

ANTX

ADVANCED NAVAL TECHNOLOGY EXERCISE

2017

BATTLESPACE PREPARATION IN A CONTESTED ENVIRONMENT



PARTICIPANTS AND TECHNOLOGIES



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Welcome

Welcome to the Advanced Naval Technology Exercise (ANTX)!

The theme “Battlespace Preparation in a Contested Environment” allows all participants to explore how different technologies can complement each other to provide the warfighter with the most comprehensive operational picture in real time.

Building on the success of last year’s ANTX, this summer the Naval Undersea Warfare Center (NUWC) Newport Division has joined forces with the Naval Surface Warfare Center (NSWC) Panama City Division for a multi-site event with fleet operators participating from Submarine Development Group Five in Keyport, WA, and the Explosive Ordnance Disposal Unit One in Panama City.

NUWC Newport Division’s focus is Intelligence, Surveillance, and Reconnaissance; NSWC Panama City Division’s focus is Mine Warfare.

Whether you are in Newport or Panama City, this is an exciting and an important event for the Naval Research and Development Establishment. Events such as ANTX, with its focus on demonstrations of specific operational-based themes, underscore the value of rapid prototyping efforts. By incorporating warfighters’ needs and focusing on the outcomes, we can make improvements that build on lessons learned and transition these new technologies more quickly than ever before.

I encourage you to start your day at the ANTX Command Center, visit all the booths, observe the exercises, and engage with our participants.

Thank you for attending ANTX Battlespace Preparation in a Contested Environment



Don McCormack, SES
Executive Director for Naval Surface
and Undersea Warfare Centers

Welcome to Division Newport! Our team has been diligently working to ensure both exercise participants and guests receive an exciting and beneficial experience. We are expecting 25 industry, two academia, and four government participants at Division Newport, fielding over 25 unmanned systems.

This year’s ANTX provides a forum with a focused theme on battlespace preparation. This theme addresses a Navy operational priority and allows us to demonstrate cross-domain solutions to Fleet operators, Navy decision-makers, and industry and academic partners.

Our Narragansett Bay Test Facility is a unique Navy asset for conducting RDT&E for surface, aerial, and underwater technologies. It is also an integrated facility that supports rapid prototyping of Navy systems.

As Division Newport is an industrial and restricted access area, please be safe and mindful of all safety and security protocols. If you have any questions or concerns please reach out to any of our team, easily identifiable by their teal blue ANTX shirts.

In closing, please consider attending the ANTX social planned on Tuesday evening starting at 5:30 at the Naval Station Newport Officers’ Club. We hope to see you there.



CAPT Michael R. Coughlin
Commanding Officer



Ronald A. Vien
Acting Technical Director



NUWC Division Newport

Undersea Superiority Today and Tomorrow

We research, develop, test, evaluate, engineer, analyze, and deliver undersea warfare capabilities to expand United States Navy readiness

PEOPLE

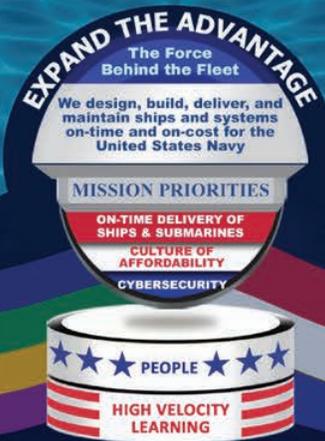
Empower our diverse team of world-class professionals

PROCESS

Optimize speed, agility, and rigor of our technical and business processes

RESULTS

Ensure fleet readiness today and innovate for next generation systems tomorrow



Navy's Design for Maintaining Maritime Superiority

- Strengthen Naval Power
- Achieve High Velocity Learning
- Strengthen Navy Team
- Expand and Strengthen Our Network of Partners

NUWC Focus Areas

- Execute with Excellence
- Continuously Build and Shape a Capable Workforce
- Drive a Culture of Affordability
- Shape and Maintain Technical and Business Capabilities
- Improve Cybersecurity in Products and Processes

NAVY

NAVSEA

NUWC

Lockblade Sonotube Deployable Quadcopter

Exercise Lead: Aviation System Engineering Company (ASEC) Inc.

ASEC will deploy a Lockblade quadcopter from a fixed wing aircraft (L-17A), which will descend, automatically unfold/lock and proceed to GPS waypoints to provide Intelligence, Surveillance, and Reconnaissance the launch aircraft and/or surface users.

The ASEC Lockblade provides a very low-cost, simple solution for remote high-fidelity sensor information from sanctuary altitudes. It is enabled by recent advances in commercial unmanned aerial systems; it unfolds in flight and stabilizes after free fall from high altitudes when released from a standard A-size sonochute. For ANTX, the MAD sensor and EO payloads are swappable. The Lockblade is truly expendable.

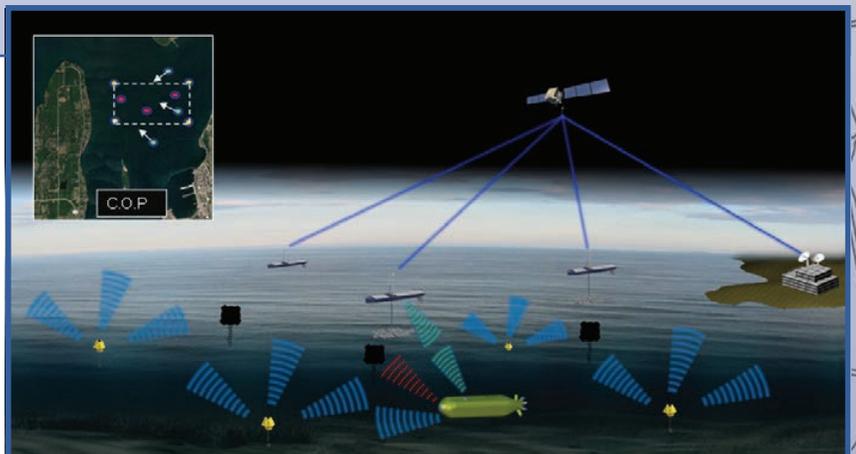


For more information, contact Bryan Barthelme, 301-862-1732 ext. 229, bryan.barthelme@asec-incorporated.com, www.asec-incorporated.com

Precision Undersea Navigation Network for Counter-Mine Operations in a Contested Battlespace

Exercise Lead: The Boeing Company

This project will demonstrate the ability to utilize a Sensor Hosting Autonomous Remote Craft (SHARC) unmanned surface vehicle to tow in and deploy an array of long baseline (LBL) precision navigation transponders to establish an undersea navigation network for UUVs, similar to GPS for air/ground vehicles. To do so, the SHARC will trail a towbody that will dispense LBL transponders at predetermined waypoints, then orbit each of them to acoustically map them precisely and communicate exact transponder geolocations to command and control and UUVs. Observers will be able to monitor SHARCs on the Common Operating Picture (COP) in the operations area tent and on a master COP. Observers will also see the LBL navigation network operate by seeing the UUV appear when in vicinity of LBL navigation grid, and disappear as it departs.



For more information, contact Jim Bray, 314-233-6947, james.f.bray@boeing.com

Maritime Mesh

Exercise Lead: Domo Tactical Communications (DTC)

DTC's Mesh technology provides high-capacity multi-domain IP connectivity in challenging environments that sits seamlessly alongside existing public or private infrastructure. The ability to project a significant bi-directional capability into areas unreachable by existing technologies is tremendously powerful and can play a pivotal role in surveillance operations.

Offered in two variants, Phase 4 which is the fourth iteration of DTC Mesh designed for a range of dedicated radio platforms and is available with 2 Watt and 5 Watt power options. Phase 5 is DTC's next generation Mesh software designed for installation on both dedicated radio platforms and the multi-capability Software Defined Radio (SDR) as a software application. All Phase 5 platforms offer the benefits of standard Mesh but are also Multiple Input/Multiple Output (MIMO) capable for double data throughput (25Mbps).



Figure 1 NetNode IP Mesh Phase 5 Plain



Figure 2 NetNode IP Mesh Phase 5 Robust



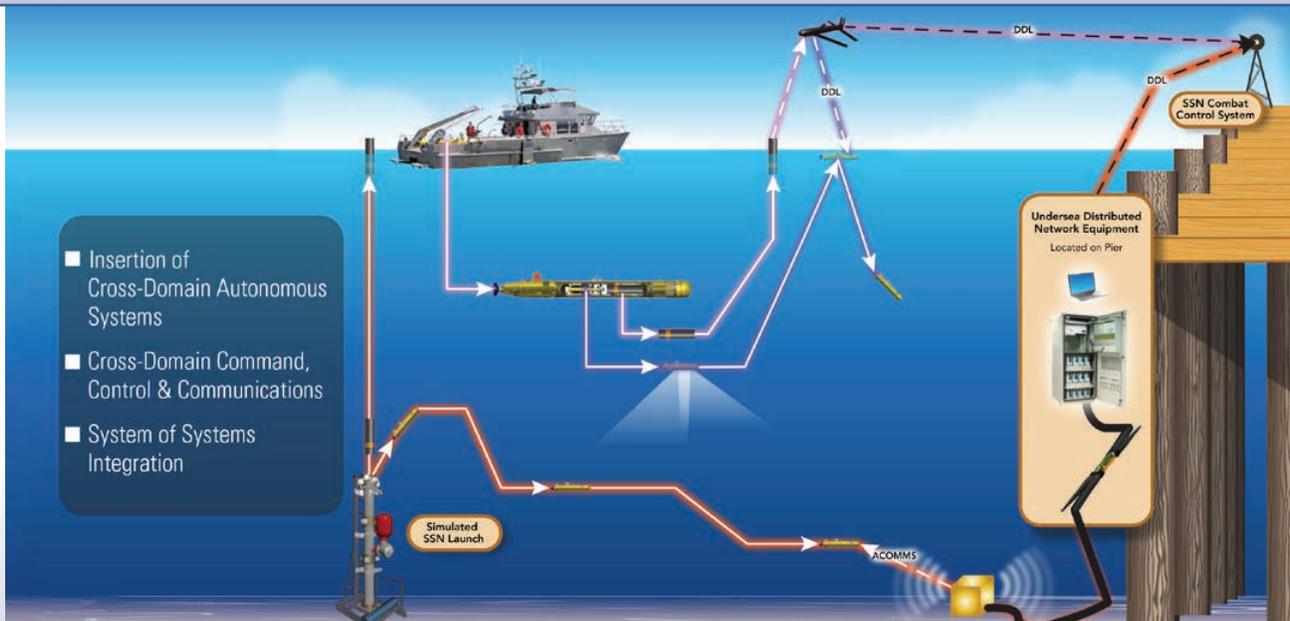
Figure 3 SOLO8 Software defined Radio (robust)

DTC

For more information, contact Grady Valentine, 571-253-4350, www.domotactical.com

Undersea Battlespace Preparation in Contested Environments

Exercise Lead: General Dynamics Mission Systems



- Insertion of Cross-Domain Autonomous Systems
- Cross-Domain Command, Control & Communications
- System of Systems Integration

GENERAL DYNAMICS
Electric Boat

GENERAL DYNAMICS
Mission Systems

BLUEFIN
ROBOTICS

For more information, contact Omer Poroy, 617-715-7019, omer.poroy@gd-ms.com

Signals Intelligence (SIGINT) on an Unmanned Underwater Vehicle

Exercise Lead: Hydroid, Inc. and L3 Technologies Mission Integration

Hydroid and L3 Mission Integration are collaborating on a mission that illustrates the latest unmanned undersea vehicle technologies and capabilities in a single interactive demonstration. The Hydroid REMUS 600 is being launched on a mission from the R/V Tiburon marine research vessel. The REMUS 600 (similar to Mk18 Mod2 or LBS-AUV UUV) will surface and conduct signals intelligence with the L3 Rio Signals Intelligence (SIGINT) System. This system intercepts, locates, monitors and records communication signals using a common set of software applications. Simulating a real satellite communications link, the data will be communicated to the Tiburon via Wi-Fi where the Signal Control Center will be based. The information will also be re-transmitted through a Freewave radio to shore where Hydroid and L3 will be displaying real-time data from the mission. When the signal intelligence data indicates it is appropriate, the REMUS 600 will submerge and, when at depth, release a Spartron Hammerhead canister that contains the AeroVironment Blackwing UAV. The UAV will launch from the canister, run reconnaissance, and relay data including a live video link back to the Hydroid Control Center. The REMUS 600 will continue its mission and transit back to the R/V Tiburon to be recovered.



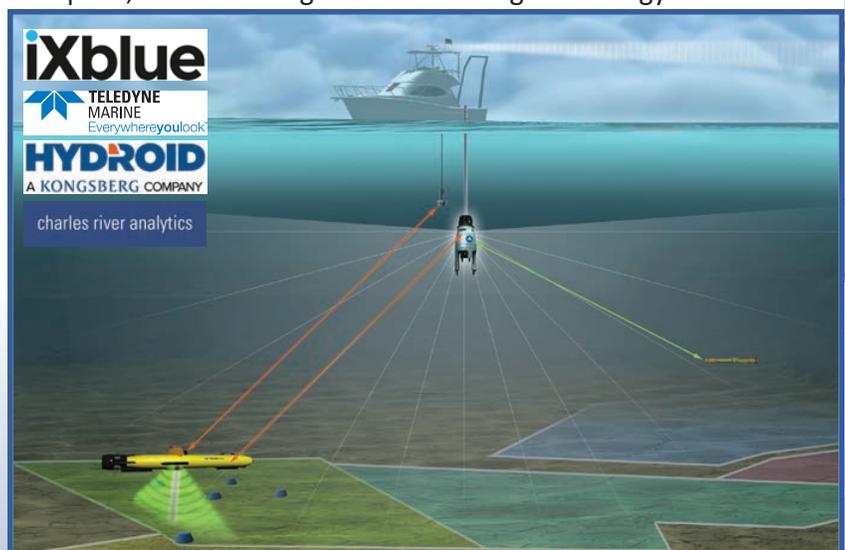
For more information, contact Tom Reynolds, 508-564-0084, treynolds@hydroid.com

Global Acoustic Positioning System (GAPS)

Exercise Lead: iXblue, Inc.

iXblue demonstrates its Global Acoustic Positioning System (GAPS) in collaboration with Teledyne and Hydroid. The man-portable pre-calibrated GAPS system is designed for precision tracking of up to 48 undersea assets simultaneously, within 200° of detection and into very shallow water. This provides situational awareness and C2 capability to users on the surface and/or at remote locations via uplink, which is being seen as enabling technology for UUV swarming.

During the demonstration the Teledyne Gavia AUV will perform a high-accuracy MCM survey, leveraging USBL fixes from GAPS as additional aiding to its standard INS/DVL navigation suite. GAPS will demonstrate omnidirectional simultaneous tracking of the Gavia AUV and the Hydroid Remus 600, and upon conclusion of the Hydroid mission the Gavia AUV will be re-tasked for a very shallow water ISR mission. Data collection and analysis will follow soon after to include navigation and sonar post-processing suites and ATR from Charles River Analytics.



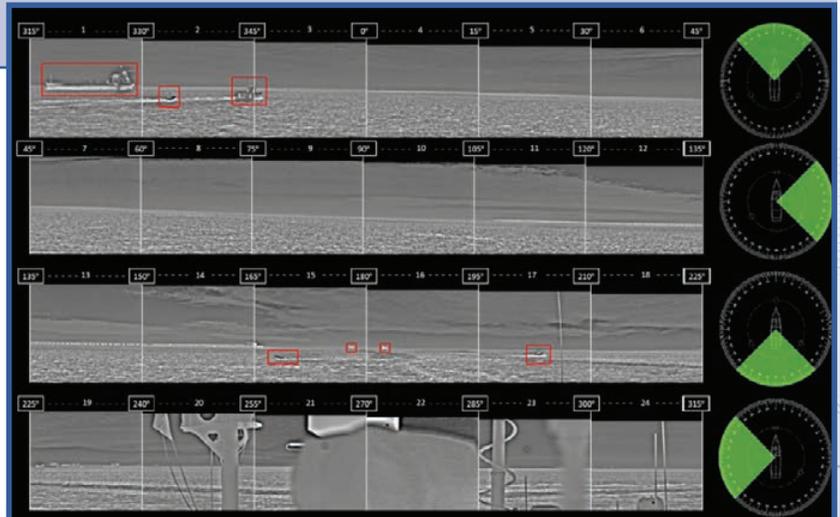
For more information, contact Robert O'Malley, 281-633-6667, robert.omalley@ixblue.com

Above Water Situational Awareness

Exercise Lead: L3 Technologies

The 360-degree high definition (360HD) and data acquisition system (DAS) sensors are installed on a surface craft (manned or unmanned) or pier side and provide panoramic imagery for above water situational awareness of other surface targets like Fast Attack Craft (FAC) / Fast Inshore Attack Craft (FIAC), and unmanned surface vehicles as well as airborne threats like Class 1 and Class 2 unmanned aerial vehicles. The situational awareness (SA) can be used for navigation and automatic detection and tracking of targets for obstacle avoidance or target hand-off to other systems and for counter unmanned aerial systems (C-UAS).

Both 360HD and DAS systems are totally passive and provide full SA and automatic target detection and passive ranging of detected targets in contested waters.



For more information, contact Stephen McClanahan, 513-573-6457, stephen.mcclanahan@l3t.com

AN/BYG-1 SCS and Distributed Command and Control of UxV for IPOE

Exercise Lead: NUWC Division Newport

Distributed Command and Control (C2) of cross-domain (air/sea) unmanned vehicles (UxV) by major platform combat systems and mobile expeditionary units maximizes opportunities in battlespace characterization with reduced risk and timelines. The CaSHMI UxV controller provides a single interface for concurrent management of multiple heterogeneous UxV, and it enables essential functions for networked C2 such as transfer of control among remote sites with discontinuous communications. JAUS messaging services provide commonality for status and data product exfiltration, and it supports dynamic retasking of UxV for in-stride response to evaluated data and for emergent missions. Advanced autonomy on the UxV support onboard processing of collected battlespace characterization data and reduction of the data for exfiltration in limited communication bandwidth scenarios for direct representation on tactical displays. Encrypted RF data links and Iridium SBD government gateways are used for bi-directional communication.



For more information, contact Michael Incze, 401-832-3436, michael.l.incze@navy.mil

Proton Exchange Membrane Fuel Cell-powered micro-UUV

*Exercise Lead: NUWC
Division Newport*

As a result of the collaboration between NUWC Newport and Riptide Autonomous Solutions at ANTX 2016, the teams partnered to integrate Riptide’s commercially available vehicle and a proton exchange membrane (PEM) fuel cell with commercial-off-the-shelf balance of plant components. The goal is to demonstrate the vehicle powered by a PEM fuel cell that replaced the micro-UUV’s battery energy section. The PEM fuel cell operates on compressed gases, hydrogen (fuel), and oxygen (oxidant). The UUV will be transported by RHIB to its mission area where it will commence a series of pre-programmed, low-speed maneuvers followed by a high-speed sprint.



For more information, contact Dr. Louis Carreiro, 401-832-5097, louis.carreiro@navy.mil

USV/UGV Collaborative Demonstration to Support Beach Reconnaissance and Clearance

*Exercise Lead: NSWC Indian Head
Explosive Ordnance Disposal
Technology Division*

This simulated mission involves deploying Explosive Ordnance Disposal Unmanned Ground Vehicle (UGV) assets from a converted autonomous Advanced Composite Riverine Craft (ACRC). The autonomous ACRC will deliver the UGVs to the beach to conduct threat detection and neutralization operations, through a combination of semi-autonomous and tele-operative control.



For more information, contact Michael Del Signore, 301-744-5791, michael.delsignore@navy.mil

Power Docks Autonomous Floating Micro-Grid Platform

Exercise Lead: Power Docks

Power Docks Autonomous Floating Micro-Grid Platform will demonstrate its air, sea, and underwater (C3) capabilities for defense applications and homeland security by supporting autonomous recharging of unmanned aerial vehicles, unmanned underwater vehicles, and unmanned surface vehicles.

Military applications for Power Docks includes surveillance-recognizance deterrence, integrated C3, rapid tactical mission deployment, extended unmanned remote control, unmanned payload delivery, homeland coastal security response, and C3 unmanned search and rescue.



For more information, contact Anthony Baro, 401-489-2273, abaro@power-docks.com

Static Participants

Adaptive Methods Tethered Buoy for Autonomous Detect, Approach, and Engaged

Booz Allen Hamilton will showcase a Cyber Resilient Security Engineering capability for assurance of ISR sensors and C2 systems in a contested Electromagnetic Maneuver Warfare Command & Control (EMC2)/Cyber environment.

Boston Engineering will showcase the GhostSwimmer, a stealthy, highly maneuverable, and modular biomimetic AUV for various missions in contested, cluttered, or denied environments.

NSWC Panama City Division

Naval Engineering Education Consortium (NEEC) will showcase their research involving new unmanned systems and related technologies as part of Battlespace Preparation in a Contested Environment including high-performance control of undersea vehicles, wave-based analysis of distributed acoustic sensor networks, and bio-inspired dynamic broadband sonar.

NUWC Newport Division Environmental will feature the latest news and video from the Navy's Energy Warrior program.

NUWC Newport Division High Velocity Learning will feature videos and information on how NAVSEA is helping the Navy through HVL; Fleet Feedback forms are located here.

NUWC Newport Division Platform and Payload Integration Department will highlight current technologies and facilities pertaining to Submarine Missile/Payload Integration, USW Launcher Systems, and Launching technologies.

NUWC Newport Division Ranges, Engineering, and Analysis Department Personnel will be available to discuss a variety of technologies and services including: Portable Tracking Range Technology, Underwater Tracking Range Equipment, Marine Species Modeling, Marine Mammal Monitoring, Industrial Service Enterprise, Narragansett Bay Facility, Environmental Qualification Services, Tracking Display and Waterside Security.

NUWC Newport Division Sensors and Sonar Systems Department

Northrop Grumman will use high-definition animation to display the multi-domain, collaborative UxV seabed warfare demonstration being conducted at NSWC Panama City.

Saab North America, Inc. will showcase the Saab Sabertooth AUV, a state of the art autonomous work class vehicle that provides significant capability as a sub-sea resident asset or as a payload operating from larger UUVs.

Southeastern New England Defense Industry Alliance (SENEDIA)

SRI will apply Intelligent Autonomy to underway ship hull scanning at sea.



Naval Surface Warfare Center Panama City Division

STRATEGIC ALIGNMENT

MISSION
We design, build, deliver, and maintain ships and systems on-time and on-cost for the United States Navy

MISSION PRIORITIES

- ON-TIME DELIVERY OF SHIPS & SUBMARINES
- CULTURE OF AFFORDABILITY
- CYBERSECURITY

TALENTED PEOPLE *and* HIGH VELOCITY LEARNING

Implementing Technical Rigor Throughout the Acquisition Process

- A Technical Competency Construct across all the technical and business domains
- Mission Engineering – SoS Capabilities
- Corporate Project Management Tools
- Alternative contract strategies for rapid prototyping hardware procurement
- Long Range R&D Investments



Expanding the Advantage in the Littorals

Building Technical Rigor in a Secure Environment

- Establish Cybersecurity Competency
- Create Cybersecurity knowledge-base throughout entire organization through formal training and learning
- Qualified Cyber Workforce
- Incorporating Lessons Learned/Best Practices from across NR&DE



Sustaining Technical Rigor in a Dynamic Budget Environment

- Technically Assertive – Speaking Truth to Power
- Partner with other Warfare Center Divisions to provide best value
- Quality Management System – 1st time quality
- Apply Common Risk Management practices
- Value Management to ensure on time delivery

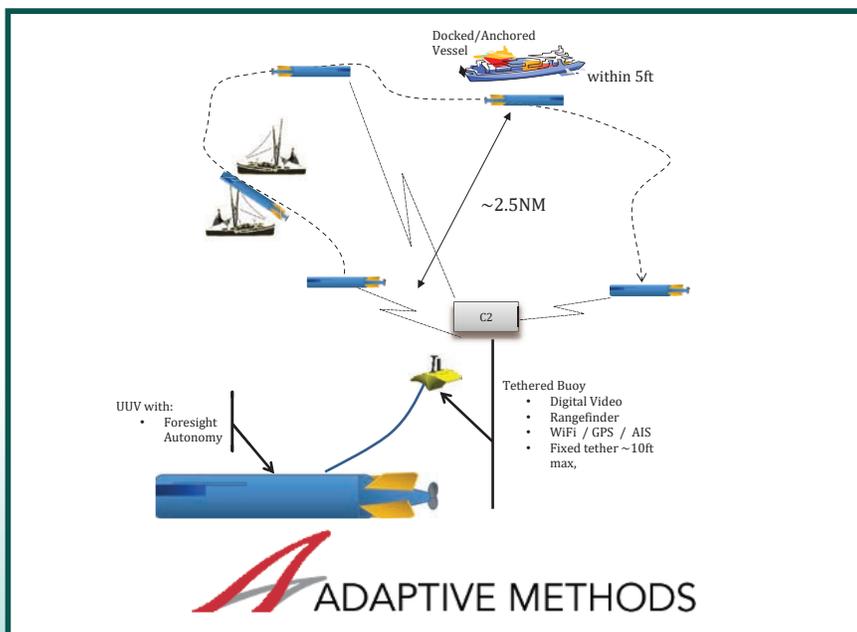


Tethered Buoy for Autonomous Detect, Approach, and Engaged

Exercise Lead: Adaptive Methods

Adaptive Methods is using a UUV with tethered buoy to autonomously locate and close to within engagement range of a target of interest from on-station position. The demonstration uses a small-to-medium UUV with a prototype tethered C2/ISR buoy for engagement with the target vessel. The buoy is outfitted with a large field of view video and LIDAR rangefinder, WiFi or VHF radio communications bridge, GPS, and AIS. The autonomous control of the UUV will be done using Foresight behaviors in a prototype implementation of an open UUV autonomy framework.

- Demonstrates tactics, techniques and procedures (TTPs) that are used in autonomous close approach, intel collection, and target engagement.
- Technology Enablers for above water and underwater ISR, communications, and payload delivery.



For more information, contact Lewis Hart, lhart@adaptivemethods.com

DeTect Counter Unmanned Aerial Systems System

Exercise Lead: DeTect Intelligent Sensors

The Harrier Radar (supplied by DeTect Inc.) will provide persistent situational awareness of surface vessels and unmanned aerial system (UAS) platforms operating in the St. Andrew Bay operational area during the ANTX 2017 exercise. The HARRIER radar system will provide radar slew to cue functionality whereby users will be able to point and click on targets to gain further insight into radar detected targets via EO sensor.



For more information, contact Jesse M. Lewis, 850-763-7200, 850-774-2905, jesse.lewis@detect-inc.com, www.detect-inc.com

Underwater Multi-Purpose Crawler

Exercise Lead: Engineering Professional Services (EPS)

EPS Corp. has developed and tested the OCTOPOD underwater crawler. This product was manufactured under EPS Corp.'s rapid prototyping initiative, it is designed to carry multiple sensor configurations. The crawler's purpose is to provide autonomous sensing, communication and relocation technologies.

The goal of this demo is to showcase the capabilities of OCTOPOD. EPS will place the crawler on the seabed where it will transmit an acoustic signal to a known buoy from multiple locations. Upon reception of the signals, the crawler will have demonstrated it can communicate from different seabed terrains, depths and ranges.

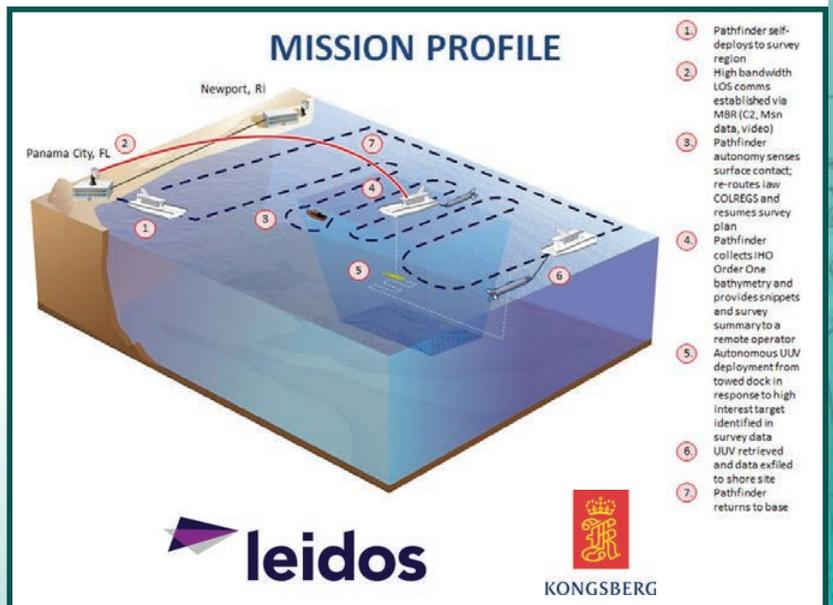


For more information, contact Bob Cowan, 850-588-6322, bob.cowan@epscorp.com

Autonomous Intelligence Preparations of the Operational Environment (IPOE) Data Collection

Exercise Lead: Leidos

Leidos will demonstrate an autonomous bathymetric survey capability using the Sea Hunter surrogate test vessel, R/V Pathfinder, equipped with a high-resolution bathymetry collection suite to collect IPOE-specific data in the waters off of Panama City. This data will include International Hydrographic Office (IHO) Order One bathymetric measurements of the sea floor, real-time meteorological observations, and ocean environmental characteristics. Then, Leidos will telemeter this data in real time to NSWC Panama City Division using two different high-bandwidth, line-of-sight, long-range, Active Electronically Scanned Array (AESA)-based radio systems, one produced by Leidos and one produced by Kongsberg Seatex. Using commercial networks, Leidos will further forward this data for display to NUWC Newport Division. Concurrent with this activity, R/V Pathfinder will operate in an autonomous navigation mode similar to Sea Hunter's capabilities. This mode enables precision track-following of survey plans while keeping the vessel compliant with COLREGs (International Regulations for Preventing Collisions at Sea) requirements based on existing navigation aids and surface contacts. Lastly, Leidos will demonstrate the autonomous launch and subsequent recovery of an unmanned underwater vehicle (UUV) simulating a platform equipped with IPOE sensors.



For more information, contact Charles Fralick, 703-907-2555, charles.r.fralick@leidos.com, www.leidos.com

Single Sortie Detect To Engage (SS DTE) Unmanned Surface Vessel Based Mine Neutralization

Exercise Lead: NSWC Panama City Division

This demonstration will employ a tetherless mine neutralization UUV surrogate which will be deployed from an 11 meter RHIB. The vehicle will self navigate and search for a mine-like target using periodic navigation updates from a USBL/Acoustic communication link. The UUV will utilize a forward looking sonar with search algorithms to locate the target. Once the target is located, station keeping on the target will be accomplished with Electro Optic tracking algorithms. The target images will be enhanced for better image quality and sent (acoustically) back to the deployment craft for operator confirmation.



Product 2, USV-Based Mine Neutralization: Neutralizer test-bed, low-cost target reacquisition sensors, navigation and communication enhancements, automated target reacquisition

Product 3, MCM Payload Automation: Blend Automatic Target Recognition (ATR) with autonomous MCM operations, develop user confidence in ATR, update framework for multiple vehicle search, in-stride re-planning.



For more information, contact Paul Moser, 850 630-0227, paul.moser@navy.mil

Smart Mine

Exercise Lead: NSWC Panama City Division

The Smart Mining Initiative (SMI) is an effort being led by NSWC PCD to modernize offensive mining for the US Navy. The effort started in FY16 with a Set-Based Design (SBD) analysis of current mining capabilities versus Fleet needs. The goal is to extend mining capabilities beyond legacy systems in order to provide the Fleet with a new generation of mining capabilities. This new generation of mines will provide the warfighter networked minefields that are capable of carrying out missions beyond the conventional mining paradigm.

As part of ANTX 2017, the Rapid Prototyping Team will demonstrate a suite of modern sensors, UAVs, UUVs, and communications equipment capable of providing Command and Control (C2) and data exfiltration from the Seabed back to a Command Center. Some of the equipment being demonstrated includes a Rapid Exfiltration Device (RED Box), a MK18 UUV, and an Iris UAV.



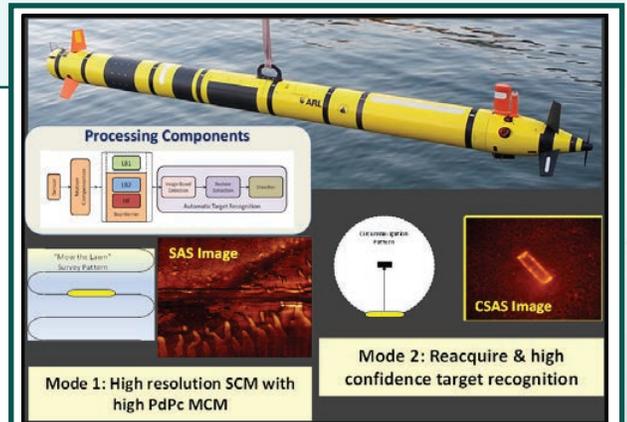
For more information, contact Shane Slusser, 850-235-5407, david.slusser@navy.mil

Multi-mode SAS System for Underwater Mapping and Mine Countermeasures

Exercise Lead: NSWC Panama City Division

This demonstration will use the latest generation small synthetic aperture minehunter (SSAMIII) / REMUS 600 autonomous underwater vehicle (AUV) system to demonstrate the effectiveness and flexibility of wide-beam, multi-frequency, multi-mode imaging synthetic aperture sonar (SAS) technologies for underwater mine countermeasures (MCM) search-classify-map (SCM), and high confidence target recognition missions. Standard linear-track high resolution SAS and cutting edge circular-track CSAS imagery will be generated from SCM and target recognition sorties in a staged underwater area representative of an amphibious operational area or assault/landing lanes.

The SSAMIII hardware, and associated signal processing, SAS image formation and automatic target recognition (ATR), and AUV technologies demonstrated are the culmination of more than 10 years of discovery and invention (D&I) investments by the Office of Naval Research, and of core developmental efforts by NSWC Panama City Division (SAS early investigations, sonar design, SAS and ATR signal processing), the Applied Research Laboratory at Penn State University (sonar transducers, electronics, mechanical design and fabrication), and Woods Hole Oceanographic Institution (AUV hardware, and guidance and control technologies).



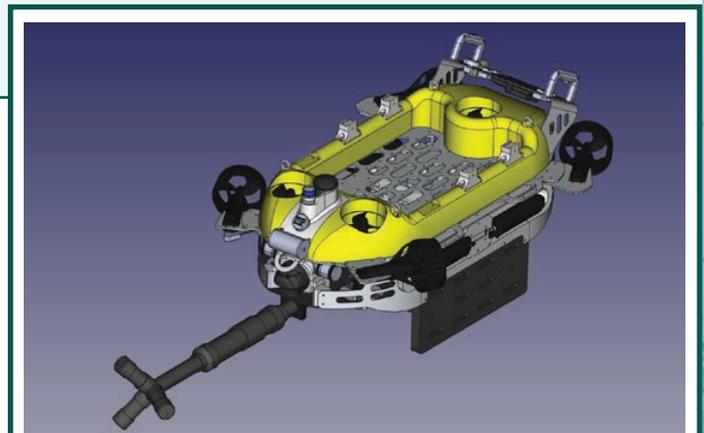
For more information, contact Jose Fernandez, 850-235-5310, jose.e.fernandez@navy.mil

Buried Object Localization Using a Supervised Autonomous Platform

Exercise Lead: NSWC Panama City Division

NSWC-PCD will demonstrate autonomous behaviors on the Dive Buddy Remotely Operated Vehicle (DBROV). These behaviors will be focused on detection and localization of buried targets with a four channel magnetic gradiometer. A forward looking sonar will be used for obstacle avoidance, situational awareness, and to evaluate any surface expression of the buried targets. The exercise will include high accuracy buried object localization through smart maneuvering of the DBROV. Marker delivery will be demonstrated by deployment of a tag on the sediment surface over the presumed target. The mission will be composed of:

- 1) Proud (FLS sonar) and buried (magnetic gradiometer) site reconnaissance/small area search.
- 2) Preprogrammed intelligent inspection of buried objects of interest.
- 3) Tagging of buried object using tag carried in grabber.
- 4) Real time multi-modal sensor data delivery to operators.
- 5) Location, depth of burial, and estimates of the magnetic size of the target will be delivered to MEDAL



For more information, contact Lee Cofer, 850-230-7067, lee.cofer@navy.mil

Advanced Autonomy for MCM Operations

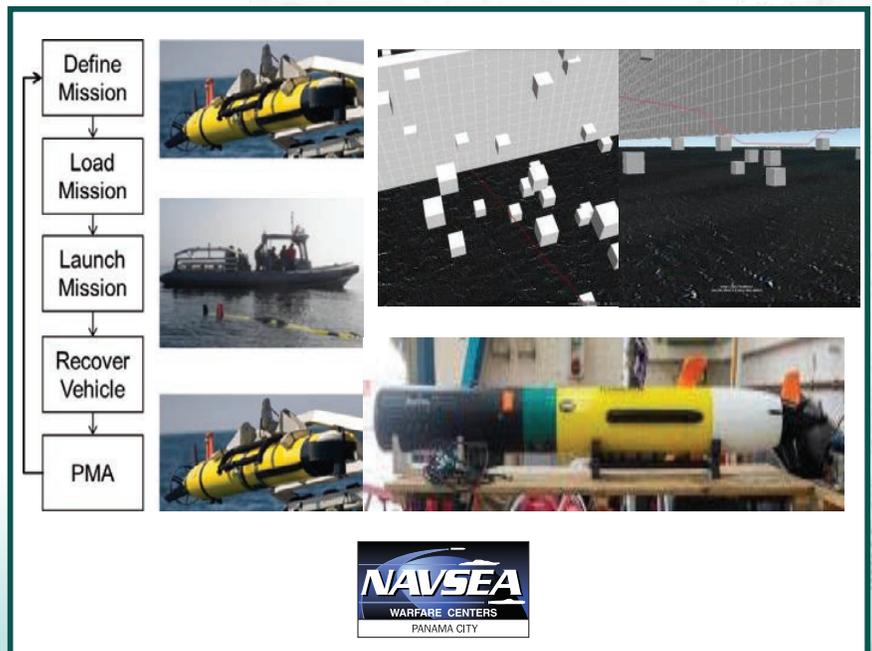
Exercise Lead: NSWC Panama City

Demonstration of two or more UUVs collaborating to complete MCM SCM missions

- Detection of objects of interest
- Data collected and stored in World Model
- Data processed through ATR algorithms
- Data transferrable to surface for viewing
- Reduce timeline
- Safety

Demonstration of Autonomy in a Box (AutoBox)

- Quick deployment of autonomy environments on vehicles
- Demonstration of Autonomous Vehicle Architecture (AVA)



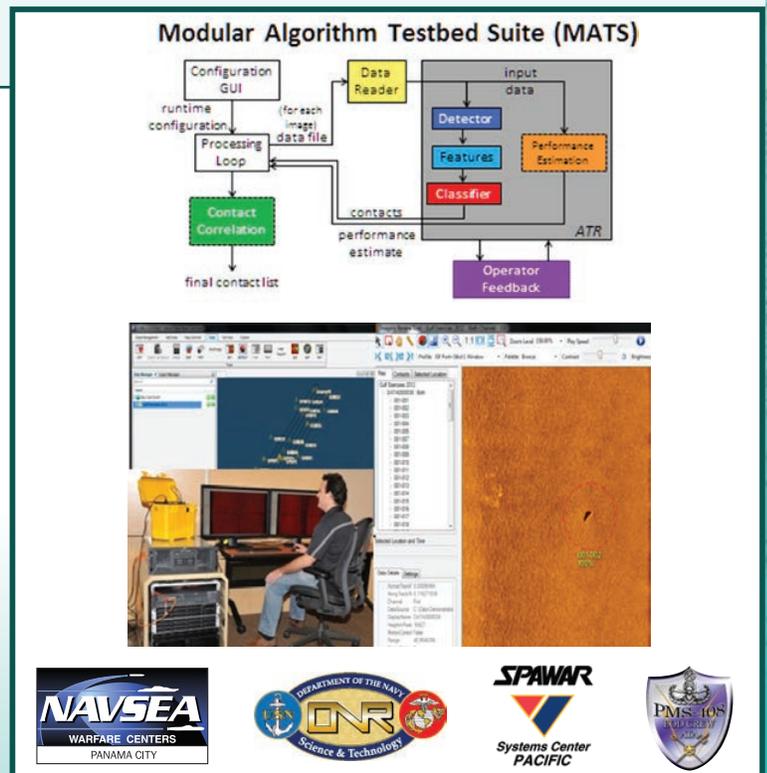
For more information, contact Dr. Joshua Weaver, 850-234-4725, joshua.n.weaver@navy.mil

Expeditionary Mine Countermeasure Automated Data Analysis

Exercise Lead: NSWC Panama City

Expeditionary Automated Mine Countermeasure (MCM) Data Analysis software tools provide advanced automated target recognition (ATR), environmental characterization, target detection/classification performance estimation, and in-situ ATR retraining algorithms for autonomous underwater vehicles outfitted with side scan and synthetic aperture sonars (SAS). Algorithms developed under this program enable both prior and in-situ real-time planning adaptation at the platform level, improve ATR robustness to various seabed environments, estimate ATR and human operator performance, and provide on-demand ATR retraining.

In this demonstration we will test new concepts to 1) improve ATR performance by exploiting human-in-the-loop tuning software and to 2) decrease MCM prosecution timelines by using ATR-cued post-mission snippet review. Side-scan and SAS sonar data will be collected at the event using NSWC PCD unmanned underwater vehicles and analyzed by operators using ATR software tools developed by the Office of Naval Research (ONR).



For more information, contact Dr. Tory Cobb, 850-235-5054, james.cobb@navy.mil

Seabed Warfare (Denied Area Access, Surveillance, and Attack)

Demonstration Lead: Northrop Grumman



Collaborative autonomous systems (6 UUVs, 2 USVs and 1 UAV Surrogate) provide access, surveillance, and attack of seabed infrastructure in a contested environment. Northrop Grumman, Huntington Ingalls, Battelle, Riptide and Ultra-USSI will demonstrate both offensive and defensive capability using multi-domain autonomous platforms equipped with networked sensors and advanced mission management for command and control.

Technologies Demonstrated

Advanced Mission Management and Control System (AMMCS) | Wave Gliders equipped as area sentries | REMUS with 3D bathymetric sensor and change detection to locate undersea infrastructure and assess battle damage | REMUS and Riptide micro-vehicles deployed from Proteus XLUUV surrogate | Joint Architecture for Unmanned Systems Standards (JAUS) | TOPSIDE | Marine Open Autonomy Architecture (MOAA)

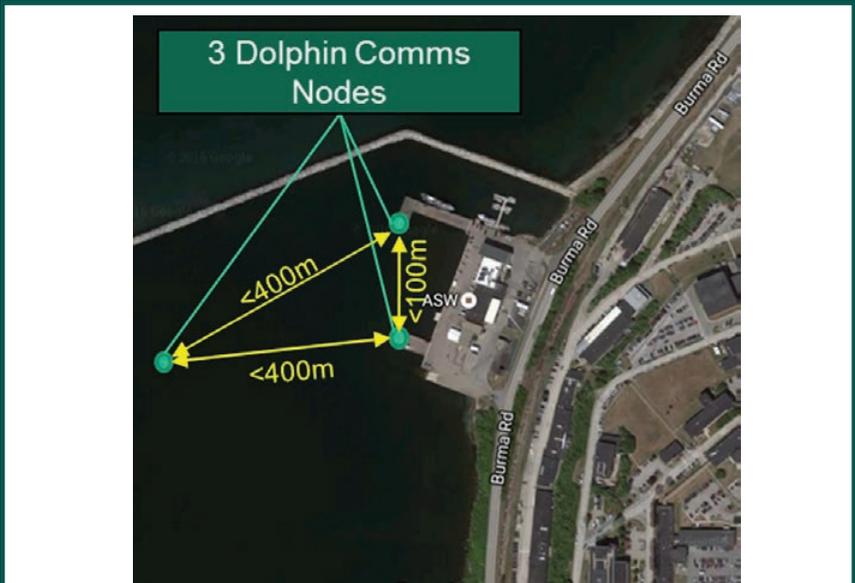


**For more information, contact Drew Sweetak, 410.260.5391, drew.sweetak@ngc.com
 Jeff Hoyle, 858.618.3793, jeffery.hoyle@ngc.com**

Dolphin Underwater Comms Network

Exercise Lead: QinetiQ North America

Underwater communication networks are critical to fast, reliable battlespace preparation in a contested environment. These need to be reliable, networkable, with high data rates and throughput. QinetiQ North America will demonstrate a network of full duplex underwater comms nodes (Dolphin Comms) in an operationally relevant environment. This comms network will demonstrate high throughput, true full duplex, high data rate, reliable, assured data transfer, and collocated transmit/receive (able to fit on unmanned underwater vehicles) all operating on a single frequency.



For more information, contact Gregory Folts, 703-480-0717, greg.folts@qinetiq-na.com

Underway Ship Hull Scanning

Exercise Lead: SRI International

SRI is demonstrating intelligent autonomous technologies that allow an autonomous underwater vehicle (AUV) to execute unobtrusive detection, discrimination, tracking, interception, & scanning of the hull of a selected vessel of interest while underway at sea. Following the scan, the AUV will exfil via RF communications the optical video and 3D sonar scan data to the support vessel. Detection of even small contraband items on the ship hull will be possible.

The technology employs a commercially available AUV with innovative intelligent autonomy software, BlueView 2D and 3D sonars, camera optics, and RF packages for AIS reception & communications. The demonstration showcases an early stage in the development of an **advanced platform-agnostic AUV capability** that can loiter for long periods in an area of responsibility and adapt to a variety of complex missions. **Adaptable intelligent autonomy** is enabled by SRI's Lumen AI framework integrated with SRI open-standard AUV interface control technology. The intelligent autonomy is controllable via user-specified policies that enable guaranteed bounds on behavior, with the policies being learned from supervised simulations requiring no software development.



For more information, contact Grant Palmer, grant.palmer@sri.com

Static Participants

NSWC PCD - Modeling and Simulation support for High Velocity Learning and Rapid Prototype Development.
NOTE: this is a live display pier side - display and simulation for SMI

NSWC PCD - Maritime Autonomy in a Box: Building a Quickly-Deployable Autonomy Solution using the Docker Container Environment

NSWC PCD - Tool for Verification of Autonomous Systems

Autonomous Surface Vehicles (ASV) - CW12P Over-The-Horizon Capable, COLREGS Compliant USV

General Dynamics Mission Systems - Mine Countermeasures in Contested Environments

NSWC PCD / Enterprise Ventures Corporation - Deployment and Recovery of UUVs from the MH-60S Helicopter

Navy Experimental Diving Unit (NEDU)

NSWC PCD - Counter UUV Defeat Technologies



GENERAL DYNAMICS
Mission Systems



TUESDAY

August 15, 2017

WEDNESDAY

August 16, 2017

TIME	ACTIVITY		
0700 0745	Check in at Bldg 80 ; Park and Shuttle/ Walk to Chafee Auditorium		
0745 0800	Opening "Welcome to ANTX" video (5 min) and CONOPS video (10 min), Chafee		
0800 0900	NPT Participant Briefs (5 min. each), Chafee		
0900 0930	NPT Technical Director introduces Keynote Speaker/Address (0800 CST), Chafee (simulcast to PCD)		
0930 1000	PCD Technical Director introduces Keynote Speaker/Address (0830 CST), Chafee (simulcast from PCD)		
1000 1010	Overview of Events, Chafee		
1015 1100	Shuttle to NBTF		
1100 1630	<table border="1"> <tr> <td> <p>Distro D at Narragansett Bay Test Facility <i>Participants including:</i> ASEC: Lockblade Airborne Release Boeing: Precision Undersea Navigation Network for Counter-mine Operations in a Contested Battlespace Domo Tactical Communications: Maritime Mesh General Dynamics Mission Systems: Undersea Battlespace Preparation in Contested Environments Hydroid: Clandestine Insertion of Above Water ISR iXblue: Global Acoustic Positioning System L3: Above Water Situational Awareness NUWC DIVNPT: AN-BYG 1 SCS and Distributed Command and Control of Unmanned Vehicles for IPOE NUWC DIVNPT: Proton Exchange Membrane Fuel Cell-powered micro-UUV NSWC IHEODTD: USV/UGV Collaborative Demonstration to Support Beach Reconnaissance and Clearance Power Docks: Blue Isles Autonomous Floating Micro-Grid Platform</p> </td> <td> <p>Distro D Panama City Broadcast in ANTX Command Center <i>Participants including:</i> Adaptive Methods DeTect, Inc. Engineering Professional Services (EPS) Gulf Coast State College Leidos NSWC PCD Northrop Grumman QinetiQ SRI</p> </td> </tr> </table>	<p>Distro D at Narragansett Bay Test Facility <i>Participants including:</i> ASEC: Lockblade Airborne Release Boeing: Precision Undersea Navigation Network for Counter-mine Operations in a Contested Battlespace Domo Tactical Communications: Maritime Mesh General Dynamics Mission Systems: Undersea Battlespace Preparation in Contested Environments Hydroid: Clandestine Insertion of Above Water ISR iXblue: Global Acoustic Positioning System L3: Above Water Situational Awareness NUWC DIVNPT: AN-BYG 1 SCS and Distributed Command and Control of Unmanned Vehicles for IPOE NUWC DIVNPT: Proton Exchange Membrane Fuel Cell-powered micro-UUV NSWC IHEODTD: USV/UGV Collaborative Demonstration to Support Beach Reconnaissance and Clearance Power Docks: Blue Isles Autonomous Floating Micro-Grid Platform</p>	<p>Distro D Panama City Broadcast in ANTX Command Center <i>Participants including:</i> Adaptive Methods DeTect, Inc. Engineering Professional Services (EPS) Gulf Coast State College Leidos NSWC PCD Northrop Grumman QinetiQ SRI</p>
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1730 2000	No Host Social, Officers' Club		

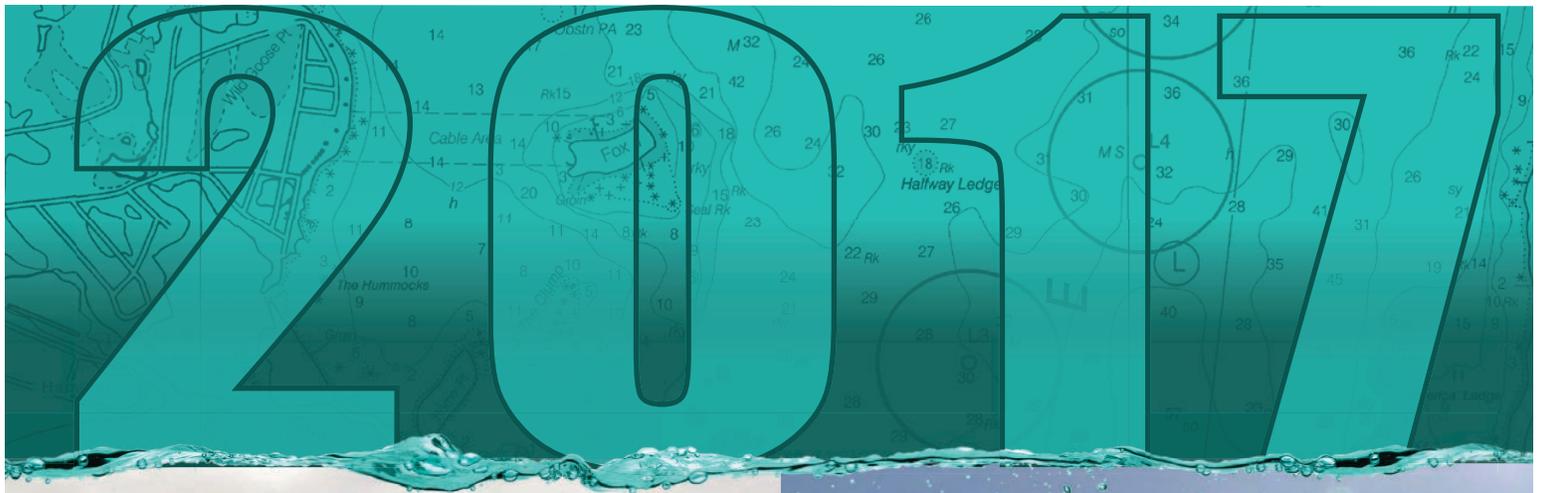
Distro D - Static Displays
Distro D - In-water Exercises until 1700

TIME	ACTIVITY		
0700 0800	Check in at Bldg 80 (if needed); Park and Shuttle to NBTF		
0800 1230	<table border="1"> <tr> <td> <p>Distro D at Narragansett Bay Test Facility <i>Participants including:</i> ASEC: Lockblade Airborne Release Boeing: Precision Undersea Navigation Network for Counter-mine Operations in a Contested Battlespace Domo Tactical Communications: Maritime Mesh General Dynamics Mission Systems: Undersea Battlespace Preparation in Contested Environments Hydroid: Clandestine Insertion of Above Water ISR iXblue: Global Acoustic Positioning System L3: Above Water Situational Awareness NUWC DIVNPT: AN-BYG 1 SCS and Distributed Command and Control of Unmanned Vehicles for IPOE NUWC DIVNPT: Proton Exchange Membrane Fuel Cell-powered micro-UUV NSWC IHEODTD: USV/UGV Collaborative Demonstration to Support Beach Reconnaissance and Clearance Power Docks: Blue Isles Autonomous Floating Micro-Grid Platform</p> </td> <td> <p>Distro D Panama City Broadcast in ANTX Command Center <i>Participants including:</i> Adaptive Methods DeTect, Inc. Engineering Professional Services (EPS) Gulf Coast State College Leidos NSWC PCD Northrop Grumman QinetiQ SRI</p> </td> </tr> </table>	<p>Distro D at Narragansett Bay Test Facility <i>Participants including:</i> ASEC: Lockblade Airborne Release Boeing: Precision Undersea Navigation Network for Counter-mine Operations in a Contested Battlespace Domo Tactical Communications: Maritime Mesh General Dynamics Mission Systems: Undersea Battlespace Preparation in Contested Environments Hydroid: Clandestine Insertion of Above Water ISR iXblue: Global Acoustic Positioning System L3: Above Water Situational Awareness NUWC DIVNPT: AN-BYG 1 SCS and Distributed Command and Control of Unmanned Vehicles for IPOE NUWC DIVNPT: Proton Exchange Membrane Fuel Cell-powered micro-UUV NSWC IHEODTD: USV/UGV Collaborative Demonstration to Support Beach Reconnaissance and Clearance Power Docks: Blue Isles Autonomous Floating Micro-Grid Platform</p>	<p>Distro D Panama City Broadcast in ANTX Command Center <i>Participants including:</i> Adaptive Methods DeTect, Inc. Engineering Professional Services (EPS) Gulf Coast State College Leidos NSWC PCD Northrop Grumman QinetiQ SRI</p>
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1230 1300	All displays become Distro A		
1300 1500	Distro A Congressional Speakers/ Media		
1500 1600	Distro A Closing Ceremonies		

Distro D - Static Displays
In-water Exercises

Rain Date is Thursday, Aug. 17.

Newport:
Unless otherwise indicated, the location for all activities is the Narragansett Bay Test Facility (NBTF)



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