

The USW Force the Nation Needs: Distributed, Netted, Capable, Agile

UNDERSEA WARFARE DIVISION



EXPANDING THE UNDERSEA ADVANTAGE



Donald F. McCormack
Executive Director, Naval Surface Warfare Center (NSWC) and Naval Undersea Warfare Center (NUWC)

The Chief of Naval Operations (CNO), Adm. John Richardson recently outlined six elements required to achieve and maintain the “Navy the nation needs” to meet the demands of the National Defense Strategy released in January – a bigger Navy, a better Navy, a networked Navy, a more talented Navy, a more agile Navy, and a more ready Navy – and emphasized that these elements must be developed in balance to achieve “wholeness.”

We can readily see the Naval Undersea Warfare Center (NUWC), in close cooperation with industry and academic partners, in each of these elements, though our most compelling role may lie at the nexus of several of them to build a larger, more distributed, and more capable battle fleet. We are responsible for providing the necessary technologies and recruiting the right talent with the right skills to enable the fleet and our warfighting mission. Urgency, effectiveness, and expediency are the overarching themes in how we conduct our business.

The increasingly competitive and fast pace of our security environment has focused pressure on demands to build a fleet of at least 350 ships. A bigger Navy is a more powerful Navy, and one way to increase naval power is to simply build a bigger fleet. However, as the CNO has emphasized, more



Rear Admiral Moises DelToro, III
Deputy Commander for Undersea Warfare, Naval Sea Systems Command (SEA07); Commander, Naval Undersea Warfare Center

A more talented Navy is characterized not only by greater numbers of personnel, but by different training and skill sets.

platforms are necessary but not sufficient; we also need new technologies and operational concepts: “A 355-ship Navy using current technology is insufficient for maintaining maritime superiority.” The CNO further singled out capabilities such as directed energy, electromagnetic maneuver warfare, machine learning, and other innovations, including a family of unmanned systems. At the Warfare Centers, our engineers and scientists are involved in all of these areas and are also teaming with the naval shipyards to bring innovative approaches to in-service methods and help improve the readiness of our current force, an effort that will get ships and submarines out of availabilities more quickly to increase naval presence and power.

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A more talented Navy is characterized not only by greater numbers of personnel, but by different training and skill sets. The workforce of the future must be technology integrators as well as developers, able to utilize a system-of-systems approach to drive rapid systems integration, apply platform considerations such as survivability and invisibility, and work with an awareness of capacity. They will repurpose commercial off-the-shelf technologies and apply them to the ever-changing demands of the fleet, and be adept at combining technologies with operational concepts in novel and clever ways. We can also anticipate the need to build skills in artificial intelligence, analytics, and man-machine interface in support of autonomous behaviors. Others, such as adeptness at virtual collaboration, will facilitate work on state-of-the-art simulations and networking capabilities for our customers, anytime and anywhere, while reducing cost, risk, and development time.

To help guide us, the Warfare Centers are continuing to build and refine Long Range Research and Development Plans for surface, undersea, mine and expeditionary warfare mission areas, as well as for platforms and lifecycle support that focus on technologies that will affect situational awareness, command and control, and engagement to identify the future technologies the Navy will rely upon. We also continue to revise our Naval Innovative Science and Engineering (NISE)/Section 219 investments, which allow demonstration labs to stretch the “art of the possible” even further in the face of changes to the playing field. These investments offer myriad partnership opportunities for industry and academia. When one of these topic areas shows promise, we have avenues such as the Small Business Innovation Research program to transition capability to the fleet.

Our contribution to giving the nation the Navy it needs lies in our ability to provide unique technical insights on the cutting edge of undersea domain research and development, ensuring that the undersea warfare (USW) science and technology portfolio is aligned with the CNO’s guidance, while simultaneously supporting the submarine fleet. This dual path forward as we build, maintain and innovate is unlikely to be linear; our success will depend on combined ability to find the intersection of getting larger and more distributed, agile, and capable. Every two years, the NAVSEA 073 team develops the objectives that communicate how we can attain leadership’s goals in the USW Science and Technology Objectives (STOs). To support this effort within the undersea domain, we conduct research across a broad spectrum of areas to deliver the best future warfighting capabilities to meet current and emerging needs. Our science and technology portfolio attempts to balance near-term needs without sacrificing basic research or the pursuit of long-term revolutionary technologies tied to future capabilities. The distribution and balance among these efforts is critical to ensure that our USW science and technology investments are healthy, relevant, and address real needs and requirements. The selection and development process attempts to cast the widest net from the outset to identify the science,

technology, and concepts that may have a direct application to the undersea warfighting domain. We are in the process of finalizing the 2018 USW STOs and expect to release them at the Submarine Technology Symposium in May.

We are also pursuing capability to address the challenges of communicating among various undersea nodes. A networked Navy can more effectively share data across the force and leverage increased awareness. Sensors, unmanned vehicles, platforms, weapons, command/control, and most importantly, human systems, all networked and communicating, can create effects that can be summoned to the warfighter’s advantage. Dramatic breakthroughs in technology and information availability and the intersection of big data with pervasive, high-fidelity sensing and deep learning offer unprecedented opportunities for the Naval Research and Development Establishment. A networked Navy requires that we technologically and operationally embrace “information-rich” conditions in which an adequate number of sensors, communicating with each other and platforms throughout the battlespace, will create and share sufficient information to support operations. However, as we rely on information systems to create a tactical and operational advantage, we must recognize that we may need to operate these systems in environments where communications are degraded but indispensable. It also requires a shift to “autonomy rich” conditions, in which an increasing number of simultaneous operations are supported by netted systems, onboard and off board, without placing added demands on Sailors.

A more agile Navy leverages the “dynamic tension” between the technologies available to the fleet and the concept of operations under which it operates. Mission engineering is crucial to getting any technology or capability into the fleet, so the Warfare Centers are working with our partners to perform the quantitative “what if” analysis on current systems-of-systems employment to ensure there is a well-prepared landing spot for that capability. Our commitment to deliver technical solutions to keep our warfighters on the winning side, and to verify the quality, safety, and effectiveness of platforms and systems was reflected in the nearly 4,000 “touches” the Warfare Centers executed in direct support of the fleet last year.

As we look at the technology that will emerge in near term and over the next 30 years, one conclusion is clear - we will need a deep bench to develop and transition unmatched capabilities quickly to the fleet. To get there, we are harnessing several new processes to open avenues for partnerships and collaboration with other government, industry, and academic organizations. These include the Navy’s adoption of rapid prototyping and the use of “other transaction authorities” (OTAs) to speed up the government contracting process while increasing levels of transparency, communication and most importantly, innovation. NUWC recently released a request for proposals utilizing the formal OTA process, which seeks to establish an Undersea Technology and Innovative Maritime Systems Consortium to

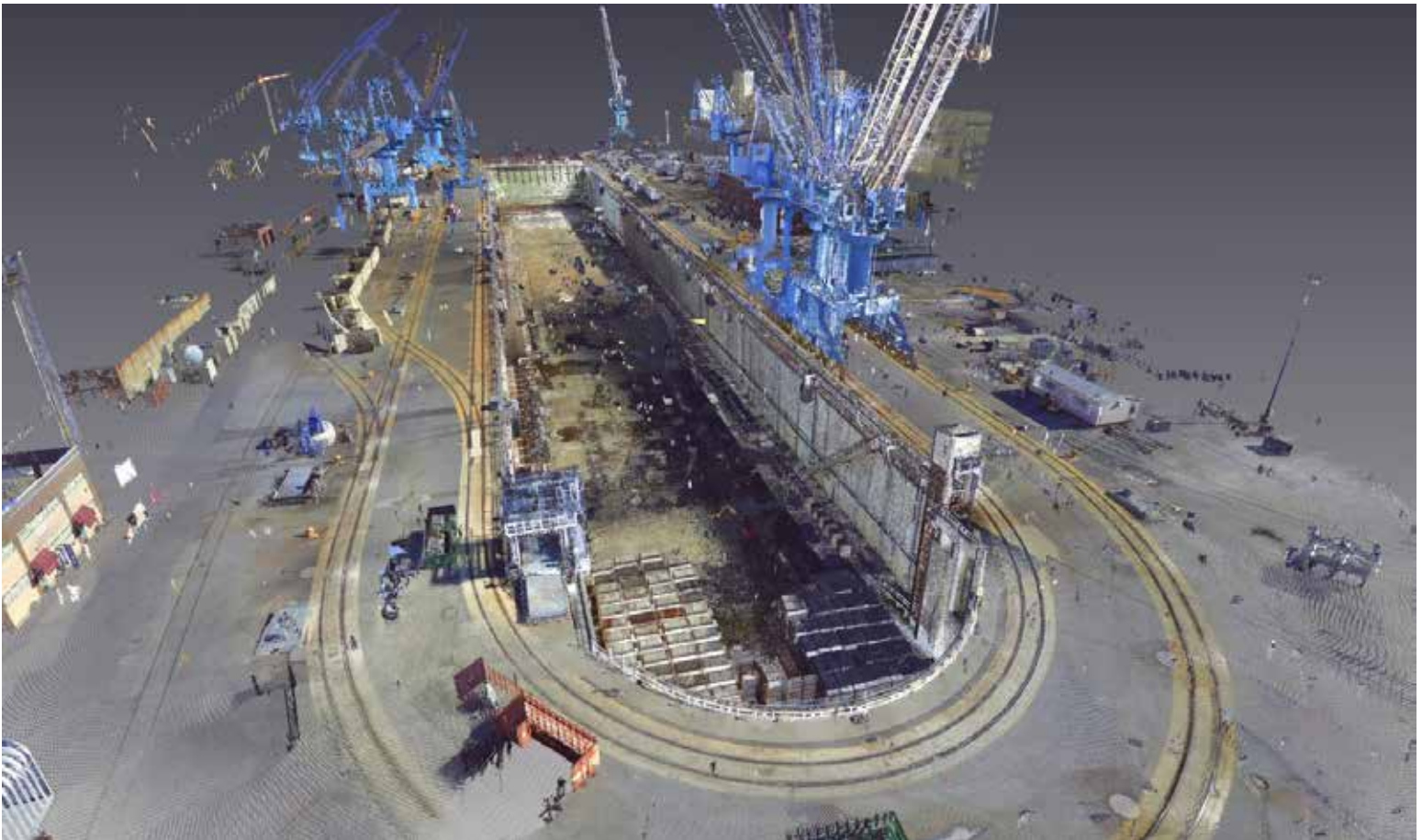
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make it easier for non-traditional businesses to work with us and our established industry partners. We are in the final stages of source selection and will announce the government/industry partnership very soon, at which point we will provide details on how you can join the winning consortium. Following the announcement, we anticipate scheduling an industry day later this year.

We are committed to forging partnerships based on shared risks and shared rewards, so we can all benefit. Working together –as a whole across government, industry, and academia – we are confident that we can expand the undersea advantage and give the Navy the USW capabilities it needs to compete, to deter, and to win.

A 3-D point cloud representation of Dry Dock 8 at Norfolk Naval Shipyard was created by engineers from the Advanced Data, Prototyping Technologies, and Virtual Environments Lab at NSWC Philadelphia Division. The NAVSEA Warfare Centers are collaborating with naval shipyards to bring innovative approaches to in-service methods and help improve the readiness of our current force.



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 the Spring Conference. Our goal is to provide you the best classified forum for understanding the Navy's vision, objectives and plan for maintaining undersea warfare superiority; and the best opportunity to interact with our diverse undersea warfare community. Please provide feedback on how we are doing and how we can improve.

I am pleased to announce that John Holmes has taken on responsibility as Chair for the Spring Conference. Many thanks to John, the technical committee chairs, NDIA and our govt. partners for the putting this conference together.

A special thanks to all of our plenary and technical committee speakers for taking the time to brief our USW community. Your briefs and the resulting discussions are the reason we are here as we put the information you provide to good use for the warfighter.

It is no secret that the reach of adversary undersea warfare capabilities continues to expand. Submarine, surface combatant and aircraft USW force structure continues to increase. Weapon and sensor capabilities continue to advance. Submarines are quieter and more lethal. Unmanned Undersea Vehicle research development and testing continues to increase. Operations continue to increase in number, persistence and geographic reach. Our challenge is to collect and leverage adversary information at tactical speeds where and when it's needed in order to detect, track and engage over increasingly large swaths of the ocean. This challenge is captured in our theme for this conference "The USW Force the Nation Needs: Distributed, Netted, Capable, Agile". Our adversaries must continue to measure their actions with the understanding that there is no place to hide.

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

Warfighters First!

Mike



**Admiral Kidd Conference center
Naval Base Point Loma**

FALL 2017 NDIA UNDERSEA WARFARE AWARDS



PIERRE CORRIVEAU, PHD
CHAIRMAN AWARDS COMMITTEE

The NDIA Undersea Warfare Division (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 UWD seeks to:

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

The NDIA UWD was pleased to present Bronze Medal Awards to the following individuals during the Plenary Session of the Fall 2016 USW Conference in Groton, CT. Unfortunately, Dr. Craun was not able to attend the fall conference to receive his award in person.

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



Dr. Matthew Craun
Naval Surface Warfare center (NSWC), Carderock Division

Dr. Craun's contributions in the area of signature control technology have directly contributed to the acoustic superiority enjoyed by operational US submarines and the future Fleet. Dr. Craun's success integrating new technologies into ship and submarine designs has enabled great advances in acoustic performance. Dr. Craun's exemplary performance and unwavering dedication to duty have brought great credit upon himself and the Navy.



Rickey D. Chapman
Johns Hopkins University Applied Physics Laboratory

In his 40-year career, Dr. Chapman has advanced submarine security and antisubmarine warfare in countless ways. His research and analysis of critical aspects of ocean behaviors and advanced sensors, coupled with his capacity to synthesize data with operational objectives has produced keystone concepts for numerous systems and strategies. His tireless devotion to the defense of our nation has been a compass guiding undersea technology to advance the art of undersea warfare. Dr. Chapman's specific contributions to the design and operation of US submarines are highly regarded and directly responsible for technical advantages enjoyed by our fleet.

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DR. EVANGELOS H. GIANNOPOULOS

NAVAL UNDERSEA WARFARE CENTER, NEWPORT DIVISION

Dr. Evangelos H. Giannopoulos has worked on all major submarine sonar systems and has made extensive contributions in the areas of AN/BQQ-10 sonar development and testing, Light Weight Wide Aperture Array calibration processes, and Large Aperture Bow array design, testing and analysis. Dr. Giannopoulos has held several leadership roles which have advanced the state of sonar systems, automation and sonar signal processing. Dr. Giannopoulos has been a significant force in advancing the state of sonar systems and sonar signal processing for the United States Navy.



MR EDWARD RISCHMANY

NAVAL UNDERSEA WARFARE CENTER, NEWPORT DIVISION

Mr. Rishmany's 33-year career at the Naval Undersea Warfare Center Division Newport is characterized not only by his leadership and technical expertise in USW Combat Systems, but also by his ability to fill multiple roles simultaneously. He is a recognized technical subject matter expert in Undersea Strike, having served as the Submarine Tomahawk Action Board engineering lead for 13 years and as USW Strike Mission Capability Manager since 2004. He also served as branch head and division head in two different departments and has executed the critical roles of Deputy Department Head for Engineering and Director of Programs for the USW Combat Systems Department. The results of his technical efforts have contributed significantly to warfighter readiness and mission availability, while his managerial accomplishments have enhanced workforce development as well as Division Newport's high standard of performance.



DR EARL G. WILLIAMS

NAVAL RESEARCH LABORATORY, WASHINGTON, DC

Dr. William's pioneering work in the field of nearfield acoustical holography is the only experimental technique which, from a single array measurement, provides a complete global analysis of the vibration, radiation, and scattering of noise sources. This work, along with innovative analysis techniques, has changed the way the Navy views vibration, radiation, and scattering from submarines. Multi-static Active Coherent (MAC) system developments has enhanced the ability of the U.S. Navy to conduct the airborne Anti-Submarine Warfare (ASW) mission to maintain this country's air and sea maritime superiority.



MR DON MCCORMACK

NAVAL SURFACE & UNDERSEA WARFARE CENTER, EXECUTIVE DIRECTOR

Throughout his thirty-year career, Mr. McCormack has been characterized by his dedication and technical vision in all aspects of Undersea Warfare, such as weapons, unmanned vehicles, countermeasures, command and control systems, acoustics and non-acoustic sensors, and the specialized and unique facilities necessary to test, evaluate, and field these systems. Mr. McCormack's outstanding contributions to the Undersea Warfare community have inspired the many scientists within the Warfare Centers. His leadership success, emphasizing technical innovations and excellence coupled with open and continuous dialogue with industry partners and stakeholders, contributes directly to the Fleet and its technical and tactical advantage over all adversaries. As a prolific contributor to National Defense Industrial Association Undersea Warfare symposia, he personally ensures that the relevant technical initiatives from his Warfare Centers are well represented in the technical sessions.

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



A final note of gratitude to David Medeiros for his leadership as the past Chair of the Awards Committee. His organizational skills and dedication to the mission of the NDIA UWD have been appreciated. The UWD thanks him for his service.

NDIA UWD 2017 ACADEMIC SPEAKER AWARD



MARK ROTHGEB
CHAIRMAN, ACADEMIC FELLOWSHIP COMMITTEE

The NDIA Undersea Warfare Division (UWD) established the Academic Fellowship Program in 1990 to provide financial aid to advanced degree 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 spring we are pleased to host three academic research contributors across the topic areas at this spring's conference.



LCDR Paul Evans is a Submarine officer set to graduate from the Naval Post Graduate School in June 2018 with a Master's in Engineering Systems. His brief "System Architecture for an Autonomous TASW Mission Package for Unmanned Surface Vessels" evaluates the potential of a fleet of autonomous surface vessels conducting collaborative Theater Anti-Submarine Warfare (TASW) to provide open ocean high volume search for persistent detection and cueing. The presentation will cover potential operational scenarios for autonomous collaborative TASW surface systems and the associated systems architecture.



Thomas Powers is a Ph.D. Candidate at the University of Washington Department of Electrical Engineering. He earned an M.S. in Electrical Engineering from the University of Washington in 2016 and a B.S. in Electrical Engineering and B.S.A.S. in Systems Science and Engineering from Washington University in St. Louis in 2013. His current research focuses are developing algorithms for discrete optimization and machine learning.



Rob Taylor is a first year acoustics PhD student at The University of Texas at Austin. After a short stint in industry as an analyst for Systems Planning and Analysis (SPA), Rob returned to Texas for graduate school and began work as a research assistant at Applied Research Laboratories (ARL:UT) focusing on underwater passive acoustics. His research involves determination of ocean environmental parameters by examining the directionality of noise. His presentation, "Passive Characterization of the Ocean Environment Using Ambient Noise", will show how to estimate local sea state, bottom loss, and sound speed profile characteristics from a vertical line array.

Please join the NDIA Executive Board in welcoming these academic presenters to the 2018 NDIA Spring conference.

UNDERSEA COMMAND, CONTROL, COMMUNICATIONS AND COMBAT SYSTEMS COMMITTEE



PAUL ROSBOLT
CHAIRMAN

DR. BOB ZARNICH
DEPUTY CHAIR

JOHN LINDERMAN
WARFIGHTER PERFORMANCE SESSION
CHAIR

The Navy is in the midst of addressing issues with theater undersea warfare (TUSW) command and control (C2) through a concerted effort to transition technology rapidly to the warfighter.

Greetings, All! I'm looking forward to a great conference in San Diego! Any excuse to get out of Washington is a good one. We have some terrific speakers lined up for the technical sessions, including CAPT Mike Boone, Program Manager for Undersea Communications & Integration (PMW 770), Lee Agin, Deputy Program Manager for Undersea Systems (IWS5), and CAPT Noel Gonzalez, from PMS 425, Submarine Combat Systems. ONI will present a special 1 hour session on Russian Submarine tactics!

The most exciting work in ASW C4I is being done in the area of Theater USW networks and C2.

The Navy is in the midst of addressing issues with theater undersea warfare (TUSW) command and control (C2) through a concerted effort to transition technology rapidly to the warfighter. Current TUSW C2 systems are managed by disparate resource sponsors, were not necessarily designed to interface with each other or higher echelon commands and TUSW assets, some are no longer unsupported, and many have an over-reliance on manual processes. This has resulted in the warfighters dealing with issues related to life cycle support, training, system interoperability, information sharing with allies and coalition partners, and data transfer across security domains.

Led by PEO IWS 5.0, OPNAV N2N6F, UWDC and the Theater ASW Warfare Commanders, the Navy has organized a TASW Integrated Product Team (IPT), defined a common vision for TUSW C2, applied innovative design thinking through a TASW Tactical Advancements for the Next Generation (TANG) workshop, and formally documented Fleet requirements. In concert with the recently created OPNAV Digital Warfare Office (DWO), the TUSW community is working through a comprehensive requirements allocation process. The results will inform existing system acquisition efforts and allow the application of the proven AxB development process where it is needed, and will identify where innovation is required to close gaps and improve the Navy's overall TUSW C2 capability.

These efforts will result in the implementation of a common integrated C2 system-of-systems architecture at all TUSW command centers that is adequately resourced and supported across the entire life cycle of the various systems. C2 system requirements will be clearly allocated to resource sponsors and program offices, with processes in place to address

seam issues and future requirements. Through aggressive incremental improvements, TUSW C2 will realize significant benefits from automation that makes sense, and improved cyber resiliency, multi-layer security and information sharing across all assets and domains. The Navy's TUSW C2 capability is on its way to being well positioned to face our maritime challenges well into the 21st century.

UNDERSEA MINE WARFARE COMMITTEE



JON TOBIAS
CHAIRMAN

ERIC HOLMES
DEPUTY CHAIRMAN

In its continuing effort to more effectively execute the mine countermeasures (MCM) mission, as well as to reduce the risk to Sailors in the minefield, the U.S. Navy Mine Warfare (MIW) force continues to

transition from its aging legacy systems to unmanned systems. Over the past months, however, some key decisions have been made that alter just where that path will lead, and the timeline the Navy has established as a goal to get there.

For the last fifteen years, except for the Explosive Ordnance Disposal (EOD) force, any new U.S. MCM system was conceived of and developed to deploy from Littoral Combat Ship (LCS) as part of the MCM Mission Package (MP). Over the last several years, however, movement to reduce LCS procurement, recognized operational limitations, and the success of non-MCM MP systems developed for the Navy expeditionary force, have culminated in the Chief of Naval Operations' position that, although LCS will still be an important MCM platform, leadership shall employ MCM systems vessels or platforms of opportunity and/or from shore. As such, U.S. Navy MCM will likely become a more expeditionary capability as the years progress. This decision has a potentially major impact on resource sponsors, program offices, and operational force structure, and it will be important to keep abreast of changes.

As we've discussed in previous newsletters, mining, the second and often overlooked, part of the MIW mission, continues to make its resurgence within the U.S. Navy, as current fleet commanders recognize the strategic utility of sea mines. A revived and evolving mining program, of course, is only one aspect of MIW that includes the development of unmanned systems.

Program Executive Office (PEO) LCS is currently pursuing an initiative to rapidly progress the capabilities of unmanned underwater and surface vehicle capabilities toward common systems and hull forms. For UUVs, this means systems that can conduct missions ranging from battlespace awareness and intelligence preparation of the operational environment (IPOE) in small UUVs such as the Sandshark; to MCM in medium class vehicles like the Knifefish; and anti-submarine warfare (ASW), anti-surface warfare (ASUW), electronic warfare (EW), and strike capabilities in extra-large UUV's (XLUUV) like the ORCA, which is currently in the design phase. For unmanned surface vehicles, the Navy plan seeks to develop a family of systems ranging from very small USVs like the GARC, that will take on intelligence, surveillance and reconnaissance (ISR), communication relay, and armed escort missions; to medium hulls building on Defense Advanced Research Projects Agency's (DARPA) Sea Hunter, that will layer on mine sweeping, mining, ASW, and counter-swarm capabilities.

As we've discussed in previous newsletters, mining, the second and often overlooked, part of the MIW mission, continues to make its resurgence within the U.S. Navy, as current fleet commanders recognize the strategic utility of sea mines.

PEO LCS's future vision for unmanned systems is being driven by accelerated acquisition and development. ORCA's \$85.5M design contracts were awarded a record 8 months' after the requirements were signed, and the PEO intends to continue pushing the acquisition envelope. Additionally, 2017 saw significant accomplishments in maturing some developing systems and bringing others closer to fleet delivery:

- Block I of the Coastal Battlefield Reconnaissance and Analysis (COBRA) system reached its initial operating capability in July of 2017 after a successful initial operational test and evaluation period conducted from Wallops Island, VA.
- The Barracuda mine neutralization system contract is expected to be awarded this Spring.



Unmanned Influence Sweep System (UISS) integrated in the MCM Unmanned Surface Vehicle (USV).

- Minehunting USVs (MHUs) continue to support Commander, FIFTH Fleet in-theatre training and operations, with the AN/AQS-24B sonar upgrade integrated in February 2017.
- The AN/AQS-24C minehunting sonar continues development.
- The Unmanned Influence Sweep System (UISS) continues contractor testing. The system is currently in builder's trials, and will commence developmental and operational assessment this spring.

UNDERSEA MINE WARFARE COMMITTEE

- The MCM USV's minehunting capability continues development, with the contract for two hulls awarded in March 2017.
- AN/AQS-20C minehunting sonar production units continue testing.
- The Knifefish UUV, which will provide volume, bottom, and buried minehunting capability, has successfully completed contractor and sea acceptance trials. Developmental testing and an operational assessment began in February.
- Phase I of the Snakehead Large Displacement UUV (LDUUV) program has completed preliminary design review, and detailed design is in progress.



Knifefish UUV detects, classifies, and identifies volume, proud, and buried mines in high-clutter underwater environments.

Although always a challenge, the key to accelerating the development and delivery of these systems to the warfighter is reliant on the commitment and alignment of resource sponsors, the science and technology (S&T) community, the acquisition community and the fleet. As unmanned systems are a key component for both the LCS and Undersea Enterprises, there is reason to be optimistic that current momentum and successes within the Navy will continue.

Guiding these efforts is the newly-established MIW Governance Council. Formed in 2017, this flag/SES-level organization consists of multiple integrated product teams, including S&T and mining), and will be an important body to manage and develop the MIW force. The group is currently focusing on development of UUVs, expeditionary MCM, renewing a focus on prioritizing MIW programs, developing technology more effectively, and getting capability to the fleet sooner. In the works currently at U.S. Fleet Forces Command is an MCM Adaptive Force Package Concept of Employment and an MCM Capability Study Plan. Of course, some of the more programmatic and technical MCM challenges still exist: adequate training and support, full logistics support

in conjunction with the initial delivery of new systems, and continuously improving and maturing automatic target recognition (ATR), as well as pursuing integrating ATR aboard UUVs. Neutralization can be improved, and the community should be looking at non-kinetic as well as kinetic solutions-- bottom mines are not contact mines; they have electronics to attack and be rendered inoperable.

The community also recognizes the need to start discussing MCM beyond LCS, all while delivering LCS MCM capability with its MPs, and maintaining the dedicated forces. Future MCM, or "MCM Next," is looking to be a deployable MIW force vice a *forward-deployed MIW force*, and a key issue for Navy leadership is finding ways to do things faster. Navy leadership is looking at options, and as one senior mine warfare expert described it, the Navy is looking at ways to "unhull" the many and diverse MCM capabilities currently being fielded and developed. Desires are for expeditionary and deployable MCM to bring a minimal logistics footprint, be rapidly mobilized and transported, and be deployable from multiple platforms. There is also an emphasis on being able to get unmanned systems where and when they're needed, recognizing that there may be operational capability trade-offs for smaller, more mobile systems that do not rely on a long/large logistics tail.

In the recently released PB19 the Navy shows a strong commitment to MCM by investing an additional \$1.2B across the FY19-23, much of which is focused on the development and procurement of unmanned systems. \$1.2B represents the largest additional new investment in MCM in over two decades. It's encouraging to see the renewed focus on MIW, and industry will play a key role in the success of current initiatives, as several key technical areas require continued development:

- Endurance
- Autonomy and precision navigation
- Command, control, and communication
- Payloads and sensors
- Platform integration (e.g., launch and recovery)

The Navy's overarching MCM vision is to reduce MCM timelines by transitioning from platform-based, sequential operations to a set of unmanned modular MCM systems employing advanced sensors in parallel operations. This Modular MCM Force will also have sufficient flexibility to be integrated in, and employed from, a variety of suitable ship platforms or operate from some shore facilities. These next-generation MCM systems are designed to quickly counter a full spectrum of mine threats, thereby assuring maritime access with minimum risk across the full range of employment options available to the combatant commanders. These key areas required for success are not new, and we continue to make progress. MIW is as critical as ever and the landscape is changing. As we look closely at defining and developing "MCM Next," I challenge you to stay engaged and creative as we collectively improve delivery of warfighting capabilities to the U.S. Navy.

UNDERSEA WARFARE VEHICLES COMMITTEE



TOM RUZIC
CHAIRMAN

CHUCK FRALICK
DEPUTY CHAIR

This issue I have a message from Mr. Howard Berkof, Deputy Program Manager for the Unmanned Maritime Systems Program Office (PMS 406) within the Program Executive Office for

Littoral Combat Ship (LCS). Howard is responsible for the development, procurement, test, fielding, and sustainment for numerous ACAT and non-ACAT unmanned platform and payload programs.

UNMANNED UNDERSEA VEHICLES: AN UPDATE

BY HOWARD BERKOF

OVERVIEW

Unmanned systems are a rapidly expanding warfare segment within the Navy's portfolio. This segment includes both unmanned undersea vehicles (UUVs) and unmanned surface vehicles (USVs), many of which are under the program management of the Unmanned Maritime Systems Program Office, PMS 406. Funding for unmanned systems within Program Executive Office (PEO) Littoral Combat Ships (LCS) has more than doubled in the last year, as the systems are a key enabler for both LCS and the Undersea Enterprise. These systems are also an important component of the strategic vision outlined by the Chief of Naval Operations (CNO), Admiral John Richardson, in his 2016 document "A Design for Maintaining Maritime Superiority."

With the growing interest and investment in unmanned maritime systems, the Navy continues to focus on maintaining stakeholder alignment in the respective UUV and USV segments. The result of this strategic effort is the formulation of common visions for the Navy's family of UUVs and USVs, their associated technology enablers, and the way in which these diverse programs all fit together into a cohesive strategy. From small to extra-large, and across multiple warfare domains, the entire family of UUVs and USVs has been mapped into a comprehensive approach. These visions are critical to efficient execution going forward.

Overall, the Navy is following the proven technology insertion process to incrementally deliver capability by advancing technologies in parallel with vehicle development and production. When specific technologies are ready and proven, they will be inserted into UUVs across the family to increase capability while ensuring production and operations are not adversely impacted. The modernization process being used by the Navy for these core UUV technologies can then maintain alignment with industry advancements. The Navy Family of UUVs, including the core UUV technologies, is a key component

Funding for unmanned systems within Program Executive Office (PEO) Littoral Combat Ships (LCS) has more than doubled in the last year, as the systems are a key enabler for both LCS and the Undersea Enterprise.

of the Navy's continual emphasis on undersea superiority. The focus is rapid, efficient expansion of UUVs into the Fleet through rapid experimentation with fleet operators, program offices, and industry.

In addition, to complement the ongoing development and delivery of the Family of UUVs, ensuring the Navy has capable, proficient operators and the infrastructure for the UUVs are also critical parts of the plan. To support this endeavor, the Navy established the UUV Homeport and Center of Operations at the Naval Undersea Warfare Center (NUWC) in Keyport, WA. Co-located in the homeport, the Navy stood up UUV Squadron One (UUVRON ONE) in October, 2017, to provide dedicated UUV operators and maintainers for the Family of UUVs. The UUVRON staff is closely tied with the NUWC Keyport support staff, the acquisition Program Offices, and the Resource Sponsors at the Pentagon to ensure a coordinated approach for the development, fielding, and operations for current and future UUV systems.

Within PEO LCS, three essential UUV efforts are managed and coordinated by PMS 406: (1) the Knifefish UUV minehunting system, (2) the Snakehead Large Displacement Unmanned Underwater Vehicle (LDUUV), and (3) the Orca Extra Large Unmanned Underwater Vehicle (XLUUV). However, PMS 406's efforts are not limited to these three programs. The office's expansive portfolio also extends to managing the following:

- The Navy's developmental Mining Expendable Delivery Unmanned Submarine Asset (MEDUSA)
- The Unmanned Influence Sweep System (UISS) USV
- The Mine Countermeasures (MCM) USV, which can conduct both influence minesweeping and minehunting operations
- The delivery of improved production AN/AQS-20 towed minehunting sonars
- The continued support of the rigid-hulled inflatable boat (RHIB)-based Minehunting Units (MHUs) supporting 5th Fleet urgent operational requirements
- Evolving discussions with the Office of the Chief of Naval Operations and the Fleet on the Future Surface Combatant (FSC) family of USVs
- Supporting SCO's Ghost Fleet initiative, which includes

UNDERSEA WARFARE VEHICLES COMMITTEE

both larger USVs and an XLUUV-class system. PMS 406 is the Execution Agent for the Ghost Fleet efforts funded by the SCO.

The following sections provide a program update on the current status and significant events expected to take place across PMS 406's unmanned portfolio over the next year.

Knifefish



Knifefish is a self-propelled UUV that operates untethered from the ship or platform from which it deploys. Operating independently in shallow ocean waters, the UUV uses a low-frequency broadband sonar to search for volume, proud (secured to ocean floor), and buried mines. Knifefish is a critical

element in the Navy's evolving MCM efforts and its overall vision for removing ships and crews from the dangers of operating within a minefield. The 21-ft-long UUV can also be launched from other Vessels of Opportunity (VOOs), including the LCS or other surface platforms. The system is being built by General Dynamics' Mission Systems unit.



Knifefish Testing

Knifefish conducted extensive Contractor Testing in the second half of FY17 and first half of FY18, with positive performance results. The program will transition to Navy Developmental

Testing, with a Milestone C production decision anticipated in Q3FY18.

While Knifefish is well along in development, opportunities still exist for industry involvement in the program. A Pre-Planned Product Improvement effort is already envisioned for Knifefish, with PMS 406 interested in new ideas, concepts, and technologies that can improve the vehicle in the areas of launch and recovery, power and endurance, sensors and reliability, navigation precision, communications and data exchange, mission data download, and transmission.



Snakehead LDUUV

The Snakehead program continues to execute as an accelerated acquisition and is currently tracking to initial in-water system testing by 2021, pending FY18 budget levels. The accelerated acquisition approach enables the Snakehead program to use a modified, more rapid approach to reduce design and development time and expedite the initial fielding of this capability. The Fleet can then conduct experimentation and assessment of the vehicle much sooner in the acquisition process and offer informed operational feedback to enable capability improvements to Snakehead.

PMS 406 is also leveraging new ways to assess the technical and manufacturing base, gauge its experience level and capabilities, and gain insights from industry. Phase I Snakehead efforts will procure subsystems, sensors, and materiel from numerous vendors across multiple states. The Government is leveraging various rapid contract mechanisms to reach industry partners for current and follow-on Snakehead phases and its family of UUVs, including the National Armaments Consortium Other Transaction Authority and a Naval Undersea Warfare Center Newport multi-award, indefinite delivery indefinite quantity contract.

Snakehead LDUUV
 Phase I



Orca XLUUV

In September 2017, the Navy awarded two contracts for the Orca XLUUV for Phase 1 design efforts, one to Lockheed Martin and another to Boeing. This significant milestone achievement is another step in the fast-track acquisition strategy being employed by PMS 406 to accelerate this capability to the Fleet.

The Orca program is a Navy accelerated acquisition program serving as the Navy's XLUUV class effort and is in response to a Joint Emergent Operational Need. This vehicle will help extend the range of current platforms to undertake specific maritime missions. Orca's modular design will enable the UUV to deploy multiple types of payloads. Key performance attributes include extended vehicle range and persistence, a reconfigurable payload bay, modular construction, autonomy, and pier-launch capability.

With the awarding of the Phase 1 contracts, the two contractors will conduct detailed design efforts over the next 15 months. Once the design phase is completed, the program will transition to fabrication and build up to five vehicles, with the first Orca delivered in 2020, followed by two additional vehicles in 2021 and two in 2022.

Orca XLUUV Concepts



UNDERSEA WARFARE AVIATION COMMITTEE



GLEN SHARPE
CHAIRMAN

MR. BOB KANYUCK
DEPUTY CHAIRMAN

CAPT. DOUGLAS BELVIN, USN
(NAVAIR PMA-264), NAVY LIAISON

Welcome back to San Diego! I can't begin to tell you how glad I'm to be here and that this event couldn't come at a better time. Like many of you, I've been doing a fair amount of hand wringing while watching with great anticipation about what would happen with the latest tax reform bill, government shutdowns, continuing resolutions, and finally passage of a two year defense bill. Combine all that with news reports of on-going global threats, a volatile stock market, and the Philadelphia Eagles beating the New England Patriots to win the Superbowl, well, I think you would agree we have had one of the wildest rides this winter in recent memory. Therefore, there is no place better to be right now to re-charge our batteries, get calibrated and level set for 2018 than right here with all you undersea warfare domain experts.

I mentioned above "on-going global threats." In the past, I've used this article to talk about and highlight accomplishments the U.S. Navy has made in Aviation Undersea Warfare as far as new platforms, sensors, processing and weapons. However, I think it is appropriate to spend some time and talk about what some global adversaries have been up to and encourage you to also research what our adversaries are doing. After all, our adversary's achievements and accomplishments is what we must continue to outpace and effectively counter as Undersea Warfare experts.

I've selected some public domain unclassified news articles that discuss some of our adversaries' capabilities to share with you and make no claims as to their accuracy. However, I think you will also conclude after reading these articles and many others like them, that there is practically no more important reason this community needs to continue getting together and sharing our expertise for others to leverage in order to maintain our undersea superiority. The research, prototyping, testing, training, development, production and on-time delivery of platforms, sensors, processing and weapons needed to counter existing and future undersea dangers are vital to keeping America and our allies safe. I'm very proud to be associated with such a professional and dedicated group that will continue to meet all challenges as they arise in the undersea warfare domain.

NORTH KOREA'S 'BALLISTIC SUBMARINE'

<https://www.usatoday.com/story/news/world/2017/11/20/north-korea-ballistic-submarine-kim-jong-un-gamble-pay-off/880097001/>



North Korea is pushing ahead with the construction of its first domestically developed ballistic missile submarine, even though the vessel is expected to be vastly technologically inferior to its rivals in the region and should be relatively easy to track and — should an imminent threat be perceived — neutralize, analysts say. Despite that huge drawback, the millions that are being invested in the project make perfect geo-political sense to the regime of Kim Jong Un, they add.

Progress on the North Korean project has been detected by images from commercial satellites that have been analyzed by experts at the U.S.-Korea Institute at Johns Hopkins University and published on the 38 North website. In the most recently available images of the Sinpo South Shipyard, taken earlier this month, the analysts point to sections of what appear to be the pressure hull of a submarine alongside construction halls at the yard, which has undergone extensive modernization work in the last 18 months, including the addition of a fabrication plant and a roof to a construction hall alongside a slipway.

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last 18 months, including the addition of a fabrication plant and a roof to a construction hall alongside a slipway.

It is not clear where North Korea has obtained its ability to create a new class of submarine designed to launch ballistic



missiles, but given that the United States has been operating submarines since the Civil War and other nations in the region, notably Japan and South Korea, have developed state-of-the-art capabilities for their underwater fleets, it is unlikely that the North Korean vessel will pose a huge threat.

“It is difficult to fully comprehend what North Korea is trying to do in the long-term, in large part because no-one is talking to them at the moment,” said Garren Mulloy, an associate professor of international relations at Japan’s Daito Bunka University.

“We can surmise that they want to be regarded as a great power and to get preferential treatment from the international community, but in the shorter term, they appear to be trying to show that they have the capability to be a significant military power and, potentially, a threat to other countries,” he told Deutsche Welle.

US SAYS RUSSIA ‘DEVELOPING’ UNDERSEA NUCLEAR-ARMED TORPEDO

This article originally appeared on DW.com. Its content is separate from USA TODAY.



<https://www.cnn.com/2018/02/02/politics/pentagon-nuclear-posture-review-russian-drone/index.html>

Washington (CNN) Just as the White House is caught in a political minefield over the Russia investigation, the Pentagon is taking its toughest line yet against Russia’s resurgent nuclear forces.

In its newly released Nuclear Posture Review, the Defense Department has focused much of its multibillion nuclear effort on an updated nuclear deterrence focused on Russia.

“Russia considers the United States and the North Atlantic Treaty Organization (NATO) to be the principal threats to its contemporary geopolitical ambitions,” the report says.

“The Defense Intelligence Agency currently estimates Russia has a stockpile of 2,000 “non-strategic” nuclear weapons including short-range ballistic missiles, gravity bombs and depth charges that can go on medium range bomber aircraft,” according to the report.

“DIA also estimates Russia has nuclear armed anti-ship, anti-submarine missiles and torpedoes. What do they need nuclear depth charges for?” one US official asked.

President Donald Trump highlighted the importance of the review’s conclusions Friday in a written statement.

“Over the past decade, despite United States efforts to reduce the roles and numbers of nuclear weapons, other nuclear nations grew their stockpiles, increased the prominence of nuclear weapons in their security strategies, and -- in some cases -- pursued the development of new nuclear capabilities to threaten other nations,” Trump said.

“The strategy develops capabilities aimed at making use of nuclear weapons less likely. It enhances deterrence of strategic

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attacks against our nation, and our allies and partners, that may not come in the form of nuclear weapons. And, importantly, it reaffirms our commitment to arms control and nuclear non-proliferation, maintains the moratorium on nuclear testing, and commits to improving efforts to prevent, detect, and respond to nuclear terrorism," he added.

The Pentagon is adamant the Nuclear Posture Review walks the line between maintaining a nuclear deterrence and encouraging controls on nuclear weapons.

"It reaffirms that the fundamental role of US nuclear policy is deterrence and continues our clear commitment to nonproliferation and arms control," said Deputy Defense Secretary Patrick Shanahan.

FIRST MENTION OF RUSSIAN NUCLEAR TORPEDO SYSTEM

The report also publicly acknowledges, for the first time, that Russia is "developing" a "new intercontinental, nuclear armed, nuclear-powered, undersea autonomous torpedo."

Known in English as the "Status-6" system, the program is described by US officials as essentially a drone-type device fired underwater that can potentially travel thousands of miles and strike US coastal targets such as military bases or cities.

Upon detonation, the device is designed to cause large zones of radioactive contamination.

Some analysts have called it a "doomsday weapon," and US Sen. Tom Cotton, R-Arkansas, has labeled the concept "destabilizing."

"The concept is a horror of the Cold War," according to Adam Mount, a senior fellow and the director of the Defense Posture Project at the Federation of American Scientists. "It is clearly inspired by overblown Russian worries that US missile defenses will make their missile forces obsolete."

"There is no indication from public information that Russia is actively developing the system, but it is alarming to see it in a Pentagon document," Mount said, adding that while the program is referenced in the Nuclear Posture Review, it is not mentioned in other government reports.

Low yield nuclear weapons

The review calls for more focus on US "low yield" nuclear weapons to try to convince Russia that the US has a credible deterrent against the potential Russian threat. The plan calls for modifying existing US warheads on submarine-launched ballistic missiles in a \$50 million five-year program.

Each submarine would only carry a few of these new missiles, armed primarily with strategic longer-range missiles.

"Neither recommendation requires developing new nuclear warheads," Shanahan said. "Neither will increase the size of our nuclear stockpile. They break no treaty."

"The idea is to have one or two or just a few to address this

Defense Secretary James Mattis said: "What we have is a nuclear deterrent, so keep those two words always together and then look at the efforts to push forward on nonproliferation and arms control, and you have to do that when you're in a position of persuasion not of hope."

potential Russian limited use," according to one Pentagon official.

But according to some experts, the plan translates Trump's urge to "greatly expand and strengthen" the arsenal into policy.

"The Trump administration's call for new nuclear weapons is a major shift in US policy," Mount said when asked the proposal for low-yield nuclear weapons.

"Programs for new nuclear weapons would follow our adversaries into a world where nuclear competition is commonplace. The programs would crowd out other military priorities, alarm allies, and have huge diplomatic cost -- for minimal deterrence benefit," he said.

Mount said that the review's outline for low-yield nuclear weapons "relies on the assumption that Russia would invade NATO allies, and glosses over important arguments about where and why these weapons would ever be necessary."

Low-yield ballistic missiles could be fielded within just a few years.

Longer-range missiles could come over the next decade, and the US would plan to develop and field sea-launched cruise missiles also with lower-yield warheads.

The review is calling for all of this along with an overall modernization of the nuclear force because the Pentagon requires an "investment in a credible nuclear deterrent with diverse capabilities," chief Pentagon spokesperson Dana White told reporters.

Defense Secretary James Mattis said: "What we have is a nuclear deterrent, so keep those two words always together and then look at the efforts to push forward on nonproliferation and arms control, and you have to do that when you're in a position of persuasion not of hope."

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CHINESE NUCLEAR ATTACK SUBMARINE THAT RAISED FLAG IN INTERNATIONAL WATERS MAY HAVE BEEN TESTING JAPAN'S PATROL CAPABILITIES

<http://www.scmp.com/news/asia/east-asia/article/2128284/chinese-nuclear-attack-submarine-spotted-near-disputed-diaoyu>

A Chinese naval submarine detected in waters near Japanese-controlled islands in the East China Sea last week was a nuclear-powered attack submarine, Japanese Defence Minister Itsunori Onodera said Monday.

The 110-metre-long Shang-class submarine was detected on Thursday while submerged just outside Japanese territorial waters near the Senkaku Islands, also known as the Diaoyu Islands.

Tokyo filed a protest with Beijing, which also claims the islands, saying the submarine's presence raised bilateral tensions. According to the Japanese Defence Ministry, the Shang-class is a new type of attack submarine equipped with ship-to-ship missiles that have a maximum firing range of 40 kilometres as well as torpedoes.

"We are seriously concerned over acts that unilaterally raise tensions. We'll keep our guard up to respond swiftly if a similar incident happens," Onodera told reporters, noting that the Shang-class submarine was capable of loading long-range cruise missiles.

"Operating a submerged submarine close to another country's territory goes against the norms of international rules."

On Friday, Onodera said the submarine surfaced in international waters flying a Chinese flag on its mast.

A Defence Ministry source speculated that China may have sent the submarine to test the Japanese Maritime Self-Defence Force's patrolling capabilities.

The sovereignty of the islands is a perennial flashpoint in relations between Asia's two largest economies, which otherwise have been recently showing signs of improving.

The latest development has alarmed Japan as it was the first time a Chinese submarine was observed in the so-called contiguous zone around the uninhabited islets.

The contiguous zone is a band of water beyond the 12 nautical mile territorial waters surrounding any national territory, it extends out to 24 nautical miles.

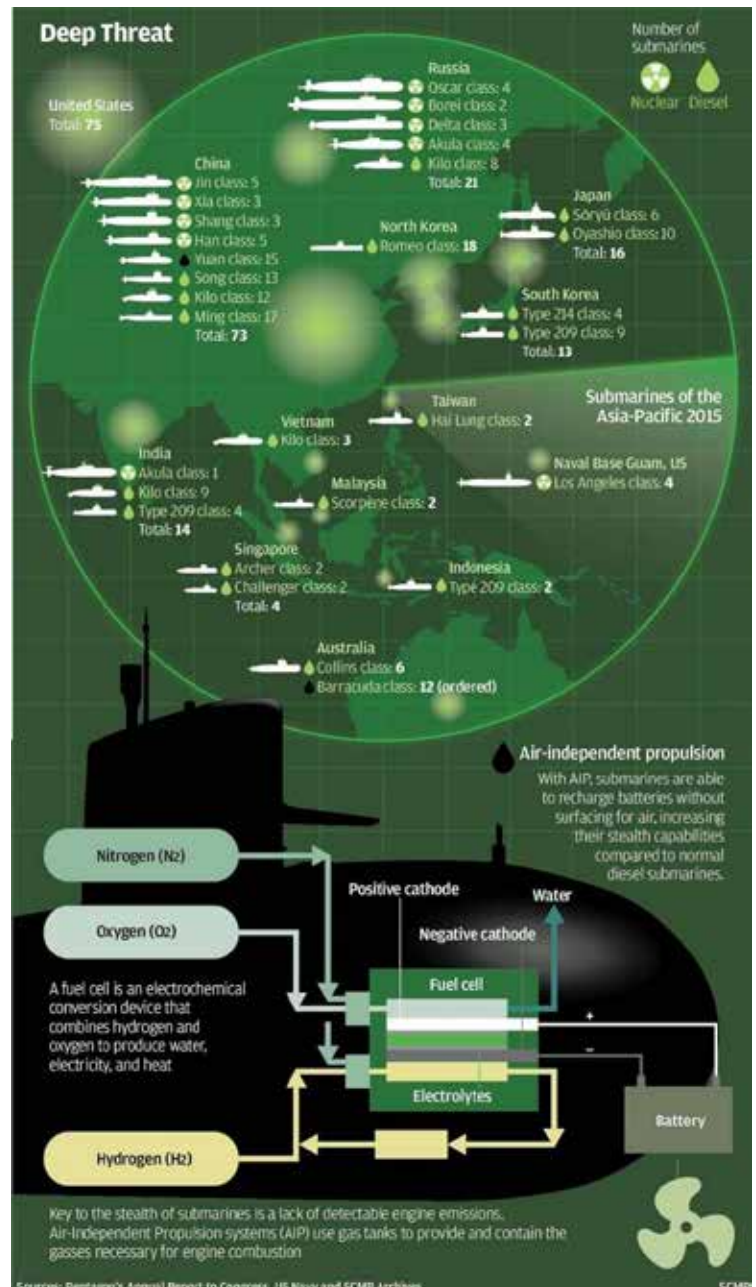
China coastguard vessels, meanwhile, have frequently entered Japanese waters around the islands as part of China testing its territorial claim to the area.

Japan's Chief Cabinet Secretary Yoshihide Suga, who last week protested against the presence of the submarine and other

Chinese navy ships near the disputed islands, described the presence of three Chinese coastguard vessels in the waters on Monday as "regrettable".

Chinese foreign ministry spokesman Lu Kang said he was not aware of the details regarding the submarine, but China would not accept Japan's "representations" on the issue of the islands.

"The Diaoyu Islands and associated islets are China's sovereign territory," he said.



UNDERSEA SENSOR SYSTEMS COMMITTEE



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MR. PETER SCALA
PEO IWS 5 NAVY LIAISON

The Sensors Committee spring 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 "The USW Force the Nation Needs: Distributed, Netted, Capable, Agile" 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 provide an update for the PEO IWS5 Undersea Advanced Development systems including future Sonar and AxB programs. Mr. Bill Traganza of PMS485 Maritime Surveillance Systems, will discuss their implementation of a rigorous system modernization strategy to pace the ever quieting threat, build system resilience, and reduce total ownership cost. 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.

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.



SPRING 2018 UNDERSEA WARFARE DIVISION CONFERENCE



JOHN HOLMES
 SPRING CONFERENCE CHAIR

The 2018 Undersea Warfare Spring Conference Theme, “The USW Force the Nation Needs: Distributed, Netted, Capable, Agile” provides an opportunity and a challenge for the Undersea Warfare community to expand our breadth and depth of thinking beyond just platforms and weapons and consider how we might bring a better force to the fight when our nation calls upon us. Big words – Distributed, Netted, Capable, Agile – how well we integrate them into what we develop, test and deliver to our warfighters is crucial to their success and what the Nation needs. The Navy Mission Statement has not changed, “...to maintain, train and equip combat-ready naval forces capable of winning wars, deterring aggression and maintaining freedom of the seas.”, how we execute the mission is forever changing. The demand signal from the type

commanders for the USW force has never been greater – how well we can Distribute the finite number of assets available – “the right system at the right time” – is made easier if they have the most Capable sensors and weapons on board. Allowing these Distributed assets to work seamlessly together – Netted – in real time, without interruption, sharing vital information and doing it covertly is a challenge onto itself – one where we must prevail. A Distributed, Capable and Netted USW Force is a force that will be by definition Agile – with the ability to change at moment’s notice where the arrow is pointed, change today’s mission tasking from one of surveillance to pre-positioning to “taking the fight to the enemy”. All four attributes – Distributed, Netted, Capable, Agile – describe the force the USW community is being challenged to deliver to a Nation that needs it!

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

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