

NUWC DIVISION NEWPORT

ANTX 2016

ANNUAL NAVAL TECHNOLOGY EXERCISE

Annual Naval Technology Exercise ANTX 2016 Overview

NUWC Division Newport

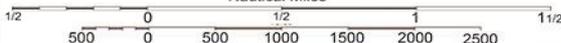
1
11
BLACKWING
COA/IFC
BOUNDRY

NEWPORT
STATE
AIRPORT

RESTRICTED
AREA

SOUNDINGS IN FEET
AT MEAN LOWER LOW WATER
Additional information can be obtained at nauticalcharts.noaa.gov.

SCALE 1:20,000
Nautical Miles



What is ANTX?

- ANTX is an annual event created by NUWC Division Newport to demonstrate future Navy technologies in action today
 - ANTX 2016 was a 3-day event, 16-18 August 2016
- Naval Warfare Centers, universities, and industry partners were invited to showcase their new unmanned systems and related technologies at the Narragansett Bay Test Facility (NBTF) range
- ANTX provides a low risk environment in which scientists and engineers may evaluate their technological innovations at the research and development level before their technologies become militarized and integrated at the operational level

*Forum for rapid prototyping,
speed-to-fleet development for budding technologies*

ANTX 2016 Theme

“Cross Domain Communications and Command & Control”

- The United States has national interests in all sea domains, from space to the sea floor, each with its own strengths and weaknesses
- Participants at ANTX 2016 demonstrated the benefit of combining operations across these domains to optimize the Navy’s collective effectiveness throughout the maritime environment
- The event highlighted communication and command and control, the connecting links that allows the disparate parts to operate collectively, such that the contribution of each will enhance the war-fighting effectiveness of the greater whole

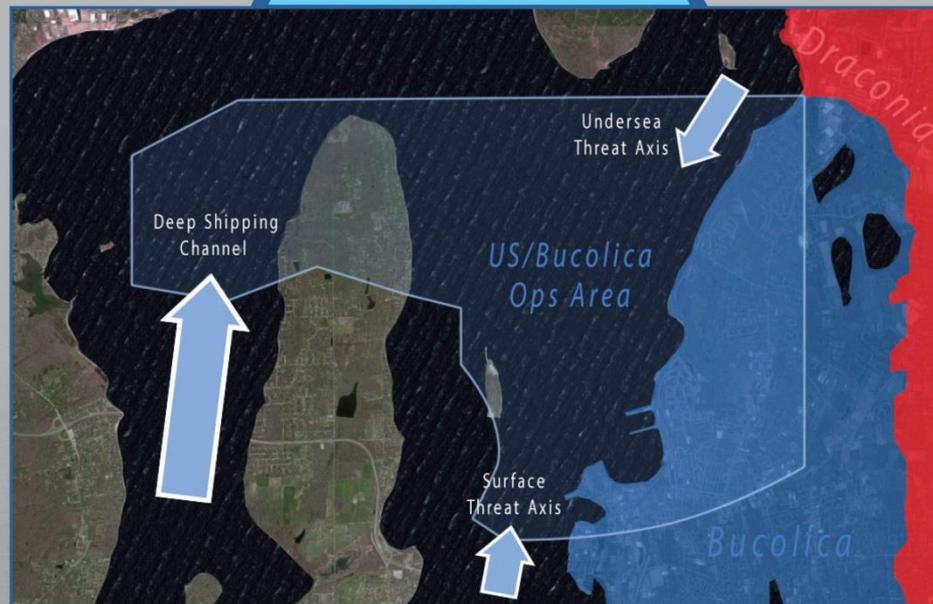
*Above, On, and Under The Sea:
Cross-domain collaboration for maritime superiority*



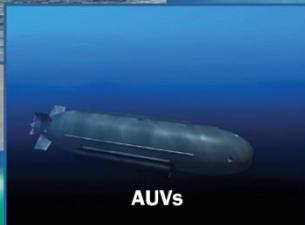
Scenario

Motivated by natural resource scarcity, aggressor nation Draconia (red force) is engaging in hybrid warfare against Bucolica (blue force) including: SOF incursions, shipping interference, potential mining and nuisance GPS and satellite phone jamming.

Area of Operations



Likely Threats



Mission Types Expected

- Bottom survey
- Salvage survey for sunken ship(s)
- General reconnaissance (air, surface, undersea)
- Mine hunting
- UAV/mini-sub search and defense
- Marine sentry duty (surface search)
- Local underwater navigation in a GPS-poor or denied environment
- C3 with shore-based operators and/or the offshore US submarine



ANTX 2016 Summary Video

EXERCISE WEEK: 16-18 Aug 2016

Over 30 Organizations from Government, Industry & Academia Demonstrating Across All Domains:

14 Unmanned Systems

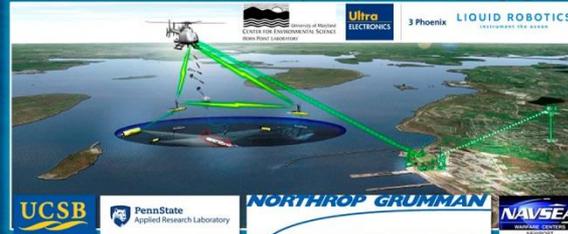
7 Command & Control Methods

11 Communication Methods

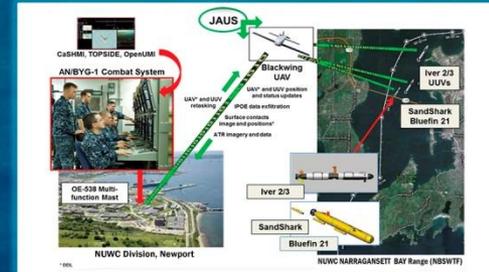
Common Air, Surface, & Subsea Control System Exercise



Cross-Domain Autonomous System Collaboration Anti-Submarine Warfare (ASW) Detect-to-Engage



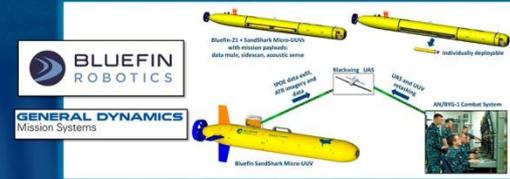
Submarine Combat System C2 of Cross-Domain UxVs



MK18 MOD 2 Increment 2



UUV Delivery of a Fleet of Micro-UUVs



ISR USV



Portable Underwater Global Positioning System (PUG)



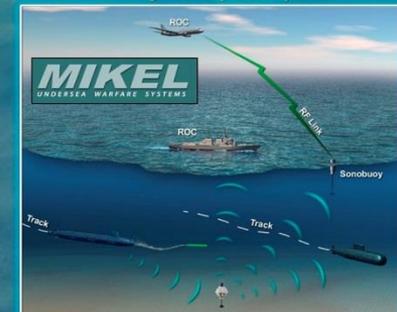
Magneto Inductive Technology for UxV COMMS



Aerial Monitoring of Rogue Drone Operations Near Maritime Ports



Submerged Acoustic Navigation System (SANS)





ANTX Static Participants

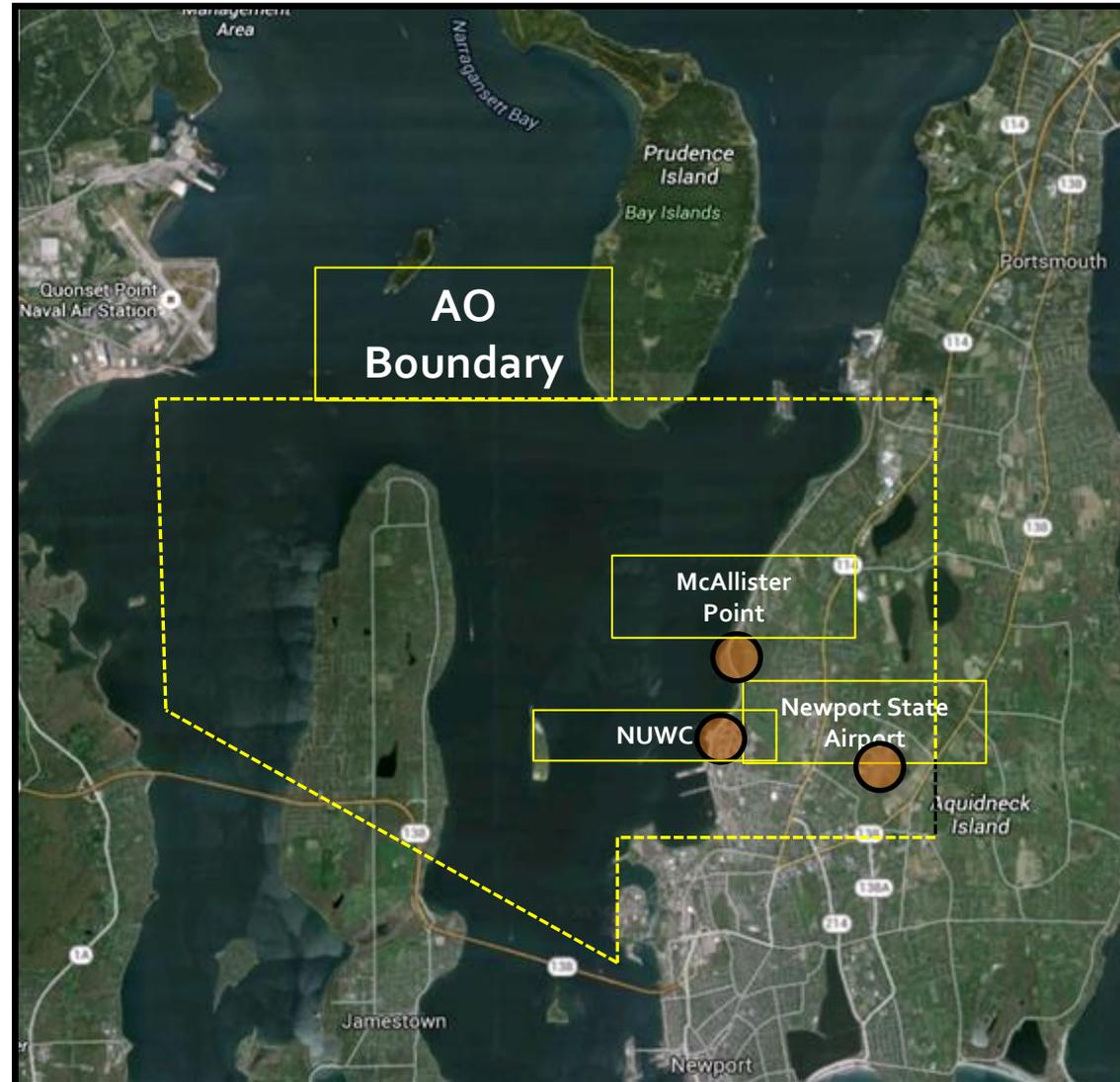


Organization	Title
PMS 485	Shallow Water Surveillance System (SWSS)
Nanocomp Technologies, Inc.	Revolutionary Carbon Nanotube Materials for Naval Warfare
L-3 Advanced Programs	Persistent Undersea Power Source (PUPS)
Hydroid	Next Generation REMUS 100 UUV
NUWC C70	Navy Acoustic Effects Model & Environmental Planning (NAEMO) Project
NUWC C10	Energy Warrior
NUWC C85	Energy for UUV Applications
Siemens Government Technologies	PEM Fuel Cell Air Independent Power Generation
NSWC Carderock	Unmanned Maritime Mobility Systems
NUWC C85	TOPSIDE
L-3 Ocean Systems	UUV / USV Sensor Systems
NUWC C85	Cyber Challenge
Raytheon	AQS-20 Minehunting Sonar System
NUWC C85	RPG of the Sea
Riptide Autonomous Solutions	Riptide Micro-UUV
NUWC C15	Next Generation Sensing

Area of Operation (AO) On Land

Three Land Sites:

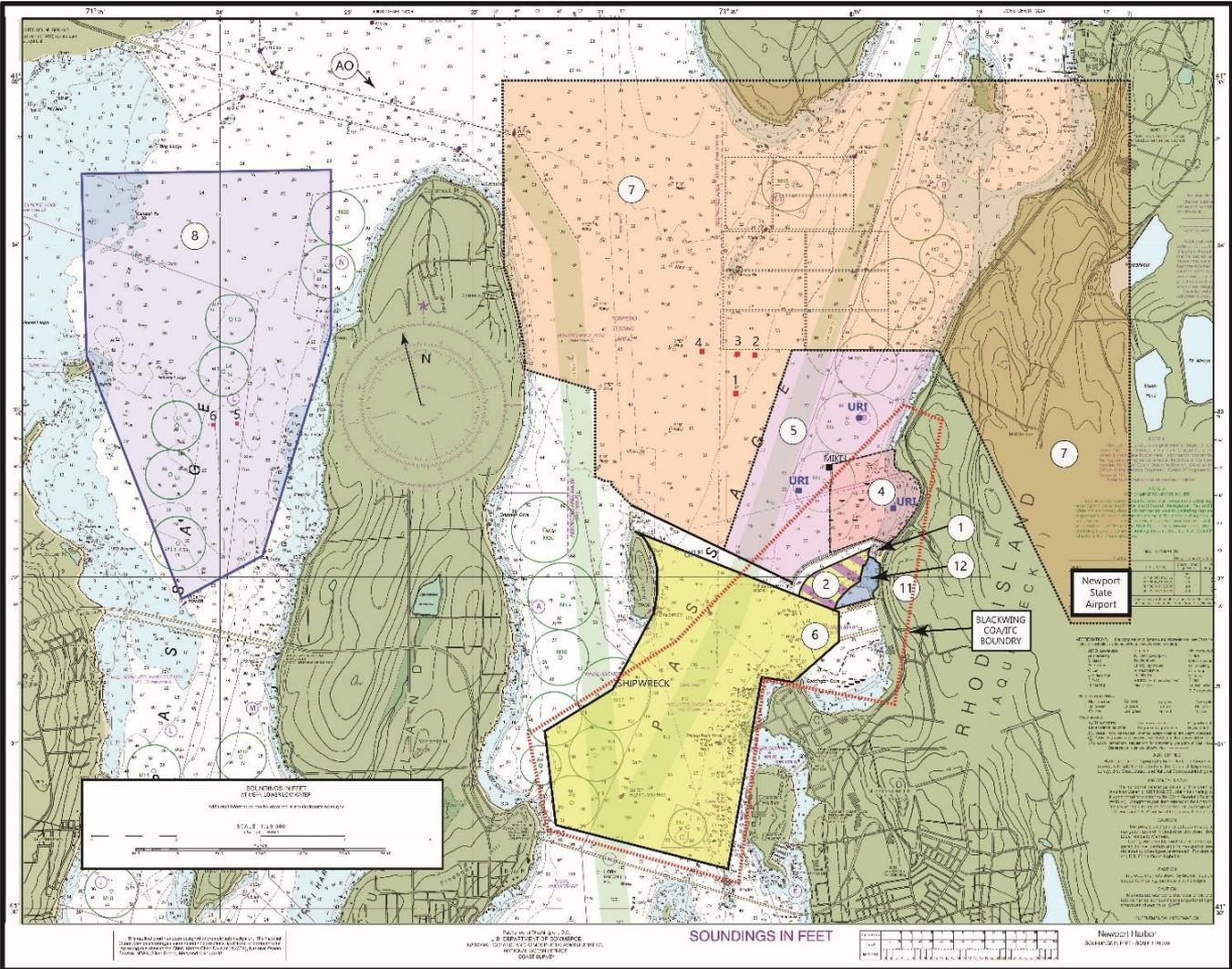
- Newport State Airport
- McAllister Point
- NUWC



Area of Operation (AO) In-Water

Narragansett Bay

Zone	Domain	Participant(s) Using Zone
1	Land (Pier) / Below Water	All
2	On Water / Below Water / Air	DDIS / ULTRA / LM
4	On Water / Below Water / Air	C25 / BFR / MIKEL / URI
5	On Water / Below Water	BFR / C25 / MIKEL / URI
6	On Water / Below Water / Air	LM
7	On Water / Below Water / Air	NG
8	On Water / Below Water	C85
11	Land	C25
12	On Water	C15



Exercise Schedule: Participant Perspective

Tuesday, August 16

Player>>	NUWC Code 25	NGC	LockMar	Bluefin	NUWC Code 15	Ultra	MIKEL, Inc	DDIS, Inc.	NUWC Code 85	URI
Product	X-Domain C2	X-Domain Collaboration	Common Control	Micro-UUVs	USV Surf Surveillance	Magneto-Inductive Comms	Submerged Acous Nav System	Aerostat	MK18/2 MCM	Low Cost Buoy
Zone	4/5	7	1/2/6	4/5	12	All	4/5	1	8	4/5
Time										
0700				uUUV survey /						
0800	UUV-uUUV		UUV	comms with	Pierside					
0900	- UAV -		Maneuver Ex.	(C25) UAV	Comms & ISR	Pier Runs				
1000	AN/BYG-1	P-10 (Fire Scout) Static Display	UUV-UAV C2	AN/BYG-1	Payload ECO	9-11				
1100										
1200				UUV-uUUV						
1300				deployment / recovery	USV ISR Operations	Diver Comms	SANS (as required)	Aerostat (shore) ISR 08-1700	MCM Operations	PUGS (as required)
1400		USV-UAV End-to-End ASW	UUV			08-1700				
1500			Maneuver Ex.							
1600			UUV-UAV C2	SANS Sorties						
1700										

Multiple events taking place simultaneously, participants had multiple opportunities to execute

Exercise Schedule: Attendee Perspective

TUESDAY
16 August 2016

VIP Day - Schedule of Events

TIME	EVENT and LOCATION			
0630 0800	Check in Building 80			
0900 1040	Keynote address Chafee			
Block 1 1100 1130	Exercise Participant Presentations NBTF	*Sign up for Tours at the Help Desk NBTF/ Collaboration Center	Display Sessions	
Block 2 1215 1245	Exercise Participant Presentations NBTF	Lunch 1130 - 1300		
Block 3 1330 1400	Exercise Participant Presentations NBTF	1315/Check in at Collaboration Center	Static Participants Bayside Tent NBTF Hillside Tent Behind Building 101; Content changes daily	
Block 4 1415 1445	Exercise Participant Presentations NBTF	YELLOW TOURS 1430/Return to Collaboration Center		
Block 5 1500 1530	Exercise Participant Presentations NBTF	1445/Check in at Collaboration Center		
Block 6 1545 1615	Exercise Participant Presentations NBTF	GREEN TOURS 1600/Return to Collaboration Center		
Block 7 1630 1700	Exercise Participant Presentations NBTF			
1800 2000	No Host Social Officer's Club, Naval Station Newport			

EARLY CHECK-IN

Available Monday in Building 80
from 1300 to 1800

COLLABORATION / BUSINESS CENTER

NUWC's Undersea Warfare Rapid Innovation Center (RIC) located in Building 1258, is available to all ANIX attendees for collaborative discussions and business needs.

WEDNESDAY
17 August 2016

Schedule of Events

TIME	EVENT and LOCATION		
0630 0800	Check in Building 80		
Block 1 0800 0830	Exercise Participant Presentations NBTF	*Sign up for Tours at the Help Desk NBTF/ Collaboration Center	Display Sessions
Block 2 0845 0915	Exercise Participant Presentations NBTF	0830/Check in at Collaboration Center	Static Participants Hillside Tent Behind Building 101; Content changes daily
Block 3 0930 1000	Exercise Participant Presentations NBTF	YELLOW TOURS 0945/Return to Collaboration Center	
Block 4 1015 1045	Exercise Participant Presentations NBTF	1015/Check in at Collaboration Center	
Block 5 1100 1130	Exercise Participant Presentations NBTF	GREEN TOURS 1130/Return to Collaboration Center	
Block 6 1215 1245	Exercise Participant Presentations NBTF	Lunch 1130 - 1300	
Block 7 1330 1400	Exercise Participant Presentations NBTF	1315/Check in at Collaboration Center	
Block 8 1415 1445	Exercise Participant Presentations NBTF	YELLOW TOURS 1430/Return to Collaboration Center	
Block 9 1500 1530	Exercise Participant Presentations NBTF	1500/Check in at Collaboration Center	(Refer to Static Participant Sheet)
Block 10 1545 1615	Exercise Participant Presentations NBTF	GREEN TOURS 1615/Return to Collaboration Center	
Block 11 1630 1700	Exercise Participant Presentations NBTF		

THURSDAY
18 August 2016

Media Day - Schedule of Events

TIME	EVENT and LOCATION		
0630 0800	Check in Building 80		
Block 1 0800 0830	Exercise Participant Presentations NBTF	*Sign up for Tours at the Help Desk NBTF/ Collaboration Center	Display Sessions
Block 2 0845 0915	Exercise Participant Presentations NBTF	0830/Check in at Collaboration Center	Static Participants Hillside Tent Behind Building 101; Content changes daily
Block 3 0930 1000	Exercise Participant Presentations NBTF	YELLOW TOURS 0945/Return to Collaboration Center	
Block 4 1015 1045	Exercise Participant Presentations NBTF	1015/Check in at Collaboration Center	
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Block 10 1545 1615	Exercise Participant Presentations NBTF	GREEN TOURS 1615/Return to Collaboration Center	
1645 1730	Closing Remarks and Participant Recognition Chafee Auditorium		

NBTF = Narragansett Bay Test Facility

Active Exercise Participants Presentations Available All Time Blocks

- Bluefin Robotics: UUV Delivery of a Fleet of Micro-UUVs
- Digital Design & Imaging Service, Inc.: Aerial Monitoring of Maritime Ports
- URI: Low Cost Acoustic Navigational Buoy
- Lockheed Martin: Common Air, Surface & Subsea Control System Demonstration
- MIKEL, Inc.: Submerged Acoustic Navigation System (SANS)
- Northrop Grumman: Cross-Domain Unmanned Systems Collaboration
- NUWC Code 15: NUWC 4 Mine Hunting Unit USV
- NUWC Code 25: Submarine Combat System C2 of Cross Domain UxV
- NUWC Code 85: Mk 18 Mod 2 Increment 2 MCM Demonstration
- Ultra EMS: Low Frequency Magneto-Inductive COMMS

Tour Session I (Choose One)

- Code 15: Acoustic Pressure Tank Facility
- Code 40: Launcher Laboratory Complex
- Code 85: Energy, Hydrodynamics, and Sensing
- Code 15: USV Laboratory (*Meet at NBTF*)
- Northrop Grumman: Fire Scout (*AM Only*)
Van pick-up at Collaboration Center.

Tour Session II (Choose One)

- Code 15: Transduction Materials
- Code 25: Fleet Readiness: Today and Tomorrow
- Code 34: Land-Based Submarine Radio Room
- Code 70: Survivability Laboratory
- Code 85: Autonomous Underwater Vehicle Laboratory

All tours originate
from Collaboration Center
unless otherwise noted.

Conclusion

- Exhibited technologies mapped to maritime conflict, under ANTX 2016 theme “Cross-Domain Communications, Command and Control”
- Collaboration opportunity for industry, academia, and warfare centers to tackle relevant Navy need
 - Exercise held at Narragansett Bay Test Facility – showcased capability to hold event of this scale (over 30 participating organizations)
- Visited by over 300 attendees over the three-day event
 - Brought together industry, academia and warfare center personnel with Navy stakeholders and congressional members

*Forum for rapid prototyping,
speed-to-fleet development for budding technologies*

Exercise Lead: Northrop Grumman



ANIX
ANNUAL NAVAL TECHNOLOGY EXERCISE
2016
CROSS-DOMAIN COMMUNICATIONS and COMMAND & CONTROL

The banner features a central image of a helicopter in flight over a coastal area, with green communication lines connecting it to various points on the ground and sea. The background is a blue sky and ocean.

UCSB
NORTHROP GRUMMAN
NAVSEA
WARFARE CENTERS
NEWPORT

PennState
Applied Research Laboratory

Ultra
ELECTRONICS

3 Phoenix

LIQUID ROBOTICS
instrument the ocean

Collaborative autonomous systems for ASW enable cross-domain detect-to-engage capability while maintaining humans-in-the-loop for key decisions

Exercise Lead: General Dynamics Mission Systems/Bluefin Robotics Products



CROSS-DOMAIN COMMUNICATIONS and COMMAND & CONTROL

Cross-Domain Data Exfiltration from a High Value Asset

Bluefin-21 + SandShark Micro-UUVs
with mission payloads:
data mule, sidescan, acoustic sense

Individually deployable

IPOE data exfil, ATR imagery and data

Blackwing UAS

UAS and UUV retasking

AN/BYG-1 Combat System

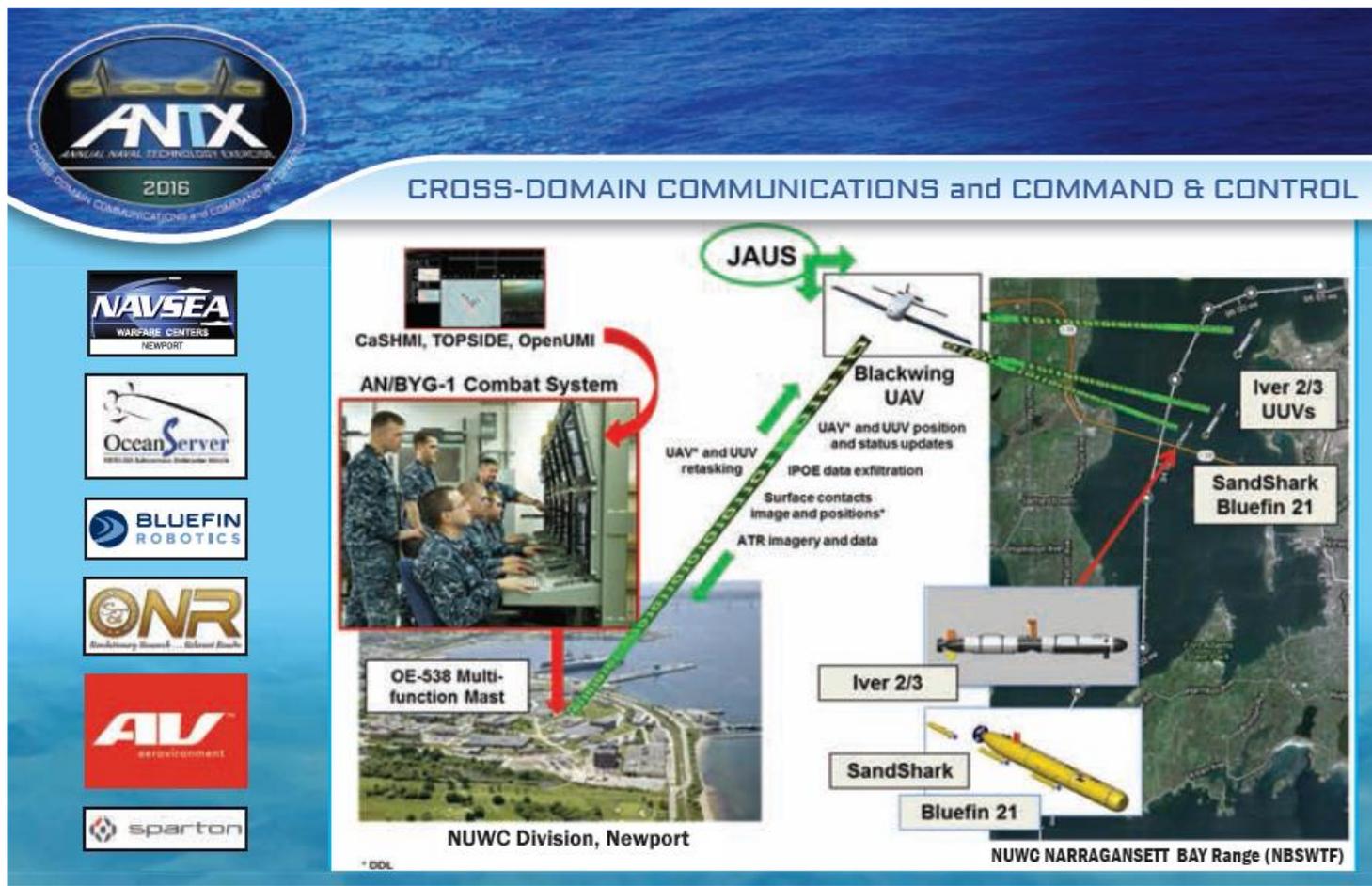
Bluefin SandShark Micro-UUV




General Dynamics Mission Systems will demonstrate Bluefin Robotics' multiple Unmanned Underwater Vehicle (UUV) "system-of-systems" concept, consisting of a Bluefin-21 carrier UUV equipped with multiple Bluefin SandShark micro-UUVs

Submarine Combat System C2 of Cross-Domain UxVs

Exercise Lead: NUWC Newport



NUWC Newport Combat Systems Department demonstration provides command and control of Unmanned Aerial Vehicles (UAV) and Unmanned Undersea Vehicles (UUV) from the AN/BYG-1 Submarine Combat System, using Fleet systems and components

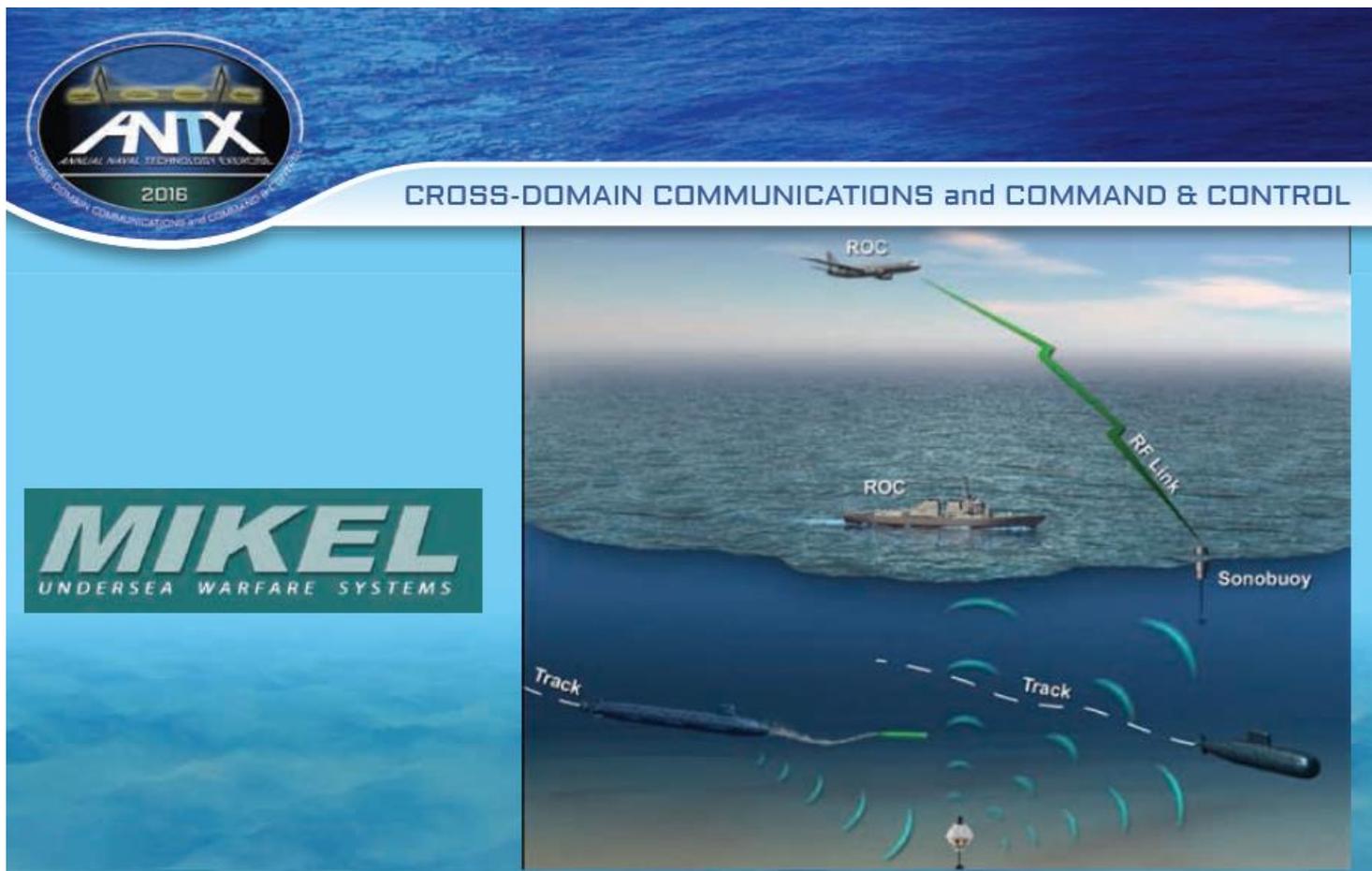
Magneto Inductive Technology for UxV Communications

Exercise Lead: Ultra Electronics EMS



Ultra Electronics EMS has developed and fielded three technologies (DiverComm, Rock Phone, and TerraComm) that utilize low-frequency magnetics to communicate through media such as rock, soil, and seawater. Exercise includes UUV and diver communications

Exercise Lead: MIKEL, Inc.



SANS utilizes one or more SANS beacons to enable a vehicle to track itself while remaining acoustically passive using the Range Only Motion Analysis (ROMA) algorithm.

Exercise Lead: Digital Design & Imaging Service, Inc.



CROSS-DOMAIN COMMUNICATIONS and COMMAND & CONTROL

ANIX
ANNUAL NAVAL TECHNOLOGY EXERCISE
2016
CROSS-DOMAIN COMMUNICATIONS and COMMAND & CONTROL

Digital Design
& Imaging Service Inc.
AirPhotosLive.com

The image is a promotional graphic for an exercise. It features a blue background with a white banner at the top containing the text 'CROSS-DOMAIN COMMUNICATIONS and COMMAND & CONTROL'. Below the banner, there are two main images: on the left, a white SUV towing a blue and white trailer with a white balloon attached to it; on the right, a white balloon with a small aircraft suspended from it. The ANIX 2016 logo is in the top right corner, and the Digital Design & Imaging Service Inc. logo and website are in the bottom right corner.

DDIS has developed and offers the ability to loft tethered aerostats for surveillance of rouge drones around sensitive maritime ports. Our rapidly deployed surveillance balloons can be winched out from a customized command and control trailer.

Exercise Lead: University of Rhode Island and DBV Technology, LLC



Three PUG systems will be anchored to the sea floor in an area of operations zone where other ANTX participants are operating, providing post-processed mission track of UUVs

Unmanned Surface Vehicle (USV) with Intelligence, Surveillance, and Reconnaissance (ISR)

Exercise Lead: NUWC Newport



NUWC Newport Sensors and Sonar Systems Department will demonstrate remote ISR operations using the NUWC-4 USV with the electro-optic/infrared (EO/IR) module and radar installed

Exercise Lead: NUWC Newport

CROSS-DOMAIN COMMUNICATIONS and COMMAND & CONTROL

MK18 MOD 2 Increment 2

Expendable Data Exfiltration (EDEX)

DTD ~1nmi Base Station (Shore or Ship) ~4nmi

Relay w/Antenna on RHIB

DTD Launch

0.5 Gb of data (~45min of UUV data) 34min Exfill
RHIB serves as "Relay" in situations when close to UUV ops.

Reacquire-Id-Marker (R-I-M) Sidescan Sonar Array

Marker Bays LED Light Bar

Still Camera Marker Drop

Marker Recovery ROV

The MK18 MOD 2 Increment 2 is a "REMUS 600" (Remote Environmental Monitoring Units) variant being developed by PMS 408 to support Explosive Ordnance Disposal (EOD) and other fleet Mine Countermeasure (MCM) missions in an effort to reduce tactical timelines and mark targets