NDIA

A Spectrum of Effects through Integrated Security and Operational Cross-Domain Systems

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EXPANDING THE UNDERSEA ADVANTAGE

"Strengthening the Connective Tissue"

The Chief of Naval Operations' A Design for Maintaining Maritime Superiority 2.0 provides guidance to link strategy with execution. As we move forward to achieve the Navy the nation needs, the importance of strengthening linkages, integration, coordination, and cross-pollination has become an imperative.

IMPERATIVES – DEMAND SIGNAL

The environment in which we operate is becoming increasingly complex, diverse, and yet still interconnected. Design 2.0 calls for strengthening naval power to respond to the forces shaping our security environment: increasing use of the maritime domain –oceans, seas, waterways, and seafloor; the rise of global information systems, especially data for decision making; and an increasing rate of technological creation and adoption. To operate most effectively, we need to fully leverage the effects of cross-domain operations, and the Navy, Army, and Air Force have signed on to buy compatible networks that share data. At a recent event at the Center for Strategic and International Studies (CSIS), Air Force Secretary Heather Wilson said, "We need to have any sensor connect to any shooter at very rapid machine-to-machine speed ..if we're going to multi-domain operations." A requisite component of reaching this goal is digital engineering efforts to set requirements via the application of system-level models and simulation efforts in traditional acquisition engineering activities, coupled with increased use of advanced tools and techniques in computational science.

In the maritime domain, responding to these global threats requires integrated and distributed multi-fleet operations leveraging a fleet-centric approach for warfighting in and across all theaters. This is another area in which Design 2.0 has evolved, indicating that the Navy will place a premium on implementing the Distributed Maritime Operations (DMO) concept as soon as possible, and reflecting more of a technological focus. The Navy DMO further defines the CNO's intent and guides development of future warfighting fighting capabilities. The good news is that the undersea warfare enterprise aligned early with DMO concept design capabilities and further defined them in Commander, Submarine Force's USW Integrated Prioritized Capability List. The challenges are to get faster in our operations, learning, processes, acquisitions, and innovation, and the concomitant ability to respond with urgency; to identify and fill fleet USW warfighting capability

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gaps; and meet the operational needs of future SSNs to outpace threats to undersea superiority.

LETHALITY AND AVAILABILITY

One of our strong suits at the Warfare Centers has been our ability to make naval technical programs successful by providing customers with unbiased technical advice. We also strive to make industry successful and work with our partners to provide options based on high-, medium- and low-risk solutions. Certainly we've experienced successes in making warfighting systems more capable, with hardware and software that deliver cutting edge offensive and defensive capabilities of individual warships, and deploying them in dispersed formations across a wide area. One example, Submarine Link 16, was called out by Secretary of the Navy Spencer at the recent CSIS event as the backbone for multi-domain operations and is now funded for submarines. However, we are delivering these capabilities with razor thin margins, which means that our task is to widen the gap to provide decisive advantages to the undersea warfighter. To this end, we're exploring a number of cutting-edge options, such as initiatives in artificial intelligence (AI) to better integrate AI and machine learning into warfare systems, analytics, man-machine interfaces in support of autonomous behaviors, additive manufacturing, and virtualization.

On the other side of the equation that we must balance is availability, because it doesn't matter how lethal a submarine is if it's unable to deploy. This is an area where our undersea warfare enterprise can also shine by working the connective tissue between the labs and the shipyards, and fully engaging our industry partners who have so successfully operated on both fronts. Two potential areas of focus stand out: idle time and shipyard overruns. At the Warfare Centers, we are looking at our in-service (ISE) and maintenance practices to examine what is needed for future ISE efforts and how can we help the fleet now. We are using technology insertion to advance maintenance processes, resolve obsolescence issues, and provide alternatives to redesign.

We must continue to ask ourselves what breakthrough sciences and technologies can we harness to give engineers more options to stretch the ship's deployment? Can we increase and enhance the ability to do material analyses on the ship? What about inspections? How much or how many processes can we translate from dry dock to the waterborne environment and thus reduce ship idle time? Think, for instance, of the impact of virtualizing combat and sonar and radio rooms, among others. Researchers at the Warfare Centers are developing analysis and engineering capabilities to enable a "digital twin" – an integration of data and models with machine-learning algorithms to create a digital replication of an actual product or process. Such advances in AI are critical for requirements setting as well as for rapid validation of those requirements.

Answering these questions, and making strides in technology or process improvement, is going to require that we make the cultural transition from risk aversion to risk management. Secretary Spencer has emphasized recently the need to empower the workforce to fix problems and stretch budget dollars, citing the example of a NAVSEA employee coming up against a $5,000 cap to fix a problem without needing to move paperwork up the chain of command. Spencer increased the authority to $25,000 and saw a 25% increase in throughput, leading him to increase the dollar limit to $100,000. Bureaucracies may not be known for being particularly flexible, but we need to find a way to strike a better balance between compliance and acceptable risk, so leaders at all levels are allowed to "fail forward" in a risk-managed environment. As Assistant Secretary of the Navy (Research, Development and Acquisition) Geurts has said, we need to move the needle from an environment in which the default is "No, but …" to "Yes, if …."

THE WAY FORWARD

Opening the aperture to diverse, innovative ideas and expanding the undersea advantage by strengthening integration and cross-pollination means drawing on the skills of our industry partners. There are many ways for industry to get the latest information about opportunities to work with us on focus areas, research efforts, and industry days. A one–page reference sheet will be distributed at this year's Spring NDIA event in San Diego. We're continuing to harness Other Transaction Authority (OTA) contracting flexibilities, such as the one with the Undersea Technology Innovation Consortium (UTIC) to provide cutting-edge undersea and maritime technologies. The UTIC OTA Phase I has multiple awards and will be soliciting Phase II topics soon. UTIC will be holding an industry day in April. Another Advanced Naval Technology Exercise (ANTX) will take place in Newport this August and promises to be an eventful showcase for rapid experimentation and evaluation of technological innovations in a lower risk environment and interface at the operational level of the Navy. The theme this year is "Prepare for Battle: Undersea Security" and one of our main initiatives is called "ANTX Every Day" to exercise technology throughout the year. We expect that these new acquisition and rapid prototyping processes will make it quicker to reach traditional and non-traditional partners to achieve the goals of fielding new capability in support of the navies of today and the future. We look forward to working with you on these efforts.

DIVISION CHAIR'S MESSAGE

MIKE TUCKER
CHAIR UNDERSEA WARFARE DIVISION

On behalf of the entire management team of the National Defense Industrial Association (NDIA) Undersea Warfare Division (UWD), welcome to the Spring Conference. Our goal is to provide you the best classified forum for understanding the Navy's vision, objectives and plan for maintaining undersea warfare superiority; and the best opportunity to interact with our diverse undersea warfare community. Please provide feedback on how we are doing and how we can improve.

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

As emphasized at our Fall conference, the pace of adversary technology development, capability fielding and deployment continues to increase at alarming rates. Our response must be broad and effective. We must protect our intent, our technology and our methods across all spectrums of capability development, employment and support. Broader access to technology on the world stage poses increasing challenges to our defense in terms of information protection and staying ahead of adversary capability development. In the face of these challenges, we and our allies must balance non-defense and defense budget needs, and continue to outpace our adversaries with unmatched warfighting capabilities. We cannot allow our adversaries to leverage advances in technology to gain investment, capability or operational advantage.

This challenge is captured in our theme for this conference "A Spectrum of Effects through Integrated Security and Operational Cross-Domain Systems". Our adversaries must continue to understand that we will field and employ unmatched warfighting capabilities that guarantee the defense of our nation and our allies.

This Spring conference concludes my two-year tour as Chair of the NDIA Undersea Warfare Division. I would like to thank Paul Normand (my predecessor and mentor) for the opportunity to serve the NDIA and the broader ASW community in this assignment. I would like to thank everyone on the Executive board and in the Advisory Council for unwavering and robust support of our division and the ASW community; and all of you for an incredibly eye opening and rewarding experience.

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

Warfighters First!

Mike

FALL 2018 NDIA UNDERSEA WARFARE AWARDS

PIERRE CORRIVEAU, PHD
CHAIRMAN AWARDS COMMITTEE

The NDIA Undersea Warfare Division (UWD) Bronze Award is granted to recognize outstanding individual achievements in either Science or Engineering in the field of Undersea Warfare and is awarded to key individuals in the principal Navy and University Laboratories engaged in Undersea Warfare related activities. By recognizing these individual achievements, the UWD seeks to:

- Reward achievement in the field of Undersea Warfare;
- Inspire accomplishment by other workers in the field;
- Increase public awareness of the field and its importance to Defense preparedness.

The NDIA UWD was pleased to present Bronze Medal Awards to the following individuals during the Plenary Session of the Fall 2018 USW Conference in Groton, CT.

In addition, Mr. Brian Howes was presented with the VADM Charles E. Weakley Award for his noteworthy contributions to effective USW Government and Industry communications.

DR. DAVID BROMLEY

NAVAL AIR WARFARE CENTER (NAWC),
AIRCRAFT DIVISION

As a Senior Scientist in the Airborne Anti-Submarine Warfare Systems Engineering Division, Research and Engineering Group, Naval Air Systems Command, Dr. Bromley leads cutting edge technology departments, evaluations, at-sea experimentations, and strategic planning for future airborne Anti-Submarine Warfare systems. He demonstrates superior technical leadership and direction in the development of advanced technologies for Anti-Submarine Warfare mission systems aboard Maritime Patrol and Reconnaissance Aircraft, specifically, the P-3 and P-8A aircraft platforms.

MR. BRIAN J. CAINE

NAVAL SURFACE WARFARE CENTER (NSWC),
CARDEROCK DIVISION

Mr. Caine's contributions in the area of acoustic intelligence systems for Undersea Warfare applications are directly reflected in his role as Technical Program Manager for the TUBA Program, a high-priority program sponsored by the Office of Naval Intelligence. His leadership in the area of systems development, full-scale testing, sensor performance evaluations, and acoustic calibration has had a direct and positive effect on the success of United States Navy operational forces as well as the Intelligence Community. Mr. Caine is a recognized authority on acoustic intelligence collection systems, and his contributions in technology and practices have added to the United States dominance in the area of anti-submarine warfare.

DR. JAMES LUBY

UNIVERSITY OF WASHINGTON
APPLIED PHYSICS LABORATORY

Dr. Luby's contributions to autonomous undersea vehicle developments, applications, hydrodynamics and especially operations of underwater gliders have resulted in changes to the way that the US Navy conducts persistent mobile underwater surveillance and data exfiltration. His work in underwater acoustic signal processing, sensor performance modeling/assessment, performance of Navy systems in the Arctic, and marine mammal monitoring via glider-based acoustic systems are already in use by the US Navy to improve their readiness, effectiveness, operations, and environmental monitoring.

MR. ROBERT M. MCGOVERN

NAVAL UNDERSEA WARFARE CENTER
NEWPORT DIVISION

Throughout Mr. McGovern's 33-year career, he has been recognized as a technical expert in USW sensor systems and sonar analysis and is currently serving as the Chief Analyst in the Sensors and Sonar Systems Department. His dedication to the warfighter through his numerous field assignments have contributed significantly to operational readiness and mission availability and is an exemplar of Division Newport's high standard of performance. Mr. McGovern's superlative leadership, numerous contributions in the area of USW, and complete dedication to duty reflect great credit upon him and are in keeping with the highest traditions of the United States Navy.

MS. DARLENE N. SULLIVAN

NAVAL UNDERSEA WARFARE CENTER
NEWPORT DIVISION

As the Director of USW Electromagnetic Maneuver Systems, Ms. Sullivan has built a well-deserved reputation for technical leadership and expertise across the USW Electromagnetic Enterprise. In her 28 years of service at the Naval Undersea Warfare Center Division Newport, Ms. Sullivan has demonstrated her ability to lead complex programs that span multiple warfare and systems centers. Her technical contributions to the successful evolution of the Common Submarine Radio Room were critical and it has become the standard for SSNs, SSGNs and the future COLUMBIA Class. Ms. Sullivan's numerous contributions in the area of USW, superlative leadership and complete dedication to duty reflect great credit upon her and are in keeping with the highest traditions of the United States Navy.

MS. JOAN E. TURNER

NAVAL UNDERSEA WARFARE CENTER
NEWPORT DIVISION

Over her 37-year tenure, Ms. Turner has conducted numerous analyses and assessments of complex challenges for major US Navy investment decisions. She is a nationally recognized expert with accomplishments spanning Littoral Combat Ship (LCS) ASW Mission Package, Surface Ship Torpedo Defense (SSTD) systems, AN/SQQ-89, and DDG 1000. Her contributions have shaped the investment and composition of Surface Fleet ASW. Her recent SSTD study examined potential torpedo defense capabilities on LCS. Ms. Turner's superlative leadership, numerous contributions in the area of sonar systems, ASW CONOPS along with a complete dedication to duty, reflect great credit upon her and are in keeping with the highest traditions of the United States Navy.

MR. BRIAN T. HOWES

CHIEF OF NAVAL OPERATIONS (OPNAV N97)
DEPUTY DIRECTOR

In his over 30 years of service, Mr. Howes has distinguished himself as a commissioned officer in the United States Navy and currently as a Senior Executive in Office of the Chief of Naval Operations. As the Deputy Director, Undersea Warfare Division, Mr. Howes is the principal civilian advisor to the CNO and Commander Submarine Forces on all matters relating to current and future undersea programs. He routinely engages with industry to better promote and sustain an atmosphere of trust, goodwill and understanding in order to ensure growth in undersea warfare capabilities and capacity. As the principal conduit to industry for submarine platforms and payloads portfolio management, Mr. Howes regularly meets with industry both large and small, to advance undersea systems opportunities including unmanned undersea vehicles. Mr. Howes also ensures that senior Navy Leadership maintain active participation during all technical sessions at the Undersea Warfare Conferences, Symposiums and formal engagements with industry.

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 2019 ACADEMIC SPEAKER AWARDS

MARK ROTHGEB
CHAIRMAN, ACADEMIC FELLOWSHIP COMMITTEE

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. The student candidate pool is primarily derived from the Navy's University Affiliated Research Centers (UARCs) and the Naval Postgraduate School (NPS). This Spring we are pleased to host three academic research contributors from different organizations presenting the topics described below.

Gabriel Venegas is a Graduate Research Assistant at the Applied Research Laboratories and a Ph.D. candidate at the Walker Department of Mechanical Engineering at the University of Texas at Austin. His research interests include acoustic reflection from and propagation through marine sediments and bubbly-liquids, plant and animal bioacoustics, and acoustic sensing of sediment-sequestered organic carbon. In his presentation, reflection coefficient measurements and simulations will be discussed to understand the effect salt diffusion into marine sediments has on acoustic reflectivity.

Mr. Della Porta is a senior engineer at The Johns Hopkins University Applied Physics Lab in the Acoustics and Electromagnetics group. He is currently the supervisor of the Advanced Concepts section where his research focuses on underwater acoustic and electromagnetic modeling, analysis and signal processing. He is currently a Ph.D. candidate in the Electrical Engineering program at the University of Maryland Baltimore County. His doctoral research explores the viability of performing classification on compressively sampled hyperspectral image data. Hyperspectral image classifiers are both trained and deployed entirely on compressed data, without the need of performing sparse reconstruction. This work promises potential savings in required data storage, processing and communication bandwidth, for many different types of Hyperspectral systems.

Jeff Collins graduated from the United States Naval Academy with a degree in Oceanography in 2012. After commissioning, he reported to USS KIDD (DDG 100) and served as Main Propulsion Officer, First Lieutenant, and Damage Control Assistant. He has spent the last two years at the Naval Postgraduate School studying Undersea Warfare while pursuing a MS in Physical Oceanography. He will be presenting in the Undersea Sensors session on the topic "The Arctic Challenge: Novel Employment of Existing Technologies to Maintain Our Undersea Dominance" and discusses the use of existing sensor technologies in new manners to provide detection opportunities of enemy submarines based on observations from field research completed during ICEX-18.

Please join the NDIA Executive Board in welcoming these academic presenters to the 2019 NDIA Undersea Warfare Division Spring conference.

UNDERSEA COMMAND, CONTROL, COMMUNICATIONS AND COMBAT SYSTEMS COMMITTEE

PAUL ROSBOLT
CHAIRMAN

DR. BOB ZARNICH
DEPUTY CHAIR

JOHN LINDERMAN
WARFIGHTER PERFORMANCE SESSION CHAIR

Greetings, All! I'm looking forward to a great conference in San Diego! Any excuse to get out of Washington is a good one. We have some terrific speakers lined up for the technical sessions, including CAPT Mike Boone, Program Manager for Undersea Communications & Integration (PMW 770), Bob Jackson, PM for Undersea Defensive Warfare Systems (PMS415), and Lee Agin, Deputy Program Manager for Undersea Systems (IWS5). In addition, we are hosting a full slate of ONI threat presentations!

A significant focus for Navy USW is how we improve our command and control. The Navy's effort to improve theater undersea warfare (TUSW) command and control (C2) took a significant step forward with the FY19 start of Project NAUTICA (Networked Architecture for Undersea Theater Integrated C2 Advantage). Project NAUTICA is the result of the first three years of work of the Theater ASW (TASW) Integrated Product Team (IPT).

Led by PEO IWS 5.0, OPNAV N2N6F, UWDC and the Theater ASW Warfare Commanders, the Navy organized the TASW IPT to examine TASW C2 issues and recommend solutions. Current TUSW C2 systems are managed by disparate resource sponsors, were not necessarily designed to interface with each other or higher echelon commands and TUSW assets, and have an over-reliance on manual processes. This has resulted in the warfighters dealing with issues related to life cycle support, training, system interoperability, information sharing with allies and coalition partners, and data transfer across security domains. The TASW IPT defined a common vision for TUSW C2, applied innovative design thinking through a TASW Tactical Advancements for the Next Generation (TANG) workshop, and formally documented Fleet requirements.

Project NAUTICA is leveraging previous and ongoing TASW IPT work and recent OPNAV Digital Warfare Office (DWO) model-based systems engineering (MBSE) pilot efforts. The Project NAUTICA team, working in close coordination with the Fleet, OPNAV and Acquisition stakeholders from the TASW IPT, is working to complete initial MBSE activities to support completion of a comprehensive TASW C2 requirements allocation process by the end of FY19. The results will inform existing system acquisition efforts, allow the application of the proven AxB development process where it is needed, and will identify where innovation is required to close gaps and improve the Navy's overall TUSW C2 capability.

These Project NAUTICA efforts will result in the implementation of a common integrated C2 system-of-systems architecture at the TUSW operations centers. Through aggressive incremental improvements, TUSW C2 will realize significant benefits from automation that makes sense, improved cyber resiliency and multi-layer security, and will be well positioned to face maritime challenges well into the 21st century.

UNDERSEA MINE WARFARE COMMITTEE

JON TOBIAS
CHAIRMAN

KEVIN HAGAN
DEPUTY CHAIRMAN

This Spring the Mine Warfare (MIW) Committee is following up an excellent Fall conference in Groton with another group of outstanding government and industry speakers, including briefs from the Naval Surface and Mine Warfare Development Command (SMWDC), Explosive Ordnance Disposal Mobile Unit ONE (EODMU1) and Naval Surface Warfare Center Panama City Division (NSWC PCD).

Arguably, the most significant MIW community event during the last six months has been the Navy's development of a comprehensive plan to lay out the investments required for a successful transition from legacy mine countermeasures (MCM) systems to more advanced capabilities. The overarching plan will be endorsed by Chief of Naval Operations (CNO), Admiral John Richardson and Marine Corps Commandant, General Robert Neller.

In the Fiscal Year 2018 National Defense Authorization Act, Congress directed the Navy to not retire, transfer, or store legacy mine countermeasures platforms (Avenger-class ships and MH-53E helicopters) before replacement capabilities have been identified and achieved initial operating capability (IOC), and the Navy is meeting combatant commander requirements. Neither the task itself, nor the supporting plans behind are easy.

The Avenger-class ships have been in service for an average of 26 years, and the MH-53 fleet underwent a life extension program that extends the aircraft service life to 10,000 hours and keeps it in service through 2025. The Littoral Combat Ship (LCS) and MH-60 helicopters were expected to have already replaced the capabilities lost as a result through employment of multi-system MCM mission packages (MP). MCM MP development, however, has been fraught with setbacks. The Rapid Airborne Mine Clearance System (RAMICS) and Remote Minehunting System (RMS) were both cancelled, and the Navy determined that the AN/AQS-20 minehunting sonar and the Organic Airborne Influence Sweep System (OASIS) could not safely be deployed from the MH-60S. The remainder of the components are working toward IOC.

Acquisition challenges have been compounded by the fact that MCM MP component capabilities are not a one-for-one swap with those of their legacy counterparts. For example, the MCM MP will not have the mechanical minesweeping capability of the Avenger-class and the MH-53E. It's ability to detect near-surface moored mines via the Airborne Laser Mine Detection System (ALMDS), however, did not exist in the legacy force. It has been a challenge to describe what a successful transition will look like. The Navy originally expected to complete its plan by the end of the 2018 calendar year, but that date has been extended and, as of release of the newsletter, has yet to be defined. In the meantime, new MIW systems continue development and testing.

Two MCM MP components successfully completed shipboard integration testing aboard USS Independence (LCS 2). The Knifefish minehunting system and the Unmanned Influence Sweep System (UISS) successfully verified the Multiple Vehicle Communications System (MVCS) link between Independence and the unmanned systems as well as executed multiple launch and recovery evolutions. Integration aboard the two LCS variants is a key milestone en-route to MCM MP initial operational test and evaluation which is currently planned for 2021.

Figure 1: UISS in LCS Launch & Recovery System

UISS is developed to deploy from Littoral Combat Ship (LCS) utilizing the MCM Unmanned Surface Vehicle (USV) and last October, OPNAV approved a program that would add two further payloads to the USV: the AN/AQS-20C and AN/AQS-24B minehunting sonar. This move will help close the gap left by the cancellation of Remote Minehunting System (RMS), which was to be the MCM MP's high-endurance, large area minehunting system. The ability of an AN/AQS-24B to operate while towed from a USV was demonstrated during the Royal Australian Navy-sponsored exercise, Autonomous Warrior 2018 in Jervis Bay, Australia, last December. Northrop Grumman used its remote controlled Mine Hunting USV (MHU) to demonstrate the sensor potential. Testing of the two sonar systems aboard the MCM USV is expected to begin this year.

Another system that the Navy envisions deploying from the MCM USV is the Barracuda mine neutralizer. Based on an A-size form factor, Barracuda is being considered by the Navy for designation as an accelerated acquisition program. The designation stems from memos released by the CNO and former Navy Secretary Ray Mabus that provides a path for programs to shorten the sometimes-cumbersome acquisition process. For Barracuda, the streamlining process will include working with the Navy's operational test and evaluation force, and the director of operational test and evaluation to significantly shorten the test and evaluation timeline. The program is scheduled for a preliminary design review this April, critical design review in January 2020, is expected to reach milestone C in the third quarter of fiscal year 2023 and initial operational capability in the fourth quarter of fiscal year 2024.

Once again, I challenge you to stay engaged and creative as we collectively improve delivery of warfighting capabilities to the U.S. Navy. This Spring's Tech Session will include information from the Expeditionary Warfare community on how the Navy plans to transition some of the MCM capabilities to expeditionary forces. At last year's NDIA Expeditionary Warfare Conference in Annapolis, Maryland, Stephen Olson, deputy branch head for mine warfare requirements, stressed that the future of mine warfare will require new, out-of-the-box ideas from industry. The Navy wants industry to be creative as it thinks about the future of mine warfare platforms, Stephen Olson said. "We've spent a lot of time in developing these systems, and one of the things that I want to put out to industry and you folks here today is what comes next?".

UNDERSEA WARFARE VEHICLES COMMITTEE

TOM RUZIC
CHAIRMAN

CHUCK FRALICK
DEPUTY CHAIR

WHERE ARE THE VERTICAL UUVS?

By Tom Ruzic

Which comes first: the bullet or the gun?

It's THE fundamental question for those of us in the defense industry.

The correct answer is, of course, "Both." All weapons are initially conceived of as a system, and when the mission requirements are known (kill the quail), the bullet is sized (a rock about an inch in diameter) and the gun (a slingshot capable of launching said rock ~30 yards) follows suit.

In the world of undersea warfare, the guns have been around for a long time and they are almost entirely 21 inches in diameter. The gun has remained fairly stable, but the bullet it shoots has evolved over time. The life cycle of submarines is very long and the bullet will invariably change while still requiring to be shot from the same old gun.

As one who works on the design of 8000+ ton submersible platforms, I'm firmly in the "gun" camp. I would be remiss to ignore the developments in the "bullet" arena, because after all, the two must work together.

And while the 21" diameter gun isn't going away, the Trident SSGN program has brought another gun to the platform: the 80 + inch diameter one. For VIRGINIA Class submarines starting with the SSN784 and later, there are two of these large tubes in the bow. Starting with SSN802 and later, there will be an additional four aft of the sail in the Virginia Payload Module. So the future of undersea payloads will reside in an increasing number of large vertical tubes.

In terms of bullets, there is no shortage of munitions that have been developed to launch from these guns.

But I'd like to talk about a different kind of "bullet:" the Unmanned Undersea Vehicle, or UUV.

All indications show mankind on an irreversible trajectory of automation. Since the inception of the humble Roomba vacuum cleaner, we seem to be headed to a future of All Things Unmanned. While air, ground and surface vehicles are rapidly advancing, unmanned underwater vehicles are maturing also, although not as fast. You can learn about many of these vehicles via this particular division of NDIA.

Looking at the future of undersea warfare, and wanting to "skate to where the puck is going to be" (a la Gretzky) I foresee the intersection of two trends:

1. Lots of vertically oriented payload volume (guns)
2. Lots of unmanned undersea vehicles (bullets)

If indeed UUVs are going to be carried into theatre via VIRGINIA Class submarines, these two trends beg a practical question:

*Is there a UUV on the market **today** compatible with being stored vertically (possibly for a long period of time), launched, reoriented to the horizontal attitude and then able to perform its mission?*

Perhaps that UUV exists and I'm not aware of it. Perhaps the reorientation is a trivial engineering problem to solve. Perhaps the 774 Class won't carry UUVs in the large payload volumes.

But if our manned undersea platforms are to carry UUVs that must be launched horizontally, then they will take up what has been heretofore considered valuable payload volume filled by war shots. Is that an acceptable trade?

These big guns will be around for a long time. Will we have all the right bullets?

I welcome your response via an abstract at a future Undersea Warfare Division conference.

UNDERSEA WARFARE AVIATION COMMITTEE

GLEN SHARPE
CHAIRMAN

MR. BOB KANYUCK
DEPUTY CHAIRMAN

CAPT. DOUGLAS BELVIN, USN
(NAVAIR PMA-264), 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 to make them commonplace are being researched and developed and are opening up new and exciting ways to tackle difficult ASW problems. The aviation platforms that carry these advanced sensors and processing are being purchased by the U.S. Navy and our allies, are in production and delivery milestones are 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 specific accomplishments are provided below and released in the public domain.

Boeing has been awarded an almost $2.5 billion contract to produce 19 P-8A Poseidon maritime patrol aircraft for the U.S. Navy, Norway and the United Kingdom, the U.S. Department of Defense said in a release.

(https://thedefensepost.com/2019/01/26/boeing-contract-19-p-8a-poseidon-us-navy-norway-uk/)

The $2,458,707,154 modification to a previously awarded firm-fixed-price, cost-plus-fixed-fee contract (N00019-14-C-0067) provides for the production and delivery of 19 P-8A Lot 10 aircraft, the Friday, January 25 release said.

Ten of the aircraft are for the U.S. Navy, four for the U.K. and five for Norway.

At almost $1.26 billion, the U.S. Navy purchase makes up 51 per cent of the total contract value, while Norway's almost $695 million makes up 28 per cent, and the U.K.'s almost $507 million makes up the remaining 21 per cent.

In March 2018, Boeing was awarded $282,275,771 for procurement of long lead parts for the 19 aircraft.

The U.S. State Department approved the sale to the U.K. of nine P-8A aircraft and associated support at an estimated cost of $3.2 billion in March 2016, while Norway's purchase of five P-8A aircraft for an estimated $1.75 billion was approved December 2016.

Last May, then-U.K. Minister for Defence Procurement Guto Bebb and his Norwegian counterpart Tone Skogen discussed plans for operational cooperation between the two nations and their P-8 fleets in the North Atlantic, including sharing training, spares and repair facilities.

Designated Poseidon MRA Mk.1 Maritime Patrol Aircraft, the first RAF Poseidon will enter service in October 2019 and U.K. initial operating capability is expected to be achieved in 2020.

Norway's aircraft are scheduled to be delivered between 2022 and 2023.

The RAF announced on January 21 that training was underway at Naval Air Station Jacksonville, Florida for Poseidon crews. The initial group of 38 personnel are a mixture of pilots, Weapon Systems Officers and groundcrew. Training will be carried out in the U.S. for the next three years before the RAF transitions to train all Poseidon personnel in the U.K.

Developed for the U.S. Navy, the P-8 Poseidon is a modified Boeing 737-800ERX designed to conduct anti-submarine warfare, anti-surface warfare, and intelligence, surveillance and reconnaissance missions. It can carry torpedoes, depth charges, Harpoon anti-ship missiles, and other weapons, and can drop and monitor sonobuoys.

The P-8 Poseidon is designed to operate alongside the Northrop Grumman MQ-4C Triton Broad Area Maritime Surveillance drone.

Boeing in October celebrated the completion of the 100th P-8 aircraft, saying at the time that P-8s had accumulated more than 150,000 flight hours.

The U.S. Navy, the Indian Navy, and the Royal Australian Air Force already operate the type.

In September, the sale to South Korea of six P-8A Poseidon patrol aircraft and 64 Patriot missiles was approved at an estimated cost of $2.6 billion.

In July, New Zealand said it would purchase four P-8 Poseidons for around $1.61 billion.

UNDERSEA WARFARE SENSORS COMMITTEE

MICHAEL JANIK
CHAIRMAN

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The Undersea Sensors Committee spring session received a good number of paper submissions ranging in topics from the traditional undersea sensors and processing for fixed surveillance systems, sensors and processing for large manned platforms, and sensors for unmanned platforms. The papers are all well suited and in line with this year's conference theme: "A Spectrum of Effects through Integrated Security and Operational Cross-Domain Systems". This time again there are a number of papers on sensors and processing for unmanned platforms. Unmanned platforms continue to be a significant component in the undersea environment.

Is the technology of underwater sensors keeping pace with requirements?

This may be considered a loaded question, but let's put the question in some context. Undersea platforms are continuously evolving with increasing sophistication in their level of technology and stealth. Manned platforms, whether US or other nations are becoming harder to detect. Every new generation of manned platforms is quieter than the previous generation. Not only manned platforms are becoming harder to detect, but unmanned platforms are increasing in numbers, size and capability, especially in the level of autonomy, and unmanned platforms are inherently quiet. Where before a mission required a manned platform because of the complexity of the mission, now portions of that same mission can be performed with unmanned platforms which can be harder to detect. If one takes the U.S. as an example, the roadmap of unmanned platforms (figure 1) clearly shows the increasing size and capability trend. Add to this the unmanned platform that other countries are developing that have been said to have significantly longer endurance and possibly stealth (figure 2), then one starts to get the picture. The question of whether undersea sensor technology is keeping up with requirements to detect these platforms becomes very relevant.

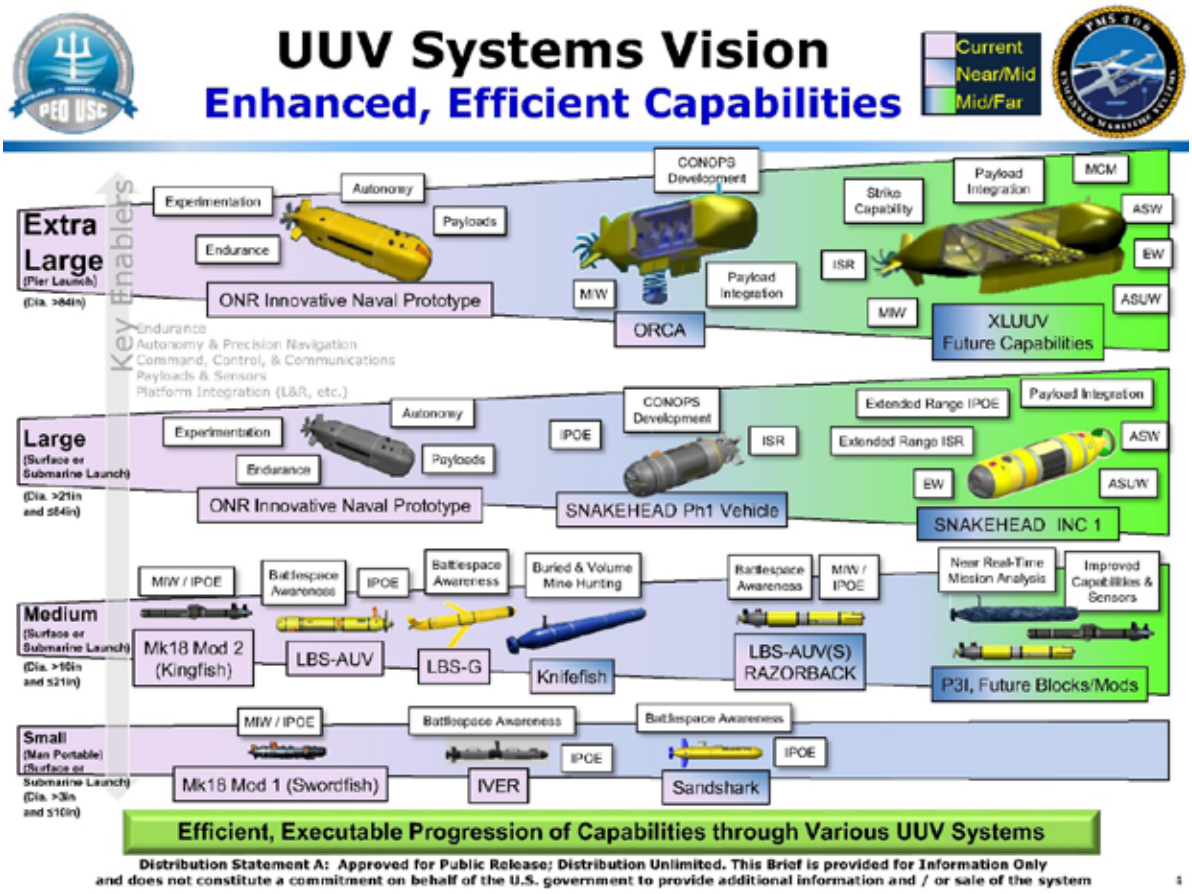

Figure 1. U.S. Unmanned Undersea Vehicle Roadmap.

UNDERSEA WARFARE SENSORS COMMITTEE

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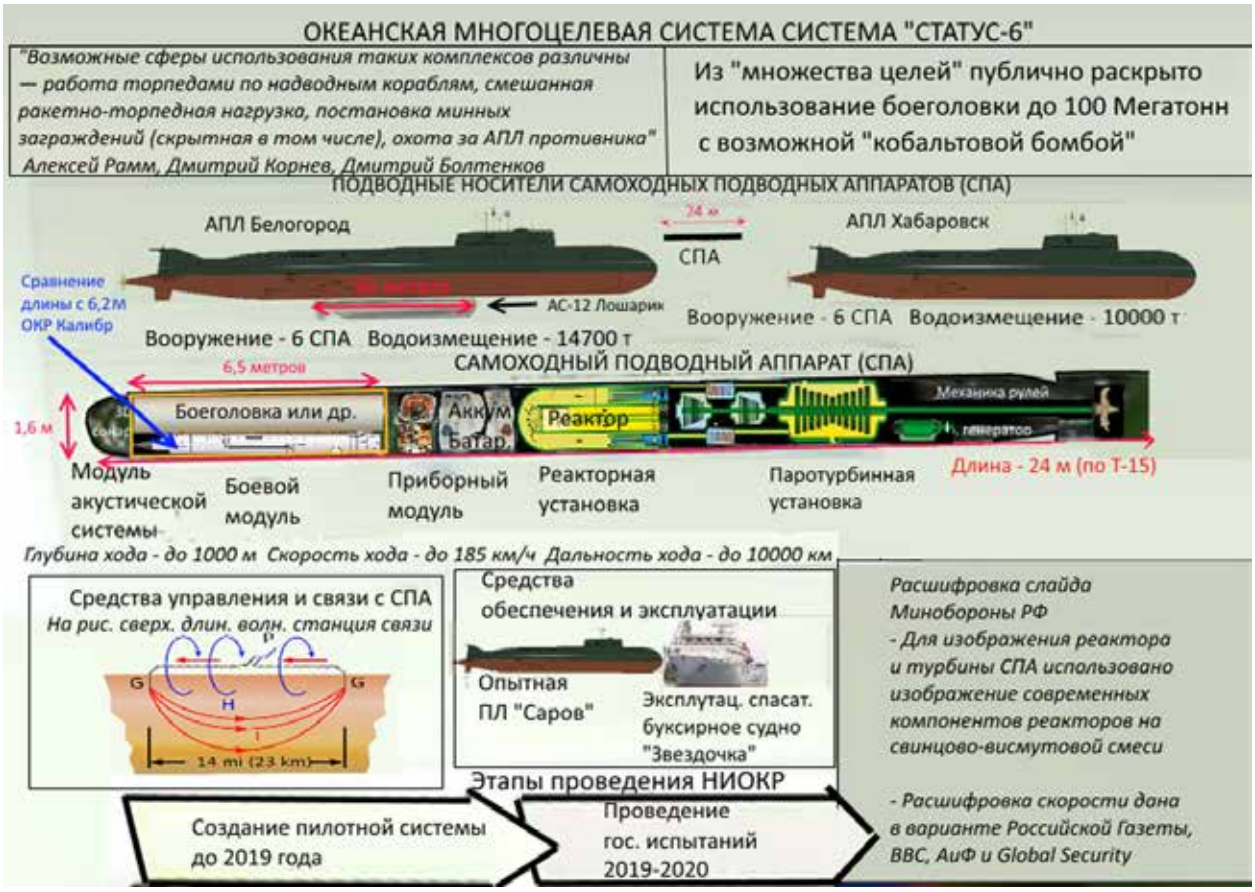

Figure 2. Possible UUV from other nations.

Traditionally undersea sensors provided a line of defense through the detection of the acoustic signature radiated by the manned or unmanned platform, provided the acoustic signature is there to be captured. Acoustics provided the physical phenomena that is known to readily propagate through seawater for long distances and provide a means for detection. Various technologies have been developed over the years, some even using unmanned platforms, to capitalize on the propagation characteristics and improve on the probability of detection and classification. However, if the amplitude of the platform acoustic signature is not much different than the ambient noise in the ocean, then the detection problem using the acoustic signature becomes that much harder. Even with the advances in signal processing, signal processing tools may not be enough to provide the necessary tools to be able to dig the acoustic signature out of the noise.

Thus, maybe it is time to consider other sensor/physical phenomena that can be used. If it is not the acoustic signature, can the magnetic signature/magnetic anomaly detection provide the answer? Magnetic signatures or magnetic anomalies in seawater decay quickly and are harder to detect unless more precise and higher sensitivity sensors become available. A recent new technology development which holds some promise in underwater magnetic sensing is nitrogen vacancies in diamonds. Nitrogen vacancies in a diamond lattice are point defects that provide a unique set of properties that if exploited can provide ultra-sensitive, high resolution magnetic vector sensors that operate at room temperature. This type of sensor provides both high sensitivity, and being inherently a vector sensor, provides a means to discriminate the magnetic signature or anomaly from the residual magnetic field. These nitrogen vacancy sensors can, at least in theory, provide the leap forward to possibly deploy magnetic anomaly/signature sensors that augment acoustic sensors underwater. Magnetic anomaly vector sensors provide significant capability and coupled with signal processing solutions may provide a sensor for the future that fills the gap with current technologies. These sensors are just one possible solution, are there other sensor modalities that are applicable?

SPRING CONFERENCE CHAIR'S MESSAGE

JOHN HOLMES
CHAIRMAN

ANDY WILDE
CO-CHAIRMAN SPRING CONFERENCE

The 2019 Undersea Warfare Spring Conference Theme, "A Spectrum of Effects through Integrated Security and Operational Cross-Domain Systems", deserves some thought and explanation. With the term "Cross-Domain" we quickly think of the operation/physical domains – air, surface and subsea platforms that carry our sailors into the fight and provide them the best resources. As a community we continue to evolve our thinking and the role unmanned platforms have in the operation/physical domains. Unmanned systems – air, surface and subsea – absolutely must be a key part of our thinking. When discussing "Cross-Domains" the conversation needs to include focus on the security domain both in multi-level data and cyber security. The security domain threat is real and continues to evolve – quickly.

The Navy Mission Statement has not changed, "…to maintain, train and equip combat-ready naval forces capable of winning wars, deterring aggression and maintaining freedom of the seas.", how we execute the mission is forever changing. Let this conference be an opportunity for the USW community to engage in thoughtful conversation on the domains we need to understand and control to execute the Navy Mission.

Our Plenary session speakers will provide a current update to attendees covering operations, investments, relevant programs, areas of continued focus, gaps, and current intelligence. We are fortunate to have with us today senior leaders who cover all of the USW domains including, surface, air, submarine, warfighter development, and threat assessment. Our six technical tracks will provide further details on specific programs, test results, and future thinking. We will continue the networking reception that immediately follows the plenary session. This reception for all attendees has been formatted to provide an enhanced opportunity for attendees and speakers to interact and discuss ideas. Thanks for your investment in time to participate with us in this conference and we look forward to the opportunity to exchange information in a classified and not-for attribution environment.

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