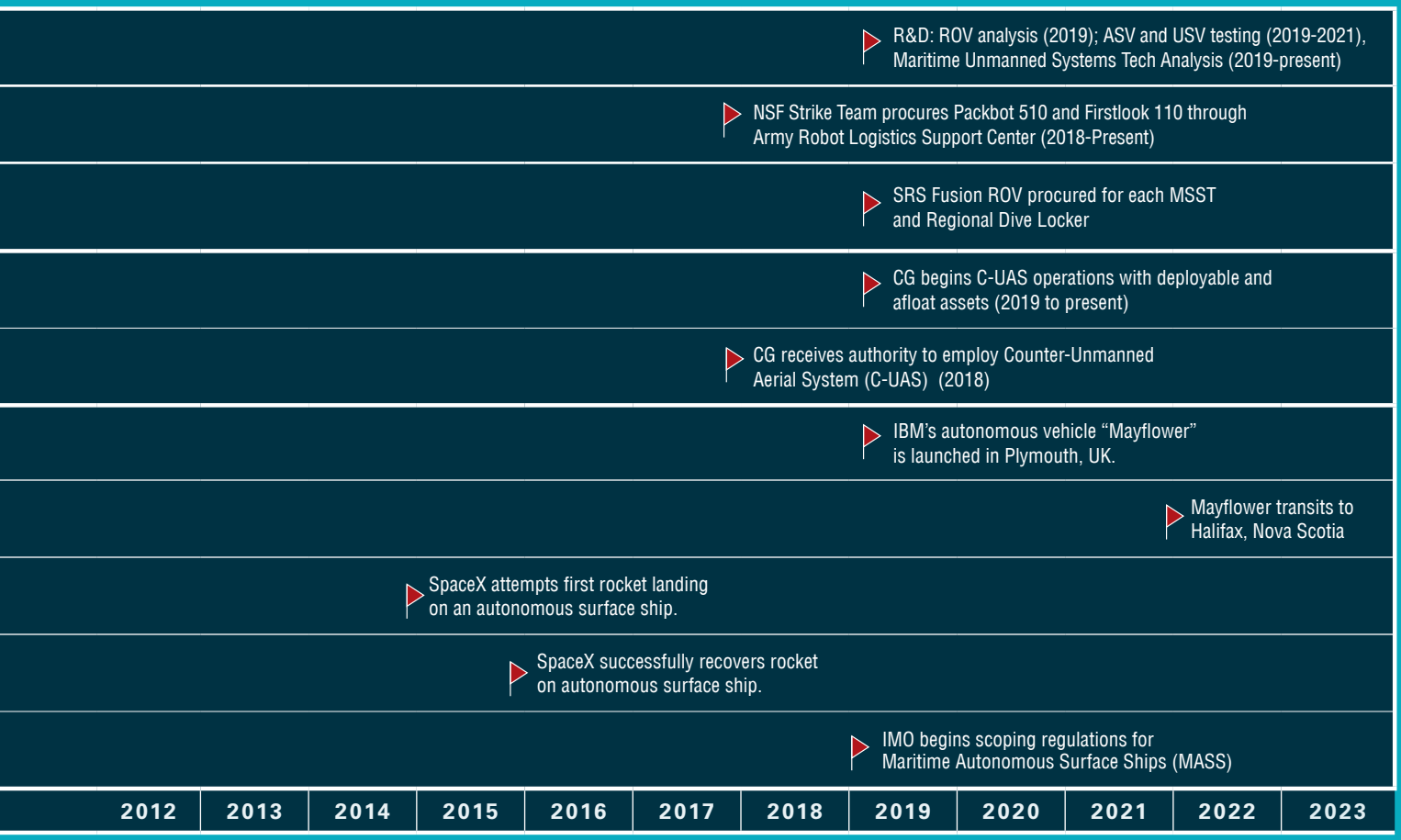
ARTIFICIAL INTELLIGENCE/ MACHINE LEARNING

- Automatic Object Recognition and Sensor Fusion
- Natural Language Processing

POLICY

- Data Generation for Low Risk "Due Regard" Operation
- Responsible Regulation of Remotely Piloted Vehicles

These existing Coast Guard UxS capabilities and research and development projects, when paired with an intelligent strategy and implementation plan, will form a robust foundation for a modernized operational employment. By building on what works and proving the utility of new capabilities with targeted and collaborative research and development, the Coast Guard will move deliberately towards a promising future state.



III. STRATEGIC OBJECTIVES

STRATEGIC GOAL #1:

Adopt a capability-centric approach that allows for delivery of multi-mission unmanned systems (UxS) and counter-unmanned systems (C-UxS) designed to integrate with and enhance existing capabilities.

- ***Objective 1.1.*** Assess capabilities across mission areas and identify current, near-term, and future capability gaps that could be closed using UxS/C-UxS.
- ***Objective 1.2.*** Develop concepts of operations for new Coast Guard force packages that combine UxS/C-UxS and manned assets in new ways to fulfill mission requirements.
- ***Objective 1.3.*** Develop a long-term, phased, scalable plan to pursue the goals and objectives of the UxS Strategic Plan.
- ***Objective 1.4.*** Conduct a business case analysis for implementing the UxS Strategic Plan, including changes to manned asset force laydowns.
- ***Objective 1.5.*** Develop effectiveness, efficiency, and affordability metrics to evaluate UxS/C-UxS opportunities and employment.
- ***Objective 1.6.*** Establish a system to continuously assess UxS/C-UxS technologies to meet mission requirements, pursue more risk tolerant acquisition policies, and sustain dedicated funding streams.
- ***Objective 1.7.*** Create a Capabilities Office with the authority to manage UxS/C-UxS strategic priorities from concept to deployment and provide unity of effort.

STRATEGIC GOAL #2:

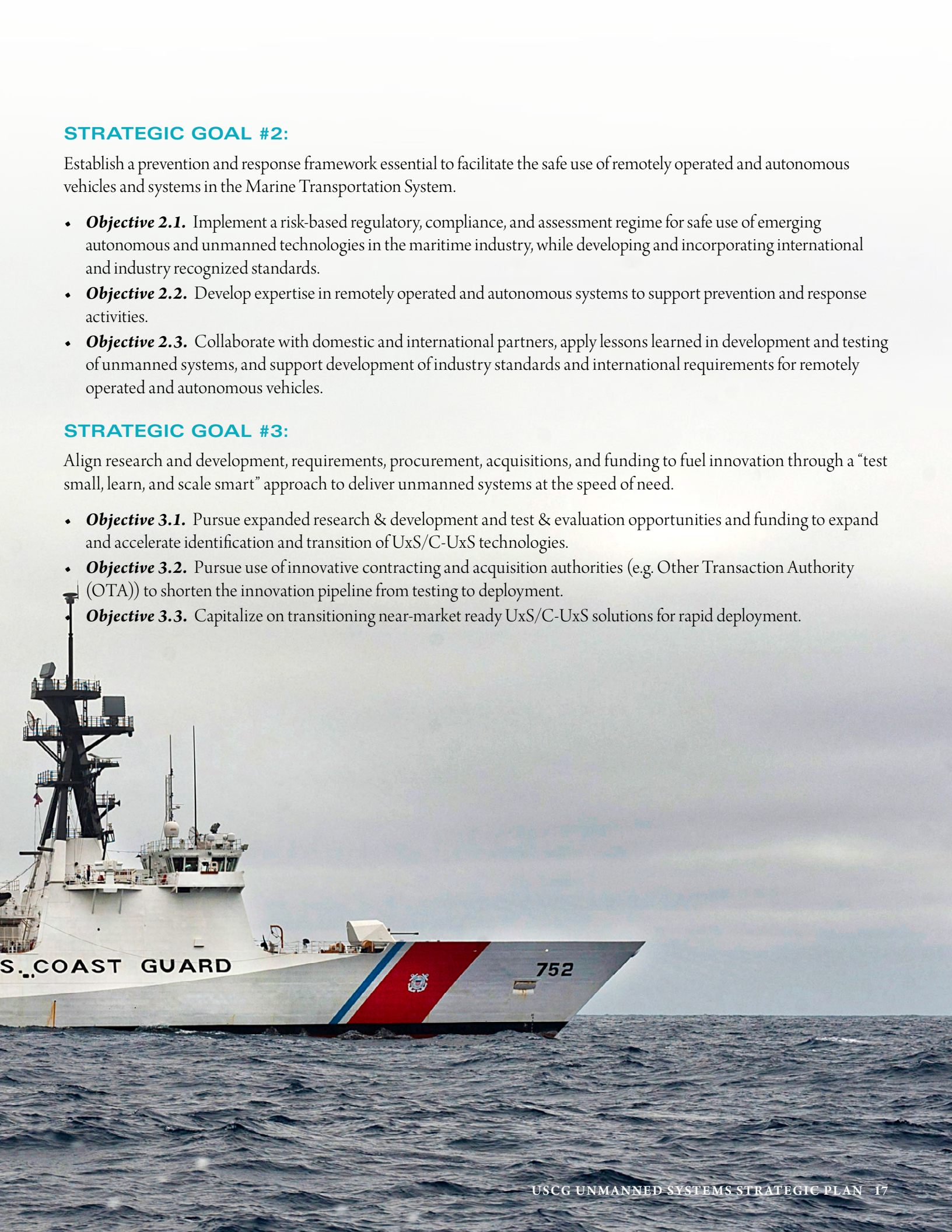
Establish a prevention and response framework essential to facilitate the safe use of remotely operated and autonomous vehicles and systems in the Marine Transportation System.

- ***Objective 2.1.*** Implement a risk-based regulatory, compliance, and assessment regime for safe use of emerging autonomous and unmanned technologies in the maritime industry, while developing and incorporating international and industry recognized standards.
- ***Objective 2.2.*** Develop expertise in remotely operated and autonomous systems to support prevention and response activities.
- ***Objective 2.3.*** Collaborate with domestic and international partners, apply lessons learned in development and testing of unmanned systems, and support development of industry standards and international requirements for remotely operated and autonomous vehicles.

STRATEGIC GOAL #3:

Align research and development, requirements, procurement, acquisitions, and funding to fuel innovation through a "test small, learn, and scale smart" approach to deliver unmanned systems at the speed of need.

- ***Objective 3.1.*** Pursue expanded research & development and test & evaluation opportunities and funding to expand and accelerate identification and transition of UxS/C-UxS technologies.
- ***Objective 3.2.*** Pursue use of innovative contracting and acquisition authorities (e.g. Other Transaction Authority (OTA)) to shorten the innovation pipeline from testing to deployment.
- ***Objective 3.3.*** Capitalize on transitioning near-market ready UxS/C-UxS solutions for rapid deployment.



STRATEGIC GOAL #4:

Build and sustain partnerships across DHS, DoD, and other stakeholders to leverage parallel efforts, ensure interoperability, and realize efficiencies for deployment of UxS and C-UxS capabilities.

- ***Objective 4.1.*** Engage with DHS and other Departments to identify common requirements and opportunities to partner in acquiring, contracting, and sustaining UxS/C-UxS capabilities.
- ***Objective 4.2.*** Initiate exchange with US Navy and DoD partners to evaluate UxS/C-UxS in fulfilling defense capabilities aboard Coast Guard Cutters.
- ***Objective 4.3.*** Seek opportunities for Joint UxS/C-UxS operational testing exercises with other federal agencies and pursue agreements to leverage expertise in the development, transition, and certification of UxS/C-UxS.
- ***Objective 4.4.*** Pursue opportunities to obtain and share UxS data from both government and commercial sources to improve maritime domain awareness.

STRATEGIC GOAL #5:

Ensure UxS interface and integrate with key enablers and core technologies in order to support, integrate, and adapt to the evolution of unmanned systems and capabilities at speed and scale.

- ***Objective 5.1.*** Pursue development of a concept of operations for an operational data ecosystem that supports and integrates UxS and sensors with key enablers including enterprise communications networks, data storage and management, AI/ML tools, and information sharing and dissemination capabilities at speed and scale.
- ***Objective 5.2.*** In concert with key enabler and core technologies, adopt and maintain command & control, data, and physical interface requirements that allow flexibility in the adoption, sustainment, and evolution of UxS despite rapidly evolving technologies and obsolescence.
- ***Objective 5.3.*** Determine threshold and objective communications network requirements to support UxS command & control and sensor data sharing with stakeholders.
- ***Objective 5.4.*** Determine minimum data engineering, management, and storage capabilities for UxS operational and mission support data.
- ***Objective 5.5.*** Determine data requirements and computing needs to employ AI/ML tools to include maritime object detection, autonomous navigation, and other UxS operational tasks.

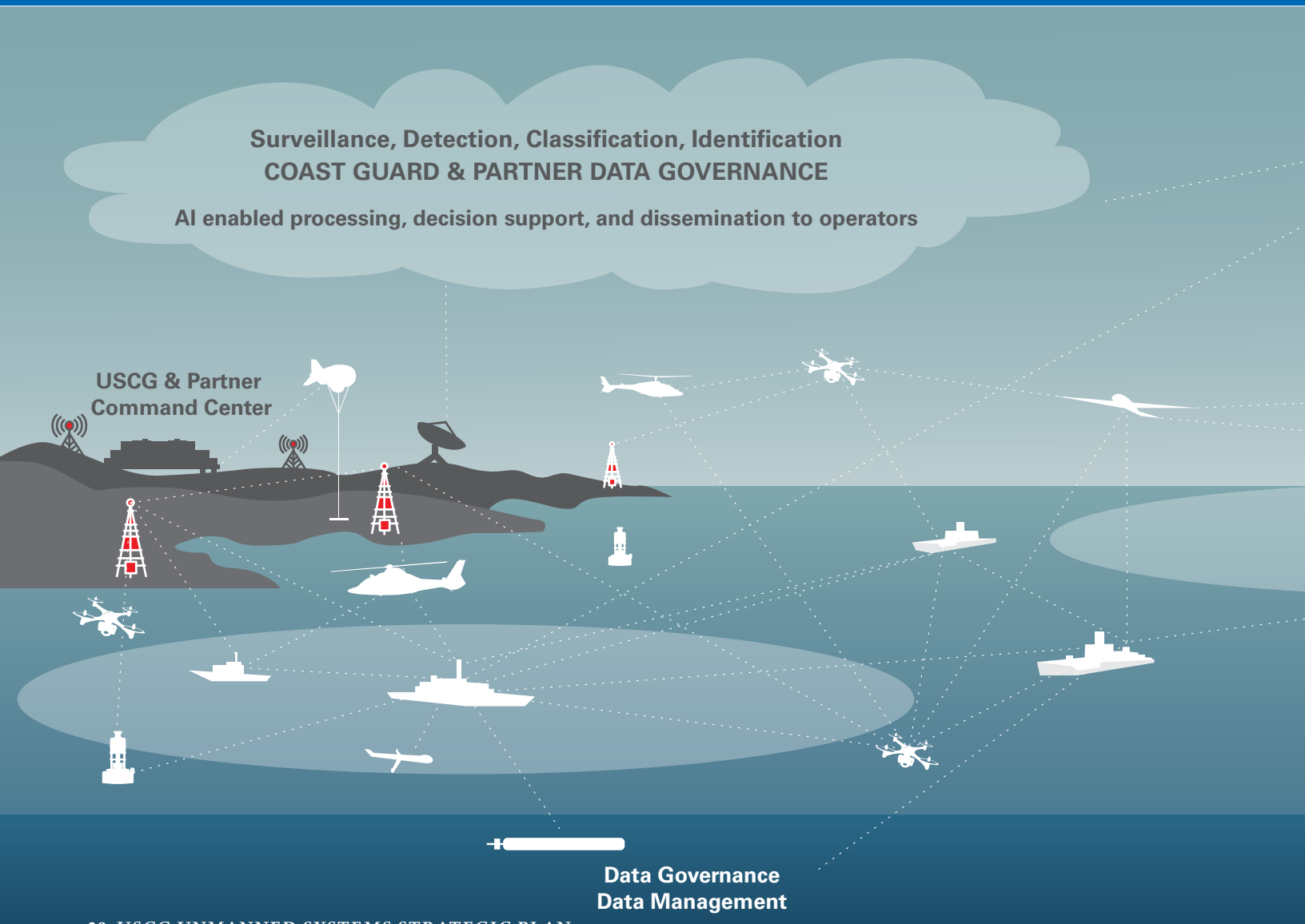
IV. DESIRED FUTURE STATE

Over the next decade, UxS can enable a more ready, more capable Coast Guard and a safer, more secure maritime environment. This vision established a trackline toward the desired future state.

VISION STATEMENT:

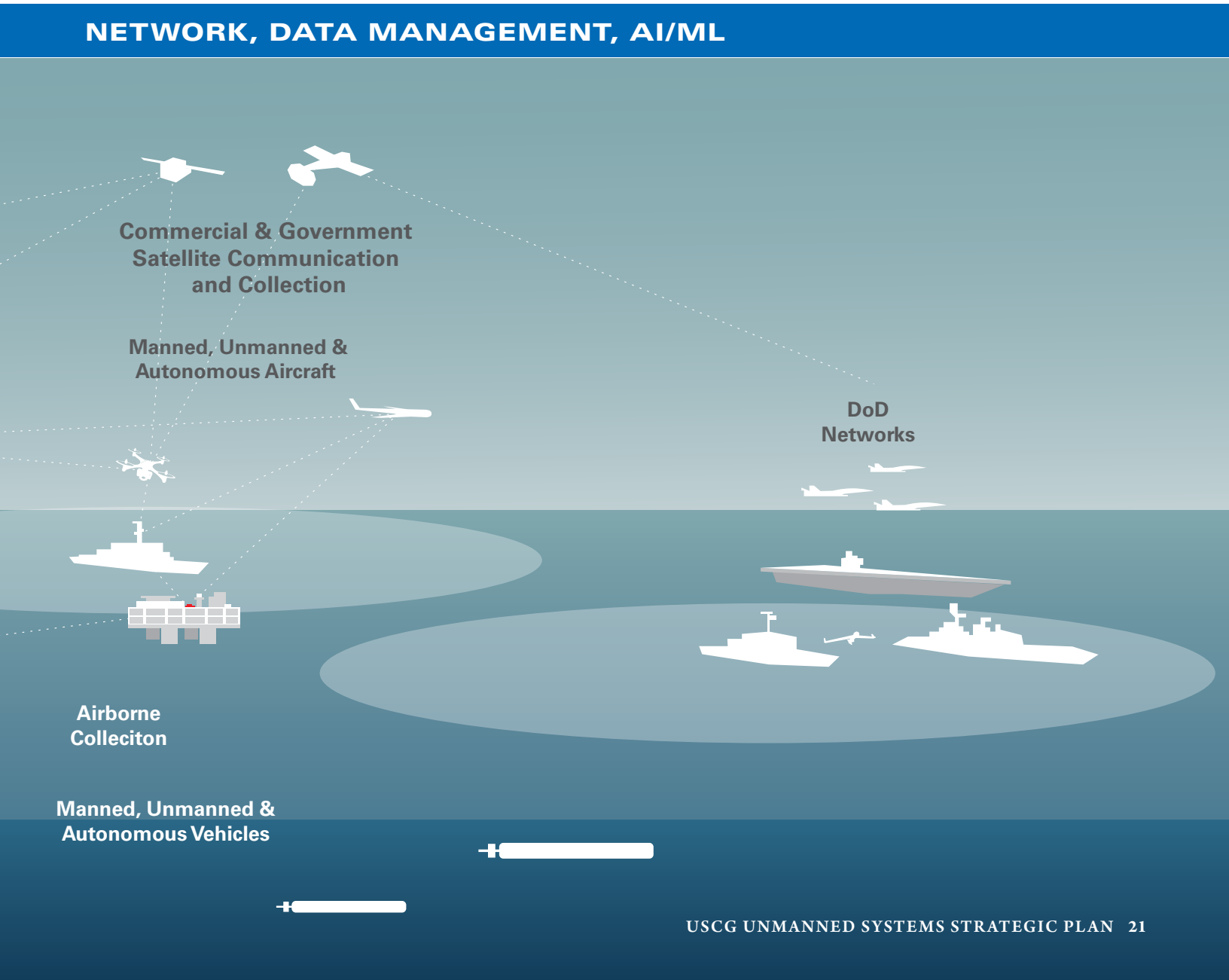
The Coast Guard effectively employs, defends against, and regulates unmanned systems in a complex maritime environment advancing maritime safety, security, and prosperity for the American public

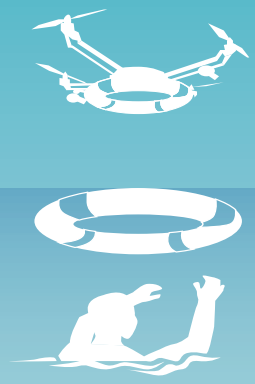
OPERATIONAL CONCEPTS: UXS, OPERATIONAL/TACTICAL ISR



Our strategic goals will achieve this vision. By adopting a capability-centric approach for multi-domain use of UxS, the Coast Guard will be nimble in leveraging unmanned platforms in the air, on the sea, underwater, on the ground, and in space. This approach will equally ensure the deployment of counter-UxS capabilities to protect against maritime threats from nefarious actors. These platforms will remain tightly connected to baseline capability requirements and rely on newly developed enabling communications, data, and analysis systems. The Coast Guard will position itself as a leader in government in establishing regulations and standards essential to the safe, secure, and responsible operation of UxS by all parties. Finally, the Coast Guard will pursue continuous innovation and widespread partnering with others conducting research, business, or operations using unmanned systems.

Looking forward to the 2030s, the vision of UxS as a trusted component of the force structure enables the Coast Guard to be far more proactive, preserving the readiness of manned platforms and improving manned-unmanned teaming across a broad set of operational use cases.





Search and Rescue

IUU Fishing

Drug and Migrant OPS

OPERATIONAL SCENARIOS

The following vignettes illustrate the wide variety of hypothetical use cases across nearly every Coast Guard mission. They demonstrate a future with UxS incorporated into the Coast Guard force structure:

Search and Rescue (SAR): In remote coastal areas , unmanned aerial system (UAS) SAR stations have been deployed to complement traditional Air Stations. These UAS SAR stations have remote-launch, medium range unmanned aerial vehicles (UAVs) to shorten the time to search for and find those in distress. These UAVs can provide longer flight times, yield quicker situational awareness, detect those in distress, establish communications through on-board cellular networks or deployable radios, and deploy lifesaving equipment. This capability preserves the readiness of more expensive, manned assets, shortens initial response and search times, and increases survival prospects.

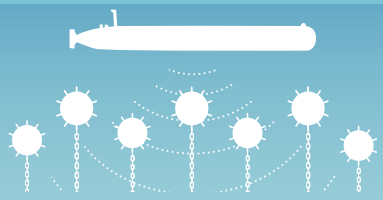
Illegal, Unreported, and Unregulated Fishing (Other Law Enforcement): In Oceania, space-based sensors surveil and detect broad movements in fishing fleets and direct low-energy, persistent autonomous surface vehicles (ASV) and autonomous underwater vehicles (AUV) to classify and identify IUU fishing. These platforms can provide data from far offshore for weeks and months at a time. An array of sensors relay data among them to feed next-generation command and control and intelligence networks with information on vessel presence, activities, and communications. They more quickly identify pattern of life among the fishing fleet to illuminate IUU activities and preserve data for interdiction and enforcement.

Drug and Migrant Interdiction: A network of unmanned air and surface platforms combined with terrestrial and space-based sensors provide strategic surveillance and wide-area detection over known narcotics and migrant trafficking lanes. These networks allow persistent surveillance, covert detection and identification, and tracking of dark targets with low risk of detection compared to manned assets. Further, they enable near-continuous monitoring of trafficking routes and greatly support partnering with other DHS components to collaborate on trafficking network development and end-game interdiction. Similar strategies are employed for offshore MDA in the U.S. Southern Command Area of Responsibility.

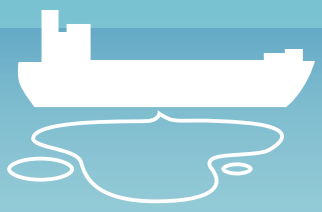
Ice Operations: Synthetic aperture radar satellite systems provide persistent detection, classification, and tracking of vessel traffic and icebergs in changing Polar Regions, improving the safety of all vessels and commercial activities in these areas. Cutter-based UAVs assess ice conditions farther ahead to determine the most efficient method for domestic, Arctic, and Antarctic icebreakers to transit ice flows, resulting in higher transit speeds, less fuel consumption, and more consistent flow of commerce. These UAS improve maneuvering, lower fuel costs, and reduce the carbon footprint of the icebreaking fleet.

Ports, Waterways, and Coastal Security: Nefarious actors and the unwitting public can disrupt the flow of commerce using UxS. A combination of fixed sensors, AUV, ASV, and UAV systems can survey the seafloor, shipping channel, and mooring areas for potential threats, as well as detect, track, and facilitate interdiction of AUVs and ASVs in near-real time. The result is a layered C-UxS system to protect our ports and waterways.

Ice Operations



Ports, Waterways, and Coastal Security



Marine Environmental Protection

Marine Safety: The rapid expansion of USVs and ASVs in the commercial sector has led to the development of a new framework of design, inspection, testing, and regulatory requirements for unmanned and autonomous vehicles and automated systems. These changes have resulted in the safe and lawful incorporation of unmanned and autonomous vehicles into domestic and international maritime environment increasing productivity and improving the safety of life at sea.

Marine Environmental Protection: Surface oil spill thickness sensors small enough to be installed on small UASs and AUVs are regularly deployed in response to oil spills and for rapidly triaging multiple spills after natural disasters. Coast Guard operators direct recovery assets to where spilled oil is thickest and fully assess areas of thin oil sheens without exposing human operators to toxic oil. Similar sensors are designed for and integrated into long range AUVs for identification and assessment of spills under sea ice as maritime traffic increases in the Arctic.

Defense Readiness: UASs from National Security Cutters, Offshore Patrol Cutters, and Polar Security Cutters monitor air and surface contacts and exchange data to increase maritime domain awareness and improve defense posture. As a result of close partnering on requirements and command and control networks, these UASs are fully interoperable and even interchangeable with joint and allied partners. Integrated C-UxS ensure the defense of these capital assets and the safety of their crews.

Aids to Navigation: Existing ATON are equipped with sensors to increase maritime domain awareness, detect pollution, and facilitate detection and location of vessels and individuals during search and rescue operations. Addition of onboard position and status sensors enable automatic notification to Sectors when ATON are off station or inoperative. Small UAS are used to perform visual inspections of hard to access ATON, while unmanned underwater vehicles (UUVs) are employed to inspect chain, sinker, and buoy underwater bodies to extend the maintenance cycle and preserve human divers for more delicate tasks that require human dexterity and skills.

Marine Safety: Small UAS are programmed to fly autonomously inside vessels to conduct internal inspections of vessel tanks and compartments containing environments that are hazardous to human inspectors. The UAS map, record, and measure vessel conditions during detailed inspections and highlight discrepancies for ship owners. A detailed digital history enables trending and analysis for a more comprehensive commercial vessel safety program.

Living Marine Resources: UAS with AI/ML object detection are routinely deployed to monitor compliance with fisheries management plans. Space-based ISR and USVs provide persistent monitoring of fishing activity in or near regulated closed areas for weeks or months at a time.

Mission Support/Logistics: UAS specifically designed for cargo transfer deliver necessary repair parts to cutters hundreds of miles offshore to enable repairs and avoid the fuel consumption and lost operational presence caused when those cutters would otherwise be forced to return to port.

V. ACRONYMS GLOSSARY

AI/ML
Artificial Intelligence and Machine Learning

ASV
Autonomous Surface Vehicle

ATON
Aids to Navigation

AUV
Autonomous Underwater Vehicle

BVLOS
Beyond Visual Line of Sight

C-UXS
Counter Unmanned Systems

C-UUV/USV
Counter Unmanned Underwater/ Unmanned Surface Vehicle

DHS
Department of Homeland Security

DOD
Department of Defense

DOTMLPF-P
Doctrine, Organization, Training, materiel, Leadership, Personnel, Facilities and Policy

IUU
Illegal, Unreported, and Unregulated

MDA
Maritime Domain Awareness

NDS
National Defense Strategy

OTA
Other Transaction Authority

PWCS
Ports, Waterways and Coastal Security

SAR
Search and Rescue

SDCIP
Surveillance, Detection, Classification, Identification, and Prosecution

UAS/UAV
Unmanned Aircraft/Aerial System/Vehicle

UGV
Unmanned Ground Vehicles

SUAS
Small Unmanned Aerial System

USS/USV
Unmanned Surface System/Vehicle

UUS/UUV
Unmanned Underwater System/ Vehicle

UXS
Unmanned Systems

VTOL
Vertical Takeoff and Landing

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