

Undersea Warfare—Enabling the Spectrum of UxV, Communication, Sensor, Payload and Platform Capabilities

UNDERSEA WARFARE DIVISION



UNDERSEA WARFARE IN THE 21ST CENTURY – RADM SCOTT HEBNER, COMMANDER, NAVAL MINE AND ANTI-SUBMARINE WARFARE COMMAND (NMAWC)



RADM SCOTT HEBNER, USN
COMMANDER, NMAWC

It is with distinct pleasure that I introduce the NDIA Undersea Warfare Division's spring newsletter, a prelude to the Spring UWD Conference to be held in San Diego later this month. The partnership between our military and industry forms a critical foundation for our readiness, and in my first year as

Commander of the Naval Mine and ASW Command I have been thoroughly impressed by the USW Division and its leadership as they continue to exhibit persistence and commitment to ensuring our forces are fully prepared to meet current and future USW threats.

2010 was a watershed year for Undersea Warfare. Real world events clearly demonstrated the need for an effective ASW capability and also illustrated to potential adversaries just how deadly even relatively unsophisticated technology can be. While we at times have a tendency to focus our energies towards countering higher levels of sophistication, we cannot ignore simpler, cheaper, and more widely proliferated threats.

These messages were not lost on Navy leadership. Those global events highlighted that while progress is being made, much work remains to be done. Accordingly, the Chief of Naval Operations directed a focused, in-depth effort throughout the Navy to improve USN proficiency in undersea warfare. As a result, numerous efforts were either initiated or accelerated to ensure the Navy maintains a sufficient capability to defend the sea base against undersea threats. As has always been the case, industry partners are central to these efforts, and promising technical solutions continue to mature while new capabilities are being developed to help close identified gaps.

“The uncertainty and dynamic nature of our national security environment demands that our Navy field flexible systems that can adapt across and between warfare areas.”

While our capabilities are improving, capacity will continue to be a challenge. The uncertainty and dynamic nature of our national security environment demands that our Navy field flexible systems that can adapt across and between warfare areas. Single-mission focus is unrealistic and capabilities must be designed with an eye towards defeating multiple threats. In the case of USW, this is a natural concept given how the threat continues to evolve. As both mines and submarines become more sophisticated and widely proliferated, the ASW and MIW mission areas grow closer and closer together. Bottomed submarines and bottom mines present similar challenges in terms of risk, detection, and neutralization, and we must be able to leverage common solutions against each.

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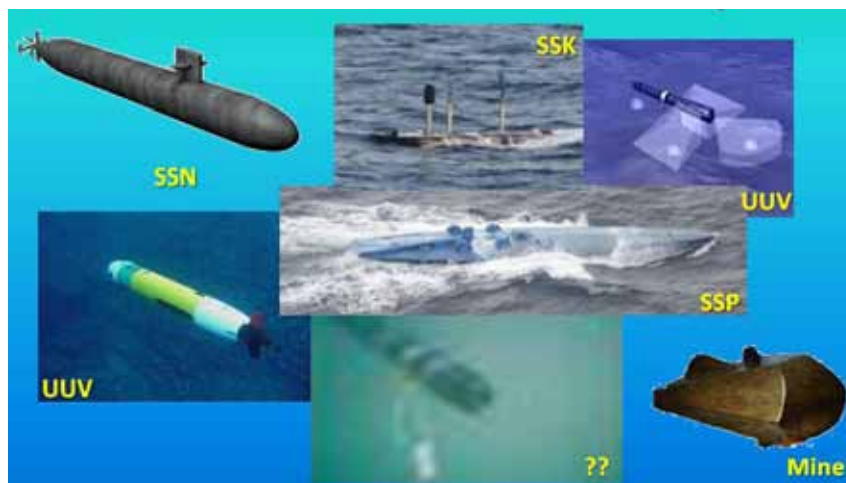
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Finally, any conversation discussing today's USW environment must include innovation and asymmetry.

The ever-evolving threat, the requirement for multi-mission capability, and the fiscal realities

facing today's military forces demand that we all consider innovative ideas and look towards ways to apply our strengths to a potential adversary's weaknesses. The double-edged sword of the information age has brought with it the high likelihood that our capabilities are being studied carefully, and that our reliance on high-technology solutions for warfighting is not lost on those who may someday wish to deny us free access to the seas. We, then, must also give due consideration to unconventional ideas and the potential employment of existing technologies in an innovative manner. Doing so will likely field a capability much sooner and at much less cost.



USW in the 21st Century – Submarine, UUV or Naval Mine...the lines are blurring.

While the challenges we face are considerable, they are not insurmountable given the talent and dedication I know pervades our partnership. I look forward to our individual and collective efforts as we work together to satisfy the biggest requirement of all: ensuring our young men and women have the best capability available to enable them to defeat any USW threat that they may face.

DIVISION CHAIR'S MESSAGE

RICK UDICIOUS, UNDERSEA WARFARE DIVISION CHAIRMAN



Almost half way through my term as chairman I would like to reflect on the best part of this job—the ability to recognize the achievement of key technologists and leaders in the field of undersea warfare and the awarding of stipends to those graduate students who will sustain our intellectual capital bench strength. Congratulations to each of these exceptional role models and upcoming champions

who are dedicated to an exciting and challenging mission! Just as recognizing this talent is important, we should all consider that sustaining our global leadership and national supremacy to dominate the undersea environment is dependent upon sustaining the pipeline of technical expertise. One area where we can all make a contribution and impact, independent of the fiscal budget, is leadership and mentoring of those who will carry forward the mission into generations to follow. Perhaps the greatest legacy of those of us baby boomers and cold war warriors will be the readiness of "Gen X & Y" to seamlessly take the reins and lead the way ahead. Being the father of five of these kinds of folks has provided some life lessons to me that we can and must facilitate and adapt to the dynamic and rapid environment. My oldest once told my middle child, "did you know that you've done more hands

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on work with technology in your high school and intern programs than I did as a junior in college?" (the gap was only seven years —perhaps a reinforcement of Moore's Law). One of the areas where I have asked our most senior division leadership to take a widened role is in the development of the next set of leaders for the Undersea Warfare Division and also to seek some diverse new talent as we turnover some of our ranks through retirements. Please join me in this rewarding volunteer effort as an investment in the security and competitiveness of our nation. I think you will also agree that the mentoring effect works both ways once the relationship matures.

I have heard continued positive feedback on our conferences, so thanks to the entire team which works tirelessly to provide our members the best quality venue and logistics for any such event. Thanks also to those of you who respond to our survey and provide constructive feedback; I hope you will notice that

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DIVISION CHAIR'S MESSAGE

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we have continuously improved the format and efficiency, many of these changes a direct response from member comments. In collaboration with the Naval Undersea Warfare Center (NUWC), we have now consolidated the process for classified information control and conference security measures to be the same for both the Spring and Fall Conferences. Although this is a "back room" process change, it reflects that partnerships can form the basis for efficiency and affordability. Thanks to RDML Tom Wears and the NUWC security team for enabling this process which will preserve our ability to sustain the conferences at the Secret Level of classification.

In our last newsletter we provided you some insight into the top issues facing the undersea warfare industrial base which we proposed to NDIA for integration into the annual top issues paper which is presented to DoD leadership. Below you will find a summary of the 2011 NDIA Top Issues with a link to the detailed

document. This year we will also compile the Undersea Warfare Division report on the USW industrial base which will be provided to the Secretary of the Navy as prescribed by our charter. If you have not seen the prior biennial report, it is available on the division website, and may provide those of you who are involved with strategy and planning a reference to support technology and market assessments. This is another key task of the UWD leadership team which presents a unified, non-company specific assessment and report on the successes and challenges facing us as we begin perhaps the most challenging decade for budget and military capability priority. As with sailing, the stronger the headwind the more significant each tack, so since we cannot change the forecast we had better be ready for sharp and focused changes.

Thank you for your engagement, leadership and support!

NDIA TOP ISSUES FOR 2011

In the Fall 2010 NDIA UWD Newsletter we presented the Undersea Warfare Division input for the top issues to be presented by NDIA to the Department of Defense. Our inputs, along with the other NDIA division inputs, were integrated and consolidated into five major issues, summarized below. As you can see, many of the challenges facing our companies are common across the defense industrial base. The full report, including the letter from NDIA's President to the Secretary of Defense, can be found at: http://www.ndia.org/Advocacy/Resources/Documents/LegislativeAlerts/Top_Issues_2011.pdf

ENSURE AN ETHICAL AND AGILE ACQUISITION SYSTEM RESPONSIVE TO THE DoD'S NEEDS

- Revise DoD business process reform
- Recognize and encourage industry profit driven methodology to reduce DoD costs
- Properly define and manage inherently governmental functions
- Revise the rules on organizational and personal conflicts of interest
- Improve education, training and retention of the federal acquisition workforce
- Continue to stress contractor ethical conduct
- Ensure that the government has full access to commercial products and services
- Improve the use of earned value management systems
- Repeal the three percent withholding on all government contracts

THE DEFENSE INDUSTRIAL BASE – NOW AND IN THE FUTURE

- Leadership and cultural perceptions
- Research and development in manufacturing
- Strategic manufacturing capabilities for national security
- Manufacturing workforce and infrastructure
- Facilitate a capable, responsive U.S. munitions base

INCREASE GOVERNMENT CONTRACT USAGE OF ALL SMALL BUSINESSES

- Disincentives for not meeting small business subcontracting goal
- Permanently reauthorize the small business innovative research program (SBIR)
- Comprehensive review of small business size standards for services industry
- Unified parity among all small business categories (8a, WOSB, VOSB, SDVOSB, HUBZONE, HBCU & MI, Indian Incentive [including Alaskans and Hawaiians], SDB) during federal contract competitions
- Impact of regulatory costs on small firms

SUSTAINING MILITARY READINESS WHILE PROVIDING FOR THE FUTURE

- Strengthen science, technology, engineering and math (STEM) educational opportunities for U.S. citizens
- NAICS codes for modeling and simulation
- Evolve enterprise information environments and security
- Increase funding for ground robotics research, development and engineering

SUPPORT EFFICIENT AND TRANSPARENT INTERNATIONAL ACCESS FOR THE U.S. DEFENSE INDUSTRIAL BASE

- Support the administration's export control reform initiative
- Improve defense technology transfers among U.S. partners and allies
- Approval of the U.K. and Australian defense trade cooperation treaties
- Increase congressional notification threshold

FALL 2010 NDIA UWD BRONZE AWARDS

BOB KITTREDGE, AWARDS CHAIRMAN



The NDIA UWD Bronze Award is issued 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 Undersea Warfare

Division seeks to: reward achievement in the field of Undersea Warfare; inspire accomplishment by other workers in the field; and increase public awareness of the field and its importance to Defense preparedness. The NDIA Undersea Warfare Division was pleased to present six Bronze Medal Awards during the Plenary Session of the Fall 2010 USW Conference in New London, CT to the following individuals:



DR. L. DALE BIBEE, NAVAL RESEARCH LABORATORY, STENNIS SPACE CENTER:

Dr. Bibee's contributions to NRL's "Through-the-Sensor" Marine Geosciences Program led to a capability to use the BQN-17 SONAR systems to provide critical environmental information. The use of fleet depth sounder systems to collect sediment

classification data enables war fighters to refine geoacoustic parameters for acoustic performance predictions for ASW and torpedo systems, support bottom-mounted systems, and predict the potential for burial of objects within sediments. These data can be taken in forward operational areas and applied to war fighting problems in real-time. The results of Dr. Bibee's work are being integrated into the Acoustic Rapid COTS Insertion 688i Legacy Replacement and eventually into all submarine depth sounders.



MR. BRIAN CONCANNON, NAVAL AIR WARFARE CENTER, PAX RIVER, MD: Mr. Concannon's contributions in the area of Light Detection and Ranging (LIDAR) systems development for Undersea Warfare applications have formed the basis for new, non acoustic Anti-Submarine Warfare (ASW) sensors.

His outstanding contributions and the dedicated support he has provided to the Naval Air Systems Command PMA264 Claymore Marine project as the Lead Engineer have led directly to the success of the Claymore Marine project. Mr. Concannon's untiring efforts, stellar work ethic, and vast knowledge of airborne LIDAR systems were instrumental in designing, building, and testing a critical new ASW sensor system.



DR. PIERRE J CORRIVEAU, NAVAL UNDERSEA WARFARE CENTER, NEWPORT DIVISION:

Dr. Corriveau is an internationally recognized expert in the area of tactical scale vehicle quieting and is a major contributor to the quieting technology that went from research & development into the production of the MK 48 ADCAP submarine launched

heavyweight Torpedo. As Chief scientist for Torpedo Radiated noise, Dr. Corriveau led the largest technology demonstration ever performed by the Navy at that time. As Principle Investigator for the Submarine Low Frequency Hull Array (LFHA) Noise Assessment Project he led the development of data analysis techniques that pinpointed the self-noise offenders and adaptive beam forming algorithms that mitigated self-noise sources.



DR. THEODORE M. FARABEE, NAVAL SURFACE WARFARE CENTER, CARDEROCK DIVISION:

Dr. Farabee's contributions in the area of Hydroacoustic Signature Control for Undersea Warfare applications are directly reflected in the enhanced stealth in SEAWOLF and VIRGINIA Class submarines. In particular, Dr. Farabee's contributions in

the understanding of hydroacoustics phenomena and the application of hydroacoustics to submarine design have allowed the Navy to achieve enhanced submarine survivability through increased stealth while reducing total ownership costs.

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FALL 2010 NDIA UWD BRONZE AWARDS



DR. GAIL W. "BILL" LAWRENCE, NAVAL SURFACE WARFARE CENTER, INDIAN HEAD DIVISION:

Dr. Lawrence is the Navy's lead formulator for underwater explosives and its expert on small-scale performance tests. Using these tests he has developed new explosive formulations at a fraction of the cost of traditional methodologies. By

applying fundamental chemical and physical principles to the art of explosive formulation, Dr. Lawrence has significantly improved the performance of underwater explosives. He has developed the tools to tailor the explosive to the application, whether the requirement is to optimize the shock effects, those of the bubble, or some combination of shock and bubble, to maximize damage to the target. Dr. Lawrence has developed and characterized over 250 new explosive formulations and some of the highest performing conventional underwater explosives known to date.



MR. WALTER N. RANKIN, NAVAL SURFACE WARFARE CENTER, PANAMA CITY DIVISION:

In Mr. Rankin's more than 32 years of service he has played a pivotal role in transitioning Mine Warfare from a dedicated warfare capability to an Organic Mine Warfare Capability. Mr. Rankin was one of the principle architects in

shaping the Navy's Mine Warfare Technology Program that transitioned to programs of record in organic mine countermeasures, including Coastal Battlefield Reconnaissance Analysis Systems (COBRA), Remote Minehunting Systems (RMS), AN/AQS-20A Mine Hunting Sonar, Airborne Laser Mine Detection System (ALMDS), Airborne Mine Neutralization System (AMNS), Rapid Airborne Mine Clearance Systems (RAMICS), and Organic Airborne Sweep Influenced Systems (OASIS).

Congratulations to our 2010 NDIA UWD Bronze Awardees.

NDIA UWD 2010-2011 ACADEMIC FELLOWSHIPS

DR. JIM KISENWETHER, ACADEMIC FELLOWSHIP CHAIRMAN



As the recently appointed chairman, I want to express my thanks to the previous chairman and my colleague at ARL Penn State, Dr. Charles Zentner, for assisting this transition. Chuck has retired to Florida and I am sure he is missing his involvement with UUV development activities.

The NDIA UWD has funded an Academic Fellowship program since 1990 for students pursuing graduate degrees in technology areas associated with undersea systems and environments. The purpose of these fellowships is to promote the education of scientists and engineers in knowledge areas critical to undersea system development and operation. Academic stipends of \$6000 are provided annually to a graduate student candidate at the University of Texas, the University of Washington, and the Pennsylvania State University.

The NDIA UWD Academic Fellowship awardees for the 2010–2011 academic year are:

JASON SAGERS has been awarded the NDIA UWD fellowship at the University of Texas at Austin. A Ph.D. candidate in Mechanical Engineering, his area of research is in shallow water ocean acoustic propagation modeling.

J. PAUL RINEHIMER has been awarded the NDIA UWD fellowship at the University of Washington in Seattle. A Ph.D. candidate in Civil and Environmental Engineering, his area of research is in infrared remote sensing of tidal areas.

SAMUEL DENES has been awarded the NDIA UWD fellowship at the Pennsylvania State University in State College. A Ph.D. candidate in acoustics, his area of research is in propagation of sound from water, through ice, and into the air in Arctic environments.

Congratulations to our NDIA UWD Academic Fellowship Awardees.

UNDERSEA COMMAND, CONTROL, COMMUNICATIONS AND COMBAT SYSTEMS COMMITTEE

PAUL ROSBOLT, CHAIRMAN
DR. BOB ZARNICH, DEPUTY CHAIRMAN
CAPT CHARLES DAVIS (PEO IWS5), NAVY LIAISON



Greetings All! As I write this in cold dark Rhode Island, I am really looking forward to the Spring conference! This year we have split the C4I and Combat Systems sessions apart in order to take advantage of the fact that we are in the home of the Space and Naval Warfare Systems Command (SPAWAR). My personal thanks go to RDML Jerry Burroughs (PEO C4I) both for his contribution to the newsletter (see below) and for his support in making his team available for briefings. CAPT Miguel San Pedro (PMW 770) will be speaking during the technical plenary, and several representatives from PEO C4I have papers for presentation during the technical sessions.

Thanks also to CAPT Charles Davis (PEO IWS5) for his participation not only in this conference, but in many in the past. CAPT Davis, our technical committee liaison for the past four years, is retiring from active duty this summer. He has written newsletter articles (see below), participated in committee meetings, and given numerous briefings.

As opposed to our usual practice, this year our committee meeting will be held during the lunch period on Wednesday, so that we can take advantage of the classified facility. We have some substantive issues to discuss—please try to attend!

The rest of this article comes not from me, but from two of our key Navy leaders—PEO C4I and PEO IWS5.

RDML JERRY BURROUGHS, USN, PEO C4I

Enabling Information Dominance

Articulated in "The U. S. Navy's Vision for Information Dominance" (dated May 2010), the Navy will seek to pioneer, field and employ game-changing capabilities to ensure Information

"...the Navy will seek to pioneer, field and employ game-changing capabilities to ensure Information Dominance over adversaries, and Decision Superiority for commanders, operational forces and the nation."

Dominance over adversaries, and Decision Superiority for commanders, operational forces and the nation. Information Dominance is the ability to gather, extract, analyze and employ information to gain a tactical advantage and/or deny an adversary the ability to do the same. Because the critical infrastructures of most advanced nations rely heavily on information technology systems, Information Dominance can also be used to destroy or disrupt an adversary's infrastructure to the point where they are no longer capable of effectively waging war. What previously required iron bombs can now, theoretically, be achieved using bits and bytes.

Headquartered on the Old Town Campus of the Space and Naval Warfare Systems Command in San Diego, the mission of the Program Executive Office for Command, Control, Communications, Computers, and Intelligence (PEO C4I) is to provide integrated communications and information technology systems that enable Information Dominance and the command and control of maritime forces.

To accomplish its mission, the 2011–2016 PEO C4I Strategic Plan established goals aimed at minimizing Total Ownership Cost (TOC) while delivering integrated capability; and fostering focused innovation to rapidly deliver relevant capabilities to meet existing and emerging warfighter needs.

TOC is the cost to develop, deploy, modernize and sustain a program or system throughout its life cycle. Today's budget climate demands that PEO C4I look for every opportunity to drive down this cost. Yet the Navy's operational climate also demands the rapid delivery of capabilities to offset adversaries who have instant access to cutting edge commercial technology.

To succeed in reducing cost while increasing its ability to deliver capability rapidly, PEO C4I is developing, integrating and



UNDERSEA COMMAND, CONTROL, COMMUNICATIONS AND COMBAT SYSTEMS COMMITTEE

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delivering C4I in a seamless capability that can support multiple mission areas. The goal is to consider the end-to-end objective while building the individual pieces of a capability, and deliver a package that connects to Navy and joint systems.

Three primary efforts are identified in PEO C4I's networks and satellite communication areas. One primary effort is the establishment of a common computing environment and services oriented architecture through the development and deployment of the Consolidated Afloat Networks and Enterprise Services (CANES).

CANES will provide common hardware and software infrastructures across all security domains. This commonality is designed to enable growth and scalability, while providing enhanced network security. This, in turn, will reduce TOC by significantly reducing the physical footprint; lower overall procurements costs by eliminating the need for applications to bring hardware; and lower logistics, training and testing costs as a result of common hardware.

To maximize the potential of CANES, PEO C4I must ensure ships are able to maximize the effective use of available bandwidth. This is the second effort, and is being addressed through the deployment of the Automated Digital Network System (ADNS). ADNS provides the tactical Wide Area Network (WAN) component for Navy and Marine Corps communications across afloat, airborne, submarine and shore platforms.

ADNS prioritizes and dynamically shares the bandwidth among the network traffic at varying security levels, ensuring a more efficient use of infrastructure resources. ADNS builds on mature communications technologies to provide a secure, reliable and tactical WAN that distributes IP traffic over multiple line-of-sight and satellite communications paths. Simultaneously, ADNS offers dynamic, flexible bandwidth allocation and localized quality of service monitoring and control.

In addition to the bandwidth enhancements provided by ADNS, the Navy Multi-band Terminal (NMT) will ensure the Navy has sufficient bandwidth to fully integrate its networks. NMT is the third effort and provides warfighters with high bandwidth, anti-jam and secure throughput for both tactical and strategic information and decision making. The system is designed to deliver four times more protected bandwidth, and more than 10 times the overall bandwidth of current Navy systems.

Highly valued by the fleet, this added bandwidth will ensure that critical missions such as time critical strikes, sea-basing and global missile defense can be accomplished when ordered. NMT also simplifies what is now a complicated arrangement of communication systems. Additionally, NMT reduces the number of

dedicated communication lines by using an "on demand" scheme that provides greater access to more users, while giving preference to the Navy's most urgent communication missions.

PEO C4I products like ADNS, CANES and NMT will provide a significant upgrade in C4I capability to the Navy. The combination provides Internet service provider-like capability and a modern server/application hosting environment with built-in information assurance, much like the commercial sector (e.g. IBM, Microsoft, Google, or Amazon).

Long term, PEO C4I is committed to strengthening engagement and alignment with its stakeholders, other systems commands and PEOs with an eye toward aligning portfolios and technologies to achieve maximum efficiency and effectiveness, in order to deliver the maximum capability to the warfighters.

CAPT CHARLES DAVIS, USN, PEO IWS5

As the Spring NDIA Undersea Warfare conference approaches, it is important to reiterate the fundamental role that industry continues to play in building, delivering and maintaining our nation's undersea warfare (USW) capabilities in the Fleet. Your perseverance, innovation, and leading technologies continue to keep the US Navy preeminent in USW.

As you continue this track record of excellence, three priorities remain: reliability, affordability and capability.

"Industry remains a cornerstone of undersea warfare."

Reliability, and more broadly, suitability remain mandatory for truly effective warfighting capability. As most of the Navy's undersea warfare systems now contain some aspects of COTS computing, and increasingly COTS networking and data exchange, system reliability faces many new challenges. Among these are ever-changing COTS products and COTS standards with their inherent obsolescence and interface issues. The Navy needs systems designed to support tech refresh and close configuration management of these COTS products and standards. Reliability must be built-in and then tested thoroughly, particularly the network aspects of the systems. Systems and networks should have built-in tools for health monitoring, diagnostics and maintenance. They should utilize redundancy and self-recoverability. Delivering systems without these attributes puts an undue burden on the operators and maintainers and invariably degrades system reliability. Too many of our current systems are requiring

UNDERSEA VEHICLES COMMITTEE

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TOM SHERMAN, DEPUTY CHAIRMAN
JIM GRIFFIN, NUWC DIVISION NEWPORT, NAVY LIAISON



OFFICE OF NAVAL RESEARCH HOLDS UUV INDUSTRY DAY

The Office of Naval Research (ONR) conducted an Industry Day on 8 February to present two upcoming Broad Agency Announcements (BAAs) for Unmanned Undersea Vehicle (UUV) Energy Systems. The Industry Day, held in Annapolis,

“The challenge was given to industry to provide an energy system that delivered as a minimum between 500 and 1000 Watt-Hours per Liter...(which) would support a threshold specification of just over 40 days mission duration for a Large Displacement UUV (LDUUV).”

centered on energy systems and discussions related to technology for energy dense air-independent, rechargeable/re-fuelable energy systems for long duration Unmanned Undersea Vehicles (UUVs). The challenge was given to industry to provide an energy system that delivered as a minimum between 500 and 1000 Watt-Hours per Liter, which is 5–10 times what current battery technology can provide. Such an energy

system would support a threshold specification of just over 40 days mission duration for a Large Displacement UUV (LDUUV). Higher capacity would be required to achieve the goal of a 70 day LDUUV mission. The ONR BAAs will be for two 24-month phases that are expected to be multiple award contracts with a goal of achieving Technology Readiness Level 6 for a land-based UUV energy section at the conclusion of Phase II.

HAAWC RFP DRAFT WILL SOLICIT INDUSTRY INPUTS

The High Altitude ASW Weapon Capability (HAAWC) Industry Day was held by the Naval Undersea Warfare Center last summer. The NAVSEA Program Management Office for Undersea Weapons (PMS 404) intends to release a draft Request for Proposals (RFP), which will include the HAAWC performance specifications, and will be looking for industry feedback to shape the final RFP.

SURFACE SHIP TORPEDO DEFENSE DELIVERY ACCELERATED

The Director of Surface Warfare (CNO N86) directed the Undersea Defensive Warfare Systems Program Office (PMS 415) to accelerate delivery of the Torpedo Warning System (TWS) and Countermeasure Anti-Torpedo (CAT) Surface Ship Torpedo Defense (SSTD) programs. The TWS and CAT programs are expected to be delivered as a User Operational

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our operators to spend valuable time and effort as network IT experts and maintainers rather than undersea warfighters.

Affordability is always a driver. In our constrained and shrinking budget environment, duplication of effort along with high development and unit costs are enemies of capacity. Employ common data strategies and propose software and hardware reuse across platform types. Work with customers to prioritize testing and requirements. Utilize strategies to manage COTS obsolescence through technology refresh and apply modular design approaches in hardware and software.

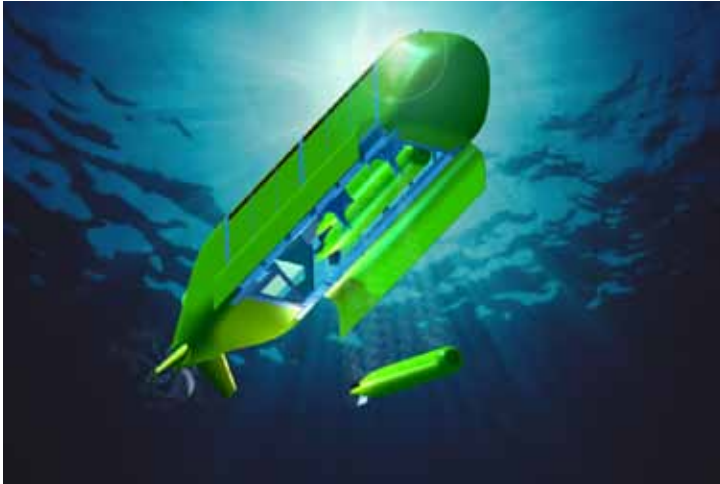
Fully effective warfighting **capability** must be delivered to the Fleet both reliably and in a timely manner. Periodic technology insertions and technology upgrades through proven Rapid COTS Insertion (RCI) approaches, and periodic software

capability additions via proven Advanced Processing Builds (APB) and Advanced Capability Builds (ACB) remain the preferred approaches. These are already implemented in the submarine acoustic and combat systems, and are now also part of the surface ship USW combat system approach. Additionally, Navy is interested in pursuing asymmetric approaches to USW that deliver increments of capability that are both potentially game-changing and affordable.

Industry remains a cornerstone of undersea warfare. Industry's continuously innovative approaches in improving system reliability, affordability, and capability will keep Navy USW peerless in the world.

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LDUUV CONCEPT (PHOTO CREDIT: U.S. NAVY)

Evaluation System (UOES), which is also known as a rapid prototype system. The TWS and CAT programs of record will continue in parallel for delivery after the UOES, thereby completing their qualification and at-sea test phases.

NAVY SELECTS NGCM DEVELOPERS

The Navy has selected Argon ST (a subsidiary of the Boeing Co.) and Ultra Electronics, in two separate contracts, to develop the U.S. Navy's Next Generation Countermeasure (NGCM). Both companies will be part of the Navy's Engineering and Manufacturing Development phase of the program that will provide the Navy with development models and test sets. The NGCM is an improved acoustic torpedo countermeasure that will provide improved performance over the current MK 2 and MK 3 countermeasure devices. The NGCM (designated the ADC-MK 5) will use advanced processors, a torpedo classifier, and full-duplex communications capability to allow it to communicate with tactical units and also with each other in a multi-countermeasure group environment. This capability will allow changing behaviors in a rapidly changing threat environment.

NAVY N2/N6 TALKS OF A FAMILY OF SYSTEMS FOR INTELLIGENCE, SURVEILLANCE AND RECONNAISSANCE (ISR) THAT INCLUDES UNMANNED SYSTEMS

At the recent Submarine Technology (SUBTECH) Industry Day held in Newport News February 15-16, RDML Klunder (OPNAV N2/N6) talked about providing "actionable intelligence to the warfighter" by increasing time on station with more collectors, use of plug and play sensors with automated processing, focusing collection, reducing manpower, the use of federated architecture enabling adaptive operations and information sharing, and maximizing use of existing shipboard interfaces and communications links. He spoke of the desire to use industry's expertise to gain technological maturity over time to achieve a goal of taking the LDUUV from concept to a Fleet asset by solving power and energy challenges, working communications and data exfiltration, protecting information and technology with information assurance and anti-tamper schemes, ensuring reliability, developing payloads, ensuring affordability, achieving launch platform compatibility, and use of open, scalable and modular autonomy.



BLUEFIN ROBOTICS ENGINEER PROVIDES UUV TRAINING TO MILITARY PERSONNEL (PHOTO CREDIT: COPYRIGHT © 2010 HENRICO BESTER)

UNDERSEA MINE WARFARE COMMITTEE

ERIC HOLMES, CHAIRMAN
 BARRY BAKOS, DEPUTY CHAIRMAN
 DONNA CARSON-JELLEY (PMS 495), NAVY LIAISON



Mine Warfare (MIW) covers a broad range of missions, programs, concepts and technologies. This is evident by the fact that PEO LMW has multiple program offices (I count five – PMS 495, PMS 403, PMS 406, PMS 420 and PMS 408) responsible for a multitude of programs. This year's Spring Conference provides a focus on

mine neutralization in the littorals and very shallow water (VSW), as well as offensive or strategic mining technologies with the Advanced Underwater Weapons System (AUWS). Together they represent approximately half of the presentations. MIW typically is about shortening the Detect-to-Engage (DTE) time line; however, there is renewed interest in mining which can allow us to take the fight to the adversary, providing a capability that has deteriorated in the U.S. Navy, which may be poised to experience a resurgence.

“Mine neutralization systems must address the full spectrum of the mine threat from buried mines to floating and drifting mines, from deep water to very shallow water.”

Mine neutralization systems must address the full spectrum of the mine threat from buried mines to floating and drifting mines, from deep water to very shallow water. ONR and NSWC Panama City (PC) have active S&T efforts for VSW and the littorals, and PMS 495 is taking the Airborne Mine Neutralization System (AMNS) program through developmental testing this year and technologies to address surface and near surface mines have been initiated. Technologies to support in-stride neutralization, key to reducing DTE timelines, are showing promise. PMS 408 is initiating the Expeditionary UUV Neutralization System (EUNS) program, scheduled for FY 2012, with the objectives of providing a faster, more efficient, and more effective solution for our expeditionary forces.

The MIW community is a major player on the Littoral Combat Ship (LCS), getting the Mine Counter-Measure (MCM) Mission Package (MP) tested and deployed. PMS 420 has declared 2011 “The year of MCM on the LCS” which will be accomplished later this year through testing on LCS-2. MCM MP Increment 1 consists of the AMNS, the AQS-20A, the Airborne Laser Mine Detection System (ALMDS), and the Unmanned Surface Sweep Vehicle (USSV). In October 2010 the MCM MP completed its end-to-end testing Phase 3; results to be released sometime in the near future. MCM Developmental Testing (DT) will occur on LCS-2 in 4Q FY 2011 and then back on LCS-1 by the end of 2012.



**MCM-8 USS SCOUT;
 MCM-11, USS GLADIATOR
 PHOTO CREDIT: U.S. NAVY**



The Remote Minehunting System (RMS) is the acknowledged workhorse of the LCS MCM Mission Package. The RMS is undergoing its Reliability Growth Program, having successfully passed the Nunn-McCurdy Certification in 2010, and has been designated an ACAT ID program. The planned buy of 54 Remote Multi-Mission Vehicles (RMMVs), coupled with the AQS-20A, will provide an outstanding mine hunting capability.

More than ever, the future of unmanned maritime vehicles (USVs and UUVs) and MCM are integrally linked. Just look at the RMS, the Unmanned Influence Sweep System, EUNS, and implementation of buried minehunting from the Surface MCM UUV. PMS 406 is the lead for USVs and is planning the future Multi-Function MCM USV program that will specifically address an MCM “in-stride” neutralization capability. The Navy's MIW leadership continues to show the future of MIW to be evolving towards unmanned MIW, the objective beyond the LCS. This would include MIW as a key mission for the Large Displacement UUV (LDUUV) program.

The U.S. Navy's mining capability has been atrophying for years, with the only remaining mines being the Quickstrike family, which can only be air deployed. The development of a much more robust mining capability has been gaining momentum for a number of years, led by the Naval Mine and ASW Warfare Command (NMAWC). The mining Initial Capabilities Document (ICD) was approved in October 2010. Requisite technologies have matured with the work at NSWC-PC to provide substantial improvements over the Quickstrike mines, eventually through the AUWS program. The US Navy spends an inordinate amount of the MIW budget on MCM, due to the adversary's mining capability and the significant damages that mines can inflict. It may be the right time for the U.S. Navy to give our adversaries the same problem that we have with mines. Hopefully we can expect to see a program and the budget for a new mining capability in the near term?

The MIW community always works under a constrained budget. Recognizing this fact, and yet having to support numerous current surface and airborne MCM systems in addition to the

UNDERSEA WARFARE AVIATION COMMITTEE

DAVE NELSON, CHAIRMAN
GLEN SHARPE, DEPUTY CHAIRMAN



2011 is a milestone year in Naval Aviation as we celebrate its 100th anniversary. Aviation has always played a major role in Undersea Warfare and the Centennial is a chance to honor those



“2011 is a milestone year in Naval Aviation as we celebrate its 100th anniversary.”

Recently, one of two static test planes completed full scale testing on the P-8A airframe. The first static test aircraft underwent 154 different tests with no failure of the primary structure. The second aircraft will begin fatigue testing this year.

The U.S. Navy plans to purchase 117 production P-8A aircraft to replace its P-3 Fleet. IOC is planned for 2013 at NAS Jacksonville, Fla.

UPGRADES MAKE P-3 ORION MORE EFFICIENT, MORE EFFECTIVE FOR THE FLEET

Newly installed computer hardware and software on-board the P-3C Orion will save the Navy money while making the aging aircraft a better submarine hunter.

The Naval Air Systems Command (NAVAIR) recently delivered to the Fleet ten newly configured Orions installed with an upgraded acoustic system, called the Acoustic Receiver Technology Refresh (ARTR). Acoustic systems with ARTR are a vital component of the P-3C mission systems, enhancing the ability to receive and analyze sonobuoy data - a primary function of the P-3C mission. This latest upgrade continues the process of bridging the gap in technology between the Orion and the P-8A Poseidon and becomes the catalyst for commonalities among Fleet aircraft.

NAVAIR plans to deliver 74 mission-ready Orions installed with ARTR by 2012. During the next two years, P-3 acoustic system upgrades will be aimed at improving system maintainability and digital sonobuoy monitoring capability, increasing system archi-

Undersea Warfare Aviation Committee continued on page 12

who have gone before us in the defense of our nation. Follow the link below to the "CONA" website for those interested in following the yearlong celebration and the associated events.

<http://www.public.navy.mil/airfor/centennial/Pages/welcome.aspx>

As we head into the Spring Conference, the FY 2012 budget recommendations have been submitted to Congress. A review of the available documentation indicates that the aviation portion of the USW portfolio did well in the FY 2012 budget and indications are that the FY 2012 budget sustained the Navy's desire to recapitalize its aviation capability. Highlights of the state of USW aviation over the last few months are illustrated in recent articles found in the following NAVAIR public affairs releases:

NAVY TO BEGIN INITIAL PRODUCTION OF P-8A

The U.S. Navy signed its first Low Rate Initial Production contract that includes spares, logistics and training devices. Production of the first LRIP aircraft will begin this summer.

Three of the six flight test aircraft, built as part of the System Development and Demonstration contract awarded in 2004, are in various stages of testing at Naval Air Station Patuxent River, Md. The Integrated Test Team has conducted sonobuoy releases and counter measures deployments.

UNDERSEA MINE WARFARE COMMITTEE

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new LCS system that will soon enter the fleet, PMS 495 has initiated a MIW Open Architecture (OA) roadmap. The OA effort is intended to be an enabler for future MIW business, supporting added capability through technology insertion into fielded systems. Industry is invited to participate through interaction with the government and the program office. This open architecture effort and a corresponding open business model should facilitate getting improvements into the MCM systems both cost effectively and on reasonable schedules.

Finally, shortening the DTE timeline, while keeping both the sailors and ships out of the mine field, has been and will continue to be a primary objective of our MCM efforts. Despite the phasing out of traditional dedicated MCM assets, complemented and eventually replaced by the LCS MCM Mission Packages, and ultimately MIW systems implementation on unmanned systems, the DTE timeline objective needs to be aggressively pursued. There are many challenges ahead for the MIW community; this Committee (Industry, Government and Academia) can be a means to help meet those challenges.

LCS-1, USS FREEDOM;
LCS-2, USS INDEPENDENCE
PHOTO CREDITS: U.S. NAVY



UNDERSEA WARFARE AVIATION COMMITTEE

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ture openness, and growth of multi-static sensor processing capability. After the initial upgrades to the Orion, both the P-3C and the P-8A will undergo the second phase of system upgrades called the Acoustic Processor Technology Refresh (APTR). APTR will enable both maritime patrol and reconnaissance aircraft to operate using a similar set of acoustic software by 2014.

NAVY PLANS MH-60R UPGRADES AND SUPPORT

The U.S. Navy is making significant upgrades to the MH-60 Seahawk anti-submarine and anti-surface helicopter. A five-year contract runs through 2013 for 131 MH-60Rs.

Beginning construction on the next MH-60R mission suites:

The Navy awarded a \$72.6 million contract for an additional 24 MH-60R mission avionics suites and 18 common cockpits for the MH-60S. The advanced acquisition contract covers long-lead items for the helicopters and cockpit systems. To date over 85 MH-60Rs and are on track to reach the century mark early in 2011.

Better periscope detection: One of the most highly advanced systems aboard the MH-60R – Automatic Radar Periscope Detection and Discrimination (ARPDD) – is under a \$36 million contract to transition the program from system development and demonstration to production.

In October 2010 the Navy successfully completed initial flight tests of the system aboard an MH-60R. The flights marked the first time a helicopter has had the functionality for its on-board radar to automatically discriminate between a periscope and other small surface objects, significantly improving the probability of finding a submarine.

The Navy will continue to test the ARPDD system in various environments prior to it entering operational evaluation in 2012. Initial operational capability is expected in 2013 aboard the 150th production MH-60R helicopter.



THE U.S. NAVY AWARDED \$360 MILLION IN CONTRACTS TO EXPAND THE CAPABILITIES AND SUPPORT FOR THE MH-60R SEAHAWK. (PHOTO CREDIT: U.S. NAVY)



MH-60R SEAHAWK. (PHOTO CREDIT: U.S. NAVY)

HIGH ALTITUDE ANTI-SUBMARINE WARFARE (HAASW)

HAASW integrates new and modifies existing sensors to enhance the P-8A capability to conduct ASW at altitudes up to FL250 and higher. Real time data will be used to update onboard Mission Planning Tools (MPT) for non-acoustic sensor optimization and Tactical Decision Aids (TDAs) for accurate sonobuoy release points. Sonobuoy modifications include integrating GPS for precise sonobuoy positional information and a digital uplink/downlink for Radio Frequency Interference (RFI) management. New sensors include a Meteorological Sensing Device for sensing atmospheric conditions from the aircraft altitude to the surface.

MULTI-STATIC ACTIVE COHERENT (MAC)

MAC is the third generation of multi-static active acoustic search systems to be developed under the Multi-Statics Family of Systems. MAC brings coherent acoustic source technology (SSQ-125) and improved signal processing to the air multi-static active ASW mission set. The coherent pulses or series of pulses provide waveform flexibility including Doppler-speed sensitive and frequency modulated (FM) clutter suppressing capabilities. The MAC program will also provide updated tactical and mission software on the P-3C Anti-Surface Warfare Improvement Program (AIP), an updated Mission Planning Tool (MPT), an updated Ground Replay System, updated TacMobile products (SPAWAR), and an updated Tactical Operational Readiness Trainer (TORT).

Once again, the Aviation USW technical session has an excellent mix of platform and sensor program status overviews along with both acoustic and non-acoustic sensor technology presentations. We look forward to your participation.

UNDERSEA SENSOR SYSTEMS COMMITTEE

JOSE RIO, CHAIRMAN
 JUERGEN KEIL, DEPUTY CHAIRMAN
 CAPT MICHAEL BYMAN, USN (PMS 401), NAVY LIAISON



Our theme for this year's Spring Conference is Undersea Warfare—Enabling the Spectrum of UXV, Communication, Sensor, Payload, and Platform Capabilities. We have a diversified list of mandates that we must satisfy to maintain superiority of the seas and that enable projection of power anywhere on the globe while protecting our homeland and our war fighting assets.

Programs of record are pushing flank array technology, moving forward with CAVES, and executing at sea testing to validate Large Vertical Array performance. Surface ship programs, such as the AN/SQQ-89(V) 15, are progressing with Multi-Function Arrays, Trainers, Continuous Active Sonar (CAS), Computer Aided Dead Reckoning, and improved streamlined maintenance. CAS represents a departure from the generic active search that promises to yield performance benefits, and trainer improvements are always important if we are to maintain readiness.

Distributed Netted Sensing Systems (DNS) have become increasingly important. Particular emphasis has been given to agility in positioning sensors in critical areas as these evolve. As an example, autonomous array burial can be used to position assets where they are needed. There has also been progress in distributed deep water use employing Active Sonar and in reconfigurable autonomous sensor deployment systems. Fiber-optic networks linking Reliable Acoustic Path (RAP) detection nodes featuring in stride placement support fast adaptation to mission needs and combine fiber and free space links to address information bandwidth demand.

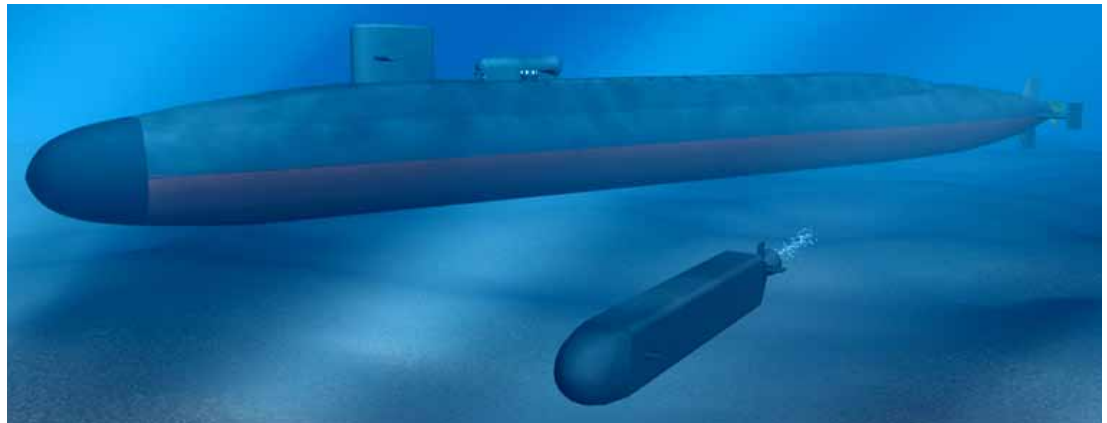
Other sensor technologies such as the low power space comprehensive surveillance radar yields performance while remaining inconspicuous. Utilization of electric field sensing to provide an independent degree of freedom increases the probability of correct target classification. Innovative mast designs are effectively minimizing self profile and reducing the probability of being detected by the adversary. The use of the anti-spoof navigation technology improves the reliability of our platform navigation systems.

There are efforts to protect High Value Assets (HVA) in constrained areas that embrace the range of potential threats including swimmers, conventional mines, Unconventional Underwater Improvised Explosive Devices (UWIEDs), and suicide divers.

“We have a diversified list of mandates that we must satisfy to maintain superiority of the seas and that enable projection of power anywhere on the globe while protecting our homeland and our war fighting assets.”

Spatial audio is being exploited to appeal to the sonar operator's sense of direction to significantly enhance situational awareness and improve contact management in submarine operations. Tools are becoming available to evaluate capabilities for ASW platforms. These refine the identification of needs and complement the process with sea data evaluation to provide the sense of direction needed to apply the newer technologies, develop effective training, and improve tactics.

Low frequency multi-aspect broadband techniques are being used to extract structural parameters from buried and water column objects using synthetic apertures and provide classification capabilities in the difficult shallow environments. Moreover, automatic classification is enabled using Relevance Vector



Machines (RVM) to enhance existing capabilities. Physically small three dimensional vector sensors promise detection with high localization accuracy. The use of environmental factors to improve operational tactics promises to improve the gain/hold of contact events and avoid loss of contact events.

There has been considerable activity on non-penetrating systems that aim to provide not only data connectivity but also power. The state of the technology for broadband projectors has been steadily progressing and supports low frequency operation with high source levels and relatively high duty cycle operation.

I want to extend my thanks to Juergen Keil, our UWD Undersea Sensor Systems Committee Deputy Chairman, for providing invaluable assistance in organizing our agenda this spring. I also want to thank Kim Williams and CAPT Bruce Roulstone, USN (Ret), who as always provide excellent support. I also want to thank CAPT Michael Byman, USN (PMS 401), our Undersea Sensor Systems Committee Navy Liaison, for his support.

FALL 2010 SPEAKER'S DINNER



FALL 2010 CLAMBAKE



SPRING 2011 UNDERSEA WARFARE DIVISION CONFERENCE

MARCH 28–31, 2011

WAYNE JAKUBOWSKI, SPRING CONFERENCE CHAIRMAN



This year's Spring and Fall undersea warfare conferences are being jointly sponsored by NDIA and the Naval Undersea Warfare Center (NUWC). I would like to specifically thank RDML Wears for his support and co-sponsorship, ultimately enabling the Spring Undersea Warfare Conference to take place.

This year's spring conference has attracted another great line-up of speakers to address a variety of topics under the theme of "Undersea Warfare – Enabling the New Generation of UxVs, Communications, Sensors, Payloads, and Platform Capabilities." In addition to being one of the CNO's focal points, UxVs with meaningful payloads are poised to fundamentally change the landscape of undersea warfare for the next several decades. Our conference will serve to keep the dialogue forward reaching as we come to grips with the many implications associated with this year's theme.

To further improve the value of this conference for all attendees, we have instituted a few important format changes. Principal among these changes is the addition of a Technical Plenary Session scheduled for Wednesday morning. This plenary, will consist of the key program/organization briefs normally given to "standing room only" committee sessions. Since these briefs have been so well attended during past conferences, but were not able to be attended by all, they have been selected for presentation in the Wednesday morning plenary forum. These key technical topics and associated speakers are being chosen by each committee area.

Following up on her remarks from last spring, RADM Wendy Carpenter is back to update our conference on the progress of her undersea warfare related CNO tasking. In addition, our new COMSUBFOR, COMSUBPAC and OPNAV N87 will attend and brief us on their perspectives. Presentations from ONR, NUWC and NSWC labs are new this year and should provide the unique insights from their undersea warfare focus areas.

In addition to presenters mentioned above, we will also receive briefings from the Naval Mine and ASW Command (NMAWC), OPNAV N2/N6F2, PEO LMW, PEO IWS, PEO SUBS, The Farragut Technical Analysis Center, and SPAWAR. This combination of presentations will be challenged with covering the full breadth of the critical undersea warfare mission area. To supplement this, Tuesday's plenary session and Wednesday morning's technical plenary are followed by a series of technical sessions, in different tracks, which are all easily attended within the Admiral Kidd Conference Center, San Diego.

"In addition to being one of the CNO's focal points, UxVs with meaningful payloads are poised to fundamentally change the landscape of undersea warfare for the next several decades."

This year's classified conference will have technical tracks that include: Aviation USW, C4I (new with its own technical track), Combat Systems, Mine Warfare, Undersea Sensors, and Undersea Vehicles. A strong group of papers will be presented for each technical committee area and the results of key NDIA projects will be addressed.

To round out the conference an award ceremony will be conducted on Tuesday, 29 March, during which we will name this year's recipients of three prestigious awards, presented to those who have made key contributions to Undersea Warfare.

As far as logistics, buses will transport conference personnel from the Hyatt Regency Islandia to the Admiral Kidd Conference Center each day of the conference. Dress for conference attendees is business casual (slacks, collared shirts, NO Ties) for industry and Khaki for military. Casual attire is appropriate for our continuing and very popular Mongolian Barbecue to be held Tuesday evening at the Hyatt, immediately following the plenary session.

We look forward to a professionally rewarding conference, great weather, and both plenary and technical sessions that push our thinking and create ideas to solve the challenges of the undersea warfare domain.



NMAWC COMPLEX, NAVAL BASE PT. LOMA

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