



DON MCCORMACK
ED, NAVAL SURFACE AND
UNDERSEA WARFARE
CENTERS

A CONSTANT STATE OF READINESS

A MESSAGE FROM THE NAVAL UNDERSEA WARFARE CENTER

What is it that keeps us at the Naval Undersea Warfare Center (NUWC) up at night? It's a growing sense of urgency as we strive to do what's right to keep the Navy in a constant state of readiness. The Chief of Naval Operations (CNO), Adm. Richardson, used the analogy of a sports game, where we head into the locker room at halftime with a big lead, only to realize that while we were celebrating our impending victory, the second half had started, our opponent had caught up, and the calculus of the contest had changed dramatically. Like that sports team, we are now engaged in a real competition with our adversaries and need to be able to get faster and outpace our competitors.

NUWC, as one of two Naval Sea Systems Command Warfare Centers (WCs), has been updating our playbook in collaboration with the fleet, Naval Research and Development Establishment

Collaborating to quickly deliver advanced capability - whether it's repurposed via mission engineering and technology refresh or fielding new systems - requires us to build and maintain a strong team and cultivate traditional and non-traditional partnerships.

(NR&DE), and the acquisition community. The WCs and our partners have been refining existing technologies like the Virtual Submarine, Advanced Processor Build (APB) and Technology Insertion (TI); adding new processes like the Long Range Research and Development Planning Process (LRRDP); restructuring Naval Innovative Science and Engineering (NISE)/ Section 219 investments; and incorporating new acquisition strategies through Rapid Prototyping, Experimentation and Demonstration (RPED) and Other Transaction Authority (OTA) contracting flexibilities. This partnership model works effectively when WCs lead development when we have unique knowledge,



RDML MOISES DELTORO, III
USN, COMMANDER, NUWC



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COLLABORATING TO LEVERAGE EMERGING TECHNOLOGIES

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skills, and facilities; follow when industry or academia develop and demonstrate groundbreaking technologies or introduce advanced processes / methods; and partner where University Affiliated Research Centers and Federally Funded Research and Development Centers (FFRDCs) possess unique skills.

Collaborating to quickly deliver advanced capability - whether it's repurposed via mission engineering and technology refresh or fielding new systems - requires us to build and maintain a strong team and cultivate traditional and non-traditional partnerships. The WCs and our industry and academic partners have a wealth of experience, facilities and mechanisms in place to facilitate innovation among the NR&DE. For example, the Virtual Submarine at NUWC Newport Division ties together shore-based engineering facilities, such as the Shore Based Radio Room; combat systems and electronic warfare laboratories; and the prototype Virginia Payload Module to perform full-scale integration of new payloads.

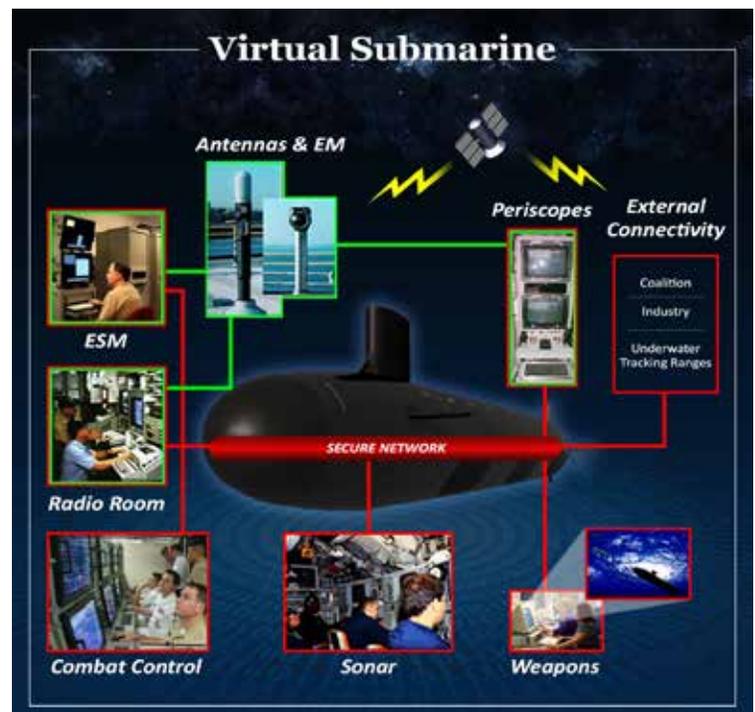
Similarly, the APB/TI process provides a structured system for industry, academia, FFRDCs, and the WCs to accelerate development of best-of-breed hardware and software for submarine combat systems, sonar, imaging, and electronic warfare system. Through the APB/TI process, candidate improvements are tested using simulated and replayed real-world data, and installed during shipyard availabilities, ensuring submarines are regularly refreshed with the latest capabilities. System improvements are vetted through a rigorous mission engineering capability, working with the Undersea Warfare Development Center to analyze current operations and tactics, emerging technologies, and developing operational and system models to facilitate the evolution of new employment strategies.

NUWC Newport Division recently conducted its third Advanced Naval Technology Exercise, which brought fleet operators, industry, and academia together to demonstrate future Navy technologies today. The dual-site event showcased 26 unmanned systems, with operations at both NUWC Newport's Narragansett Bay Test Facility in Newport, Rhode Island, and Naval Surface Warfare Center Panama City's operational areas. Submarine Development Squadron 5 participated at both sites and virtually from Keyport, Washington, offering a prime example of the type of collaboration we must continue to pursue to provide better tools more quickly for our warfighters' toolkits.

But quickly demonstrating and delivering new capabilities is only a part of our playbook. In-service engineering; and sustaining and refreshing the fleet are core capabilities for the WCs and our partners. We have been working with shipyards on an innovation initiative that promises improvements in the areas of bio-fouling, laser and plasma cutters; additive manufacturing to replace traditional casting techniques; and non-intrusive maintenance testing, including infrared thermography. Collaboration between the fleet, NUWC, and Applied Research Laboratory – Pennsylvania State University led to a UUV homeport at NUWC Keyport Division for fleet introduction, in-service engineering,

sustainment, maintenance, life-cycle logistics, material fabrication and repair, test and evaluation, and performance assessment.

NUWC is also teaming with industry and state government to innovate in the area of non-intrusive ship maintenance. NUWC scientists are developing an instrumented test method that can be used to remotely detect de-bonding of acoustic tiles on submarines. A R.I.-based company was recently awarded an innovation voucher from the state of Rhode Island to partner with NUWC Newport Division to develop a system that can conduct hull inspections using an existing NUWC technology. This allows the Navy to potentially avoid costly dry-dock repair periods by diagnosing and replacing acoustic tiles in-water.



The NAVSEA Warfare Centers' unique technical facilities are available for industry, academia, and DoD partners to test and evaluate their ideas and products through a variety of partnership vehicles. One example is NUWC Newport Division's Virtual Submarine, which provides full end-to-end engineering testing capabilities on a secure network.

COLLABORATING TO LEVERAGE EMERGING TECHNOLOGIES

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As we consider updates to our playbook that will enable us to get faster, we have incorporated focus areas for 10, 20, and 30 years down the road. Through the LRRDP, we have been working on setting priorities for research and development to support future capabilities. We take seriously our role in implementing the NR&DE, the DoN 30 Year Plan, and the Undersea Warfare S&T Objectives. Some areas for further exploration that have emerged include:

- Augmented systems/Artificial Intelligence/Machine learning
- Autonomy
- Materials Engineering / Additive Manufacturing / Synthetic Biology
- Power & Energy
- Cyber
- Weapons & Lethality
- Quantum Computing & Sensing
- Integrated & Distributed Forces
- Warfighter Performance

These are areas where we, as part of the Navy's NR&DE, can invest resources. A key element of the WCs' future playbook is developing and recruiting a workforce that is trained and experienced across science, engineering, medical, and social science disciplines. We need to invest in infrastructure and facilities that will serve our workforce and foster exploration, discovery, and development of new or repurposed capabilities. We also need to empower the workforce we are building today to adapt to the world as it develops through the same build, buy, or partner strategy we use for technology.

Finally, we are trying to get faster in our acquisition processes. While it is important to ensure that our procurements provide the best value to the American taxpayer, the acquisition process must operate at the speed we need to innovate. Examples of novel approaches to procurement include the rapid prototyping program and the use of OTA contracts. OTAs invigorate collaboration between government, industry, and academia by teaming traditional and non-traditional partners to develop advanced technology and deliver prototypes for fleet use and experimentation to fill capability gaps. The OTA language gives us the flexibility to develop consortiums of traditional and non-traditional members where the government can openly communicate requirements, priorities and funding to foster innovation. NUWC Newport Division will be issuing a request for proposals soon to create an Undersea Technology OTA Consortium.

These recent developments illustrate that the processes, procedures, and contract vehicles are falling into place to achieve the CNO's goal of delivering technology faster. We recognize that this is a sea change in doing things differently and will likely require time to also modify the culture. We need your ideas on how to do this effectively.

If the CNO is the "coach" of the Navy team, we like to think our USW community is his offensive coordinator, leading the charge to take the fight to our adversaries by adding new plays and players to the playbook. Consider this article a huddle talk. The second half has started, and we know that we must buckle down to protect and expand our narrow lead. Now more than ever, we must work together to push technology further and get it there faster.

DIVISION CHAIR'S MESSAGE

MIKE TUCKER, CHAIR
UNDERSEA WARFARE DIVISION



On behalf of the entire management team of the National Defense Industrial Association Undersea Warfare Division, welcome to our Fall 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.

We are in the process of generating our Biennial report on the state of the USW Industry which we provide to the Navy's Undersea Warfare leadership. Our past reports can be found on our website. I encourage all of you to pass on any thoughts you may have to our USW Division management team. We will neck down to four to five points for our report.

I am pleased to announce that Michael Cortese has taken on responsibility as Deputy Chair for our division. We thank Michael for his outstanding leadership and execution of the fall conference each year and congratulate Robert Dunn who has assumed responsibility as Fall Conference chair. Rob previously served as Fall Conference deputy chair. We have an outstanding team of speakers for this conference, many thanks to Rob for pulling it all together.

Thank all of you for your dedication to USW. The importance and urgency of our 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. Relationships between non-nation state and nation state actors that hold world views counter to our values, continue to evolve with uncertain outcomes. Our warfighters need our focus and dedication to the capabilities they need to succeed in every conflict at any time, and preserve our world view and our way of life. Our theme for this conference "Prepared for War... Today?" is complex and possibly controversial but undeniably relevant.

As many of you know Paul Normand stepped down from USW Division chair after serving a remarkable two terms. Under Paul's leadership, the division attracted an incredibly talented and distinguished group of industry, warfighter and government professionals to our executive board and advisory committee. We published highly regarded State of the USW Industry reports and held eight very successful conferences. I am very pleased to say that Paul remains engaged with our division as a member of our executive board and is working with ONI to organize and hold an ONI conference early next year. I'd like to personally thank you Paul, one could not have had a better mentor.

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

Warfighters First!

Mike

CONFERENCE CHAIR'S MESSAGE

ROBERT DUNN, CHAIRMAN
ERIC IRWIN, CO-CHAIRMAN
FALL CONFERENCE

The fall conference theme, "Ready for War...Today?" focuses on the capabilities and gaps in the Navy's vision for sustaining undersea superiority now and into 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 ADM Caldwell, the Director, Naval Nuclear Propulsion Program. Following him will be the Commander, Submarine Forces; Commander, Naval Surface Forces; Deputy Commander, USSTRATCOM; Principal Military Deputy to ASN/RDA; Commander, Submarine Force, U.S. Pacific Fleet; Program Executive Officer Submarines; Program Executive Officer C4I; Program Executive Officer Air ASW Programs; Commander, Naval Undersea Warfare Center; Chief of Naval Research and the Deputy Director, Undersea Warfare Division, N97.

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 leaders' 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.

SPRING 2017 NDIA UNDERSEA WARFARE AWARDS



DAVID MEDEIROS, CHAIRMAN
AWARDS COMMITTEE

At this year's spring conference, the Undersea Warfare Division (UWD) of the National Defense Industrial Association (NDIA) was pleased to present the Vice Admiral Charles E. Weakley Award to Mr. Don Hoffer, Executive Director for the U.S. Submarine Force, the Vice Admiral Charles B. Martell-David Bushnell Award to Mr. John (Jack) Chapman of General Dynamics Electric Boat, and the Captain George W. Ringenberg Award to Mr. Wayne Jakubowski and Mr. Greg Vaughn, co-chairmen of the Undersea Warfare Division's Spring Conference. In addition, we had the special pleasure of presenting the Rear Admiral Jack Jarabak Award to Lt Michael Schambach at the Officer's Club Sub in Groton, Ct with his SOAC classmates on April 21st. LT Schambach was unable to attend the spring conference in San Diego.

One additional award was presented at the spring conference. Our Undersea Warfare Division (UWD) departing president, Paul Normand, was presented the prestigious NDIA Gold Medal.



MR. DON HOFFER
EXECUTIVE DIRECTOR, US SUBMARINE FORCE

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

Throughout his 30 years of service to the submarine force and Naval Intelligence, including his achieving both Senior Executive Service (SES) rank at Team Submarine and Defense Intelligence Senior Level (DISL) rank in the intelligence community, Don has aggressively reached across the bridge to industry and the University Affiliated Research Centers (UARC) to address the challenges facing our Undersea Warriors. Throughout all his assigned roles he has demonstrated a steadfast commitment to ensuring effective government industry communications. These roles have included Naval Sea Systems Command's Deputy Director for the Advanced Undersea Systems Program, Director for Advance Undersea Integration, Executive Director for PEO SUBS, and his current role as Executive Director for Commander Submarine Force (SUBFOR). In this current role, Mr. Hoffer is the principal advisor to the Submarine Force Commander on all matters relating to Undersea Warfare programs and requirements. He is responsible for the prioritization of future Submarine Force capabilities, undersea technology development, engaging with industry partners and the implementation of unmanned systems in the undersea force. In recent years, he has been one of the principal conduits to industry for unmanned undersea vehicles, manned submersibles and systems and currently supports all aspects of submarine warfare as Executive Director, US Submarine Force.

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 was pleased to present Mr. Don Hoffer with the VADM Charles E. Weakley Award.



MR. JACK CHAPMAN
GENERAL DYNAMICS ELECTRIC BOAT

The VADM Charles B. Martell-David Bushnell Award for exceptional contributions in the field of ASW and/or Undersea Warfare Technology was presented to Mr. Jack Chapman.

Mr. John (Jack) Chapman, a staff engineer at Electric Boat with over 30 years of experience, has been developing and testing submarine and unmanned underwater vehicle (UUV) power equipment and propulsion systems for the Department of Defense. He has over 20 U.S. and international patents on power conversion systems for applications ranging from shipboard propulsion to magnetic bearings and artificial hearts. His current focus is on development of advanced power systems and rotating machinery that include submarine and UUV propulsion motors, generators, lithium-ion battery systems, circuit protection, system safety, power semiconductors and controls for integrated power conversion systems

Mr. Chapman has been recognized on numerous occasions for his innovative and forward thinking concepts. Most recently, he received a General Dynamics Innovation Award in recognition of several significant innovations he introduced in fields as diverse as supercavitation, magnetic bearing control systems, and quiet high-torque motors. Mr. Chapman's revolutionary development of a supercavitating vehicle (DARPA's Underwater Express) resulted in a number of international firsts in the field of supercavitation. Mr. Chapman is widely recognized throughout the technical and academic communities for his expertise and frequently presents at conferences.

For his excellent leadership and unwavering dedication that have significantly benefited our Submarine Force over his long career, the Undersea Warfare Division of the National Defense Industrial Association was honored to present this prestigious award to Mr. Jack Chapman.

SPRING 2017 NDIA UNDERSEA WARFARE AWARDS

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**MR. WAYNE JAKUBOWSKI
MR. GREG VAUGHN
CO-CHAIRMEN, SPRING
UNDERSEA WARFARE
CONFERENCE**

The Captain George Ringenberg Award is presented to those who, through their service and leadership, have made noteworthy contributions to the Undersea Warfare Division. This year's recipients of this prestigious award was Mr. Wayne Jakubowski and Mr. Greg Vaughn.

As the co-chairmen of the Undersea Warfare Division's Spring Conference, their selection of relevant and challenging themes coupled with their coordination of distinguished speakers for the plenary sessions of the conference ensured that industry, academia and other government officials received the most current and relevant information covering the full spectrum in the undersea domain.

Through their efforts, communications between the Navy Undersea warfare operators, the Navy requirements staffs, Navy research and development and procurement commands, and industry and academia were greatly enhanced providing the best mutual understanding of capabilities required by the Navy to preserve the nation's unique posture of undersea dominance. Through their tireless efforts, they left a mark of outstanding achievement.

The Undersea Warfare Division was proud to recognize Wayne Jakubowski and Greg Vaughn with the Captain George Ringenberg Award for their outstanding contributions and service to the U.S. Government, the National Defense Industrial Association, and the Undersea Warfare Division.



LT MICHAEL SCHAMBACH, USN

The Rear Admiral Jack Jarabak Award is presented each year by the UWD in conjunction with the Naval Post Graduate School's Undersea Warfare Executive Committee, to recognize a deserving student for his or her contribution in the field of USW as part of their study requirements. This year

the award was presented to LT Michael Schambach, USN, for his personal commitment and academic achievements in the area of Undersea Warfare Technology.

Lieutenant Schambach distinguished himself while attending the Naval Postgraduate School in the difficult and highly technical research curriculum. His thesis entitled "Analysis of a long-Range Undersea Strike Weapon," involved a modeling and simulation effort to analyze the effectiveness of a long-range torpedo and focused on determining the best way to balance navigation accuracy and detectability to maximize the probability

that the long-range torpedo reaches its destination. His time-stepped simulation uses geo-spherical and inertial navigation error calculations and concludes that if navigating for long distances, the torpedo must obtain navigational fixes to increase the kill probability to an acceptable level. This thesis also presents a robust algorithm that generates a set of waypoints that produces a kill probability near one, while minimizing risk by taking a limited number of fixes.

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 Mike Schambach, USN, by its award of the 2017 RADM Jack Jarabak Bronze Medal Award and wished him a continued productive and rewarding naval career.



**MR. PAUL NORMAND
PRESIDENT, NDIA UWD (2013-2017)**

For his outstanding performance and dedicated service as Chairman of the NDIA Undersea Warfare Division (USW), the National Defense Industrial Association (NDIA) awarded Paul E. Normand the Gold Medal. His citation read as follows:

Paul served the USW division for two terms as chair and 5 years as chair of the fall conference committee. Prior to entering the Submarine industrial base and joining NDIA, Paul served our nation with 30 years in the Submarine Force with tours including command of the USS Alexandria. As USW Division Chairman, Paul brought inspiration, energy, insight and dedication to the USW division team. Under Paul's steady hand, the division expanded its engagement with Air, Surface and Subsurface undersea warfare communities. The division conducted highly successful spring and fall conferences, fleet visits, round tables, published well received reports on the health of the USW industrial base to Navy leadership and provided grants to university students in USW related studies. In the face of intense defense budget challenges, Paul's efforts ensured that the USW division's conferences continued to provide the USW community with an opportunity to share needs, plans and technology and get capability to our sailors.

Paul provided inspired leadership to his USW division team. His commitment to "Warfighter First" and diversity of views exemplify core NDIA values. He brought together a cohesive dedicated team of large and small business leaders with an emphasis on all of the division's events being positive, relevant and useful. Paul's efforts directly contributed to a stronger NDIA USW division and an informed USW community.

In recognition of his sustained superior service, the National Defense Industrial Association was pleased to present this award to Paul.

The NDIA UWD is honored to recognize these significant contributions to the Undersea Warfare community through our awards program.



Congratulations to the Awardees!

On a final note, this will be my last conference as the Awards Committee chairman. Dr. Pierre Corriveau, Raytheon, will be the new chairman.

It's been an honor and pleasure in being part of this process which recognizes the individuals that have made such significant contributions to undersea warfare and our Nation's defense.

NDIA UWD 2017 ACADEMIC SPEAKER AWARD



MARK ROTHGEB, CHAIRMAN
ACADEMIC FELLOWSHIP 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. The student candidate pool is derived from the Navy's University Affiliated Research Centers (UARCs), the Naval Postgraduate School (NPS) and other research within the community. This fall we are pleased to host four academic research contributors and one alternate from these organizations covering a broad spectrum of topics.



LT Ian Taylor is a native of Kwajalein, Marshall Islands and currently is a student at the Naval Postgraduate School where he conducts and supports research at

the Center for Autonomous Vehicle Research. He is pursuing a Master of Science in Mechanical Engineering. He has developed a model that accurately captures the six degrees of freedom of a small diameter REMUS 100 with cross-tunnel thrusters. His presentation entitled "Variable Speed Hydrodynamic Model of an AUV Utilizing Cross Tunnel Thrusters" was developed in light of the need for better control during AUV homing and docking but is generally applicable to maneuverability in constricted and dynamic environments. He will provide an overview of model design, experimentation, and verification results.



LT Josh Collins is a Submarine officer set to graduate from the Naval Post Graduate School in September 2017 with a degree in Engineering Acoustics. His briefing topic "Bio-Inspired MEMS

Underwater Direction Finding Acoustic Sensor" is of considerable interest for miniaturizing sensors for the detection and localization of threats in underwater

environments. A micromechanical sensor using MEMS technology models the direction finding of the Ormia Ochracea fly on a miniature scale. In this talk, the design, fabrication and characteristics of the underwater directional sound sensor will be described.



MAJ James K. Starling is an active duty officer attending the University of Washington's Industrial and Systems Engineering department funded through the Army's Advanced Civil

Schooling program. His research topic is titled "Predicting Obsolescence Dates using Reliability Models" and focuses on obsolescence management which has the potential to assist in the supply chain and lifecycle management of most combat systems. The reliability based models used in this research are expected to outperform the mean time to failure methods currently in use. Additionally, the methods used will provide decision makers with a measure of the level of certainty (or uncertainty) associated with the predictive probability allowing for better acquisition decisions earlier in decision cycle.



Trent Christensen is an Engineering Scientist in the Advanced Technology Laboratory within Applied

Research Laboratories at The University of Texas at Austin. He is pursuing his Ph.D. degree in electrical and computer engineering. His topic of "Automated Detection Association" for mine countermeasures proposes a feature-based solution to the data association problem commonly seen in simultaneous localization and mapping (SLAM) applications. He will discuss a method to correctly associate target detections without dependency on high navigational accuracy, and to produce corresponding navigation correction sufficient for high-fidelity.



Bellamarie Ludwig is an engineer at the Applied Research Laboratory of the Pennsylvania State University and is working on her PhD focusing on the aluminum-seawater

combustion system. Sustained power for unmanned underwater systems and vehicles is critical to maintaining and extending the present asymmetric advantages that the United States enjoys in the undersea domain and her "alternate" topic covers the current state of the development of the systems engineering for bringing this potentially promising technology into practical use.

Please join the NDIA Executive Board in welcoming these academic presenters to the 2017 NDIA Fall conference.

UNDERSEA WARFARE AVIATION COMMITTEE

GLEN SHARPE – CHAIRMAN

CAPTAIN DOUG BELVIN USN (NAVAIR PMA-264), NAVY LIAISON

BOB KANYUCK – DEPUTY CHAIR



Welcome back to Groton and hope everyone has had a safe, relaxing and enjoyable summer, but from the looks of what has been going on in the Aviation ASW community, everyone has been extremely busy with a variety of ASW projects. The continued advancement in the development and delivery platforms, weapons, sensors, systems, and training devices are ensuring our Aviation Undersea Warfighters

have exactly what they need, when they need it. Real-world events are being addressed Real-time with the P-8A and MH-60R on the front lines keeping watch on adversaries. The sailors who operate those platforms are doing a remarkable job as platform transitions continue, and adapting to the new technologies delivered! The Undersea Warfare Aviation Committee will provide a collaborative environment for information exchange to support our sailors and platforms in a very dynamic technical and geo-political environment. Below are just a few specific accomplishments released in the public domain.

Navy continues project to install submarine-hunting radar aboard MH-60R helicopter

<http://www.militaryaerospace.com/articles/2016/08/submarine-hunting-helicopter-radar.html>



PATUXENT RIVER NAS, Md., 4 Aug. 2016. U.S. Navy anti-submarine warfare (ASW) experts are upgrading the MH-60R ASW helicopter fleet with a special submarine-hunting radar system designed to detect and classify submarine periscopes as they pop briefly out of the water.

Telephonics engineers designed and developed the AN/APS-153(V) for the rugged maritime operating environment of Navy MH-60R helicopter, which the Navy uses for ASW; anti-surface warfare; command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR); surface surveillance; maritime interdiction; combat search and rescue; medical evacuation; logistical support; identification friend or foe; battle damage assessment; naval surface fire support; and imaging.

The AN/APS-153(V) provides the MH-60R and its host ship with persistent littoral and maritime domain awareness. It enables operators to classify detected moving ship targets under night and restricted visibility using its high-resolution inverse synthetic aperture radar (ISAR) mode.

ISAR enables the MH-60R to operate outside of visual and lethal range of a potential enemy and to identify detected targets when images are combined with other intelligence.

The MH-60R helicopter controls the AN/APS-153(V) radar through the rotorcraft's mission computer with returns shown on 8-by-10-inch color multi-function displays. The Lockheed Martin Corp. Mission Systems and Training segment in Owego, N.Y., integrates the AN/APS-153(V) into the MH-60R avionics suite.

The AN/APS-153(V) weapons replacement assembly integrates an IFF interrogator, which provides Mark XII IFF modes 1, 2, 3A and 4 to identify friendly IFF-equipped aircraft, surface ships, and submarines.

The MH-60R helicopter can send visual information from the AN/APS-153(V) to its host ship via the helicopter's C-band data link. Future upgrades to the radar may include capabilities like low probability of intercept; ISAR automatic classification aids; synthetic aperture radar; Mode 5/Mode S IFF; and weather.

On this contract Lockheed Martin will do the work of integrating the AN/APS-153(V) onto the MH-60R helicopter in Farmingdale, Owego, and Syracuse, N.Y., and Oldsmar, Fla., and should be finished by September 2020.

US Navy to receive first deployable P-8A Poseidon trainers

<http://navaltoday.com/2017/06/09/us-navy-to-receive-first-deployable-p-8a-poseidon-trainers/>



The U.S. Navy will receive its first deployable P-8A Poseidon trainers, allowing aircrew and operators to improve their mission readiness even while serving away from home.

Under a recently signed contract, Boeing will provide seven Deployable Mission Readiness Trainers (DMRTs) to the Navy, starting in 2019.

“Training ensures the Maritime Patrol Reconnaissance community is proficient in anti-submarine warfare. By using these trainers, crews are trained without adding flight hours to the aircraft,” said CDR. John Thoe, P-8A training systems integrated product team lead. “DMRTs will fulfill these important requirements by providing high-fidelity, crew-based training to deployed squadrons.”

The proposed DMRT design is portable with low-power requirements and includes Boeing’s Weapons Tactics Trainer system, which incorporates sonobuoy and ocean acoustics modeling.

The U.S. Navy trains P-8A Poseidon aircrews at naval air stations in Jacksonville, Fla., and Whidbey Island, Wash. Seventy percent of the training for P-8A aircrews takes place in simulators and other trainers; the remaining 30 percent uses the actual aircraft.

Boeing is also under contract to deliver a complete P-8A training system to the Royal Australian Air Force, beginning in 2018.

P-8A Roll Out to U.S. Navy Accelerates With ASW Mission

<http://www.ainonline.com/aviation-news/defense/2017-06-18/p-8a-roll-out-us-navy-accelerates-asw-mission>



Recently the recipient of a mischievous “greeting” by a Russian Sukhoi Su-30 fighter over the Black Sea, the Boeing P-8A Poseidon continues rolling out to the U.S. Navy, bringing new capability in anti-submarine warfare (ASW) and no doubt annoying adversaries. Since it first started delivering Poseidons to the Navy in March 2012, Boeing this spring had handed over nearly half of the 117 jets the service seeks.

Prior to the Farnborough Airshow last year, Boeing (Chalets 332, 335) sponsored a press trip to Naval Air Station Jacksonville, Florida, where six U.S. east coast squadrons had completed the transition from the aging Lockheed P-3C Orion four-engine turboprop to the Poseidon, a Boeing 737-800ERX derivative with reinforced 737-900 wings. Last month, the press visited Naval Air Station Whidbey Island in the Puget Sound north of Seattle, Washington. There, west coast squadrons are undergoing transition

training.

From steamy Jacksonville to chilly Whidbey Island there was at least one familiar face—Capt. Andy Miller, officer in charge of P-8 fleet integration with Patrol Squadron Thirty (VP-30), a flight crew training unit, said he accepted the Navy’s offer to lead the P-3 to P-8 transition on both coasts.

VP-4, “The Skinny Dragons,” achieved safe-for-flight certification to operate the P-8A on May 5 at Whidbey Island, becoming the first U.S. west coast squadron to complete the transition. Formerly based at Kaneohe Bay, Hawaii, the squadron had received two of the seven Poseidons it will operate for a scheduled deployment next March. VP-47, “The Golden Swordsmen,” was next in line to complete the transition.

Jacksonville-based VP-16, the “War Eagles,” became the first operational P-8A squadron in December 2013 when it deployed with the jet to Kadena Air Base, Japan, to support the Navy’s 7th Fleet. By 2020, the Navy plans to base six P-8A squadrons at Jacksonville and six at Whidbey Island, Miller said.

Some P-3s will be assigned to training and reserve squadrons after 2020; others have been sent to the aircraft “boneyard” at Davis-Monthan Air Force Base in Tucson, Arizona. There were 28 P-3s remaining at NAS Whidbey Island, plus a handful at Jacksonville, Navy officers said.

While most P-3 flight training took place on the aircraft, 70 percent of P-8A training is accomplished in a simulator, a major efficiency advantage, Navy officers said. There are 10 CAE-built full-flight simulators at Jacksonville and as of May three of seven planned simulators at Whidbey Island. Transitioning pilots fly 29 four-hour simulator sessions and 40 actual flight hours (50 for commanders), said LCDR Matt Olson assistant officer in charge of the Whidbey Island transition.

P-8A crewmembers described other enhancements the Poseidon brings to the ASW mission. The P-8A has storage capacity for 129 sonobuoys—50 percent more than the P-3 can carry—which are dispensed from rotary launchers in its aft section to detect and track submarines.

The Poseidon’s sensor mix includes SSQ-36 bathythermograph buoys (providing vertical seawater temperature profiles); GPS-enabled SSQ-53G passive and SSQ-62F active sonobuoys; and SSQ-101 multi-static non-coherent source and SSQ-125 multi-static coherent source sonobuoys. Its third generation Multi-Static Active Coherent (MAC) acoustic search system makes use of multiple receiver buoys in a multistatic field to support wide-area searches with greater sensitivity in a wider variety of ocean acoustic environments.

A planned upgrade, the Boeing-built High Altitude Anti-Submarine Warfare Capability (HAAWC) air-launched accessory kit adds GPS guidance and folding wings to the Raytheon MK 54 torpedo, turning it into a glide weapon the Poseidon can release from as high as 30,000 feet; it will undergo flight testing this year. The P-8A cradles five MK 54 torpedoes or MK 82 depth charges in its belly weapons bay, plus AGM-84 Harpoon anti-ship missiles on four wing stations. “This is going to be great for our high-altitude ASW,” remarked Lieutenant Max Casillas, a VP-4 tactical coordinator.

The P-8A operates from a ceiling of 41,000 feet down to 200 feet above the water’s surface. “We’re not going as low as that because

UNDERSEA WARFARE AVIATION COMMITTEE

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we don't need to," Olson said. "We're down to 500, 1,000, 1,500 (feet), so we're still low," he added. "Because of the speeds, the turn rates (of the P-8) we're still able to do all the same stuff as with the P-3. It's good to go down there to show force, too."

Boeing was under contract with the U.S. Navy for 91 P-8As and with the Royal Australian Air Force (RAAF) for 12. The first two of nine Poseidons the UK plans to buy were contained in \$2.2 billion Lot 8 full-rate production contract the Naval Air Systems Command awarded Boeing on March 30. As of that contract award, Boeing had delivered 53 Poseidons to the U.S. Navy and two to the RAAF.

Meanwhile, the Indian Navy had received eight P-8Is and was under contract for four additional aircraft. Boeing started delivering the P-8I with India-unique design features and indigenous subsystems in May 2013.

Among other pending users, Norway plans to buy five P-8As, for which Boeing awaited a foreign military sales contract from the Navy. New Zealand has expressed a need for up to four Poseidons, according to a Pentagon notification to the U.S. Congress in late April. Weeks after that, Saudi Arabia was revealed as a potential seventh P-8 customer when the White House announced a \$110 billion arms package during a visit by President Donald Trump to Riyadh in May.

P-8A software upgrade will increase communication, connectivity

<https://defensesystems.com/articles/2017/08/17/navy-poseidon-spy-plane.aspx>

By Katherine Owens, Aug 17, 2017



The Navy's latest "spy plane," the P-8A Poseidon, will now receive upgraded performance software on the road to achieving full operational capacity in 2023. The new software will enhance communication and navigation capabilities with new network connectivity, according to the Navy.

The P-8A will soon operate using the updated MilPlanner, FliteDeck Pro, and On-Board Performance Tool software. Jeppesen Sanderson Inc., a Boeing company, is the developer behind each of these software tools and has been tasked with integrating them with

the P-8A as part of a \$13, 846,460 contract.

"Pilots say improved communications capability is one of the P-8A's key benefits," said a Navy spokesperson. In the P-8A acquisition requirements process, "increment 3 is focused on network ready open architecture and net-enabled weapons."

The latest MilPlanner software is a flight planning and optimization program. The P-8A will be installed with a version of MilPlanner6 specifically tailored to the mission set of the reconnaissance aircraft, according to statements by the Navy.

FliteDeckPro, another enhanced software being installed in the P-8A, now includes Smart Notes software. According to Jeppesen, Smart Notes analyzes flight data in terms of chronology and geospatial locations without needing an operator to initiate or oversee the process.

A new version of the Tailored Enroute program in the P-8A means that now the data collected in-flight can be combined with the operator's mission information set to provide a detailed situational picture. Additionally, the Tip Kit-On-Demand software feature ensures that navigation and charting data is all saved on a secure cloud network.

"The aircraft communication suite is robust and crews are able to submit post-mission reports while taxiing back to their line. Additionally, its connectivity is boosted by improved computing power and integrated datalinks and workstations," said the Navy spokesperson. "Connectivity also augments its sonobuoy processing capability; this along with improved sensors and higher-resolution displays is said to improve the operator's recognition differential."

Dispensing and monitoring sonobuoys is one crucial function of the P-8A, according to the Navy. The aircraft deposits both passive and active sonobuoys--ones that simply record frequency transmissions and ones that emit and receive signals. According to Sparton, a major industry developer, sonobuoys are a key asset in anti-submarine warfare.

For navigational connectivity, the P-8A relies on the ARINC 424 Navigational Data program. According to a Jeppesen spokesperson, the ARINC 424 is the world's largest navigational data, supplied with navigational data and information that is reviewed and verified.

"The introduction of Jeppesen FliteDeck Pro...continues the digital transformation of flight operations... The addition of Smart Notes, Tailored Enroute ... capabilities now offer flight crews with the most accurate information in the industry, to increase situational awareness and efficiency in today's complex airspace environment," said Tim Huegel, Director of Jeppesen Flight Deck Solutions.

As a platform for this advanced software, the P-8A provides anti-submarine and anti-surface warfare capabilities, as well as general littoral reconnaissance, according to the Naval Air Systems Command. Armed with torpedoes and cruise missiles, the aircraft can fly at speeds of up to 564 mph.

"The P-8A and MQ-4 Triton are part of the Maritime Patrol and Reconnaissance family of systems," explained the Navy spokesperson. "Information flow between the platforms and between their Tactical Operations Center will provide seamless intelligence to combatant commanders."

UNDERSEA WARFARE VEHICLES COMMITTEE

TOM RUZIC – CHAIRMAN
CHUCK FRALIK – DEPUTY CHAIRMAN



For this issue, I've got a summary of the recently concluded Advanced Naval Technology Exercise (ANTX), which Jessica Shaffer will be briefing in the Vehicles Section September 20th. I encourage you to make plans to attend and or participate in upcoming ANTX events in 2018.

Advanced Naval Technology Exercise: Battlespace Preparation in a Contested Environment

From Aug. 15-16, the Advanced Naval Technology Exercise (ANTX) 2017 "Battlespace Preparation in a Contested Environment," took place at both the Naval Undersea Warfare Center Division Newport and the Naval Surface Warfare Center Panama City Division, partnering with Fleet operators from Submarine Development Squadron Five from Keyport, Washington, and the Explosive Ordnance Disposal Mobile Unit One in Panama City, Fla.

ANTX provides an opportunity for scientists and engineers to exercise potential future Navy technologies by providing a low-risk environment to evaluate innovative, emerging technologies. At this year's multi-site ANTX, more than 700 attendees observed 50 unmanned systems in action — 11 unmanned aerial vehicles, 9 unmanned surface vehicles, 28 unmanned underwater vehicles, and 2 unmanned ground vehicles.

ANTX featured live cross-domain exercises of unmanned systems. Critical goals for this year's operation include the undetected collection, fusion, and transmission of data, technology enablers that facilitate autonomous operations, and coordination among autonomous platforms and their operators. NUWC Newport's exercises focused on Intelligence, Surveillance, and Reconnaissance, while NSWC Panama City's exercises focused on Mine Warfare and Mine Countermeasures.

"ANTX is a very powerful construct for advancing technology. It provides a venue to scientists and engineers in a non-threatening environment, which encourages risk taking and innovation," said Denise Crimmins, Senior Scientific Technical Manager and Director of Undersea Warfare Rapid Prototyping. "In ANTX events, actual prototyped systems are exercised, which enhances a mutual understanding of how to employ technology in realistic scenarios. The process gets the warfighter, the warfare centers, industry, and academia working side by side learning, sharing, communicating on the best ways to develop and deliver critical technology quickly."

Pier-side rapid prototyping was on full display at ANTX17 as research engineers and chemists from NUWC Newport's Energy

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and Propulsion Branch partnered with Riptide Autonomous Solutions to successfully test a proton exchange membrane fuel cell-powered unmanned underwater vehicle (UUV). This collaboration began at ANTX 2016 when research engineer and Navy diver Christian Schumacher, working with NUWC Newport's Engineering and Diving Support Unit, provided support to Massachusetts-based Riptide Autonomous Solutions, who was testing their micro-UUV.

"I brought the Riptide team from the dive boat to our Power and Energy tent and all of us quickly coalesced on one of our display fuel cells that would fit in their vehicle," said Schumacher. "In fact, Riptide brought an empty hull section over to our tent, and we dry fit the fuel cell real time."



NUWC Division Newport engineers Craig Urian, Christian Schumacher, and Charles Wesley test the proton exchange membrane fuel cell-powered integrated in a Riptide Autonomous Solutions micro unmanned underwater vehicle. (U.S. Navy photo by James Travassos)

The pier side collaboration between Navy, industry and academia exercised at ANTX is invaluable to the rapid prototyping process. In closing, Don McCormack, SES,

UNDERSEA WARFARE AVIATION COMMITTEE

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Designed as the eventual replacement for the legacy P-3C Orion reconnaissance aircraft, the P8-A is expected to have completely upgraded software by 2022, in time to become fully operational in 2023.

MH-60 updates could feed into Future Vertical Lift

<https://www.flightglobal.com/news/articles/mh-60-updates-could-feed-into-future-vertical-lift-435840/>

A set of mid-life updates to the US Navy's MH-60R Seahawk helicopter will likely appear in the Future Vertical Lift rotorcraft, along with the service's next MH-XX maritime helicopter, according to the H-60 programme manager.

In order to keep the MH-60 relevant through the 2030s and even 2040s, the Navy is planning a series of upgrades that will migrate new avionics and mission systems onto the existing aircraft. The service will implement HOST (Hardware Open Systems Technology) and the Future Airborne Capability Environment (FACE) standards, an open architecture initiative led by the navy that supports the integration of off-the-shelf hardware and common software across aviation platforms.

Those upgrades would begin in 2025 and continue over the next decade, and then migrate into the Navy's next generation helicopter, Capt Craig Grubb told reporters 3 April at the annual Sea Air Space conference outside Washington.

"Hopefully [we'll] migrate as either a risk reduction to whatever comes next from an air vehicle standpoint," Grubb says.

The modifications would come at the same time as the service's planned service life extension programme for the MH-60 and the open architecture capabilities wouldn't require redevelopment for the FVL or MH-XX, he adds.

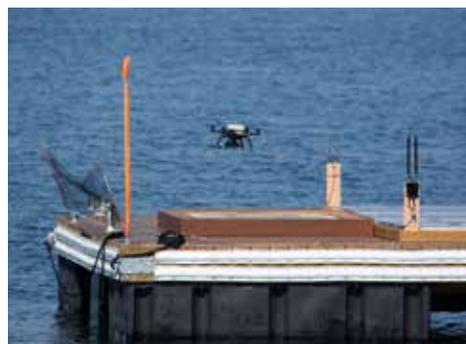
Apart from avionics, the next-generation helicopter may closely resemble the legacy MH-60. Whatever comes next for the Navy must fit into a destroyer's hangar, creating some unique requirements for the service's follow-on helicopter, Grubb says. The service hasn't thrown out the idea of a tiltrotor aircraft, but is steadfast on the destroyer requirement.

"It will be a similar size, similar shape-ish, at least from a fuselage standpoint [and], likely, how it's propelled, to be determined based on FVL or what we call MH-XX," he says. "We'll look at what that FVL might look like for a H-60 follow on."

UNDERSEA WARFARE VEHICLES COMMITTEE

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Executive Director for Naval Surface and Undersea Warfare Centers, said, "Events such as ANTX, with its focus on demonstrations of specific operational-based themes, underscore the value of rapid prototyping efforts. By incorporating warfighters' needs and focusing on the outcomes, we can make improvements that build on lessons learned and transition these new technologies more quickly than ever before."



Power Docks showcases its Autonomous Floating Micro-Grid Platform, demonstrating its air, sea, and underwater charging capabilities for defense applications and homeland security during the 2017 Advanced Naval

Training Exercise, Narragansett Bay Test Facility, Aug. 16. (U.S. Navy photo by James Travassos)



Naval Surface Warfare Center Indian Head Explosive Ordnance Disposal (EOD) Technology Division simulates threat detection and neutralization using a converted autonomous

Advanced Composite Riverine Craft (ACRC) to deploy a EOD unmanned ground vehicle. (U.S. Navy photo by Dave Stoehr)



U.S. Sen. Sheldon Whitehouse addresses the audience, while in the distance the ACRC heads out to exercise. On 16 August, U.S. Sen. Sheldon Whitehouse, U.S. Rep. David Cicilline and R.I.

Commerce Secretary visited ANTX17 at the Narragansett Bay Test Facility. (U.S. Navy photo by Rich Allen)

UNDERSEA MINE WARFARE COMMITTEE

JON TOBIAS – CHAIRMAN
ERIC HOLMES – DEPUTY CHAIRMAN



During this interim period between the last spring and the upcoming fall conferences, we were provided some additional insight from the Naval Surface and Mine Warfighting Development Command regarding areas where industry can assist and support to improve Mine Warfare (MIW) capabilities. The first area identified was regarding ‘in-stride’ data transfer to support Automatic

Target Recognition (ATR) and Post-Mission Analysis (PMA). Second, which also impacts the Undersea Vehicles committee, is the need for improved unmanned underwater vehicle (UUV) capabilities in support of MIW. The desired improvements include longer endurance, neutralization capability for in-stride detect-to-engage, modularity for sensor upgrades, and high sea state launch/recovery. Third, more durable, safe, and compact power supplies are critically needed. Fourth, there is a requirement for improved intelligence preparation of the environment (IPOE) and change-detect algorithm development. Fifth, as expeditionary forces assume a greater role in Mine Countermeasures (MCM), the Fleet is looking to employ MCM capabilities from platforms of opportunity that provide space, logistics support, and operational utility for self-contained capabilities with a small footprint. Finally, there is a movement to resurrect minefield planning and to develop advanced minefield planning capabilities.

The US Navy has spent substantial funds on programs to counter adversary mines via clearance or neutralization, from undersea, surface and airborne platforms. There have been numerous MCM programs as part of the MIW portfolio over the past two decades. MCM is a very hard problem with no silver bullet. Unlike MCM, focus and resources for mining programs have been few and far between until recently, and the future of advanced mining programs looks promising.

In conjunction with the fall conference theme, “Prepared for war...today?” and with a renewed focus on naval mining, it is noted that although the Navy spends less than one percent of its Total Obligation Authority (TOA) on MIW, and only about five percent of that is obligated for mining, that does not diminish the operational significance of mining capability. The Navy’s mine inventory consists mainly of the Quickstrike series mines that are aircraft deployed (primarily Air Force) that have been in service since the early 1980’s. Efforts to improve our mining capability have not been proven successful, with any programs started not proceeding too far; until now.

Driven by demands from the Fleet and the Combatant Commanders (COCOMs), there is a better appreciation for the advantages of an effective mining capability, one that can challenge our potential adversaries in numerous ways, threatening their fleets and sea lines of communication, altering

their tactical plans, and making them think about MCM and the consequences. Making the adversary spend significant resources and time conducting MCM, as has been done to the U.S. Navy, is long overdue.



Mk 62 Quickstrike Exercise Mines

Upgrades to the Quickstrike series mine, including stand-off delivery, extended-range and precision guidance, have recently been developed and tested. Innovative concepts for employing Submarine Launched Mobile Mine (SLMM) warheads are being considered. However, the future is in smart mines. Programs like the Clandestinely Delivered Mine (CDM), the Smart Mine Initiative (SMI), Advanced Undersea Warfare System (AUWS) and Mobile Undersea Effectors (MUSE) have been initiated to provide more precise, scalable, controllable and deliverable capability. The CDM has proceeded into engineering development model development and testing. Office of Naval Research (ONR) along with Naval Surface Warfare Center (NSWC) Panama City Division, is leading development efforts in AUWS and MUSE.

These smart mines are facilitated by efforts in unmanned vehicles such as Unmanned Underwater Vehicles (UUVs) and Unmanned Surface Vehicles (USVs). The Large Displacement UUV (LDUUV) and Extra-Large UUV (XLUUV) programs will support clandestine unmanned delivery of advanced smart mines. The Navy has a vision of even larger USVs than the Defense Advanced Research Projects Agency (DARPA)-developed Sea Hunter vehicle, enabling an alternative robust mine delivery method. Precise mine placement supported by new minefield planning tools, advanced sensors, reliable communication links, and remote-control capability, coupled with lethal and non-lethal weapons will provide a robust set of tools for use by the Navy, making the adversary rethink his strategy and MCM efforts.

An update to the US Navy offensive mining capabilities is long overdue and it is promising to see efforts underway to address this capability area. There is no reason to believe that the demand from the Fleet will cause a change in direction any time soon.

UNDERSEA WARFARE SENSORS COMMITTEE

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MR. PETER SCALA PEO IWS 5 NAVY LIAISON



The Sensors Committee fall session addresses sensor needs for submarines and surface ships as well as sensors on fixed surveillance systems, distributed netted sensors and unmanned vehicles. This year's theme "Prepared for war... today?" emphasizes the need for enhanced sensors and signal processing that provide improved performance as the demands on our warfighters increase. These sensors and signal processing will be necessary to maintain tactical and strategic awareness in the evolving maritime undersea battle space. During this session we will receive a brief from our Navy liaison Mr. Pete Scala, Director of IWS5A Advanced Development. Mr. Scala will discuss the AxB process, APB sensor algorithms and new conformal submarine arrays. Mr. Bill Traganza of PMS485 Maritime Surveillance Systems, will discuss new CONOPs, out-of-the-box re-architecting and technologies that are needed to keep pace with the threat and achieve the undersea dominance vision. In addition, we have two papers discussing DARPA's Mobile Off-board Clandestine Communications and Approach (MOCCA) that aims to achieve breakthrough capability for extended range submarine detection and precision target tracking.

"This year's theme "Prepared for war... today?" emphasizes the need for enhanced sensors and signal processing that provide improved performance as the demands on our warfighters increase."



These presentations are just a sample of the stimulating session we have planned. NDIA is a team effort. Forums such as the USW Division of NDIA bring together intellectual resources, i.e. the Uniformed Services, Navy Labs, Academia, and Industry. We all work together to share information, collaborate, and coordinate our investment resources so that we can provide the best systems to the warfighter. The presenters are key to the information transfer and I want to thank them for their effort. I want to thank Joe Cuschieri, the Deputy Chairman, for helping organize the agenda. Finally, I'd like to express our sincere appreciation to Pete Scala from the IWS 5 PEO who is the Navy Liaison for our USW Sensors committee. Pete has a wealth of pertinent experience and is a strong asset to the team.

UNDERSEA COMMAND, CONTROL, COMMUNICATIONS AND COMBAT SYSTEMS COMMITTEE

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Greetings, All! I'm looking forward to a great conference in New London! Any excuse to get out of this Washington heat is a good one. We have two great technical sessions lined up for Wednesday 20 September. In C4I, we have a series of presentations on theater ASW and the networks required to support it. This leads off with a presentation by Mike O'Hare, who is co-chair of the Theater ASW IPT, and includes a presentation by CAPT Michael Boone, Program Manager for Undersea Integration (PMW 770). In a combined Combat Systems and Warfighter Performance session, we will hear from CAPT Doug Adams, Program Manager for Undersea Systems (IWS5) on plans for the SQQ-89 USW combat system, and from CAPT Ron Toland, CO of the Fleet ASW Training Center on plans for officer and enlisted ASW training. And now, a word from our Technical Committee Liaison, CAPT Doug Adams:

IWS 5's mission is to develop, deliver and sustain ASW capabilities to dominate the undersea domain through exploitation of technology and streamlined acquisition. We do this across a large spectrum of systems and platforms including: submarine combat systems, surface ASW combat systems, surveillance sonar systems, CVN Tactical Operations Center, and ASW Command and Control. Consistent with messages from leadership, our cornerstones are rapid delivery, innovation, and bringing the warfighters into the development process to give them what they really need. Below I provide an update on our Theater ASW (TASW) and Undersea Warfare Decision Support System (USW-DSS), and SQQ-89 (surface ship ASW combat system) efforts.

TASW

The Navy is leveraging existing studies and campaign analyses to collectively determine how to best field an improved TASW capability. Collectively, the Navy is determining what existing Program of Record changes are needed to deliver a more interoperable family of systems. Key enabling requirements include fully-realized USW data fusion technologies, collaborative mission planning, networked communications systems, centralized data management, and flexibility/robustness.

These efforts continue to become better defined and systems engineering efforts will continue in FY18. I expect they will ramp up significantly in FY19 and tie into the delivery of USW DSS Fleet Capability Release (FCR) 1 in late 2020; all driven toward delivering the latest ASW capability to the warfighter.

USW-DSS

USW-DSS enables the ASW Commander (ASWC) to plan, coordinate, establish, and maintain an undersea common tactical picture to better execute tactical control. Employing net-centric decision-making tools in an open-architecture framework, it enables near-real-time sharing of key ASW tactical data and shortens the ASW kill chain. USW-DSS Build 2 Release 3 (B2R3) completed initial operational test and evaluation (IOT&E) in FY13. By the end of FY17, USW-DSS will be delivered to a total of 61 surface combatants, aircraft carriers, and shore commands. Fielding of the current build continues until 2020.

The next build of USW-DSS (Build 3 FCR 1) started this year and focuses on improvements at the TASW Commander's watchfloor. Prototyping is taking place now at CTF-34 with capability drops occurring as development continues. The first installation of FCR 1 is scheduled at the end of 2020.

AN/SQQ-89

The first installation of Advanced Capability Build (ACB) 13 was completed and other installations continue. ACB-13 continues to deliver improved capability to pace the threat. This build focuses on common displays to improve operator performance.



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NDIA HEADQUARTERS

Director, Meeting & Business Partnerships
Tammy Kicker
tkicker@ndia.org
Tel: (703) 247-9494

NDIA UWD NEWSLETTER

Published periodically to communicate activities and plans. For inputs or suggestions contact:
Laurie Carter, Editor
Rite-Solutions, Inc.
lcarter@rite-solutions.com
Tel: (703) 517-9904