DEPARTMENT OF THE NAVY

UNMANNED

Campaign Framework

March 16th, 2021

CONTENTS

Message from the Secretary of the Navy 1
Message from the Chief of Naval Operations 2
Message from the Commandant of the Marine Corps 3
Part I THE MISSION — Why Unmanned? 4
Introduction 6
Why a Campaign? 8
Executing the Campaign POA&M 9
Why Unmanned? 10
Alignment to the National Defense Strategy 11
Part II UNMANNED PORTFOLIO — Where Are We Now? 12
Air Portfolio 14
Surface Portfolio 15
Undersea Portfolio 16
Ground Portfolio 17
Unmanned Areas of Opportunity 18
Part III DELIVERING THE FUTURE — How Will We Get There? 20
Challenges 22
Building a Credible Plan and Future 23
Changing the Narrative 24
De-risking the Development of Technology 26
Providing Total Solutions 27
A Nationwide Approach 28
Industry and Academia 29
Allies and Partners 30
Legal, Policy, and Ethical Considerations 31
Exploring Opportunities 33
Appendix A: Unmanned Portfolio 34
Glossary 36

A Knifefish Unmanned Undersea Vehicle (UUV) training model undergoes crane operations aboard the Military Sealift Command expeditionary fast transport vessel USNS Spearhead (T-EPF 1).

Cover: U.S. Navy photo illustration by Jason Kennickell
(This is a computer-generated illustration)

MESSAGE FROM THE SECRETARY OF THE NAVY

The Department of the Navy is moving with purpose to innovate and adapt new technology to build a more lethal and distributed naval force for the future. 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.

These sustained investments will yield new capabilities extending well beyond the effectiveness of standalone platforms or human-centered systems. They will transform naval warfare by providing asymmetric advantages to each and every Sailor and Marine.

The Navy and Marine Corps have now taken the next step by aligning our unmanned systems vision to execute Distributed Maritime Operations (DMO) and Littoral Operations in a Contested Environment (LOCE). To ensure success, the Navy and Marine Corps are tightly coupling our **requirements, resources, and acquisition policies** to develop, build, integrate and deploy effective unmanned systems faster.

The Department of the Navy's unmanned campaign plan spans the entire doctrine, organization, training, materiel solutions, leadership and education, personnel, facilities and policy construct. This document provides the overarching framework for the campaign plan, and is supported by detailed implementation plans at a higher classification. Together, they outline a concrete strategy rooted in a realistic assessment of each domain today. The path forward requires a holistic approach to developing and deploying unmanned systems, ensuring that individual technologies can operate within a broader architecture of networked warfighting systems, supported by the right people, policies, operational concepts, and other enablers.

The entire Naval enterprise is committed to providing our nation and every Sailor and Marine with the strategic and tactical advantages that human-machine teaming provides to guarantee freedom of the seas for all.

THOMAS W. HARKER
Secretary of the Navy (Acting)

U.S. Navy Sailors and civil service mariners launch an unmanned surface vehicle (USV) from USNS Hershel Woody Williams, September 14, 2019.

MESSAGE FROM THE CHIEF OF NAVAL OPERATIONS

As the Navy adapts to an increasingly complex security environment, it is imperative that we understand what our future force will need to operate both in day-to-day competition as well as a high-end fight.

Unmanned Systems (UxS) have and will continue to play a key part in future Distributed Maritime Operations (DMO), and there is a clear need to field affordable, lethal, scalable, and connected capabilities. That is why the Navy is expanding and developing a range of unmanned aerial vehicles (UAV), unmanned undersea vehicles (UUV), and unmanned surface vessels (USV) that will play key roles as we shift our focus toward smaller platforms that operate in a more dispersed manner.

A hybrid fleet will be necessary for the Navy to meet emerging security concerns. We need platforms to deliver lethal and non-lethal effects simultaneously in all domains across multiple axes. UxS will provide added capacity in our Future Fleet — in the air, on the surface, and under the water.

The campaign plan will serve as the comprehensive strategy for realizing a future where unmanned systems serve as an integral part of the Navy's warfighting team. It will be a living, iterative document that articulates our vision for a more ready, lethal, and capable fleet through acceleration of critical enablers in technology, processes, and partnerships.

We are mindful of past shortcomings, so therefore our approach is deliberate, but with a sense of urgency. We will address every aspect of Doctrine, Organization, Training, materiel, Leadership and Education, Personnel, Facilities, and Policy (DOTmLPF-P), identify and close capability gaps, and work to create and maintain our future naval force, together.

M. M. GILDAY
Admiral, U.S. Navy
Chief of Naval Operations

MQ-25 T1 with Aerial Refueling Store under left wing, on the ramp.

MESSAGE FROM THE COMMANDANT OF THE MARINE CORPS

The speed with which unmanned technology is available to U.S., allied, and adversary forces requires that we have both a vision and roadmap for maximizing this capability. The Marine Corps requires unmanned air, surface, and ground systems to fully exploit our inherent expeditionary nature and capabilities. Partnered with our shipmates in the Navy, we will provide a Joint Force Maritime Component Command that supports the Joint Force in the unique maritime domain we inhabit. When operating forward, in small groups, under austere conditions, the ability to maximize unmanned systems to create outsized effects for our allies and against our adversaries is a key element of our future success.

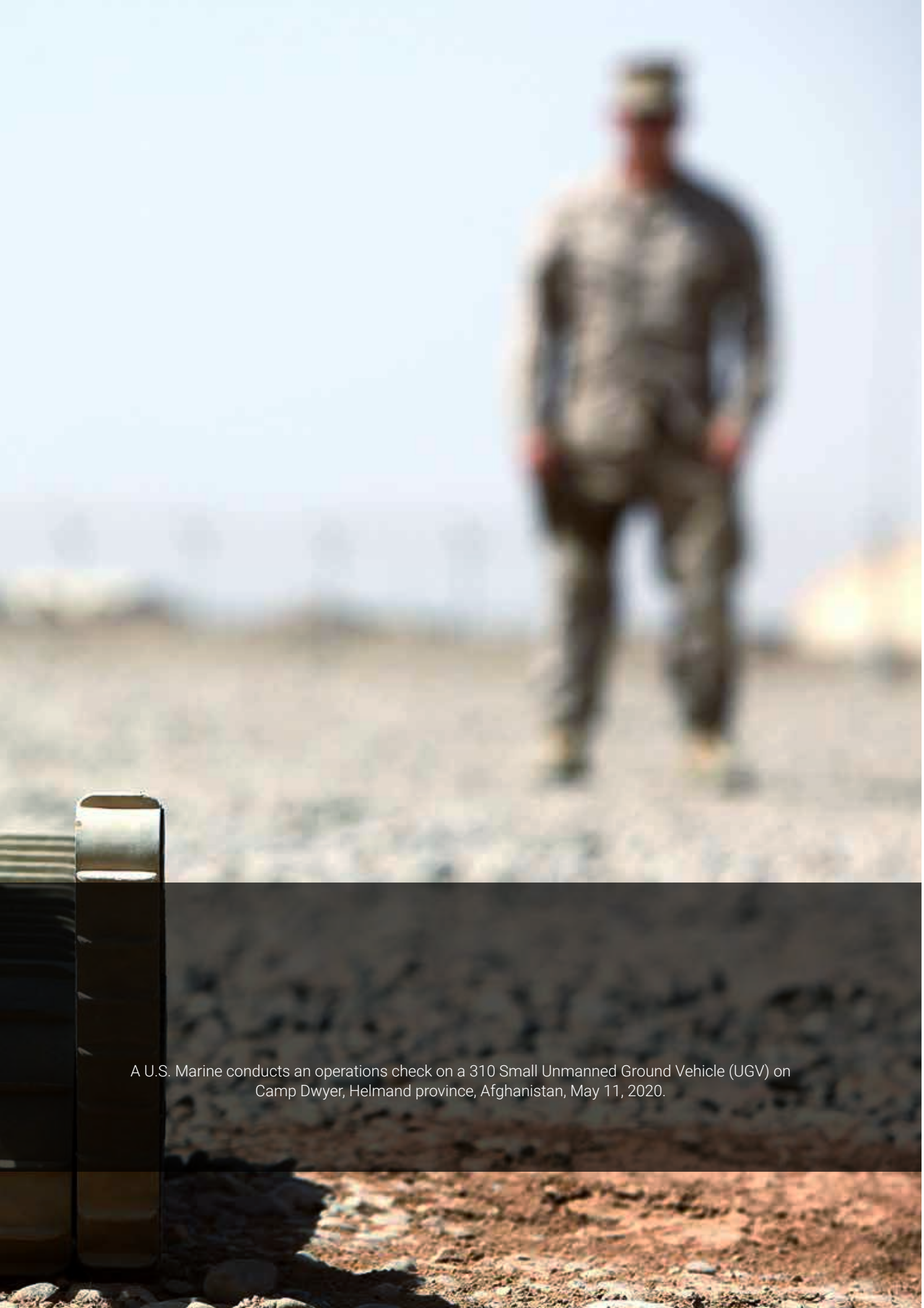
The campaign plan serves as a starting point for the Marine Corps to understand that unmanned systems must and will take on greater importance in our near future. Concepts such as half of our aviation fleet being unmanned in the near- to mid-term, or most of our expeditionary logistics being unmanned in the near- to mid-term should not frighten anyone. Rather, these ideas should ignite the creative and cunning nature of our Marines so that our forward-deployed forces are even more lethal and useful to the joint force.

Together with the Chief of Naval Operations (CNO), I am committed to a deliberate, but aggressive pathway forward for Marine Corps unmanned systems. This document offers the initial sight picture and depends on an iterative discussion with the Fleet Marine Force, our Shipmates, the Joint Force, Congress, allies, and industry. I expect Marines to embrace this future of warfare and turn it to their advantage on the battlefield; from daily competition to large-scale combat operations.

DAVID H. BERGER
General, U.S. Marine Corps
Commandant of the Marine Corps

A VBAT vertical take-off and landing (VTOL) unmanned aerial system (UAS) prepares to land on the flight deck of a naval ship.

Part I
THE MISSION
Why Unmanned?



A U.S. Marine conducts an operations check on a 310 Small Unmanned Ground Vehicle (UGV) on Camp Dwyer, Helmand province, Afghanistan, May 11, 2020.

INTRODUCTION

The National Defense Strategy (NDS) defines "the central challenge to U.S. prosperity and security as the reemergence of long-term, strategic competition" posed by Russia and China. It emphasizes that, "America's military has no preordained right to victory on the battlefield." **The developing abilities of near-peer competitors drive the need for increased Naval capability distributed over a wider area**. In order to meet the challenges of the future and align with strategic goals defined in the Tri-Service Maritime Strategy, the CNO's Navigation Plan, and the Commandant's Planning Guidance, the Navy and Marine Corps must innovate and accelerate delivery of credible and reliable unmanned systems in conjunction with increasingly capable manned platforms into the fleet.

Autonomous systems provide additional warfighting capability and capacity to augment our traditional combatant force, allowing the option to take on greater operational risk while maintaining a tactical and strategic advantage. The Navy and Marine Corps are already operating unmanned systems, and going forward will seek to achieve a seamlessly integrated manned-unmanned force across all domains. The question is not "if" the Naval force will prioritize and leverage unmanned platforms and systems, but how quickly and efficiently, in resource-constrained environments.

New technologies have changed society and the character of war. Many technological developments are sourced in the commercial sector which means competitors and non-state actors can access them. Maintaining the Department's technological advantage will require deeper understanding of and integration with industry culture, better leveraging of unique investment sources, and enhanced protection across the National Security Innovation Base. In order for the Department to deliver unmanned capability at the speed of technology in an environment of competing budget priorities, the DON has created an Unmanned Campaign Plan that will create a collaborative and actionable effort, focused on delivering and sustaining manned unmanned teaming for the future maritime fight. This campaign plan is comprised of two elements, the framework which contains overall concepts and strategies, and the execution plan of action and milestones (POA&M) that ensures collaboration across Naval Forces to determine how unmanned systems will fit into the future fleet, and maximizes the value that they will provide for national security.

Unmanned systems will increase lethality, capacity, survivability, operational tempo, deterrence, and operational readiness. The Navy and Marine Corps must use tried and true measures of program development, such as the Navy's AEGIS Program, where Rear Admiral Wayne E. Meyer, established a philosophy of "Build a Little, Test a Little, and Learn a Lot." Through this philosophy the Department will move as quickly as technology allows, to develop and field proven capabilities to maintain a strategic and tactical advantage.

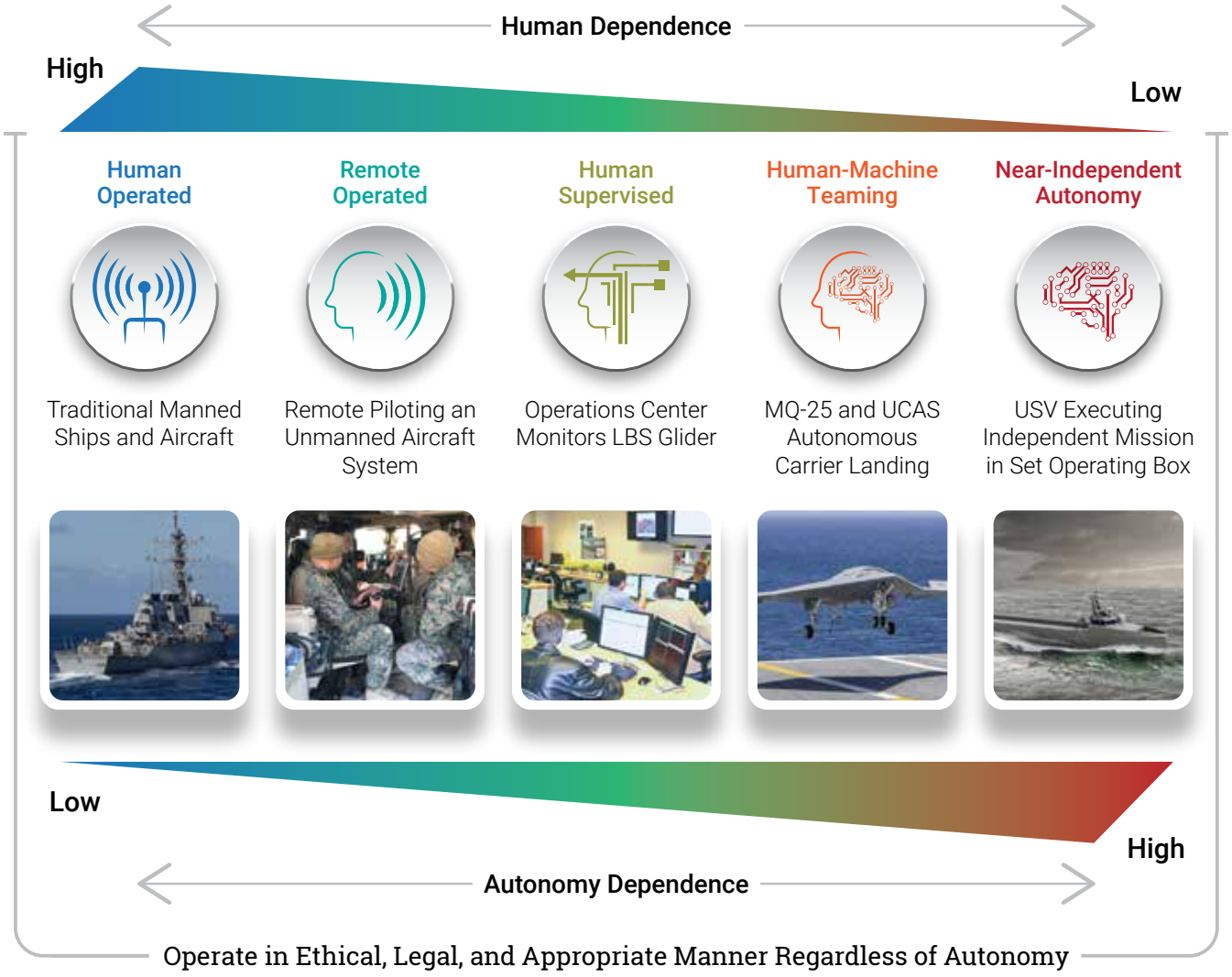
Field radio operator, assigned to 1st Air Naval Gunfire Liaison Company, I Marine Expeditionary Force Information Group, prepares to launch the RQ-20 Puma for a surveillance mission at San Clemente Island, California.

ADDRESSING UNMANNED SYSTEMS – WHAT ARE WE TALKING ABOUT?

The essence of unmanned is the physical removal or remote location of the human from the platform. Autonomy gives capable machines the ability to adapt interactively to the dynamic maritime environment. This is critical when:

- The world cannot be predicted
- Adaptation must occur at machine speed
- Adaptation must occur in the face of overwhelming data
- Communications are limited or unreliable

Different missions call for different amounts of human-machine interdependence. "Unmanned" refers to the spectrum of autonomy from remote to autonomous and can be platform, system, or subsystem specific. The Navy and Marine Corps will incorporate autonomy where it is desired, credible, reliable, and effective; additionally, they will always adhere to legal and ethical foundations.



WHY A CAMPAIGN?

VISION

Make unmanned systems a trusted and sustainable part of the Naval force structure, integrated at speed to provide lethal, survivable, and scalable effects in support of the future maritime mission.

GOALS

Advance manned-unmanned teaming within the full range of Naval and joint operations.	Build a digital infrastructure that integrates and adopts unmanned capabilities at speed and scale.	Incentivize rapid incremental development and testing cycles for unmanned systems.	Disaggregate common problems, solve once, and scale solutions across platforms and domains.	Create a capability-centric and sustainable approach for unmanned contributions (platforms, systems, subsystems) to the force.

What needs to change?

It is imperative that we employ new and different strategies to win the future fight. Unmanned concepts allow us to rewrite the narrative on traditional warfare. Through a capabilities-based approach we can build a future where unmanned systems are at the front lines of our competitive advantage. The Naval force needs to move toward a capability-centric proactive environment able to incorporate unmanned systems at the speed of technology, to provide maximum agility to the future force.

How will the campaign contribute to change?

Department of Navy (DON) leadership will generate a forum for executing transparent efforts to drive the advancement of unmanned and autonomous solutions. The campaign articulates the strategy, provides a framework for execution, and accelerates critical enablers in technology, process, policy, and partnerships. The campaign will work with partner projects that help integrate all Naval systems, such as Project Overmatch, the Naval Tactical Grid and Joint All-Domain Command and Control (JADC2). As networks and foundations grow, unmanned systems will be designed to integrate seamlessly. Leadership will focus on resourcing and building an environment that can partner with industry, apply resources, and accelerate development in a synchronized and deliberate way.

Sea Hunter, an unmanned sea surface vehicle developed in partnership between the Office of Naval Research and the Defense Advanced Research Projects Agency.

EXECUTING THE CAMPAIGN POA&M

A vision alone will not bring about change. The Campaign will need advocacy and action to succeed in its vision. Central to the campaign is the creation of an enduring and dynamic plan of action, accountable through a concentrated group of senior authorities. This empowered and engaged team of leaders will work across boundaries and barriers to connect enterprise vision with collaborative solutions. This team will have membership across the Secretariat, Fleet, OPNAV and HQMC.

The leadership team will use the POA&M to drive the Department through a cultural and technological behavior change to accelerate development and a broader adoption of unmanned systems across the Force. Driving behavioral change will focus on:

- Transition from reporting activity to driving action on high-leverage outcomes that solve operational problems and increase capability.
- Increased confidence in data-driven cause and effect relationships.
- Increased velocity and scale of learning.
- Encouraging deliberate risk and embracing the "Red" culture improvement models.
- Adapting, learning, correcting, and attacking barriers.
- Driving a sense of urgency in improvement.

Through centralized accountability and decentralized execution we will maintain cohesion of plan and vision, while unleashing the innovative power and resources of our workforce at all levels in all functional areas.

The Campaign is focused around eight functional areas that will ensure a complete and holistic approach to delivering capabilities to the fleet:

PLATFORMS & ENABLERS

Requirements, resources and investment plans through development of a cross-domain capability-centric lens, addressing whole capability solutions that enable UxS to rapidly integrate across the Force.

STRATEGY, CONCEPTS, & ANALYSIS

Alignment of strategic priorities, connecting cycle of analytics and informing and reporting on wargames, studies, exercises and experiments.

FLEET CAPABILITY, CAPACITY, READINESS & WHOLENESS

Derive employment plans, exercises and CONOPs to inform requirements applied to fleet issues regarding manning, training, and equipping the fleet.

RDT&E/SCIENCE & TECHNOLOGY

Identifying, informing, and integrating the Naval Research Enterprise on focused capability development, validation and insertion.

PEOPLE, EDUCATION & TALENT

Future personnel, talent recruitment and education necessary to field and sustain autonomous operations securely and reliably.

LOGISTICS & INFRASTRUCTURE

Ensuring the maintenance, sustainment, basing, and support of unmanned systems is understood and prepared to scale with the fleet.

POLICY, LAW, & ETHICS

Addressing barriers, gaps, interpretations and issues of policy that support the advancement and employment of autonomous solutions.

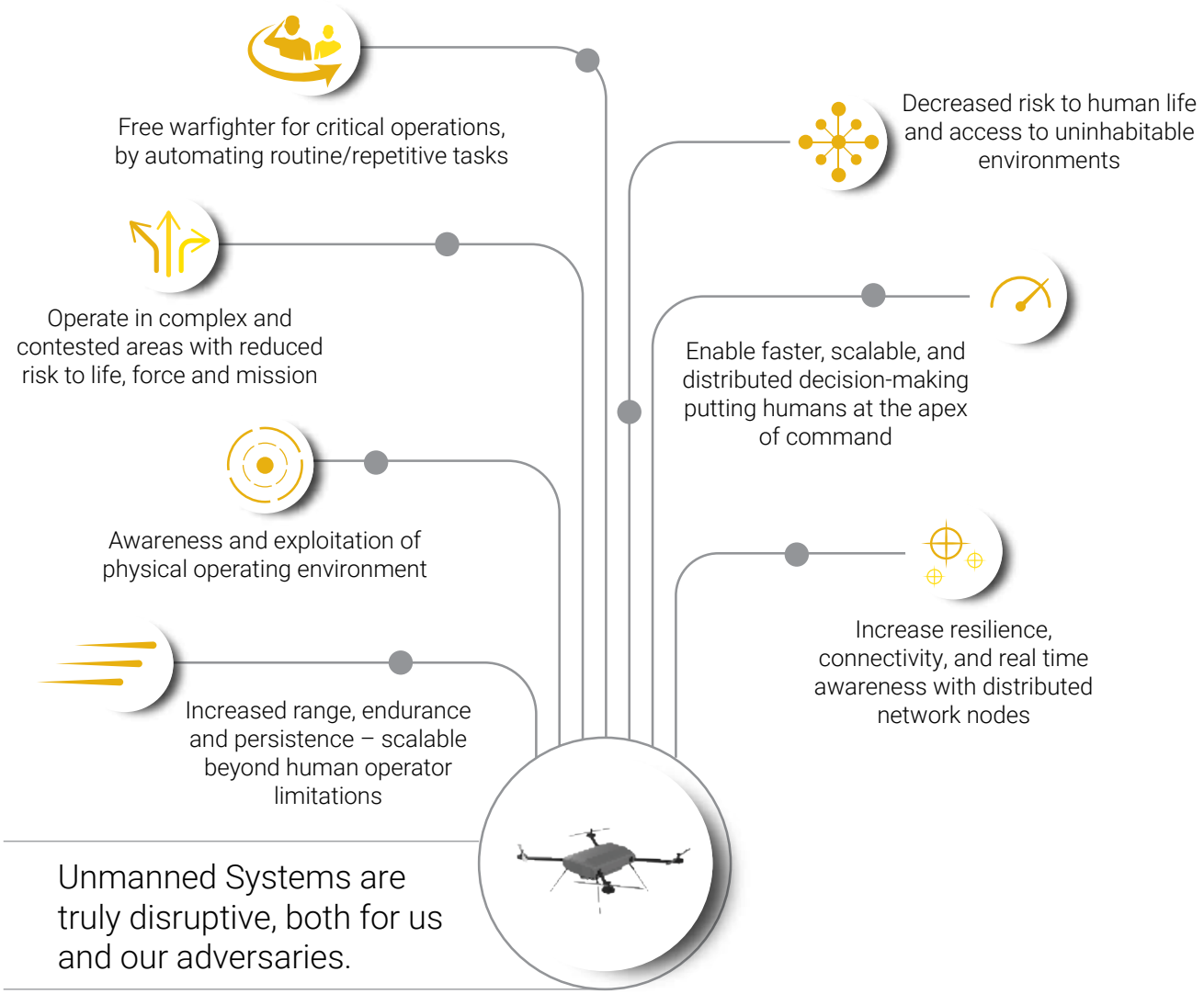
COMMUNICATION & MESSAGING

Collecting, consolidating and communicating the Naval narrative on unmanned systems. Ensuring one coherent voice and vision is shared across the DON when it comes to the future of UxS.

WHY UNMANNED?

Today's global security environment has seen a return to Great Power Competition. This shift has placed the Department at an inflection point, and we cannot continue with a traditional force structure in the face of new warfighting demands. We must develop detailed technology maturation and acquisition roadmaps to enable us to innovate quickly to provide solutions for hard-to-solve problems of current and future conflicts.

Unmanned Systems Desired End-State



ALIGNMENT TO THE NATIONAL DEFENSE STRATEGY

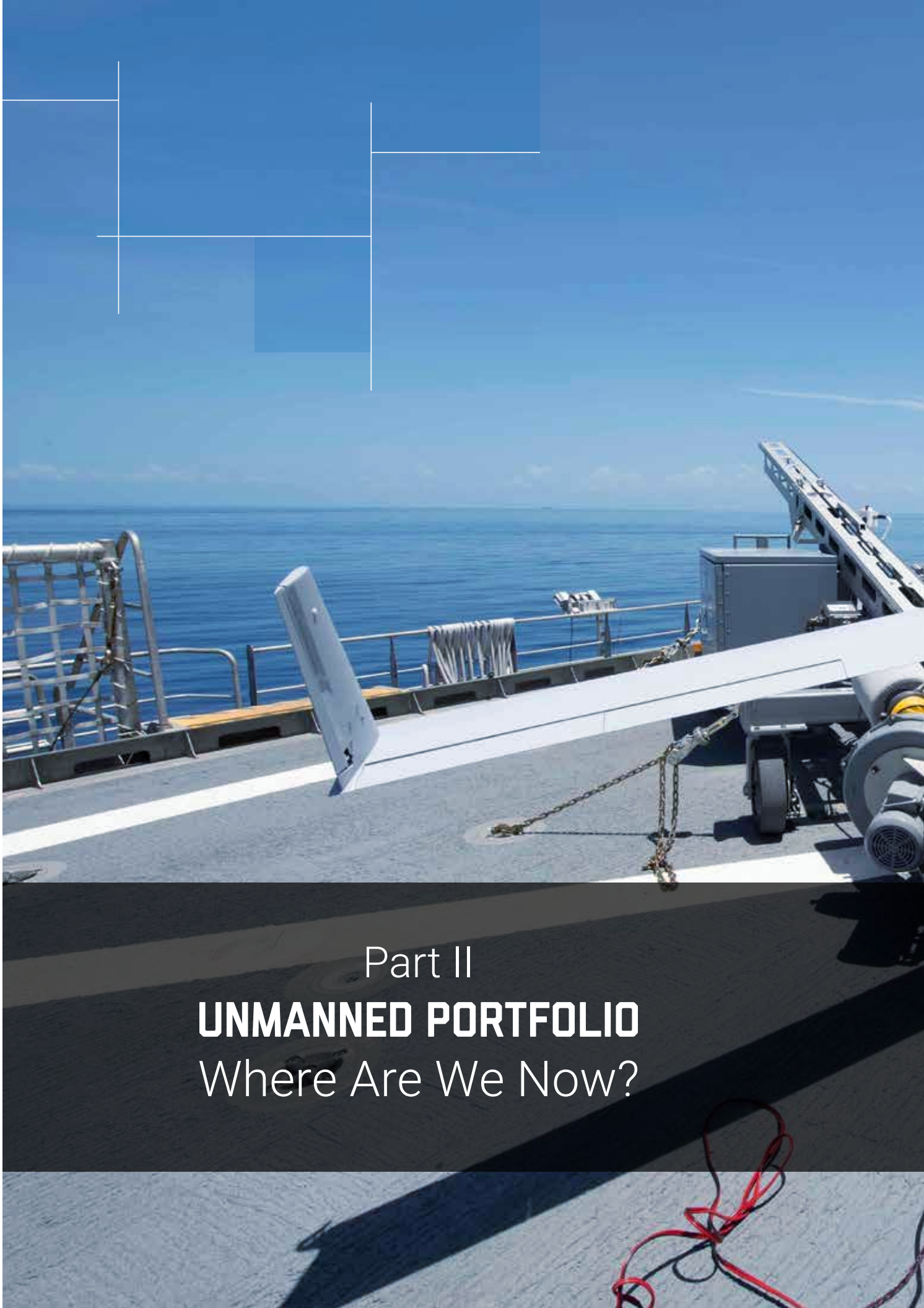
NDS LINE OF EFFORT	UNMANNED STRATEGIC OBJECTIVES	UNMANNED OPPORTUNITY AREAS
1 Build a More Lethal Force	**Modernize key capabilities using unmanned systems**	Space and Cyberspace Warfighting Domains
		Command, Control, Communications, Computers, Intelligence, Surveillance, Reconnaissance, and Targeting (C4ISR-T)
		Joint Lethality in contested environment
		Advanced autonomous systems
	Evolve innovative operational concepts	Develop innovative unmanned operational concepts
		Develop innovative Manned-Unmanned Teaming (MUM-T) operational concepts
		Utilize UxS capabilities and MUM-T operational concepts in planning to execute operations in new and unpredictable ways
	Develop a lethal, agile, mobile and resilient force	Include unmanned systems in Dynamic Force Employment plans
		Include unmanned systems in the Global Operating Model
		Forward Force maneuver and posture resilience
		Resilient and agile logistics
2 Strengthen Alliances and Attract New Partners	**Deepen Interoperability**	Develop allied partnerships and train combined forces for missions using MUM-T systems in joint operations
		Integrate UxS and MUM-T into strategic planning and employment schemes with allies
3 Reform the Department for Greater Performance & Affordability	**Deliver performance at the speed of relevance**	Prioritize reliable and proven delivery of unmanned systems
		Execute continuous adaptation
		Accept frequent modular upgrades
	Organize for innovation	Consolidate, eliminate or restructure as necessary to increase lethality or performance
	Streamline rapid, iterative approaches from development to fielding	Ensure S&T organizations, Sponsors, Program Offices, SYSCOMS and the Fleet employ streamlined rapid, iterative approaches from development to fielding of unmanned systems
	Integrate with US interagency	Share DON UxS and MUM-T systems and operating concepts with other agencies as appropriate
		Utilize other agency UxS and MUM-T systems and operating concepts where capabilities and/or cost effectiveness is needed

"Unmanned platforms play a vital role in our future fleet. They will expand our intelligence, surveillance, and reconnaissance advantage, add depth to our missile magazines, and provide additional means to keep our distributed force provisioned. Furthermore, moving toward smaller platforms improves our offensive punch while providing affordable solutions to grow.

– CNO Navigation Plan, 2021

By exploiting the technical revolution in autonomy, advanced manufacturing, and artificial intelligence, the naval forces can create many new risk-worthy unmanned and minimally-manned platforms that can be employed in stand-in engagements to create tactical dilemmas that adversaries will confront when attacking our allies and forces forward."

– Commandant's Planning Guidance, 2019



Part II

UNMANNED PORTFOLIO

Where Are We Now?

A Scan Eagle unmanned aerial vehicle sits on the flight deck aboard the Expeditionary Fast Transport Vessel USNS Spearhead (T-EPF 1).

AIR PORTFOLIO

UCAS X-47B has first landing of an autonomous aerial vehicle on an aircraft carrier.

Today's Navy and Marine Corps unmanned aircraft systems (UAS) have leveraged 30-plus years of UAS experience in support of the naval mission and feature technologies that enhance our forces. Currently, UAS support enhanced maritime domain awareness with extended range and persistent Intelligence, Surveillance, Reconnaissance and Targeting (ISR&T) capabilities. The Broad Area Maritime Surveillance Demonstrator (BAMS-D) is a High Altitude Long Endurance (HALE) UAS equipped with a maritime ISR&T sensor package that has operated for over 10 years, providing more than 35,000 hours of critical maritime overwatch. The MQ-8C Fire Scout provides organic ISR&T to Littoral Combat Ships (LCS) and other suitably equipped air capable ships. The Navy's MQ-4C Triton and USMC's MQ-9A are both executing Early Operational Capability (EOC) deployments. Additionally, the Navy and Marine Corps continue to leverage numerous smaller UAS across the spectrum of naval operations.

The Navy and Marine Corps are leveraging rapidly evolving unmanned technologies to develop cutting-edge systems with resilient command and control architectures to support a future distributed force. The MQ-25A Stingray will be the first carrier-based UAS, functioning primarily as a mission tanker to extend the range and reach of the Carrier Air Wing (CVW).

The United States Marine Corps (USMC) continues to develop and experiment with a family of longer range, longer endurance UAS with a variety of plug-and-play payloads. These systems will give ground combat units organic Reconnaissance, Surveillance, and Target Acquisition (RSTA) assets capable of supporting long-range precision kinetic and non-kinetic fires, both afloat and ashore. This includes conducting extended user evaluations with industry leading systems to include the UAV V-BAT and the Stalker UAS to inform requirements for the Ground Combat Element. The USMC is also the lead for the development of a Joint family of aerial unmanned logistics systems capable of facilitating the automated distribution of supplies in the maritime environment. These types of "delivery drones" are essential components to the overall Navy and USMC logistics modernization efforts in support of DMO and EABO.

The Department will continue building on lessons learned from Naval UAS operational experience, leveraging advances in autonomy, and pursuing Manned-Unmanned Teaming (MUM-T) opportunities. The Navy and Marine Corps team is committed to exploring the utility of UAS across the full spectrum of naval operations and fielding more capable UAS that are fully integrated into the manned/unmanned future force.

SURFACE PORTFOLIO

Sea Hunter travels thousands of miles autonomously between San Diego and Pearl Harbor in a first of its kind demonstration.

The large and medium unmanned surface vessels are the newest additions to this portfolio. The Medium and Large Unmanned Surface Vessels (M/LUSV) of today are prototype efforts using Sea Hunter (SH1) and Overlord to provide assets for fleet experimentation and technology development and demonstration. Sea Hunter is in operation with Surface Development Squadron One participating in Fleet Exercises to develop familiarization and Tactics, Techniques, and Procedures (TTPs) for manned and unmanned operations. A second Sea Hunter, Seahawk (SH2), was launched in August 2020 and is undergoing testing and will eventually join SH1 for additional platform testing and experimentation. The Overlord program is converting commercial Fast Supply Vessels to develop and mature reliable USV autonomy and develop a fleet integrated C4I system. The Overlord project has converted two existing vessels and contracted for two new vessels in FY20. Following the cancellation of the Remote Multi-Mission Vehicle (RMMV) Program in FY16, the Mine Countermeasures Unmanned Surface Vehicle (MCM USV) was designated as the new tow platform to replace RMMV for mine countermeasure operations. MCM USV is now a program of record in low-rate production, and integration tests to launch and recover MCM USV from LCS have begun.

The Medium and Large USVs of tomorrow offer promising solutions to expand the sensor and weapons capacity of the current Fleet. They will be Program of Record, purpose-built vessels that support distributed maritime operations through the Navy Tactical Grid. The MUSV platform is designed as an unmanned sensor-ship, built to carry modular payloads, and standardized to integrate with current and future Navy systems. The LUSV platform will be a high endurance, adjunct magazine, based on commercial designs and built around a common missile launcher with an integrated combat system. The LUSV will add meaningful offensive weapons capability and capacity in Strike and Anti-Surface Warfare.

The Marine Corps is developing the Long-Range Unmanned Surface Vessel (LRUSV) to enhance maritime reconnaissance and long-range precision fires in support of sea denial and sea control operations. This small autonomous vessel will provide a variety of new disruptive capabilities. The Marine Corps, in coordination with Office of Naval Research (ONR), is also developing the Autonomous Littoral Connector (ALC), a sensor and software suite that can be applied to current and future surface connectors. ALC will provide multiple levels of autonomous surface mobility and beaching capabilities to enhance the overall maneuverability and sustainability of units operating in the littorals.

UNDERSEA PORTFOLIO

A Mk-18 Mod 2 UUV with the ATLAS forward looking sonar module attached begins its dive for a mine hunting mission.

The undersea domain has decades of operational use with small UUVs and is scaling size and complexity going forward as technology advances. The Navy has increased collaboration with industry through competitive prototyping accelerating new technology delivery to the fleet. This collaboration enables prudent prototyping, experimentation, and demonstration of new capabilities prior to transitioning to Programs of Record. Since the 1990s, UUVs operating from both submarines and surface ships, small and large, have conducted intelligence preparation of the environment enhancing battlespace awareness throughout the world.

Submarine Force, Naval Expeditionary Combatant Command, Naval Special Warfare and Naval Oceanographic UUVs have supported UUV operations in the mission areas of Mine Warfare, Intelligence, Surveillance and Reconnaissance (ISR), and intelligence preparation of the operational environment. This includes remote command and control from the Navy's Glider Operations Center (GOC) and the UUV Operations Center (UOC) that provide overwatch and reachback. These operations have resulted in the force gaining experience that is foundational and culminates in a deep understanding of maritime unmanned systems, particularly in the areas of navigation, sensing and autonomy, and mission endurance. The Navy will build upon these lessons to accelerate adoption throughout the Fleet.

Fabrication of the Orca Extra Large Unmanned Undersea Vehicle (XLUUV), a pier or shipboard launched, long endurance vehicle with a modular design to accommodate a variety of large payloads has begun. The first vehicle is expected to deliver in FY22. Snakehead Large Displacement UUV Phase 1 prototype, designed for launch and recovery from submarine large ocean interfaces for deep or long duration missions, is completing fabrication and will begin test and evaluation in FY22. Request for Proposal (RFP) for the next phase of Snakehead has been issued with award projected in FY21.

Small/Medium UUV efforts leverage successful operations over the last 10 years, are derived from commercial vehicles and modified for surface and submarine host platforms. The Razorback submarine launched and recovered UUVs extend the submarine's reach to areas too deep, too shallow, or too dangerous for submarine operations. The initial variant of Razorback relies on launch and recovery from a dry deck shelter, but ongoing torpedo tube launch and recovery (TTL&R) demonstrations and experimentation will enable the submarine force to conduct operations on virtually any submarine without the need for divers or a dry deck shelter. In May 2020, the Navy released an RFP for the next generation of Razorback and small UUVs that include TTL&R capabilities. The production of the Mk-18 Family of Systems continues as the Navy's most successful UUV program. Both Mk-18 Mod 1 and 2 are used for Expeditionary Mine Countermeasures (MCM) and Maritime Homeland Defense (MHD). The Knifefish medium MCM UUV has been in low-rate production since 2019. A future Maritime Expeditionary MCM UUV is leveraging the Razorback RFP to reduce lifetime operating costs through a common medium UUV outfitted with sensors and payloads tailored to support multiple communities.

The Navy continues to explore new concepts of operation, new means of integrating unmanned and manned vessels, and new capabilities afforded by these advances.

GROUND PORTFOLIO

Marine Explosive Ordnance Disposal (EOD) technicians in the Republic of Korea train in UGV manned-unmanned teaming techniques to reduce risk for unexploded ordnance detection and disposal operations.

In the Ground Domain, the USMC is seeking to develop a variety of Unmanned Ground Vehicles (UGVs) that are interoperable, survivable, and modular with flexible levels of autonomy, and high levels of human-machine collaboration. The USMC is taking advantage of industry advancements in self-driving vehicles and commercial mobile robotic systems while also leveraging US Army UGV efforts. The USMC UGV strategy includes the exploitation of robotic and autonomy capabilities with the following objectives: employing Manned-Unmanned Teaming (MUM-T); leveraging autonomy and matching autonomy to mission; and integrating robotic and autonomous capabilities to develop innovative concepts of operation. The overarching goal of the ground portfolio is to provide the following to maritime ground forces: increase situational awareness; lighten the cognitive and physical burden; improve sustainment; facilitate movement and maneuver; and to protect the force. In partnership with Navy and Industry, the USMC has developed the Remotely Operated Ground Unit for Expeditionary (ROGUE)-Fires platform. This program utilizes a Joint Light Tactical Vehicle chassis and powertrain kitted with an autonomy kit to serve as a launch platform for the transportation and firing of a variety of ground-based missile systems.

In a culmination of work with numerous ground robotic/autonomous systems over the past fifteen years, the Marine Corps Warfighting Laboratory (MCWL) developed the prototype Expeditionary Modular Autonomous Vehicle (EMAV) small unit UGV with a modular payload integration architecture supporting a variety of missions across multiple warfighting functions. The Army selected the EMAV and the prototype/demonstrator for their Robotic Combat Vehicle – Light program setting the groundwork for a potentially significant Joint UGV program. Experimentation and advanced development continues for a squad level semi- autonomous UGV know as Modular Advanced Armed Robotic System (MAARS 2.0) that is designed specifically for small unit reconnaissance, surveillance, and target acquisition missions.

MCWL is also developing and experimenting with a variety of other ground robotic systems with common system architectures and controllers to include everything from small throwbots that can be used to identify occupants or hazards in a room, cave, or tunnel; to weapon carrying systems that can remotely maneuver, target, and fire a variety of crew served small arms. All these systems seek to reduce the physical and cognitive burden of Marines while increasing lethality and survivability while contributing to larger maritime operations.

UNMANNED AREAS OF OPPORTUNITY

To deliver effective unmanned capabilities to the fleet, proper development of not only platforms, but also key enablers and core technologies are required to seize the opportunities unmanned systems present.

Repetitive and Routine Automation

Example: Mine Countermeasures

Search, locate, identify, process, and neutralize sea mines, ensuring safety and security of sea lanes.

Enduring and Persistent Effects

Example: Denied-Area Intelligence, Surveillance, and Reconnaissance (ISR)

To collect intelligence and perform surveillance and reconnaissance.

Attritable Systems

Example: Distributed Nodes

Increased capacity at decreased cost allows robust connectivity and communication resiliency.

New Concepts with Unmanned Systems

Example: Unique Missions

Exploration of unique missions and opportunities only available through unmanned systems.

KEY ENABLERS

- People & Training
- Networks
- Infrastructure & C2
- Data & Autonomy
- Interfaces & Standards
- Facilities, Sustainment & Maintenance

CORE TECHNOLOGIES

- Positioning
- Navigation & Timing
- Sense & Decide
- Communications
- Mission AI
- Cyber & Physical Security
- Reliability
- Payload Integration
- Power & Endurance
- Edge Processing

UNMANNED PLATFORMS

- RQ-21 Blackjack/ ScanEagle
- LRLE
- MQ-4 Triton
- MQ-25A Stingray
- MQ-8C Fire Scout
- MQ-9A Reaper
- Sea Hunter
- MCM USV
- LUSV
- Overlord Prototype
- MUSV
- LRUSV
- XLUUV Orca
- LDUUV Snakehead
- Knifefish
- Razorback
- MK-18 Mod 1 & Mod 2
- LBS-AUV & LBS-Glider
- ALC
- ROGUE-Fires
- RCV-L
- SUGV

A Ghost Fleet Overlord test vessel takes part in a capstone demonstration during the conclusion of Phase I of the program in September 2019. Two existing commercial fast supply vessels were converted into unmanned surface vessels (USVs) for Overlord testing, which will play a vital role in informing the Navy's new classes of USVs.

Part III

DELIVERING THE FUTURE

How Will We Get There?

A Marine Corps Warfighting Laboratory Robotic Combat Vehicle-Light (RCV-L) autonomously departing an Assault Craft Unit-2 Autonomous Littoral Connector (ALC), a legacy Navy landing craft outfitted with sensors and software giving the craft both remote-control and full autonomous capabilities.

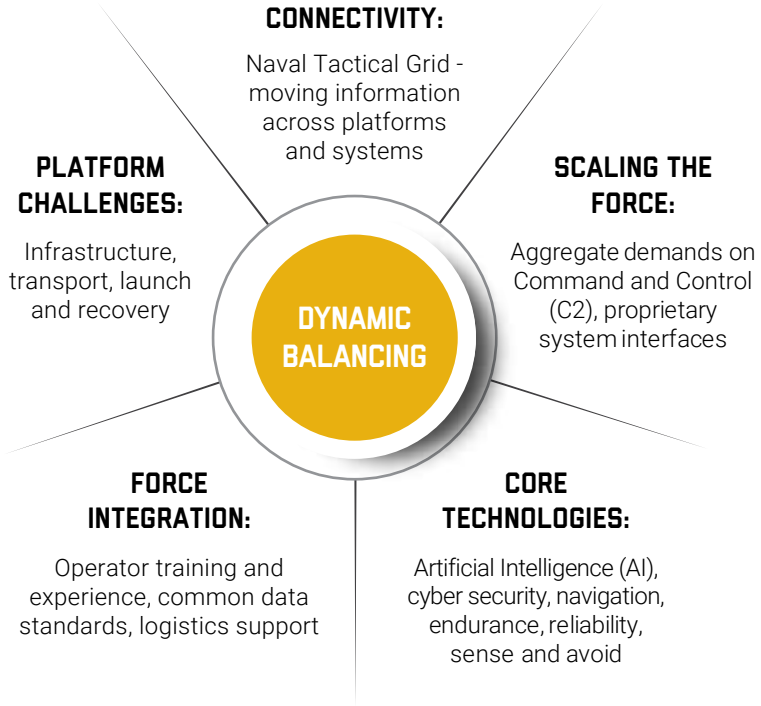
CHALLENGES

The Navy and Marine Corps' structure and vision for deliberate and successful delivery of unmanned systems has evolved in the face of technological advancements and emerging threats. The successful adoption of unmanned systems at scale is and will be challenged by technical, cultural, policy, fiscal, and procedural barriers. To reach the full potential of unmanned systems in the Naval force, these barriers must be addressed. This is the charge of the Unmanned Campaign.

Procedural and organizational barriers slow UxS innovation.	**Coalesce whole of government coordination efforts in programming, resources, and acquisition.**
Platform focused narratives minimize priority of common enablers.	**Create platform agnostic and unmanned capability-centric narratives.**
Competing platform priorities in challenging fiscal environments.	**Free resources through common systems that enhance overall capacity and readiness.**
Zero tolerance culture for failure.	**Build a little, test a little, and learn a lot.**

DESIGN: A BALANCING ACT

A physical platform alone cannot carry out missions without the appropriate key enablers, core technologies, and interoperability standards. This campaign aims to create the organizational coordination necessary to address the challenge of developing new innovative systems to meet the future challenges. The Navy and Marine Corps will scale tested and proven successes, and rather than developing bespoke software and subsequent training for every platform, will invest in technologies that cut across platforms.



BUILDING A CREDIBLE PLAN AND FUTURE

In order to meet the challenge of defining the end operations environment and prioritizing which unmanned capabilities to develop, the Navy will:

- Advance a culture of learning to broaden and deepen knowledge.
- Advance a culture of adaptation for continuous improvement.
- Maximize teamwork to align investments, reuse and development of capabilities, and interoperability of all analytic data.
- Utilize analysis, experimentation, and feedback loops to drive lethality.
- Focus on providing total solutions to include enablers and not only platforms.
- Scale subsystems, prototypes, and technologies that have been tested and proven.
- Strengthen relationships with stakeholders and build solutions for emerging needs.

The Navy and Marine Corps will build credible systems and plans through a comprehensive Science and Technology (S&T) Strategy based on rigorous analysis. The S&T strategy and Campaign will be informed by the Navy's Analytic Master Plan and the Marine Corps' Campaign of Learning to orchestrate analysis in support of future force design and concepts. This analysis includes intelligence, studies, wargames, experiments, exercises, testing, modeling, and simulation – all to inform the strategic decision-making needed to succeed in long-term great power competition.

SPECTRUM OF ANALYSIS	
Studies & Analysis	Ensure studies and analysis include unmanned focus, coordinate with Naval Warfare Analysis Office on existing knowledge base, and monitor execution.
Wargames	Include unmanned elements in all operational wargames and conduct iterative unmanned centric games.
	Incorporate appropriate, realistic assumptions around unmanned aspects of wargaming.
Modeling & Simulation	Incorporate unmanned system behavior and performance into the building of modeling and simulation environments. Mature these tools and use resultant findings to identify gaps.
Experimentation & Exercises	Identify areas where Fleet, industry, and warfare centers can perform experiments to test and exercises to validate prototypes and hypotheses regarding potential unmanned solutions at the platform, system, and subsystem levels.

INFORMS

- Budget
- Resourcing
- Decisions
- Requirements
- Capability
- Policy
- Guidance

For Example: In April 2021, U.S. Pacific Fleet will execute a series of events called an Integrated Fleet Battle Problem (IBP-21). The events will be coordinated throughout the Department and focus on unmanned contributions to the maritime fight. IBP-21 will build on the unmanned experience and success established in Naval aviation, and add unmanned systems that operate above and under the sea. IBP-21 will test and grade the unmanned capabilities we have today through the lens of how they contribute at both the operational and tactical level.

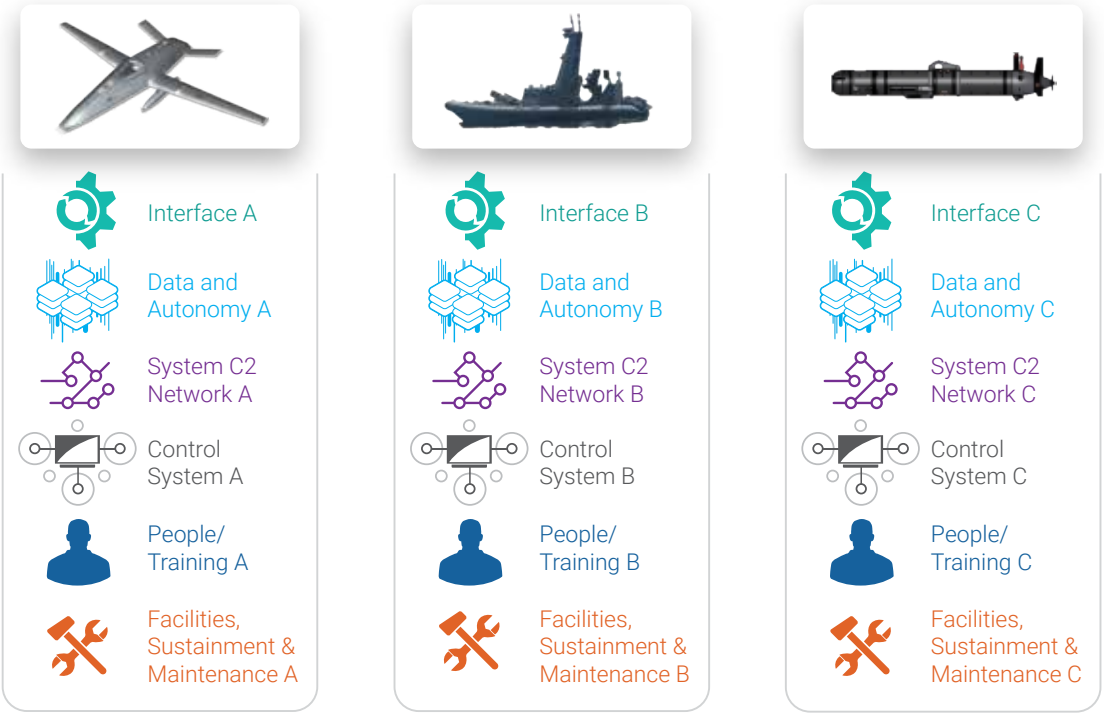
CHANGING THE NARRATIVE

FUNDING A CAPABILITY... NOT A PLATFORM

Currently we resource independent system solutions, but need to drive "solve once and scale" mindsets.

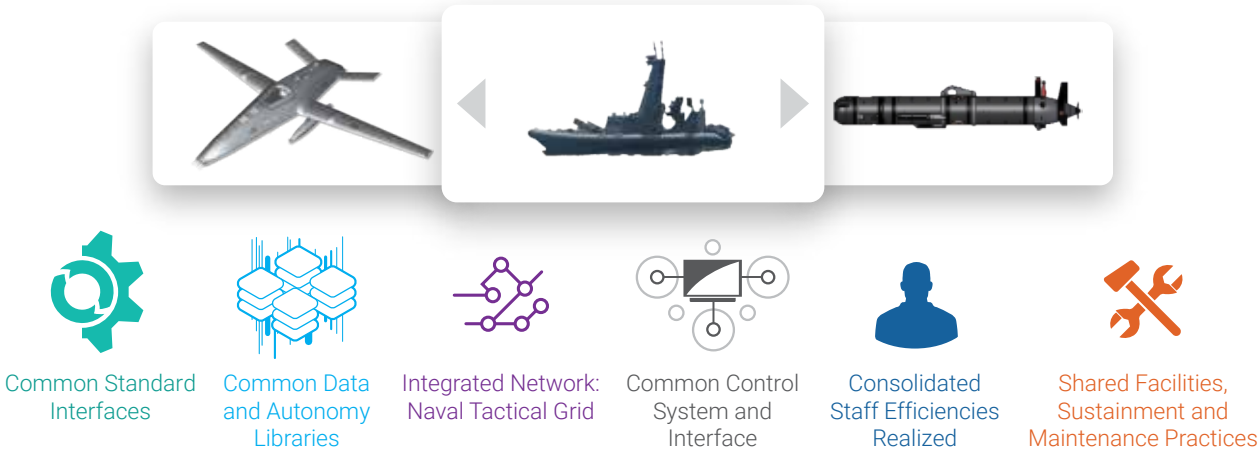
Current Model: Platform-Centric Approach

Siloed development leads to unique capabilities and infrastructure per platform.



Desired Shift: Capability-Centric Approach

Capabilities are delivered and updated through a modular and open system environment.



TEST, PROVE, AND SCALE

The Navy and Marine Corps are exploring the full spectrum of opportunity presented by industry, partners, and prototyping.

Rapid Autonomy Integration Lab (RAIL)

RAIL is an autonomy lab to test and integrate autonomy software advances with existing unmanned vessels. This allows for the most current technology at a lower development cost. It will allow for the Navy to quickly and effectively develop, update and maintain autonomy software.

Coordinated Standards

The Unmanned Maritime Autonomy Architecture (UMAA) is an initiative that serves to standardize autonomy interfaces and enable interoperability for all USV and UUV programs. It allows for better coordination between military and industry and opens industry competition.

Naval Aviators Learn to "fly" the MQ-25

Through agile development and strong partnerships with industry, Naval aviators learn how to fly the MQ-25 through live virtual trainers long before the first MQ-25 is even manufactured and delivered to the Navy. This is a best practice for the Navy to shorten fielding times by leveraging scale modeling and live virtual environments in parallel to system development, which builds trust and expertise as systems are created.

Experimentation at DEVRONs

The Navy established Unmanned Undersea and Surface Development Squadrons, UUVRON 1 and SURFDEVRON in 2017 and 2019, respectively. SURFDEVRON and UUVRON provide rapid feedback to developers and incorporate unmanned into the fleet. Additionally, the Air Test & Evaluation Squadron Two Four (UX-24) was commissioned in 2018. UX-24's mission is to provide operators, unmanned aircraft assets, maintenance, operational and safety oversight, and facility support to RDT&E of all Unmanned Aircraft Systems.

Naval Capabilities Integration Process

The Navy and Marine Corps are executing the annual Naval Capabilities Integration Process to evaluate current and future programs through mission level modeling and simulation. The analysis identifies how programmed platforms (both manned and unmanned) contribute to completing mission-specific kill chains. The annual process informs programmatic decision-making and assists in identifying strengths and weaknesses within each kill chain.

Marine Corps Force Design 2030

The Marine Corps is reshaping its force structure from a focus on large scale ground combat operations to support future Naval mission sets throughout the globe. Critical enabling technologies to support future Naval operations include manned and unmanned systems to support sensing, communications, logistics, and long-range precision fires. HQMC is constantly refining its future capability requirements and operational concepts through modeling and simulation, wargames, and experiments with the Fleet, OPNAV staff, Warfare Centers, and other key research and development agencies.

Fleet Experimentation

The Navy Warfare Development Command (NWDC) designs, plans, and executes the Fleet Experimentation (FLEX) program on behalf of U.S. Fleet Forces Command, U.S. Pacific Fleet, and U.S. Naval Forces Europe-Africa. FLEX identifies and examines potential materiel and non-materiel solutions to address the fleet's most important warfighting priorities. NWDC is currently developing multi-year experiment campaigns that include the examination and integration of unmanned solutions in all domains.

DE-RISKING THE DEVELOPMENT OF TECHNOLOGY

Development of unmanned systems and integration into operating constructs like Distributed Maritime Operations (DMO) and Littoral Operations in a Contested Environment (LOCE), requires **an environment that translates between development and operations rapidly**. Concepts of employment, tactics, techniques, and procedures, plus analysis and exercise outcomes will feed technological developers to quickly iterate for insertion back in the operational environment. This **learning and feedback cycle will allow for iterative development**, which is an industry best practice for technology maturation and user adoption. The enduring unmanned campaign group will focus on the complex synchronization of stakeholders critical to the development of unmanned capabilities, and organize efforts across all functional areas that touch unmanned development.

Use early prototyping to prove out new technologies prior to integrating these subsystems onto a platform.

Develop an adaptive infrastructure base that can support testing, sustainment and maintenance.

Drive virtual modeling and simulation environments to study and compare technical and operational trades earlier in the design process.

Strengthen collaboration and partnership across the unmanned enterprise – technology developers, users, government, and industry – to accelerate innovation and adoption while reducing duplication of effort on foundational capabilities.

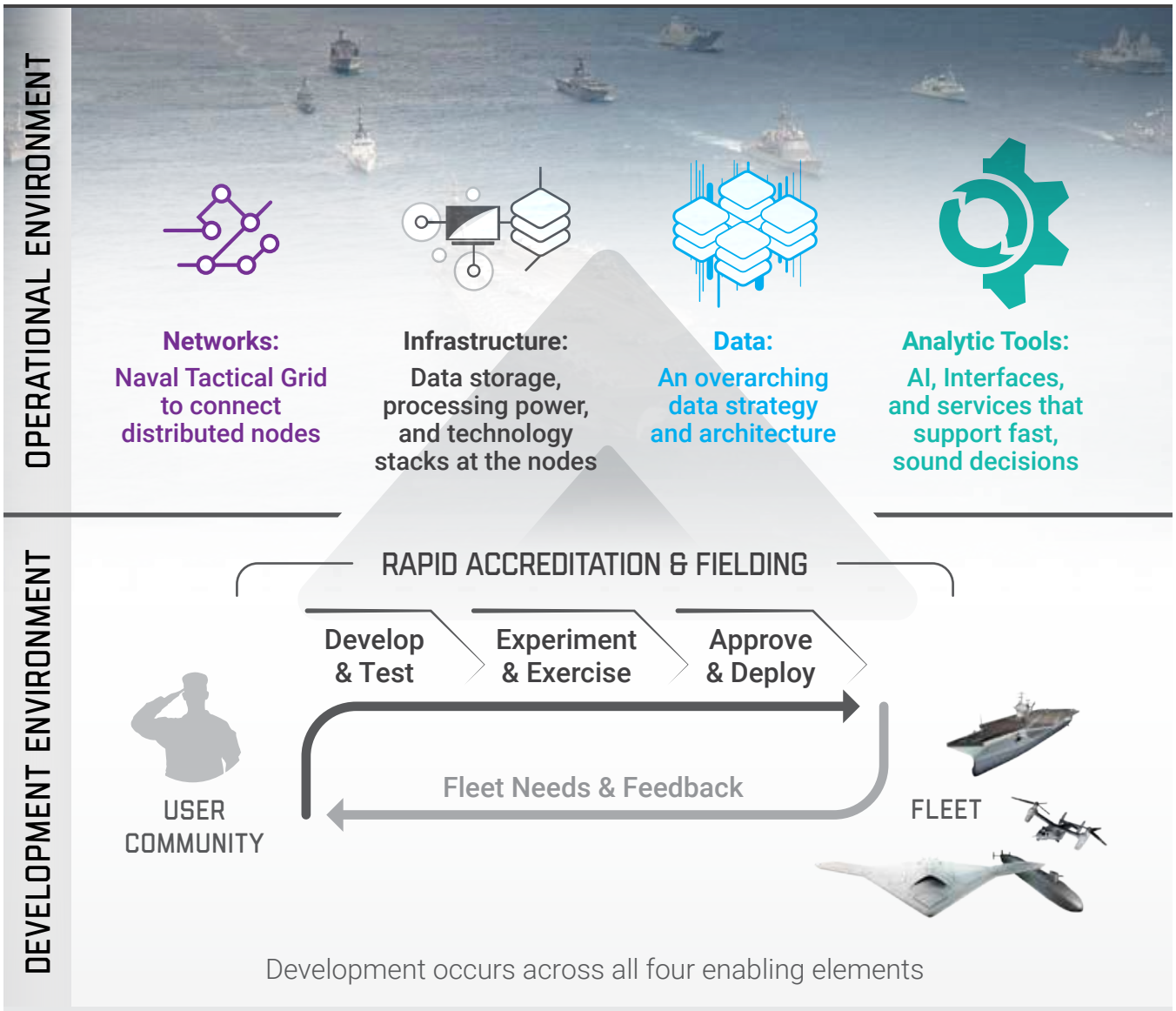
Consider entire solution including logistics, training, infrastructure, and Fleet Engagement from outset for successful fielding.

Utilize land-based testing sites to allow for decoupling critical systems and testing prior to major design decisions, reducing risk before scaling into production.

PROVIDING TOTAL SOLUTIONS

Unmanned Systems deliver a **capability to achieve mission outcomes** through unlocking constraints on manned systems. No mission outcome can be achieved through building the platform alone. In order to **provide total solutions in the unmanned space**, the DON will **increase focus on developing enablers required to successfully scale lessons across investments**. Some of these key enablers include: Networks, Control Systems, Infrastructure, Interfaces, Artificial Intelligence, and Data. The Navy and Marine Corps are designing and implementing a comprehensive operational architecture to support DMO. This architecture will provide accurate, timely, analyzed information to units, warfighting groups, and fleets.

NAVAL OPERATIONAL ARCHITECTURE (NOA)

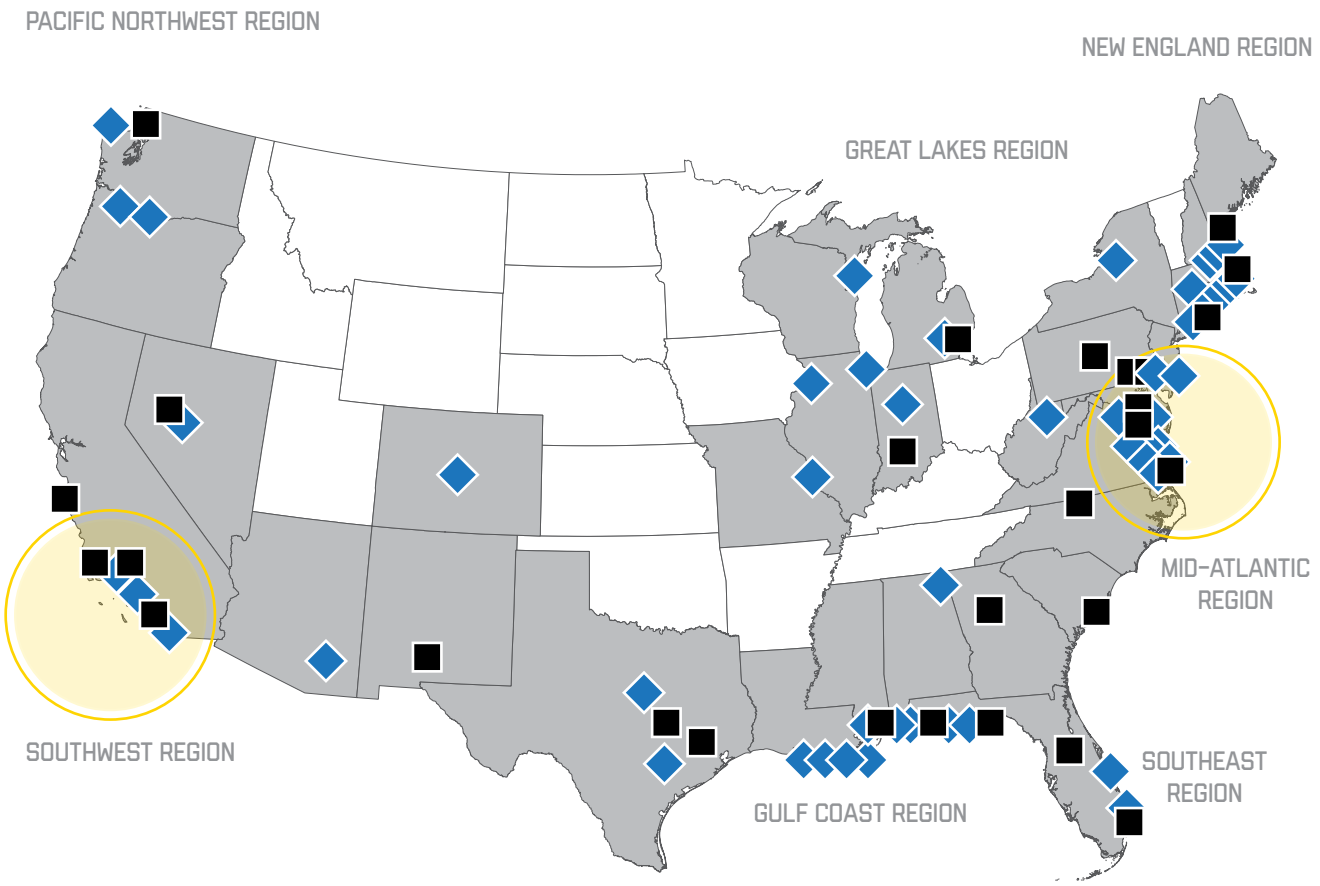


A NATIONWIDE APPROACH

UxS Industrial Base

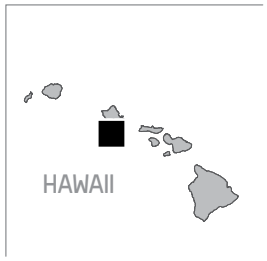
Fleet Concentration Areas

Support Activity (Warfare Centers, Research Labs, Government Field Activities, NavalX Tech Bridges)



STATE OF THE INDUSTRY

- Robust industrial base for UxS and related technology – high number of companies who possess the technical expertise, capability, and capacity to develop UxS technology and platforms
- Mix of large corporations and small businesses
- Very high level of interest in UxS programs – continuous and varied engagement



INDUSTRY AND ACADEMIA

Government, industry, and academia each have complementary roles to play in national security, and this campaign aims to leverage and contribute to this healthy symbiosis. For example, the DON has a wide array of existing academic performers that concurrently staff, lead, or perform for top industry innovators such as Google, Toyota, etc. There are also a host of other DON performers that have recently founded high-tech startups in the areas of autonomy and AI. Thus, the collaborative and complementary roles of government, industry, and academia can be critical drivers of the industrial ecosystem.

While industry investment in research and development dwarfs that of government, a September 2020 study by the U.S. Government Accountability Office illustrated that only 38% of industry's independent research and development products align with DoD priorities. This is due in part to the fact that the DON has Naval Unique Needs for which Industry is not incentivized to invest absent DON leadership, guidance, or investment. These needs include weaponization, non-permissive environments, covert or clandestine, force multiplication, high-tempo, expendability and long duration, among others. There are specific considerations and military requirements that prevent direct transition of commercial systems for military purposes. Maintaining the Department's technological advantage will require cultural changes across the ecosystem, innovative investment strategies, and thoughtful consideration of research protection across the National Security Innovation Base. Successful execution of this campaign requires that the Navy and Marine Corps collaborate with and inform industry and academic partners to develop technologies, concepts, and approaches with Naval Unique Needs in mind.

Taking into account these unique needs, the department has converted a number of commercially available systems and platforms to fit specific naval requirements. For instance, the MQ-8C Fire Scout is an example of an UAV that was built from a commercial helicopter, and many additional platforms such as the Mk18 Mod1 UUV have similar commercial origins. It is important to note that the government relationship with industry and academia can also support developments for commercial applications. In another example, U.S. Naval Research Laboratory assessments and research regarding flight design and data will have implications for future commercial applications.

Across the Naval Research and Development Establishment, the DoD engages in an array of collaborative research at government funded labs. In FY19 the DON invested nearly $300 million in engineering projects. Such efforts resulted in over 1,000 technical publications including authors from government, academia, and industry. In addition to collaboration, Warfare Centers and labs strategize project selection based on closing technology gaps needed to deter and defeat future threats and adversaries. Such relevant projects include a Counter Small Unmanned System Adaptive Multi-Sensor, Multi Weapon Fusion and Fleet Experiment, a Mission Ready Unmanned Assault Amphibious Vehicle, and Machine Learning for Auto-Identification of Target Objects from Unmanned Aerial Systems.

The successful adoption of unmanned platforms is also supported by DON affiliated University Applied Research Centers (UARCs) and other institutions of higher learning working to innovate, test, and develop platforms and systems for the future fleet. Additionally, DoD works with Federally Funded Research and Development Centers (FFRDCs), public-private partnerships that conduct research and development efforts for multiple departments of the U.S. government. These and other partners through the Naval Research and Development Establishment have vital roles in the development and testing of innovative technologies to support unmanned capabilities. Aside from the partnerships for development, there is also the important aspect of information sharing. Many professional societies have served as important touchpoints with industry and academia members across the defense, civil, and commercial markets.

The Navy and Marine Corps are working with external stakeholders in a variety of ways, and will continue to invest in symbiotic relationships to execute this campaign. Successful development and integration of unmanned hinges on effective collaboration between government, industry, and academia.

ALLIES AND PARTNERS

STRENGTHENING GLOBAL PARTNERSHIPS TO LEVERAGE AND SHARE INNOVATION

The scale and pace of autonomy-related investments in both private and international economies far exceed any nation's capacity to compete on all fronts. Therefore, allies and partners must collaborate in order to truly capitalize on the pace of technology and ensure operational advantage.

As Naval Forces across the globe, including those of our adversaries, undergo a fundamental shift in transitioning to unmanned and autonomous warfighting, strengthening international alliances and strategic partnerships has never been more important. Actively pursuing and investing in international cooperative programs will maximize innovation potential, synergize S&T and R&D efforts, and enable joint solutions that are interoperable or even interchangeable by design. Early commitment will yield significant Return on Investment in both the acquisition and operational arenas.

One example of strengthening global partnerships to achieve advancements in the unmanned space is the October 2018 Maritime Unmanned Systems Initiative, Declaration of Intent, signed by defense ministers from 17 Nations with three additional nations signing their commitment to the original Declaration of Intent. The NATO Maritime Unmanned Systems Initiative is led by the United States and is an exemplar for international collaboration and innovation delivered at pace.

Engagement with our allies will focus on the following areas:

Operational Experimentation to increase allied interoperability between conventional forces and unmanned vessels.

New tactics, techniques and procedures to maximize the potential of new technologies, and CONOPS for coalition forces to ensure safe operations, reliability and endurance.

Secure digital communication standards and common C2 interface protocols to enable shared situational awareness.

Development of multi-national secure supply chains, and joint operational maintenance and repair capacity around the globe.

System development to ensure core technologies, enablers, and standards are common to all and testing happens early and often.

Maximum output potential for international cooperation requires invigorated commitment, supportive policy, and resources. Through sophisticated information exchange and strategic partnerships, interoperability has the potential to evolve into interchangeability, making allied forces a symbiotic deliverer of effect.

Officer in charge of the Remote Environmental Measuring Units (REMUS) Team from Italian Mine Countermeasures Forces Command, points out different aspects of an Italian Navy's unmanned undersea vehicle (UUV) to the commander of U.S. Navy Expeditionary Task Force Europe and Africa (CTF 68), at the NATO experimentation exercise Recognized Environmental Picture augmented by Maritime Unmanned Systems REP (MUS) in Troia, Portugal.

LEGAL, POLICY, AND ETHICAL CONSIDERATIONS

Law, policy, and ethical principles applied to unmanned systems are critical to maintaining good order and discipline, ensuring compliance with international obligations, and protecting liberties and rights. The overarching task for the DON is to develop, procure, field, and employ increasingly sophisticated unmanned systems that maximize warfighting effectiveness through their incorporation of autonomy and artificial intelligence, while remaining consistent with the Law of Armed Conflict, DOD policy, and AI ethical principles. As these unmanned systems become increasingly sophisticated, an enduring central tenet to their use will be the continued exercise of appropriate levels of human judgment. The DON will continue to partner with Congress to develop the legal and ethical frameworks for the employment of autonomous systems. The DON is committed to ensuring unmanned systems and autonomous weapon systems are used ethically and in compliance with the Law of Armed Conflict and other applicable bodies of law.

A Marine with 1st Air Naval Gunfire Liaison Company (ANGLICO), I Marine Expeditionary Force Information Group, launches an Organic Precision Fires (OPF) unmanned aerial loitering munition during an exercise at Marine Corps Base Camp Pendleton, CA.

The task currently facing the DON is to elaborate on applicable policy considerations, given the rapid and diverse emergence of unmanned capabilities. The DON should specifically take into account the following actions:

Determine which systems are counted as part of the battle force

This review should consider the design, command and control structure, intended area of employment, and capability of the unmanned system.

Detail the degree to which an unmanned system may operate autonomously

Humans remain responsible for complying with the Law of Armed Conflict in their use of unmanned and autonomous systems. In the future some degree of autonomy will be delegated to these systems to make determinations. This includes weapon systems and non-weapons (e.g., casualty evacuation, search & rescue, etc.), and traditional systems (e.g., reconnaissance). The use of MUM-T operations will help ensure humans retain the responsible use and operation of warfare systems.

Ensure we maintain our competitive advantage

Even if an adversary does not share our legal, moral, or ethical foundations, or employs unmanned systems in ways the U.S. will not, effective countermeasures do not require engaging in these same unethical practices (e.g. indiscriminate targeting). Respect for the rule of law is not only "right" but also a competitive advantage—it is an enduring position that humans embrace and often demand.

Ensure clarity in ethical principles for unmanned systems

The DOD has adopted and continues to evaluate a set of Ethical Principles for the use of Artificial Intelligence. The DON will ensure implementation of the DOD AI Ethical Principles in alignment as they apply to the use of Unmanned Autonomous Systems capable of applying force on the battlefield.

A VBAT vertical take-off and landing (VTOL) unmanned aircraft system (UAS) prepares to launch from the cargo deck of a Landing Craft Air Cushioned (LCAC) attached to the 31st Marine Expeditionary Unit / America Amphibious Ready Group.

EXPLORING OPPORTUNITIES

Ocean of Things

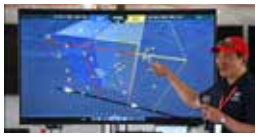
The Ocean of Things program seeks to enable persistent maritime situational awareness through a distributed sensor network over large ocean areas by deploying thousands of small, low-cost floats that transmit data via satellite for storage and real-time analysis.

No Manning Required Ship (NOMARS)

The NOMARS program seeks to design a ship that can operate autonomously for long durations at sea. NOMARS aims to challenge the traditional naval architecture model, designing a seaframe from the ground up with no provision, allowance, or expectation for humans at sea. By removing the human element from all ship design considerations, the program intends to demonstrate significant advantages to size, cost, at-sea reliability, survivability to sea-state, and survivability to adversary actions.

Advanced Naval Technology Exercises (ANTX)

ANTX allow for the exploration of concepts, tactics and technology. Military research and development organizations join with industry to demonstrate rapidly-emerging technologies and concepts. One example of ANTX as a critical tool for experimentation with UxS, was the Urban 5th Generation Marine Exploration and Experimentation 2018 exercise at Camp Pendleton where solicited ideas included quadcopters, counter-unmanned air systems, unmanned ground vehicles, command and control, communications and electronic warfare.



Super Swarm Research

The DON is developing universal strategies against "Super Swarms" of overwhelming (air, surface, and subsurface) forces attempting to decipher algorithms and outmaneuver in real time.

Unmanned Logistics Systems

The Navy and Marine Corps are developing and acquiring a variety of unmanned air, surface, undersea, and ground systems to demonstrate multi-range, multi-payload, ship-to-ship, ship-to-shore, and land-based cargo transport options.

Sea Train

Aims to demonstrate long-range deployment capabilities for a distributed fleet of USVs. Seeks to enable extended transit and long-range operations through a system of connected vessels.

Medium Unmanned Undersea Vehicle (MUUV)

The Medium UUV will be a modular, open systems, and open architecture platform. The MUUV will support both the torpedo tube-launched environmental sensing mission, as well as the Maritime Expeditionary Mine Countermeasures mission.

Joint Interagency Field Experimentation (JIFX)

The JIFX is a Naval Postgraduate School operational field experimentation resource where private companies and academia can demonstrate, evaluate, and experiment with new technologies. As a part of JIFX, researchers pitted two swarms of autonomous aircraft against one another as the first example of a live engagement between two swarms of UAVs, and allowed teams to demonstrate different combat tactics in flight.

Maritime Collaborative Autonomy

The Marine Corps Warfighting Laboratory is conducting a multi-year Science & Technology effort focused on the integration and collaboration of multi-domain autonomous systems in support of DMO and LOCE concepts.

APPENDIX A: UNMANNED PORTFOLIO

AIR

MQ-4 Triton

Persistent Maritime Intelligence, Surveillance, and Reconnaissance (ISR)

MQ-25A Stingray

CVN-Based Aerial Refueling and ISR

MQ-9 Reaper

USMC Medium Altitude Long Endurance (MALE), USMC persistent tactical maritime ISR and C2 gateway

MQ-8C Fire Scout

Tactical User ISR&T – LCS/ESB/FFGX/Land Based

SURFACE

LUSV Large Unmanned Surface Vessel

Open-ocean, long-range vessel with Vertical Launch System and other potential payloads

Overlord Prototype

Experimental unmanned surface craft with long range and endurance, and configurable payload capacity as predecessor to LUSV

MUSV Medium Unmanned Surface Vehicle

Extend the operational commander's battlespace awareness and netted command and control capability

Sea Hunter

Demonstrates long-range and endurance autonomous operations of an MUSV under sparse remote human supervisory control

UNDERSEA

XLUUV Orca

Pier-launched, long-endurance vehicle with a modular design to accommodate a variety of large payloads

LDUUV Snakehead

Largest UUV hosted and deployed from submarines for subsea/seabed warfare missions

Knifefish

LCS and Vessels of Opportunity mission module asset for buried and bottom mine hunting

Razorback

Submarine deployable battlespace awareness and sensing capability

RQ-21 Blackjack/ ScanEagle

ISR Naval Special Warfare Operations, USMC Unmanned Aerial Vehicle Squadrons

LRLE Long Range / Long Endurance Unmanned Aerial Family of Systems

Family of Ground Unit Commander's small day/night reconnaissance, surveillance, and target acquisition UAS

Unmanned Logistics System - Air

Family of autonomous air delivery systems capable of facilitating logistics distribution between afloat and land supply points

MCM USV Mine Counter Measure

Mine-hunting, sweeping, long-range reconnaissance and fires capability

LRUSV Long Range Unmanned Surface Vessel

USMC Long-range autonomous platform for the launch of loitering munitions and hosting of other systems to address sea targets

ALC Autonomous Littoral Connector

Integrates autonomy onto current and future beachable surface connectors to provide maneuver and sustainment throughout the littoral environment

Mk-18 Mod 2 Kingfish

Missions include reconnaissance support, mine countermeasures, and mapping capability

Mk-18 Mod 1 Swordfish

Missions include mine hunting, bottom mapping/survey, IPOE, reconnaissance, rapid object localization, and ISR

LBS-AUV

LBS-Glider

Sense/measure the ocean environment to gather meteorological and oceanographic data

GROUND

ROGUE-Fires Remotely Operated Ground Unit for Expeditionary-Fires

USMC unmanned chassis for transportation and firing of ground-based missile systems

RCV-L Robotic Combat Vehicle-Light

Multi-purpose USMC and USA autonomous vehicle with a modular payload integration architecture supporting a variety of missions across multiple warfighting functions

SUGV Small Unmanned Ground Vehicles

Family of small man-transportable robotic systems capable of supporting a variety of combat and combat support operations

GLOSSARY

AEGIS: US Navy phased array radar-based combat system

AI/ML: Artificial Intelligence / Machine Learning

ANTX: Advanced Naval Technology Exercises

BAMS-D: Broad Area Maritime Surveillance Demonstrator

C2: Command and Control

C4ISR-T: Command, Control, Communications, Computers, Intelligence, Surveillance, Reconnaissance, and Targeting

CNO: Chief of Naval Operations

CONOPS: Concept of Operations

CVN: Aircraft Carrier, Nuclear-Powered

CVW: Carrier Air Wing

DMO: Distributed Maritime Operations

DOD: Department of Defense

DON: Department of the Navy

DOTmLPF-P: Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, Facilities and Policy

EABO: Expeditionary Advanced Basing Operations

EMAV: Expeditionary Modular Autonomous Vehicle

EOC: Early Operational Capability

FFRDC: Federally Funded Research and Development Center

FLEX: Fleet Experimentation Program

GOC: Navy's Glider Operations Center

HALE: High Altitude Long Endurance

HQMC: Headquarters Marine Corps

ISR: Intelligence, Surveillance, Reconnaissance

ISR&T: Intelligence, Surveillance, Reconnaissance, and Targeting

JADC2: Joint All-Domain Command and Control

JIFX: Joint Interagency Field Experimentation

LBS-G: Littoral Battlespace Sensing - Glider

LCS: Littoral Combat Ships

LDUUV: Large Displacement Unmanned Undersea Vehicle

LOCE: Littoral Operations in a Contested Environment

LUSV: Large Unmanned Surface Vessels

MCM: Mine Countermeasures

MCM USV: Mine Countermeasures Unmanned Surface Vehicle

MCWL: Marine Corps Warfighting Laboratory

MHD: Maritime Homeland Defense

MUM-T: Manned-Unmanned Teaming

MUSV: Medium Unmanned Surface Vessel

MUUV: Medium Unmanned Undersea Vehicle

NATO: North Atlantic Treaty Organization

NDS: National Defense Strategy

NOA: Naval Operational Architecture

NOMARS: No Manning Required Ship

NWDC: Navy Warfare Development Command

OPNAV: Office of the Chief of Naval Operations

POA&M: Plan of Action and Milestones

R&D: Research and Development

RAIL: Rapid Autonomy Integration Lab

RDT&E: Research, Development, Test, and Evaluation

RFP: Request for Proposals

RMMV: Remote Multi-Mission Vehicle

ROGUE-Fires: Remotely Operated Ground Unit for Expeditionary-Fires

RSTA: Reconnaissance, Surveillance, and Target Acquisition

S&T: Science and Technology

SYSCOMS: Systems Commands

TTL&R: Torpedo Tube Launch and Recovery

TTP: Tactics, Techniques, and Procedures

UARC: University Applied Research Center

UAS: Unmanned Aircraft Systems

UAV: Unmanned Aerial Vehicle

UCAS: Unmanned Combat Air System

UGV: Unmanned Ground Vehicle

UMAA: Unmanned Maritime Autonomy Architecture

UOC: UUV Operations Center

USMC: United States Marine Corps

USV: Unmanned Surface Vehicle/Vessel

UUV: Unmanned Undersea Vehicle

UUVRON-1: Unmanned Undersea Vehicles Squadron ONE

UX-24: Air Test & Evaluation Squadron Two Four

UxS: Unmanned Systems

VTOL: Vertical Take-Off and Landing

XLUUV: Extra Large Unmanned Undersea Vehicle

A full complement of unmanned LBS Gliders are readied for deployment from a T-AGS Oceanographic Survey Ship. Once launched they will support the collection of oceanographic environmental data for up to 90 days.

DEPARTMENT OF THE NAVY

Unmanned Campaign Framework