ENABLING THE UNDERSEA FORCE FOR HIGH-END COMBAT TODAY WHILE FIELDING THE UNDERSEA FORCE OF TOMORROW

RONALD VIEN, SES
Technical Director, Naval Undersea Warfare Center (NUWC) Division, Newport

A global pandemic brought on many challenges for all of us, both personally and professionally. We quickly changed the way we interacted with each other, at home and at work. Hugs and handshakes were replaced with the awkward elbow bump. We saw a lot of the inside of each other's homes with all those remote meetings. Nevertheless, we accomplished our goals. And, one thing that did not change was our mission.

If we learned one thing in 2020, it was that our ability to adapt to new circumstances got stronger. We really flexed those muscles. How many times did we hear the phrase "the new normal"? Throughout a most unusual year, both the Warfare Centers and our industry partners continued to support the Fleet.

We continue to improve our current undersea warfare capabilities. We enable the Undersea Force for high-end combat today by focusing on our current submarine, surveillance, and surface ship platforms and systems to provide expertise from research and development (R&D) through in-service.

Our systems provide the decision-making critical to mission kill chains and kill webs and connect sensors to effects. We, along with our partners and customers, provide cybersecurity solutions to ensure the submarine can operate and execute in a challenged environment.

We continue to revolutionize test realism, training, and modeling and simulation through the institutionalization of Live, Virtual and Constructive — otherwise known as LVC.

We must maintain that willingness to adapt. We must continue to look inward at sustaining readiness while we look for ways to advance the state of the art in undersea warfare.

For the Warfare Centers, the multi-dimensional domain of digital transformation is on our horizon to include: Physics-based modeling. LVC events. Model Based Systems Engineering, Autonomous Systems, Artificial Intelligence, Machine Learning and Data Analytics, to name a few.

The Navy is supporting these and other new initiatives to help inform our data-driven culture and inspire our workforce to take new actions in their daily tasks.

The Navy's data is vast and varied. If we can create a common language, a common protocol for all this data, then we can quickly inform the Fleet and enhance warfighting capability.

When we consider the Undersea Force of tomorrow, we must think about making it more efficient and better informed to make faster decisions. Automating information collection will go a long way to improving agility on the watchfloor. It will give our operators the time and space they need to make the best decisions quickly and move on to the next challenge.

There is no autonomy without data. If we are going to add autonomy to our manned and unmanned platforms, we need a massive amount of data to develop even the simplest of autonomous behaviors and we need a way to store that critical data in a usable, secure method.

Terms like "cloud storage" and "data lakes" did not exist when

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I started as a new hire; now, those are the concepts guiding us into our future. The new normal!

The task of collecting, storing, and parsing data is monumental. It is not something that the Navy enterprise can accomplish on its own. The critical need for building cyber-resilient systems requires collaborative solutions among the Warfare Centers, academia, and our industry partners.

In its Final Report, the National Security Commission for Artificial Intelligence (NSCAI) recommends that the Department of Defense build a common digital infrastructure, develop a digitally literate workforce, and institute more agile acquisition, budget, and oversight processes.

If there is one point to amplify, it is workforce development; it is the key to our digital transformation. Technology is not going to put us ahead of our peer competitors — but a diverse, technologically advanced and dedicated workforce will. Providing robust training programs and modern computing tools to accomplish their tasks will go a long way toward developing that workforce.

This quote from the NSCAI Report really resonates: "By focusing on solving real human problems that impact the lives of millions of people, we can build a new raison d'etre for the triangular alliance of government, academia, and industry."

We are using digital engineering now to develop, test, and iterate new systems through the LVC environment. That is how we are enabling our Undersea Force today. Developing a tech-savvy workforce with the data and tools they need to innovate will be what enables our Undersea Force of the future.

NDIA UNDERSEA WARFARE DIVISION
FALL 2021, NUMBER 48

DIVISION CHAIR'S MESSAGE

MIKE CORTESE
CHAIRMAN UNDERSEA WARFARE DIVISION

On behalf of the entire management team of the National Defense Industrial Association's Undersea Warfare Division, welcome to the Fall Conference. To say that the past year and a half has been a challenge with respect to the conduct of our normal classified forums would be a significant understatement. While we were able to conduct the last two conferences virtually, they were no substitute for our normal classified events. I am sure you will agree it is great to be back in Groton to attend the first in-person conference we have conducted in two years!

The importance and urgency of our USW effort is great. Growing regional and global threats continue to advance interests, operations, and capabilities that challenge freedom of the seas, nation sovereignty, and many of the freedoms we hold dear. Our warfighters need our focus and dedication to develop the capabilities they require to succeed and preserve our way of life.

Over the past decade, Navy and Defense Department leaders have consistently articulated the need to maintain our USW advantage. As our military partners outline their plans for more USW platforms, a broad array of new payloads, and the sensors and other supporting elements of a sophisticated network of undersea assets, it is more important than ever that members of government, industry and academia remain aligned, communicate effectively, and collectively move forward toward the shared goal of ensuring our USW dominance.

A special thanks to all of our plenary speakers, program managers, and technical presenters for taking the time to brief our USW community. While your briefs and the resulting discussions are the reason we are here, the information you provide is critical to our support of the warfighter and the defense of our nation.

On behalf of the Executive Board, the Advisory Council, and NDIA, thank you and your organizations for your continued support of the National Defense Industrial Association, the Undersea Warfare Division, our warfighters, and these conferences. We hope you enjoy this Fall Conference and look forward to seeing you at the Spring Conference in San Diego.

SPRING 2021 NDIA UNDERSEA WARFARE AWARDS

PIERRE CORRIVEAU, CHAIRMAN
AWARDS COMMITTEE

At this year's virtual spring conference, the Undersea Warfare Division (UWD) of the National Defense Industrial Association (NDIA) was pleased to present the **Vice Admiral Charles B. Martell-David Bushnell Award** to **Dr. Donald P. Brutzman,** Associate Professor at the Naval Postgraduate School (NPS) in Monterey, California; the **Vice Admiral Charles E. Weakley Award** to **CAPT Bradford Neff, USN (Ret)**, Deputy Director (SES), Undersea Warfare Division (OPNAV N97B); and the **Captain George W. Ringenberg Award** to **Laurie Carter**, Senior Vice President of DC Operations & Business Development, Rite-Solutions. In addition, we were pleased to present the **Rear Admiral Jack Jarabak Award** to **LT Bryan Lowry** for his exceptional contributions in the field of Anti-Submarine Warfare.

DR. DONALD BRUTZMAN
ASSOCIATE PROFESSOR AT THE NAVAL POSTGRADUATE SCHOOL (NPS) IN MONTEREY, CALIFORNIA

The **VADM Charles B. Martell-David Bushnell Award** for exceptional contributions in the field of ASW and/or Undersea Warfare Technology.

Over his 40+ year career, Dr. Brutzman made tremendous contributions to the Undersea Warfare community. Dr. Brutzman is an investigator in the NPS Center for Autonomous Underwater Vehicle (AUV) Research. He is leading research in the development of the Autonomous Vehicle Command Language, an underwater robot software, in combination with comprehensive virtual-world modeling of underwater hydrodynamics, sonar, and robot hardware response. Research in unmanned undersea systems is critical to Undersea Warfare, especially in human-machine teaming and unmanned undersea systems command and control. In this vein, Dr. Brutzman is a member of the IEEE Working Group drafting an Ontological Standard for Ethically Driven Robotics and Automation Systems, in which he is contributing to the establishment of ontological standards for ethically-driven methodologies in the design of these systems.

Dr. Brutzman is a founding designer and developer of an open-source software that enables interoperability between the Distributed Interactive Simulation (DIS) protocol, Java programming language, and the Virtual Reality Modeling Language (VRML) international standard. This influential implementation of DIS-Java-VRML software enables shared multi-user virtual worlds via regular web browsers. Naval Facilities Engineering Command is using this technology in its SPIDERS3D Virtual Environment to improve facility-platform interoperability, integration, and systems engineering in Naval Installations.

Dr. Brutzman has ensured the advancement of the United States Navy's Undersea Warfare capabilities for many years to come.

FOR HIS EXCELLENT LEADERSHIP AND UNWAVERING DEDICATION THAT HAS SIGNIFICANTLY BENEFITED OUR SUBMARINE FORCE, THE UNDERSEA WARFARE DIVISION OF THE NATIONAL DEFENSE INDUSTRIAL ASSOCIATION IS HONORED TO PRESENT THIS PRESTIGIOUS AWARD TO DR. DONALD BRUTZMAN.

CAPT BRADFORD NEFF, USN (RET)
DEPUTY DIRECTOR (SES), UNDERSEA WARFARE DIVISION (OPNAV N97B)

The **VADM Charles E. Weakley Award** for meritorious service and noteworthy contributions to effective Government Industry communications in the field of Undersea Warfare.

As Major Program Manager, Submarine Acoustic Systems (PMS401) then-Captain Neff provided cost effective development, acquisition, testing, and installation support for surface and submarine acoustic sensor systems. His unrelenting advocacy for undersea superiority led directly to the Navy's development, demonstration, and acquisition of the Large Vertical Array. As Head of the Tactical Submarine Branch (N972) at OPNAV, Captain Neff provided strong leadership while supervising budgeting activities relating to submarine fast-attack platforms, tactical systems and payloads.

In 2019, Mr. Neff was appointed to the Senior Executive Service (SES) when he became the Deputy Director, Undersea Warfare Division (OPNAV N97B). Mr. Neff is responsible for development of the entire undersea warfare budget submission supporting the CNO's annual Program Objective Memorandum (POM) proposal to the Secretary of the Navy. This undersea warfare portfolio stretches from manpower to R&D, procurement and sustainment of undersea platforms, combat systems, sensors and weapons.

As N97B, Mr. Neff is the principal civilian advisor to the CNO and COMSUBFOR on all matters relating to Undersea Warfare. Mr. Neff routinely reaches out and engages industry leadership both large and small to determine their strategic trends, risks, morale, and the overall health of the industry. He has been one of the principal conduits to industry for matters relating to unmanned undersea vehicles and systems and provides the critical vision for the future of Undersea Warfare.

Mr. Neff's support to NDIA UWD of has been noteworthy. In addition to being a frequent and sought-after speaker at UWD events he has worked to secure Navy leadership attendance at Undersea Warfare conferences, symposiums, and formal engagements with industry.

IN RECOGNITION OF HIS NOTEWORTHY CONTRIBUTIONS TO ADVANCING THE FIELD OF UNDERSEA WARFARE AND IN PROMOTING EFFECTIVE GOVERNMENT/INDUSTRY COMMUNICATIONS, THE UNDERSEA WARFARE DIVISION OF THE NATIONAL DEFENSE INDUSTRIAL ASSOCIATION IS PLEASED TO PRESENT CAPT. BRADFORD NEFF, USN (RET) WITH THE VADM CHARLES E. WEAKLEY AWARD.

LAURIE CARTER
SENIOR VICE PRESIDENT OF DC OPERATIONS & BUSINESS DEVELOPMENT, RITE-SOLUTIONS

The **Captain George Ringenberg Award** is presented to those who, through their service and leadership, have made noteworthy contributions to the Undersea Warfare Division.

Since Spring of 2014, Laurie Carter has served on the NDIA UWD Executive Board as the Communications Committee Chair. In this role, she has been responsible for the development of the Undersea Warfare Division bi-annual Newsletters for both the Spring and Fall conferences. As such, Laurie has worked in collaboration with the UWD Committee Chairs and NDIA staff to coordinate, assemble, edit and publish the Spring and Fall Newsletters.

Through her efforts the UWD NDIA newsletter has complemented our conferences and themes, providing the undersea warfare community with the most relevant information related to undersea warfare technology. She has devoted countless hours providing guidance to the contributors to ensure a consistently professional product throughout each newsletter. Her tireless efforts and dedication to delivering the newsletter on time in advance of each conference has left a mark of outstanding achievement.

THE UNDERSEA WARFARE DIVISION WAS PROUD TO RECOGNIZE MS. LAURIE CARTER WITH THE CAPTAIN GEORGE RINGENBERG AWARD FOR HER OUTSTANDING CONTRIBUTIONS AND SERVICE TO THE U.S. GOVERNMENT, THE NATIONAL DEFENSE INDUSTRIAL ASSOCIATION, AND THE UNDERSEA WARFARE DIVISION.

LT BRYAN LOWRY, USN
ACADEMIC ACHIEVEMENTS IN USW UNDERSEA WARFARE TECHNOLOGY AT NAVAL POSTGRADUATE SCHOOL

The **Rear Admiral Jack Jarabak Award** is presented by the NDIA Undersea Warfare Division in conjunction with the Naval Postgraduate School's Undersea Warfare Executive Committee, to recognize a deserving student for their contribution in the field of USW.

This year the award was presented to LT Bryan Lowry for his personal commitment and academic achievements in the area of Undersea Warfare Technology.

While attending the Naval Postgraduate School from April 2019 to March 2020, he distinguished himself through outstanding performance in the Undersea Warfare Curriculum. His exceptional research clearly demonstrated his intellectual ability, analytical skills, and mastery of undersea warfare. As a submarine officer with nuclear power school experience, he brought a unique perspective to his classes as well as his thesis work. His thesis, "Distributed Submodular Optimization for a UXV Network Control System" developed a simplified computational methodology to solving optimal Network Control System configurations by using a novel distributed submodular representation. His results show value to expeditionary warfare scenarios but can be extended to generic fleet operations. His superior performance in this program stood out among his peers and has laid the foundation for significantly improving our undersea warfare posture.

THE UNDERSEA WARFARE DIVISION, IN CONJUNCTION WITH THE NAVAL POSTGRADUATE SCHOOL, TOOK GREAT PLEASURE AND WELCOMED THE OPPORTUNITY TO RECOGNIZE THE IMPORTANT CONTRIBUTIONS OF LT BRYAN LOWRY, USN, BY ITS AWARD OF THE 2019 RADM JACK JARABAK BRONZE MEDAL AWARD.

THE NDIA UWD IS HONORED TO RECOGNIZE THESE SIGNIFICANT CONTRIBUTIONS TO THE UNDERSEA WARFARE COMMUNITY THROUGH OUR AWARDS PROGRAM.

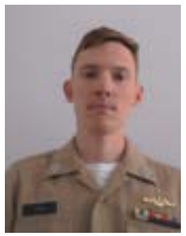
CONGRATULATIONS TO THE AWARDEES!

NDIA UWD 2021 ACADEMIC SPEAKER AWARD

MARK ROTHGEB
CHAIRMAN, ACADEMIC FELLOWSHIP COMMITTEE

DR. MICAH CLARK
CO-CHAIR

The NDIA Undersea Warfare Division (UWD) established the Academic Fellowship Program in 1990 to provide financial aid to Ph.D. candidates at universities closely associated with the Navy's undersea warfare community. The objective is to encourage outstanding science and engineering students specializing in fields pertinent to undersea warfare to present their research at our conferences. NDIA Warfare Division makes Academic Fellowship awards to students from the Navy's University Affiliated Research Centers (UARCs), the Naval Postgraduate School (NPS), and other academic institutions. This fall, we are pleased to host three academic research contributors from these organizations presenting the topics described below.



LT Andrew Pfau is a 2014 US Naval Academy graduate with a B. S. in Computer Science. He completed his division officer tour on USS HOUSTON (SSN 713) and USS CHEYENNE (SSN 773). He received his M. S. in Computer Science from NPS in December 2020 and received the Rear Admiral Grace Hopper award for academic excellence in Computer Science. He is currently an instructor in the Computer Science department at the US Naval Academy. His research focuses on the use of machine learning methods applied to passive sonar data. His presentation will discuss the challenges faced by machine learning systems in classifying ship targets in complex, high contact density environments. He will discuss the application of multi-label models, Bayesian models, and environmental factors in solving these challenges.

Christopher Stockinger is a Ph.D. student in Acoustics at the University of Texas and works at the University of Texas, Applied Research Laboratories. He is a graduate from Hampden-Sydney College with a B.S. in Applied Mathematics and Physics and received his M.S. in Mechanical Engineering from Virginia Polytechnic Institute and State University. His presentation explores low frequency wind-correlated noise and provides empirical models to predict ambient noise. The goal of his research is to improve modeling practices and provide more accurate wind-generated dipole source levels at low frequencies.

Michael Wheatman is a 2015 graduate of Carleton College in Northfield, Minnesota with a B.A. in Computer Science. Currently he is a graduate student in the Computer Science and Engineering department at the Pennsylvania State University in University Park. His presentation covers the design and implementation of an Agent-based vehicle control system. This system serves as the reference implementation of the Unmanned Maritime Autonomy Architecture (UMAA) standard. His presentation will provide an overview of the goals of the UMAA standard

Timothy Cleary earned his B.S. and M.S. degrees in Mechanical Engineering from Penn State University. Currently he is a Ph.D. student in Mechanical Engineering at Penn State and the lead for battery system design and testing efforts at Penn State's Applied Research Laboratory (ARL). His presentation surveys recent ARL-designed undersea propulsion battery systems and details two ongoing science and technology projects focused on improved near-term battery technologies with the potential of increased safety

UNDERSEA COMMAND, CONTROL, COMMUNICATIONS AND COMBAT SYSTEMS COMMITTEE

PAUL ROSBOLT
CO-CHAIRMAN

DR. BOB ZARNICH
DEPUTY CHAIR

JOHN LINDERMAN
WARFIGHTER PERFORMANCE SESSION CHAIR

Greetings, all! I am really excited to be getting back to an in person conference---and you can't beat the clambake! We have some really interesting speakers lined up this year.

In **C4I,** we will hear from Captain David Kuhn (PMW 770) on plans and advances in Undersea Communications. We will also hear from several speakers, including The Hudson Institute's Bryan Clark, a noted navalist, on autonomous systems at sea. We foresee a huge role in both unmanned surface vehicles and unmanned subsurface vehicles in our future navy, and these systems are significant technological enablers. Our other focus in C4I, as in the past several sessions, will be cybersecurity.

In **Warfighter Performance**, Dr Ben Lawson will treat us to a tour of the Naval Submarine Medical Research Laboratory. In addition, we will hear more about Artificial Intelligence and under ice activities.

In **Combat Systems**, we will hear from Mr. Pete Scala on advance in submarine combat systems, and from CAPT Jill Cesari, PEO IWS5 on her office's activities in undersea warfare capability across the board---surface ASW, Submarine USW and ASW Command and Control. In particular, we will hear the latest on USW DSS and Nautica. For those not familiar, here's a brief induction to those last two systems.

Undersea Warfare Decision Support System (USW DSS) is the pillar USW command and control (C2) battle management aid (BMA) program of record (PoR) supporting intelligent C2 of theater and group forces (e.g. surface, subsurface, and air) against high-end adversaries. USW DSS enables planning and execution of group and theater USW operations; provides "best fit" asset/sensor assignments for exploitation of the environment; manages available resources; balances mission objectives versus risk; and provides a vulnerability assessment of the operational environment. The Navy is in the early stages of transitioning from USW DSS Build 2 Revision 3 (B2R3) to USW DSS Build 3 (B3). B2R3 is hosted on internal shipboard hardware environments and is focused on networked C2 for surface group ASW planning and execution. B3 is hardware agnostic, virtualized, and focused on implementing a new architecture enabling rapid incremental delivery of both theater and group USW C2 capabilities.

Project NAUTICA (Networked Architecture for Undersea Theater Integrated C2 Advantage), led by IWS5, is the Navy's project to vertically integrate the USW C2 system-of-systems (SoS). Project NAUTICA spans over a dozen program offices, three resource sponsors, three TYCOMs, and variety of S&T efforts. Having utilized a SoS approach to identify and address theater USW C2 gaps, NAUTICA is employing model-based system engineering (MBSE) to support continuous, flexible, and rapid changes to fleet doctrine and operational requirements and their translation into capability requirements.

UNDERSEA MINE WARFARE COMMMITTEE

KEVIN HAGAN
CHAIRMAN

BRIAN AMADOR
CO-CHAIRMAN

First off, I'd like to thank outgoing chair, Jon Tobias, for his outstanding leadership of the committee. His dedication to this warfare area cannot be understated and his enthusiasm and mentorship will be sorely missed. I'd also like to welcome aboard a new deputy chair, Brian Amador, whose mine warfare experience spans multiple careers, and whose depth of knowledge and experience will be an enormous benefit to NDIA's mission.

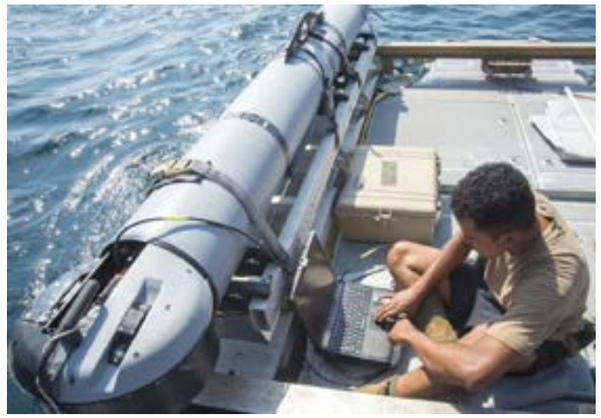
Like the other technical sessions, we're getting back into the swing of things after an extended break and are fortunate to have an excellent program lined up, including briefs from PMS 420, PMS 408, ONR and the Director of SMWDC's Mine Warfare Division. The mix of RDT&E, acquisition, and fleet perspectives will make for some outstanding discussion.

While we've been away the Navy has continued to develop and experiment with its LCS-based mine countermeasures (MCM) capabilities. Independence-variant LCSs Tulsa and Charleston (LCS-16 and 18) are deployed to the Pacific AOR carrying aviation mission modules of the MCM Mission Package (MP) which are seeing their first operational use. The ships are employing the Airborne Laser Mine Detection System and the Airborne Mine Neutralization System, which are carried aboard the MH-60 helicopter, and the Coastal Battlefield Reconnaissance and Analysis system, carried by the MQ-8B Fire Scout drone. The LCS Mission Modules Program Office (PMS 420) is driving towards Initial Operational Test and Evaluation (IOT&E) for the MP aboard USS Cincinnati (LCS 20) next summer. Completing IOT&E and achieving Initial Operational Capability (IOC) will allow the Navy to implement LCS CONOPS at the single and multi-ship level and subsequently replace the ageing Avenger-class minesweeper. RDML Casey Moton, PEO USC, has indicated that overcoming a history of schedule delays and reliability issues to field the MCM MP is one of his top priorities. The remainder of the MCM MP, which includes the Knifefish unmanned underwater vehicle (UUV) and the MCM Unmanned Surface Vehicle (USV) with its minehunting payloads, are still undergoing testing. MCM USV with the sweep payload recently completed IOT&E.

In May, General Dynamics was awarded a $73M contract to retrofit five of its Knifefish UUVs to the Block I configuration, which includes improvements to the vehicle's performance and sensors. The medium-class UUV uses low-frequency broadband sonar and automated target recognition software to detect mines, even those in high clutter environments or those that may be buried. The five-unit LRIP run is expected to be followed by competition for an FRP contract in the next two years. Meanwhile, the Navy is moving closer to selecting a replacement for the Mk 18 Mod 1 Swordfish, Mk 18 Mod 2 Kingfish, and Razorback small- and medium-class UUVs that will support both the Submarine Force and the Explosive Ordnance Disposal communities. The Lionfish small UUV and the Viperfish medium UUV programs that will replace decades-old legacy programs are expected to replace their predecessors in the next two to three years. L3Harris' Iver4 and Huntington Ingalls' Remus 300 are being evaluated as candidates for the Lionfish system with no announcement yet of platforms under consideration for Viperfish.

In the meantime, Sailors assigned to EOD's Expeditionary Mine Countermeasures (ExMCM) Companies, continue to operate using the Mk 18 family of systems, with ExMCM Company 2-2 completing an Advanced Certification Exercise, or CERTEX, in April of this year prior to deployment. Each 27-sailor company includes an unmanned systems platoon that employs the Mod 1 and Mod 2 vehicles to detect potential mines. Across the globe, a sister unit, ExMCM Company 1-2, participated in Mine Warfare Exercise 2JA along with units of Japan's Mine Division 2 and the U.S. Navy's forward deployed MCM Squadron 7.

As always, while our operational forces continue to train to face real-world challenge, I challenge the MIW community of interest to stay engaged and creative as we work together to improve the development and delivery of warfighting capabilities to those on the tip of the spear.



Mineman 3rd Class John Stephen-Torres observes data from an unmanned underwater vehicle during a squadron exercise. (MC3 Jonah Stepanik/U.S. Navy)

UNDERSEA WARFARE VEHICLES COMMITTEE

TOM RUZIC
CHAIRMAN

CHUCK FRALICK
CO-CHAIRMAN

This issue I have an update from Captain Pete Small, Program Manager for Unmanned Maritime Systems PMS406 with PEO USC.

The Navy continues to invest in a family of unmanned undersea vehicles (UUVs) to meet a variety of missions for maintaining undersea domain superiority. Unmanned autonomous systems are designed to expand the Navy's undersea reach and persistence, perform the dull, dirty, dangerous work and to complement, enhance and enable missions performed by manned platforms.

UUVs and unmanned surface vehicles (USVs) are being developed in response to Great Power Competition threats. The Tri-Service Maritime Strategy, released in December 2020, emphasizes the role of unmanned platforms in generating integrated all-domain naval power.

The Chief of Naval Operations' (CNO's) Navigation Plan, issued in January 2021, identifies the need to develop unmanned capability and capacity in support of a larger, hybrid fleet of manned and unmanned platforms required for Distributed Maritime Operations. The CNO then released an Unmanned Campaign Framework in March 2021 that emphasized the future hybrid fleet requires a coordinated effort across the entire service to deliver true unmanned capabilities, and not just standalone unmanned platforms.

The Unmanned Maritime Systems Program Office (PMS 406), within the Program Executive Office, Unmanned and Small Combatants (PEO USC), is responsible for driving the majority of the Navy's development, delivery and sustainment of unmanned surface and undersea platforms, along with the development of key enabling technologies to support advanced autonomy.

PMS 406 is managing a diverse portfolio of medium, large and extra-large UUVs and USVs. Its Advanced Autonomous Capabilities division is leading the development and integration of technology enablers to support both UUVs and USVs. The office collaborates with program offices across PEO USC, as well as with Program Executive Office, Unmanned Aviation and Strike Weapons.

Despite the pandemic, the Navy's UUV and USV portfolios have made significant developmental progress. Contracts were awarded for the first Medium USV prototype, Large USV studies (to six industry teams) and for two additional Navy-funded Overlord prototype USVs; industry solicitations were issued for Medium UUVs (MUUV) and Snakehead Large Displacement UUV (LDUUV) Phase 2; fabrication moved forward on five Orca Extra Large UUV (XLUUV) prototypes and the Snakehead Phase 1 vehicle; and deliveries of the Razorback dry deck shelter (DDS) medium UUV continued.

Prototyping and testing efforts also ramped up to validate new technology, develop concepts of operations and build trust in unmanned systems at both the Surface Development Squadron (SURFDEVRON) One, headquartered in San Diego, and UUV Squadron One (UUVRON-1) in Keyport, WA. A variety of UUVs and USVs participated in several fleet exercises including Integrated Battle Problem 21, the Navy's first multi-domain manned and unmanned capabilities exercise, which was led by U.S. Pacific Fleet and executed by U.S. 3rd Fleet in April.

Site preparations have begun at Naval Base Ventura County (NBVC) in Southern California for the initial testing, experimentation and operations of large unmanned maritime prototype platforms, including five Orca XLUUVs, Sea Hunter and Seahawk USVs, four Overlord USVs, and the first MUSV prototype that will begin arriving in FY22. Detachments from UUVRON-1 and SURFDEVRON will be co-located at Port Hueneme for collaborative testing, experimentation, learning and maturation of doctrine, organization, training, material, logistics, personnel and facilities requirements.

The parallel development of modular unmanned platforms with standardized technology enablers ensures these surface and undersea vehicles, will remain capable and sustainable throughout their service life. Along with the development and integration of these enabling capabilities and technologies – including standards, autonomy, communications, command and control, platform integration, payloads and sensors, networks, data and endurance – is a drive for standardization and commonality to meet future needs to upgrade sensors, add payloads and missions, and refresh autonomy technology as it matures.

The Navy's recent work on foundational efforts like the Unmanned Maritime Autonomy Architecture (UMAA) and Common Control System (CCS) is key to achieving this goal. UMAA is a new standard for the development of common, modular and scalable autonomy software for unmanned vehicles that is independent of a particular mission and platform, and has been invoked contractually since 2019. CCS is a government-furnished vessel control software with common source code, user interface and components that the Navy can integrate into a variety of unmanned systems to provide

common vehicle management, mission planning and mission management capabilities.

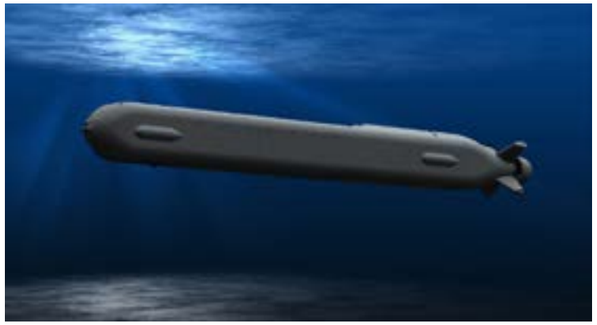
The Rapid Autonomy Integration Lab (RAIL) is the next step forward in executing the Navy's vision for development and deployment of unmanned system capability. The RAIL builds off the UMAA and CCS efforts to provide the infrastructure, tools and processes to develop, test, certify and deploy new and updated integrated software baselines to those vehicles. RAIL is the software factory that will continuously deliver improved combat systems to unmanned platforms.

UUV program organization underwent several notable changes in fall 2020 that will provide greater opportunity for collaboration to pursue opportunities for commonality, cost savings and sustainment efficiencies across this portfolio. A reorganization within PEO USC transferred the unmanned platforms in the littoral combat ship (LCS) Mine Countermeasures (MCM) mission packages, including the Knifefish UUV and MCM USV, from PMS 406 to PMS 420 (LCS Mission Modules) to consolidate the efforts to complete Operational Testing and fielding of these systems into one program office. At the same time, PMS 340 (Naval Special Warfare) and PMS 408 (Expeditionary Missions) joined PEO USC, bringing a variety of small and medium UUVs programs and greater synergy across programs.

The following section provides a program snapshot on status and significant events expected across the Navy's unmanned UUV portfolio over the next year.

Orca Extra Large UUV (PMS 406)

The Orca XLUUV is a pier-launched, long-endurance vehicle with a modular design to accommodate a variety of large payloads. The Navy competitively awarded a fabrication contract to Boeing for five Orca prototypes and associated support elements in 2019 and fabrication of these prototypes continues. The first vehicle is expected to commence testing in 2022.



Orca XLUUV

Snakehead Large Displacement UUV (PMS 406)

Snakehead LDUUV is the largest UUV capable of being hosted on a submarine with large ocean interfaces. Initial missions for Snakehead are Subsea and Seabed Warfare and Intelligence Preparation of the Operating Environment (IPOE).

Development continues on a single Phase 1 prototype vehicle intended to reduce risk in the areas of hull certification, lithium-ion battery hosting on submarines, and large UUV launch and recovery from submarines. A competitive solicitation for Phase 2 vehicles was issued in early FY21, with a contract award expected in FY22.

Knifefish Surface MCM UUV (PMS 420)

Knifefish is part of the LCS MCM Mission Package and is specifically designed to find stealthy or buried mines. Low rate production of 10 UUVs awarded in 2019 continues along with development of additional capability to be inserted in future blocks.

Razorback Littoral Battlespace Sensing Autonomous Undersea Vehicle (Submarine) (PMS 406)

Razorback is a submarine launched and recovered medium UUV initially focused on IPOE. Deliveries of nine vehicles configured for launch and recovery from dry-deck shelter-equipped submarines will complete in FY21. A solicitation for development and fabrication of a torpedo tube-launched and -recovered (TTL&R) variant of the Razorback vehicle is planned to be awarded in FY22.

Razorback Medium UUV

PMS 406 and PMS 408 are collaborating on a combined Medium UUV contract for the Razorback TTL&R variant and Maritime Expeditionary Mine Countermeasures UUV (MEMUUV, or Viperfish) that leverages similar technologies/capabilities, industry economies of scale, and training and sustainment efficiencies. A RFP for the contract was released in 2020.

Viperfish Medium MEMUUV (PMS 408)

Viperfish is the next-generation, surface-launched medium UUV that will be used by Expeditionary Mine Countermeasures (ExMCM) Companies to find and identify mines. Viperfish will help fill the Navy's increased ExMCM capacity requirements and eventually replace the MK 18 Mod 2 UUV with a more advanced and capable system.

Lionfish Small UUV (PMS 408)

Lionfish is the next-generation, surface-launched small UUV used by the expeditionary community for MCM operations. Along with Viperfish, Lionfish will initially be used to meet the Navy's increased ExMCM capacity requirements and eventually replace the MK 18 Mod 1 UUV. Lionfish is continuing its prototyping and development period through FY22 in partnership with the Defense Innovation Unit in order to increase computational efficiency with advanced Autonomy and Automated Target Recognition (ATR) features over traditional capabilities.

MK 18 Mod 1 and 2 UUVs (PMS 408)

MK 18 Mod 1 and 2 are small and medium UUVs, respectively, currently fielded and used by the Navy Explosive Ordnance Disposal community for ExMCM missions. Deliveries of additional MK 18 Mod 1 and 2 UUVs are ongoing and will continue through FY22 to meet the Navy's increased capacity requirements.

The MK 18 Mod 2 Increment II obtained Milestone C approval to enter production and deployment in the fourth quarter of FY20, nine months ahead of schedule. Utilizing multi-modal fusion and incorporating advanced Autonomy and ATR, the MK 18 Mod 2 Increment II will significantly reduce the MCM tactical timeline by expediting the reacquire and identification phases for ExMCM operations.

Mining Expendable Delivery Unmanned Submarine Asset (MEDUSA) (PMS 406)

MEDUSA is a Navy demonstration for a submarine-launched payload delivery vehicle. The MEDUSA demonstration effort has completed, and lessons learned will inform a new program start in FY2022, with a potential contract award in FY2023.

TETRA (PMS 394)

TETRA is a submarine torpedo-tube launched and recovered remotely operated vehicle (ROV) with the capacity for multiple mission payloads, and is a key enabler to Subsea and Seabed Warfare. It will become a new program of record in FY22. The Tetra small ROV is managed by PMS 394 (Advanced Undersea Systems), under PEO Submarines.

UNDERSEA WARFARE AVIATION COMMITTEE

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NAVAIR PMA264 NAVY LIAISON

Aviation undersea warfare is much more than fixed and rotary wing manned platforms that drop sonobuoys, although for the foreseeable future they provide our core aviation ASW capability. The sensors and technologies needed that will make them commonplace are being researched and developed opening up new and exciting ways to tackle difficult ASW problems. The aviation platforms that carry these advanced sensors and processing are being purchased for the U.S. Navy and our allies, are in production and delivery milestones being met. The Aviation Committee and its presenters will discuss very broad and diverse current and future programs and how they are contributing to the ASW Enterprise.

More relevant accomplishments, events and views of fleet operational leadership are provided below and released in the public domain:

MPA_Magazine_2021Q3.pdf (wildapricot.org) page #5

Checking On Station

Maritime Patrol and Reconnaissance Warriors Past and Present, Winston Churchill once said that, "There is at least one thing worse than fighting with allies – And that is to fight without them." At the time, Mr. Churchill was referring to the United States and the importance of developing – and maintaining – strong alliances. Not surprisingly, in rolling out a new maritime strategy fifteen years ago, then CNO, Admiral Mike Mullen, strongly advocated for a "1,000-ship Navy." His vision was one of world-wide naval forces forming regional partnerships that work together and share information to bolster maritime security. Now CNO, Admiral Mike Gilday, reinforces why relationships matter in our current NAVPLAN 2021 and the need to "strengthen our alliances and partnerships to ensure our success across the continuum of day-to-day competition, crisis, and conflict." A foundational tenet of the Maritime Patrol and Reconnaissance Force (MPRF), we stand with our allies and partners sharing a long and storied history of flying, fighting, and winning against a common foe. As developing and reemerging threats narrow the gap in technological advantage and pressurize our resources, there is a clear mandate to reaffirm our ties with our international partners. No one would argue that the P-3 Orion is easily the most successful Maritime Patrol and Reconnaissance Aircraft (MPRA) in aviation history. Introduced in the early 1960's, over 550 P-3s were eventually built by Lockheed Martin for the United States Navy. The Mighty Orion's legacy encompasses 17 nations that have flown or are currently flying some variant of P-3 aircraft. However, the P-3 is an aging champion that over the last decade has significantly declined in numbers with less than 20 planes remaining in our U.S. inventory today. While the decrease in P-3 numbers was to be expected, the increase in operational tempo of Strategic Competitors – particularly in the undersea domain – point to a "back to the future" scenario where MPRA remain the best choice to effectively locate, track, and kill adversary submarines. Let me be clear, today's ASW threat is real and the primary driver behind the recapitalization of active and reserve P-3 squadrons with the P-8A Poseidon. To date, Boeing has delivered 110 of 128 P-8A aircraft contracted to the US Navy and we have transitioned all 12 active component VP squadrons and the Fleet Replacement Squadron with our Reserve squadrons on deck to follow suit beginning in the fall of 2022. Since its introduction in 2013, the P-8A's performance has exceeded expectations and five of our closest allies and partners have joined us in modernizing their MPRA fleets with P-8As. There are more countries seeking to acquire their own P-8As in the future as well. Allied and Partner countries have accepted 19 aircraft with at least 24 more on the way. Our cooperative partner Australia has 12 RAAF P-8As on their flight-line with two more on contract. In the European theater, the UK has accepted five of nine planned P-8A aircraft and are operating side by side with US crews from their base at RAF Lossiemouth and other traditional MPRA bases in the area of operations. Norway has five aircraft on the way, followed closely by the Republic of Korea and New Zealand with six and four jets respectively. Most recently, Germany came on board with an order for five P-8As to replace their P-3s. These countries' commitment to maintaining a strong MPRA presence increase maritime security and provide the United States options when deciding where and when to deploy our own assets. I recently returned from visiting our forces in the Indo-Pacific and European Command areas of responsibility. The opportunity to fly and experience theater operations firsthand and interact with coalition counterparts served to reinforce the importance of strengthening our relationships, while emphasizing the need to seamlessly operate together on-station. The force multiplying effect of a closely allied MPRF is not a new concept. I believe we could exponentially increase global security and anti-submarine warfare (ASW) efficiency and effectiveness by working side-by-side and sharing information in real-time. Real-world operations, exercises, and information flow should be unencumbered by tail feathers. As technology pushes capabilities and communication into ever higher classification levels, there is concern that this trend significantly hampers our ability to work with our closest allies. To address this challenge we must begin with a presumption of releasability and are diligently working those permissions through official channels. If Strategic Competition leads to conflict, our maritime partners will be there with us and must be able to engage quickly and seamlessly in any scenario. Preserving our military advantage, and upholding the rules-based international order depends on strong integration with our Joint Force Allies and Partners. We strengthen our alliances and partnerships through development of interoperable capabilities, combined operations, theater security cooperation, and capacity-building efforts. Theater ASW is a "team sport" and reenergizing our partnerships and relationships is key to maintaining the lethal advantage we hold in the maritime domain. I look forward to hearing your thoughts in Whidbey Island at the next MPA Symposium, scheduled for 5-7 October, 2021. Until then, we will continue to Fly, Fight, Lead and Win! With Great Respect, Lance Scott Rear Admiral, U.S. Navy Commander Patrol and Reconnaissance Group/ Patrol and Reconnaissance Group Pacific

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U.S. NAVY P-8 POSEIDON EMPLOYS HARPOON DURING FORMIDABLE SHIELD 2021 EXERCISE

A US Navy's P-8A Poseidon MPA (Credit: Boeing Defense)

U.S. Navy Patrol Squadron FOUR (VP-4) successfully conducted a coordinated missile launch with VP-40 using two Air to Surface Missile (AGM-84D) Harpoons against a target barge off the coast of Norway during exercise At-Sea Demo/Formidable Shield (ASD/FS), May 31, 2021.

U.S Navy 6th Fleet press release – Story by Lt. j.g. Christian Daniels

This marked the first use of Harpoon missiles by P-8A Poseidons in the European theater.

"Having multinational allies, with whom we are capable of integrating seamlessly within the air and maritime domains, is critical to our strategic and operational objectives in the North Atlantic."
Cmdr. Johnny Harkins, VP-4 commanding officer.
"Our Combat Aircrews demonstrated their expertise using the P-8A to enhance the common operating picture in support of multi-unit strike operations."

The AGM-84D gives the Poseidon the ability to challenge enemy naval movements, either in support of offensive operations or in order to defend friendly forces. VP-4 supported At-Sea Demo/ Formidable Shield by employing three Poseidon aircraft to ensure the safety of military and civilian ships and aircraft.

"At-Sea Demo/Formidable Shield showcased the collaborative approach required to effectively conduct coordinated engagements as well as defeat ballistic missile threats."
"Having multiple opportunities to work with our NATO Allies enables us to dominate the battlespace and continually improve interoperability for future operations."
Lt. Ted Diamond, VP-4 ASD/FS action officer.

Throughout the exercise, NATO forces conducted live engagements with Driven Ammunition Reduced Time of flight (DART) munitions, Standard Missile-2, Evolved Sea Sparrow Missiles (ESSM), Aster 15, and Aster 30 missiles against various targets, including subsonic Banshee, Mirach, and Firejet targets and ground-launched supersonic drone (GQM-163A) targets. Additionally, ballistic missile defense tests with Standard Missile-3 launches were conducted.

The Arleigh Burke-class guided-missile destroyer USS Paul Ignatius (DDG 117) fired its second SM-3 interceptor to engage a ballistic missile target during exercise At-Sea Demo/Formidable Shield, May 26, 2021. U.S. Navy picture. BRITISH ISLES (May 30, 2021)

At-Sea Demonstration is a recurring live maritime exercise planned and supported by the Maritime Theater Missile Defense Forum (MTMD-F), a coalition of twelve nations with a focus on improving interoperability and force capabilities in maritime missile defense.

Formidable Shield is a biennial training exercise led by U.S. Sixth Fleet and conducted by Naval Striking and Support Forces NATO which aims to improve allied interoperability in a live-fire, integrated air and missile defense (IAMD) environment using NATO command and control reporting structures.

In total, approximately 3,300 personnel, 16 naval vessels, and more than 10 aircraft participated in the training exercise conducted on the U.K. Ministry of Defense's Hebrides Range located on the Western Isles of Scotland and the Andøya Space Defense facility in Andenes, Norway. Alongside the United States, participating nations included Belgium, Denmark, France, Germany, Italy, the Netherlands, Norway, Spain, and the United Kingdom.

VP-4 is currently assigned to Commander, Task Force (CTF) 67 and is deployed to the U.S. Sixth Fleet area of responsibility. CTF 67 is composed of land-based maritime patrol aircraft that operate over the waters of the Mediterranean and North Atlantic conducting anti-submarine, reconnaissance, surveillance, and search and rescue missions.

Evaluation of the Readiness of the U.S. Navy's P-8A Poseidon Aircraft to Meet the U.S. European Command's Anti-Submarine Warfare Requirements (DODIG-2021-083)

Evaluation

Publicly Released: May 21, 2021

Objective

The objective of this evaluation was to determine whether the readiness of the U.S. Navy's P-8A Poseidon fleet met the anti-submarine warfare requirements of the U.S. European Command (USEUCOM).

Background

The P-8A Poseidon is a multi-mission maritime aircraft. It is primarily used by Theater Commanders to conduct Anti-Submarine Warfare operations to deny the enemy the effective use of its submarines against the U.S. or allied assets.

In its area of responsibility, USEUCOM faces a Russian naval force that operates ballistic missile submarines capable of reaching targets in the United States, as well as attack submarines that can destroy surface, subsurface, and land targets.

Findings

[REDACTED] Commander, Naval Air Forces Instruction 4790.2 requires that U.S. Navy squadrons maintain a mission capability rate of 80 percent. However, during the same period, October 2018 through March 2020, the Navy's mission capability rates for the P-8A Poseidon fleet were between 53 and 70 percent.

Examples of sustainment problems within the P-8A Poseidon fleet included:

- P-8A Poseidon squadron maintenance personnel experienced delays identifying and receiving P-8A Poseidon spare parts.
- The Maritime Patrol Reconnaissance Aircraft (MPRA) Program Office and the Naval Supply Systems Command Weapon Systems Support personnel did not provide maintenance personnel with detailed maintenance procedures and technical data for P-8A Poseidon's mission-specific systems and equipment.
- P-8A Poseidon squadrons experienced consumable spare parts shortages, such as O rings, valve assemblies, bolts, and rivets, while deployed in the USEUCOM area of responsibility.

The P-8A Poseidon's low mission capability rate occurred because the MPRA Program Office and Program Executive Office, Air Anti-Submarine Warfare, Assault and Special Mission Programs (PEO) did not develop a supportable sustainment strategy for the P-8A Poseidon fleet. Also, the PEO(A) officials did not oversee the MPRA Program Office personnel's implementation of corrective actions to address sustainment challenges identified in P-8A independent logistics assessments, in accordance with Secretary of the Navy Instruction 4105.1B and Secretary of the Navy Instruction 4105.1C.

Furthermore, Navy officials did not require the MPRA Program Office to conduct the 5-year sustainment review in accordance with United States Code. Finally, MPRA Program Office and Naval Supply Systems Command personnel did not provide sufficient on-hand stocks of P-8A Poseidon consumable spare parts to meet the USEUCOM demand.

MPRA's implementation of an incomplete sustainment strategy and program along with a lack of oversight by the PEO(A) throughout the P-8A lifecycle led to sustainment problems that further contributed to the P-8A Poseidon's low mission capability rate.

Recommendations

We recommend that the MPRA Program Manager, in coordination with the Commander, Naval Supply Systems Command Weapon Systems Support, and the Naval Air Systems Command P-8A Poseidon Fleet Support Team Engineering and Logistics Leads, develop and implement a plan to address sustainment challenges of the P-8A Poseidon Fleet.

Further, we recommend that the Commander, Naval Supply Systems Command Weapon Systems Support coordinate with the MPRA Program Manager to develop and implement a demand forecast for P-8A Poseidon consumable spare parts in the USEUCOM area of responsibility.

We recommend that the PEO(A):

- Develop and implement a plan of action and milestones to correct and monitor sustainment
- deficiencies in the P-8A Poseidon program, in coordination with the MPRA Program Office.
- Conduct a review of the MPRA Program Office's processes and procedures to determine whether critical sustainment analyses are conducted, and to improve internal controls of the P-8A Poseidon sustainment strategy.

Finally, we recommend that the Deputy Assistant Secretary of the Navy for Sustainment direct the MPRA Program Manager to conduct 5-year sustainment reviews in accordance with 10 U.S.C. § 2441 (2016) for P-8A Poseidon aircraft.

Management Comments and Our Response

The MPRA Program Manager agreed to develop a plan to address the incomplete provisioning of P-8A Poseidon parts and the lack of P-8A Poseidon technical data. This recommendation is resolved but remains open. (U) The NAVSUP Weapon Systems Support Commander addressed P-8A consumable parts at NAS Sigonella, therefore, we consider this recommendation closed.

The PEO(A) agreed to develop plans of action and milestones to correct, monitor, and validate P-8A Poseidon sustainment deficiencies, and review processes for critical sustainment analyses and improving internal controls. This recommendation is resolved but remains open.

The Deputy Assistant Secretary of the Navy for Sustainment addressed our recommendation to conduct a P-8A Poseidon sustainment review. This recommendation is resolved but remains open.

This report is the product of Proj. No. D2020-DEV0PC-0094.000.

TAIWAN'S MILITARY ADJUST DEFENSE BUDGET FOR NEW MH-60R ASW HELICOPTERS

August 24, 2021, Taiwanese media Liberty Times Net (LTN) reported that the government has approved the 2022 national defense budget. The total defense budget for 2022 is estimated to be NT$372.6 billion (US$13.34 billion), a 3% increase from 2021.

Tso-Juei Hsu 30 Aug 2021

Tso-Juei Hsu story with additional reporting by Xavier Vavasseur

PACIFIC OCEAN (July 29, 2018) An MH-60R Sea Hawk helicopter assigned to the "Blue Hawks" of Helicopter Maritime Strike Squadron (HSM) 78 flies over the Pacific Ocean. (U.S. Navy photo by Mass Communication Specialist 2nd Class Devin M. Langer/Released)

Ministry of National Defense (MND) spokesperson, Major General Shih Shun-wen (史順文) said that the Cabinet is examining the defense budget, MND has no comment on the rumors about the defense budget.
According to UP MEDIA, the 2022 national defense budget will include 4 MQ-9B SeaGuardian UAVs and 8 MH-60R Seahawk anti-submarine warfare (ASW) helicopters.

Cabinet comptroller Tsu Tse-min (朱澤民) told media that the government has approved the 2022 national defense budget and that any purchase of Seahawk ASW helicopters will depend on the military's own adjustments and accommodations to the budget (for example, meaning the army or air force would have to cancel programs or make some savings in order to free-up some budget for the procurement of the MH-60R).

The Republic of China (ROC) Navy have been seeking to purchase MH-60R ASW helicopters from the United States since 2014. However, priority was always given to other military procurement, such as the Indigenous Defense Submarine (IDS) and the new Frigate (FFG) projects since DPP took office in 2016. In 2020, the ROC Navy had to give up MH-60R ASW helicopters procurement again, because the budget was

secured for Harpoon Coastal Defense Systems and related equipment. Procurement of Harpoon Coastal Defense Systems was an extra urgent issue for both Taiwanese and U.S. top officials.

About MH-60R "Romeo" maritime helicopter

ALFS dipping sonar on MH-60R helicopter. Lockheed Martin picture.

The U.S Navy is the main operator of the MH-60R with 289 units in its fleet. It is the primary anti-submarine warfare and anti-surface warfare helicopter in the fleet.

The MH-60R combines the features of the SH-60B and SH-60F aircraft. Its sensors package includes an MTS-FLIR, the AN/APS-147 multi-mode radar/IFF interrogator, an advanced airborne fleet data link, and a more advanced airborne active low frequency sonar (ALFS). Offensive capabilities are improved by the addition of new Mk-54 air-launched torpedoes and AGM-114 Hellfire missiles.

So far, the Romeo has been selected by the navies of the United States, Denmark, Australia and Saudi Arabia. In 2019, the U.S. State Department approved similar deals for the ROK Navy (South Korea) as well as for the **Hellenic Navy**. India became the latest country to place an order for 24 MH-60Rs in February 2020.

Current Taiwanese ASW aircraft fleet

P-3C MPA of the ROC Air Force. Taiwan MND photo.

The ROC Armed Forces currently operate 3 types of ASW aircrafts.
P-3C aircrafts were being delivered to Taiwan since 2013, and the squadrons become combat-ready in 2017. The aircrafts were originally planned to be operated by ROC Navy, but MND transferred all fixed wing aircrafts to ROC Air Force in 2013 for the reason of "resource integration". Navy P-3C crew were also transferred to Air Force. Some navy flag officers even retire or resign to express their dissatisfaction with the decision at the time.

ROC Navy operates two types of ASW helicopters. 500MD/ASW was purchased from the U.S. in 1977 and commissioned in 1979. ROC Navy had a fleet of 12 500MD/ASW, but only about 9 were still operational as of 2020. 500MD/ASW will be replaced with MH-60R.

MD-500 of the ROC Navy carrying a single torpedo. ROC Navy picture.

Taiwan bought S-70C (M) ASW helicopters 2 times from the U.S., The first time was 1983. The U.S. planned to sale modified land-based S-70C with ASW equipment to the ROC Navy via direct commercial sales (DCS). ROC Navy was not satisfied with land-based S-70C, and have spent years negotiating with

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the U.S. and finally got a variant of ship-based SH-60. The first batch of 10 S-70C (M) 1 (1 means the 1st batch) was delivered in the U.S. in July, 1990, The helicopters arrived in Taiwan in January 1991.

Taiwan procured a second batch of S-70C (M) 2 (means the 2nd batch) in June 1997, the first three were delivered in March 2000. All S-70C (M) 2 arrived Taiwan and became combat-ready in July, 2001. Taiwanese S-70C (M) 1 are equipped with an AN/APS-143(V)3 under-nose radar and AN/AQS 18(V)3 dipping sonar. S-70C(M)-1 has the CT7-2D1 engines, S-70C(M)-2 is uprated with the T700-GE-401C.

ROC (Taiwan) Navy Kang Ding frigate (PFG3-1202) with S-70C helicopter. Taiwan MND photo.

Although the ROC Nave have a plan to upgrade the engines of these helicopters, they are considered old and outdated today.

Sources quoted in this article:

Liberty Times
UP Media

NASC consortium is referenced below to help industry locate the naval aviation opportunity resources. Home (nascsolutions.org)

About the Naval Aviation Systems Consortium (NASC)

The Naval Aviation Systems Consortium (NASC) has been formed to support the technology needs of the Naval Air Warfare Centers (NAWCs) and the Naval Air Systems Command (NAVAIR) through the use of Other Transaction (OT) Authority. NASC is being built as an agile, collaborative and enduring enterprise with world-class capabilities that will provide the Navy with broad reach, robust competition and a comprehensive range of technology solutions. Through its unique structure, consortium members will be able to work with the Government to identify opportunities, target their technology offerings, expand into new markets and grow their businesses.

Consortium Management Group, Inc. (CMG) manages the Consortium and administers the Other Transaction Agreement with Naval Air Warfare Center Aircraft Division (NAWCAD), serving as an independent, transparent single interface between members and the Government.

Home (nascsolutions.org)

UNDERSEA WARFARE SENSORS COMMITTEE

JOSEPH CUSCHIERI
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PEO IWS 5 NAVY LIAISON

First off, I would like to welcome Shelby Sullivan as the Deputy Chair of this Committee. With the conference only one month away, scheduled September 27 to 29, 2021, the expectation at this point is that the Conference will be in-person, albeit with some limitations on number of people attending and the requirements for social distancing. The Fall Conference will have the same three elements as in previous conferences. Starting on Monday with the opening networking reception, Tuesday is the day of Plenaries covering different aspects of Undersea Warfare within the Conference theme "Enabling the Undersea Force for High-End Combat Today, While Fielding the Undersea Force of Tomorrow", and on Wednesday there will be the presentation of contributed technical papers in each of the Committees. This fall, the Undersea Sensor Committee received a large number of high quality presentation abstracts. In order to accommodate the 27-quality abstract selected, Undersea Sensors plans to run two parallel technical sessions. Please be sure to see the conference agenda for the final topic presentation schedule and room assignments.

In line with the Fall 2021 Conference theme, the topic of this issue of the newsletter is being dedicated autonomous systems and the challenges that these bring to sensor technologies.

Today, undersea sensing operations rely predominately on fixed seabed sensors such as the Sound Surveillance System (SOSUS), the Surveillance Towed Array Sensor System (SURTASS), electronic intelligence (ELINT), electro-optical/infrared (EO/IR) satellites and other forms of relocatable sensors, such as the transformational reliable acoustic path sensor (TRAPS). These sensors detect undersea platforms deployed in choke points and known transit lanes. However, as subsea platforms become quieter and harder to track, fixed systems may not be sufficient. Alternatives to fixed deployed systems include unmanned mobile systems used for detection and cuing, tracking, and possibly trailing. Unmanned concepts can significantly increase the US Navy's capability in the undersea environment with the added advantage that unmanned systems can be more scalable and less costly especially over time.

The concept would be to deploy a fleet of mobile sensors. The mobile sensors may consist of passive or active sonar arrays towed by or hull mounted on such unmanned platforms as eXtra-Large Unmanned Underwater Vehicles (XLUUVs), Large Displacement Unmanned Underwater Vehicles (LDUUVs) and Unmanned Surface Vessels (USVs). These unmanned platforms may also integrate and share data with the fixed undersea sensors systems. The fleet of autonomous platforms would be equipped with automated target recognition solutions to identify specific targets of interest.

Cooperative autonomous platforms concepts under development aggregate multiple sensor system of systems consisting of connected elements that taken together as a sum perform better than the individual elements. With emphasis on unmanned systems, unmanned undersea operations can concentrate on choke points and home waters and reduce the risk to manned platforms at such locations, potentially reduce the operations required in open oceans and enable effective monitoring of the undersea environment. New developments in Artificial Intelligence (AI) and Machine Learning technologies to improve search patterns, automated target recognition used for detection and tracking strategies provide the ability to improve the performance of unmanned systems. AI technologies enhance future systems performance by improving the capability of real-time autonomous mission optimization using the in-situ measurements by the on-board sensors from not one, but possibly many unmanned platforms. Arguably, some of the undersea sensor technologies required for the unmanned distributed sensor platform approach are already available, though they need further development to mature to the state where they deliver robust performance and are operationally relevant.

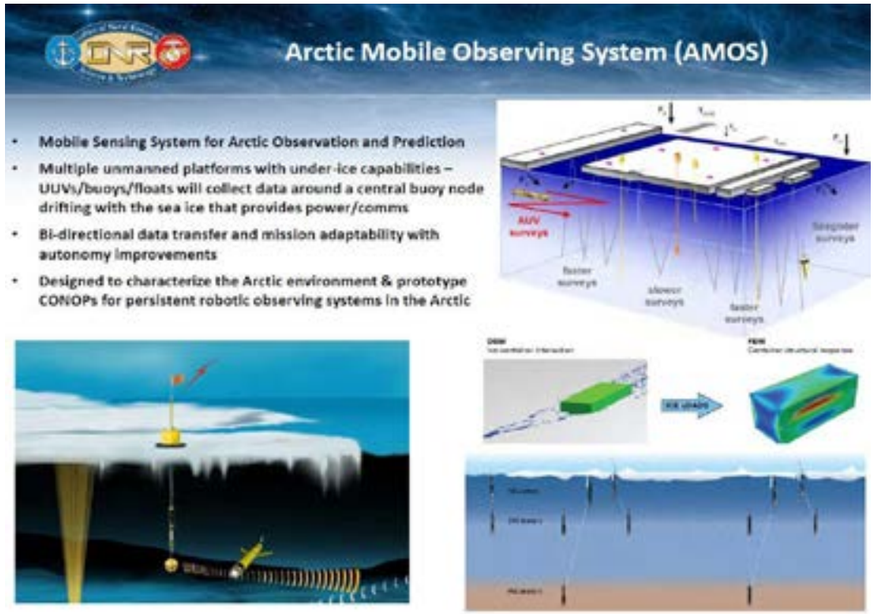
The deployment of unmanned systems as alternatives to fixed sensor systems is not without challenges. Improvements and maturation of technologies for autonomous vehicles, autonomy, automated acoustic processing, networking, communication, and sonar sensors that will go on autonomous systems, are required. Starting with the development of the undersea sensors to provide situational awareness, Pennsylvania State University's research arm is working with other Navy Labs to better understand the requirements and technical challenges of the acoustic sensor technologies onboard mobile unmanned platforms. It is sometimes suggested that while the use of COTS sensors may reduce the cost and development risks of Navy systems. However, the detection and identification of hard to detect, ultra-quiet threat submarines may exceed the capabilities of COTS sensors and processing applications and solutions. This is especially true when considering the technical challenges of compact sensors, navigation suites and embedded processing solutions for mobile and distributed Unmanned Autonomous Vehicle systems.

A critical component in the development of a distributed system of sensors is communications between the sensors. The distributed sensors cannot act independently but as a system. Thus for the undersea environment a robust networking infrastructure that links the mobile sensors together to share sensor and position data is needed. The concept of distributed mobile sensors is only viable if the autonomous mobile elements are integrated through an undersea communication network. Work in this critical area of undersea networking is being spearheaded by Woods Hole Oceanographic Institution (WHOI) with navy funding in the form of the AMOS (Arctic Mobile Observing System) system. The objective of AMOS is to lay the groundwork for an improved, intelligent, autonomous undersea sensor network based on both autonomous mobile sensor platforms and fixed sensors.

The WHOI AMOS effort has a scientific purpose mainly focused on the development, design, integration and testing of an autonomous undersea sensor system that will have reliable acoustic navigation with distributed communication to monitor the under ice environmental in the Arctic. Under ice the autonomous fleet of UUVs will not have access to GPS and must have a robust navigation and communication system. The technology of AMOS would directly contribute to an improved, intelligent, autonomous undersea persistent surveillance system.

The US-Navy is not the only Navy exploring the enhancement of the undersea sensor environment. Other countries' navies are also investing in increasing the undersea presence utilizing autonomous platforms. Most of the work done by other countries is said to be scientific but as shown above it could easily have adaptations to non-scientific applications.

The undersea environment will always be a challenging environment to both the platforms and the sensors that are in a constant cat and mouse scenario. We look forward to hearing about your technical advancements and achievements in this year's Undersea Sensors technical session.



Arctic Mobile Observing System (AMOS) Overview

FALL CONFERENCE CHAIR'S MESSAGE

ROBERT DUNN
CHAIRMAN

ERIC IRWIN
CO-CHAIRMAN
FALL CONFERENCE

The Fall Conference theme, "Enabling the undersea force for high-end combat today, while fielding the undersea force of tomorrow" focuses on maximizing present undersea warfare capabilities and readiness while designing and fielding the undersea warfare systems of the future.

This year's outstanding group of plenary speakers represents the full spectrum of undersea warfare expertise. The plenary session will begin with our keynote speaker VADM Houston, Commander, Submarine Forces. Following him and throughout the day briefs will be presented by the Commander, Submarine Force Pacific Fleet; Program Executive Officer Submarines; Technical Director, Naval Undersea and Surface Warfare Centers; Chief of Naval Research; Program Executive Officer Columbia; Director, OSD Strategic Capabilities Office; Commodore, SUBDEVRON FIVE; Deputy Commander, Office of Naval Intelligence; Commander, Naval Meteorological and Oceanography Command; Program Manager for Unmanned Systems; Program Manager for Air ASW Programs, and the Director, Undersea Warfare Division, N97. It has been two years since you have had the opportunity to ask these speakers questions in a classified forum and I encourage you to do so.

Attendance provides you the opportunity to gain insight into the challenges and capability gaps that the Navy faces across the entire spectrum of the undersea domain. Take advantage of this opportunity to hear our Defense and Navy leader's views on the issues confronting the Navy-industry-academia team as we navigate the waters of an uncertain future that will present new challenges to sustaining our undersea dominance.

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