Autonomy Solutions

ADVANCED MARINE
VEHICLES

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Advanced Coastal Monitor (ACM) 3

Characteristics	ACM 12	ACM 3	Unit
Length	12.0	3.8	m
Beam	7.0	2.1	m
Draft	2.0	0.5	m
Payload	1,280	20	kg
Speed, Cruise	4.0	2.0	Knots
Speed, Top	7.0	3.5	Knots
Op Wave Height	2.0	0.5	m

Fully capable 3m ASV

Prototype based on 12m full scale design and includes all relevant performance capabilities

Autonomous Surface Vessel

Capable of autonomous operation including transect and pattern following, with on-the-fly path changes supported by full collision avoidance

SWATH Design

Stable with large deck space, moonpool and stern ramp, fixed and articulating gantries, and drop pole as required. A SWATH hullform providing the ultimate in data acquisition and sensor stability.

Flexible Propulsion Options

Twin electric motors and propellers with nozzles or guards to match speed and survey requirements.

Green Powered

Large battery banks sized for persistent survey operation, solar cells for extended operations, low emission generator for backup and high-speed operations

Modular Sensor Bay

Platform is designed around an open architecture modular sensor capability in order to rapidly be configured to support various mission sets. Capable of simultaneous sensor operations, including multiple marine, sea-air interface, and atmospheric sensor installations.

Aluminum and Composite Construction

Reduced structural weight means increased endurance and payload carrying capacity

Integration with UxS

Currently developing means of interacting with UUVs and UAVs. This Is a "game changing" technology.

Cost

Dramatic reduction in the acquisition, maintenance and operational costs of similar methods for acquiring marine data.

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ACM 3 Operations

- Survey operations in Aquia Creek, VA
  - Water quality (dissolved O_2 top right)
  - Imaging multibeam sonar (middle right)
  - Side scan sonar (bottom right)
  - Single beam sounding
- Advanced Aquaculture Monitoring (NOAA SBIR Grant)
  - Analyzed the monitoring requirements for near shore aquaculture installations (chart lower right)
  - Established a baseline survey regimen and experiment parameters
  - Performed spatial and temporal water quality surveys and 3D current mapping
  - Provided point data validation using moored buoys with identical water quality sensors
  - Developed a path forward to commercialize survey and monitoring support for near-shore aquaculture sites
  - Operated well beyond its sea state design point

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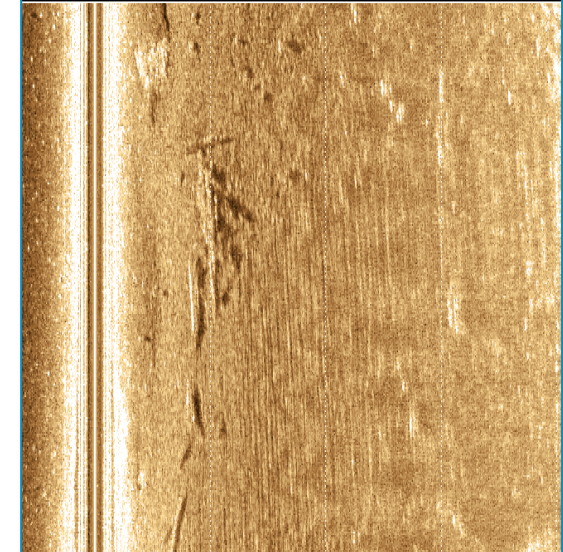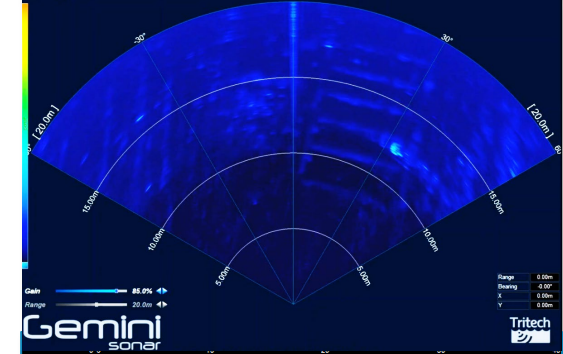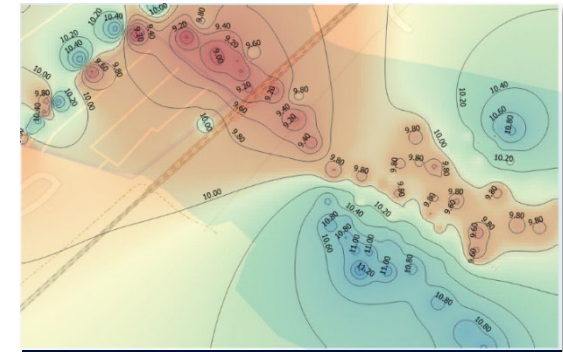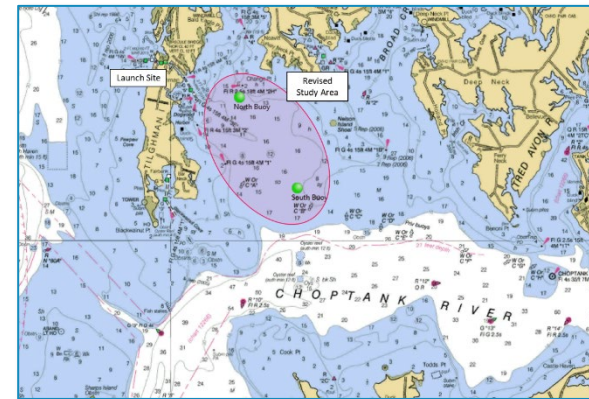
ACM Sensor Matrix

- The ACM 12 is the parent design for the ACM 3 and therefore does not have any issues integrating the same sensors given consideration for the difference in size of the vehicles and additional operational modules on the ACM 12

- The AMC 3 is currently limited employing sensors on a drop pole, extension frame, directly from the cross deck, or mast due to its size.

- The ACM 12 can employ a stern A-Frame gantry, articulated gantry, J-frame, moon pool, drop pole, mast or hull mounts to deploy sensors

Sensor Type \ Vehicle	ACM 3	ACM 12
Sonar		
Sidescan (Fixed Mount)	Demonstrated	By extension
Sidescan (Towed)	By extension	In development
Single Beam	Demonstrated	By extension
Multibeam	By extension	By extension
Imaging Multibeam	Demonstrated	By extension
Sub-Bottom Profiler	In development	In development
Hydrophone	In development	In development
Towed Array	In development	In development
Bathymetric LIDAR	Future expansion	Future expansion
Current Profiling		
Acoustic Doppler Current Profiler (ADCP)	Demonstrated	By extension
Water Quality		
Multi-Parameter Water Quality Sonde	Demonstrated	By extension
Vertical Profiling Sonde/CTD	In development	In development
Optical Petrolium Contamination	In development	In development
Atmospheric		
Multi-Parameter Weather Station	Demonstrated	By extension
Solar Radiation	By extension	By extension
Wave Height and Direction	Future expansion	Future expansion
Wind Profiling	Future expansion	Future expansion
Visibility	Future expansion	Future expansion
Imaging/Ocean Color		
HD Video	Demonstrated	By extension
Spectroradiometer (Upwelling and Downwelling)	In development	In development
Imaging Spectroradiometer	Future expansion	Future expansion

Detection and Tracking		
Radar, Surface Search	Demonstrated	By extension
Radar, Air Search*	N/A	Future expansion
LIDAR	In development	In development
EO/IR	In development	In development
Acoustic	Future expansion	Future expansion
Offboard Vehicle LAR and Operations		
Remotely Operated Vehicle	In development	In development
Autonomous Underwater Vehicle	In development	In development
Autonomous Aerial Vehicle	In development	In development
Aerostat	In development	Future expansion
Autonomous Surface Vehicle	Future expansion	Future expansion
Communications		
900 MHz RF	Demonstrated	By extension
Wifi	Demonstrated	By extension
Cellular	By extension	By extension
Satellite	In development	By extension

Notes:
* Current air search radars are too large for the ACM 3.

Legend	
Demonstrated	Technology has been operationally demonstrated on the vehicle
By extension	The use of this technology requires only minor adaptation to be operationally demonstrated on the vehicle and/or scaled to the larger vehicle
In development	This technology is in the pipeline for adaptation on either vehicle
Future expansion	This technology is planned for future adaptation on either vehicle

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Port Security and Emergency Response Demonstration (PS&ER)

- Being conducted for the Virginia Institute for Spaceflight and Autonomy (VISA)

  - Associated with Old Dominion University, Norfolk, VA

  - Background

    "As a result of a PS&ER Workshop (July 28, 2021) involving users, operators, and emergency response officials of the Port of Virginia, opportunities that lend themselves to unmanned technologies, to enhance safety and security and improve the operational effectiveness were identified. From this workshop, "pain points" were identified and prioritized, along with requirements to fill those pain points. On July 28, 2021, the UxS PS&ER Industry Summit was held to communicate these challenges to Public Organizations, Industry, and Academia. Feedback from attendees was provided as to the technical and operational readiness of UxS platforms, sensors and information management systems to solve these challenges. This AO will be the first step in providing opportunities to demonstrate system application(s) of UxS platform(s), sensor(s), and data/information management capabilities that could solve the challenging problems identified."

- Demonstration scheduled for April 2023

- Demonstration location: Hampton Roads area in Virginia

PS&ER Scenarios

- Post-natural disaster survey
  - Evaluate positions of ATON
  - Identify new submerged hazards
  - Identify shoaling
- Port accident – Oil/chemical/sewage spill
  - Survey for extent of spill
  - Sample spill for shoreside contamination identification
- Perceived threat to port or naval base
  - Monitor for aerial, surface, and submerged threats
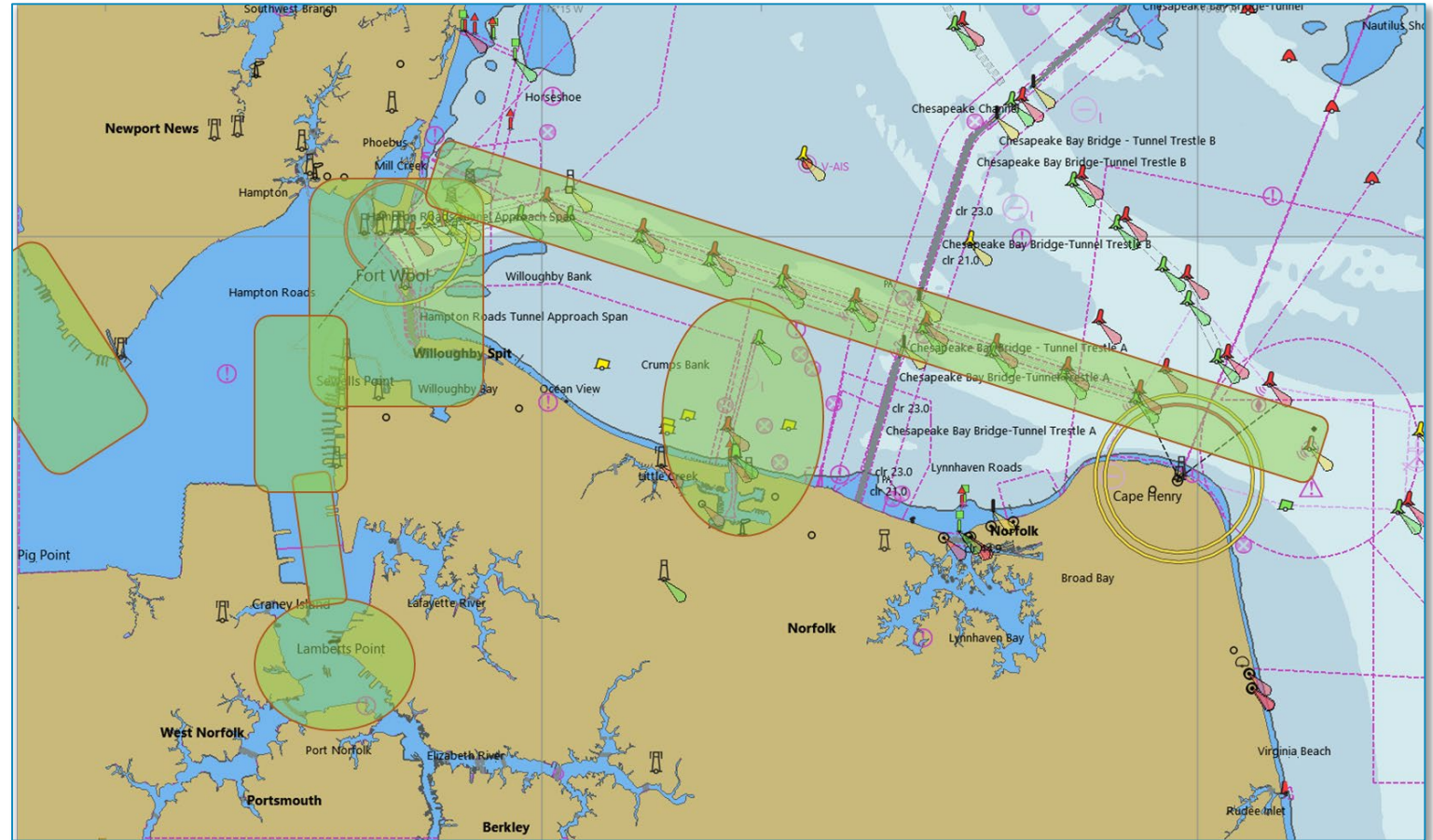
Potential scenario impact sites

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Harbor Comparison

Hampton Roads, VA

San Juan, PR
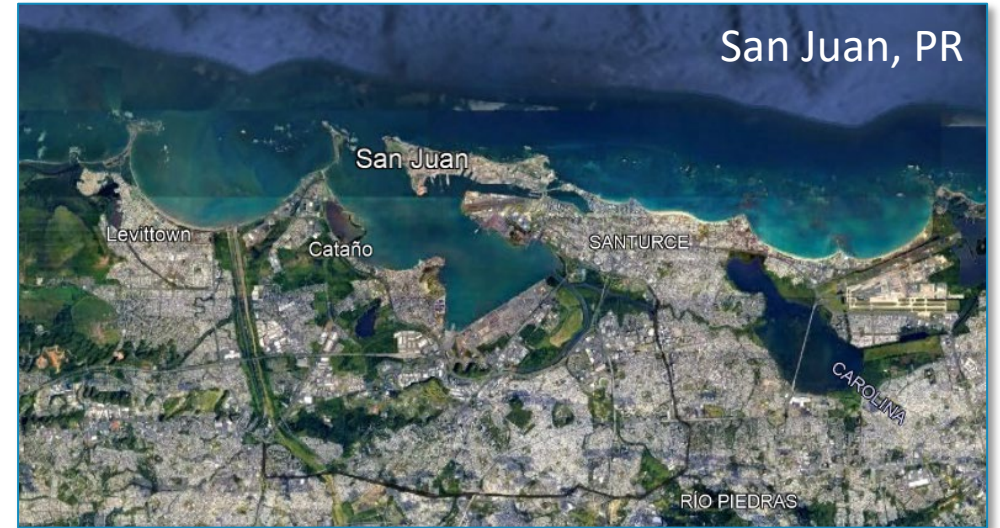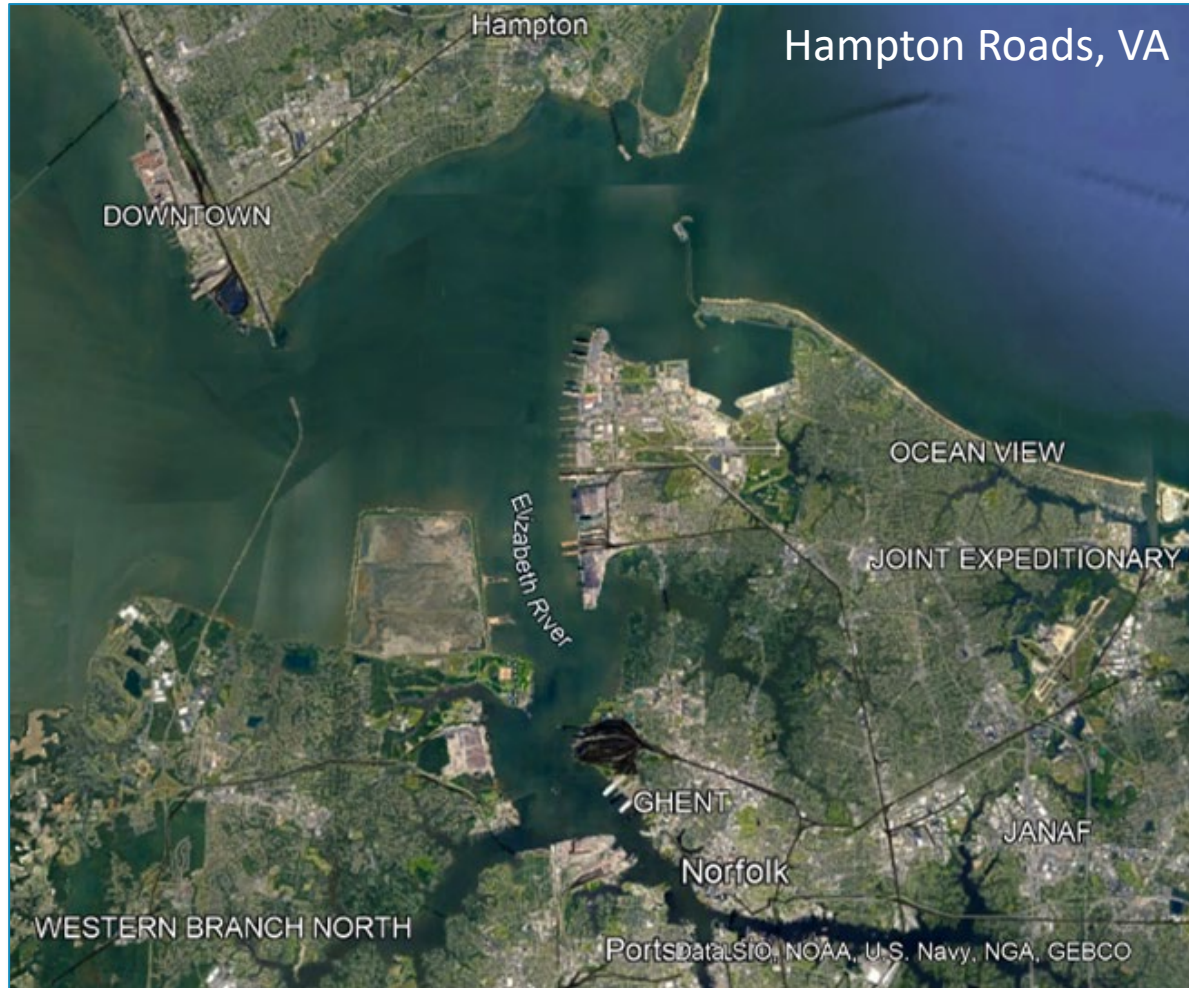
- Similar scale for harbors and inlets
- Similar infrastructure
- Similar potential for weather related damage
- Similar requirements for a post-disaster survey

(Images are the same scale for comparison)

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Post-natural Disaster Survey

- Evaluate positions of ATON
  - Onboard RTK GPS
  - Sidescan sonar
  - Survey alongside marked channels
- Identify new submerged hazards
  - Onboard RTK GPS
  - Sidescan or multibeam sonar
  - Area survey
- Identify shoaling
  - Onboard RTK GPS
  - Multibeam sonar
  - Area survey
- ACM projected performance
  - 10.7 NM
 - 3H 35M @ 3 knots

Port accident – Oil/chemical/sewage spill

- Very dependent on the type of contaminant.
- Survey for extent of spill
  - Onboard RTK GPS
  - Hydrocarbon sniffer/WQ sensor/e coli. real time sensor
  - Quadrant survey
- Sample spill for shoreside contamination identification
  - Onboard RTK GPS
  - Sampling pack
  - Point location sampling
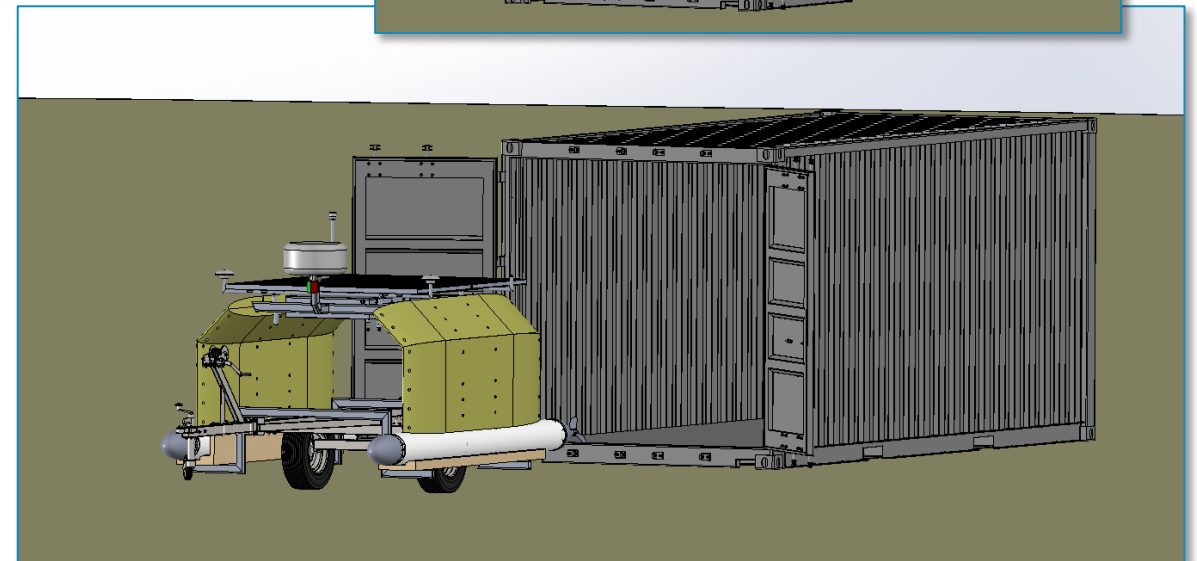- ACM projected performance
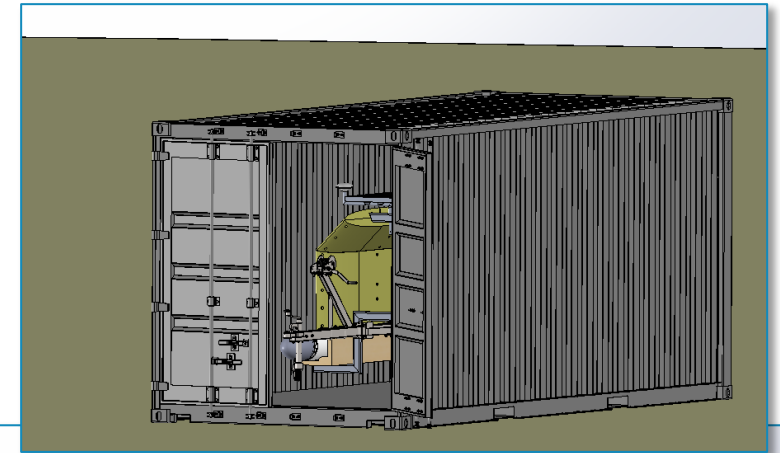 - 11 NM
  - 3H 40M @ 3 knots
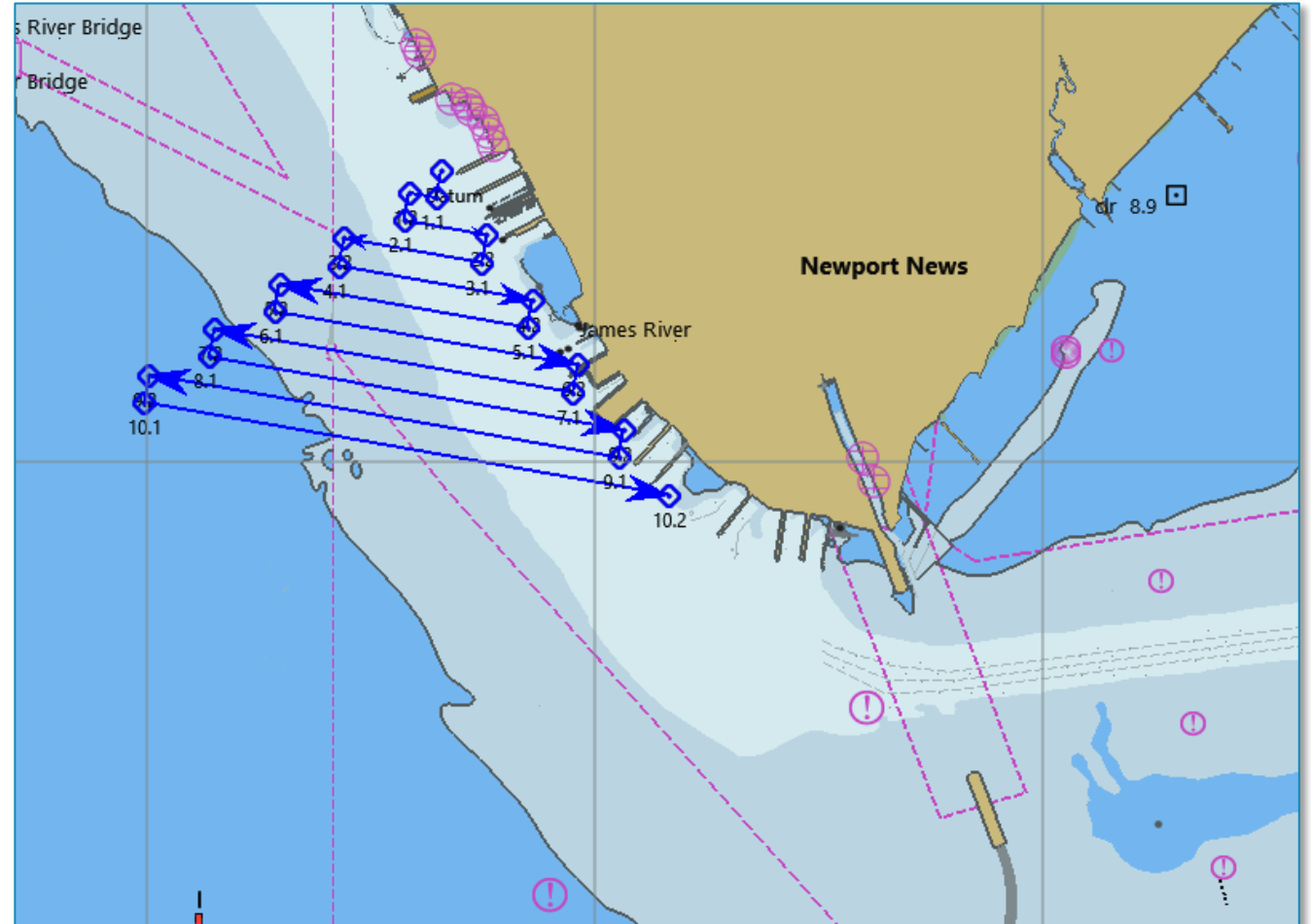
Perceived threat to port or naval base
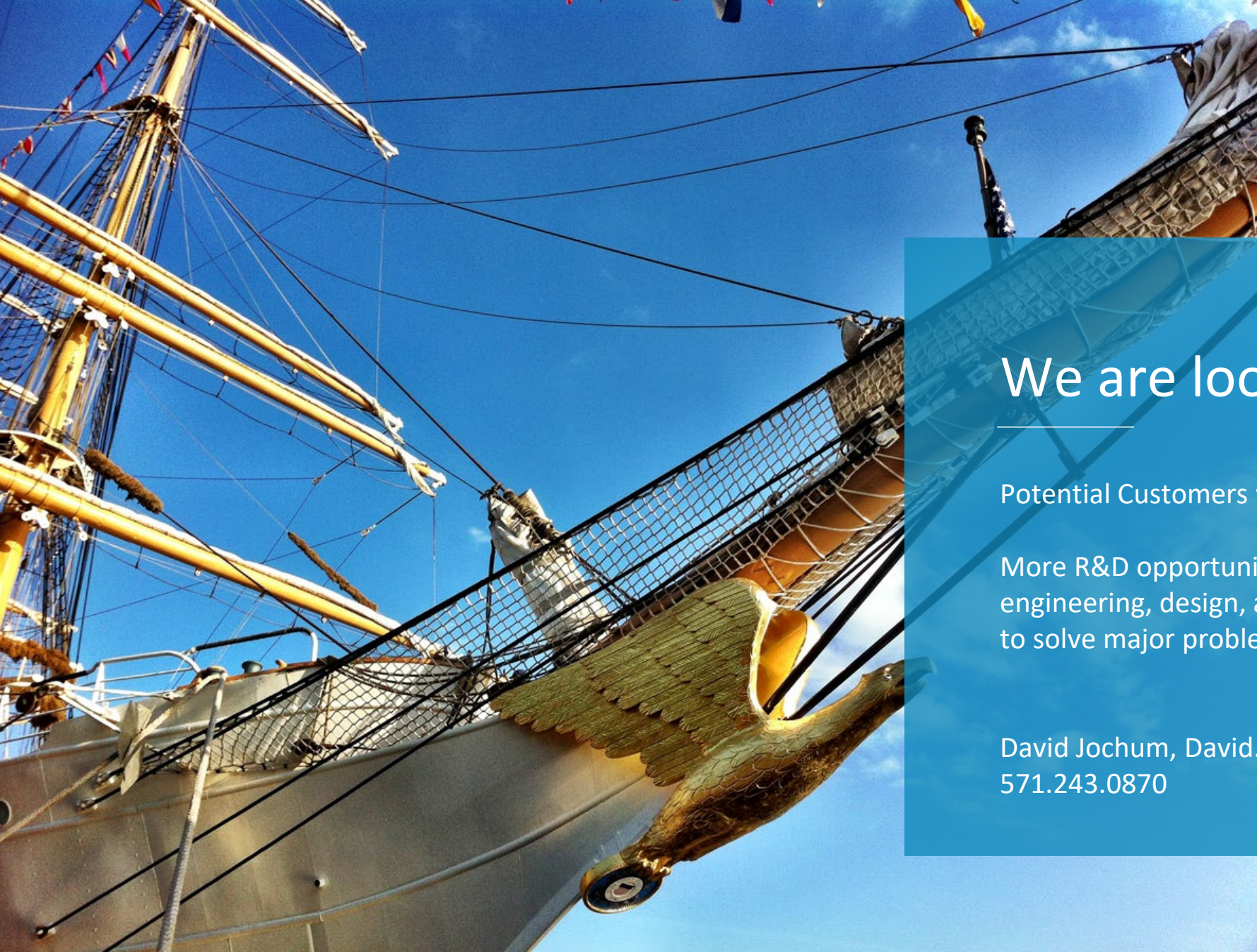
- Perceived threat to port or naval base
- Monitor for aerial, surface, and submerged threats
  - Onboard RTK GPS
  - Radar
  - AIS
  - Tethered drone
  - Hydrophone
  - Scanning sonar
- Racetrack, repeating path, or random path operations
- ACM projected performance for racetrack operations
  - 4.3 NM each circuit
  - 1H 26M @ 3 knots

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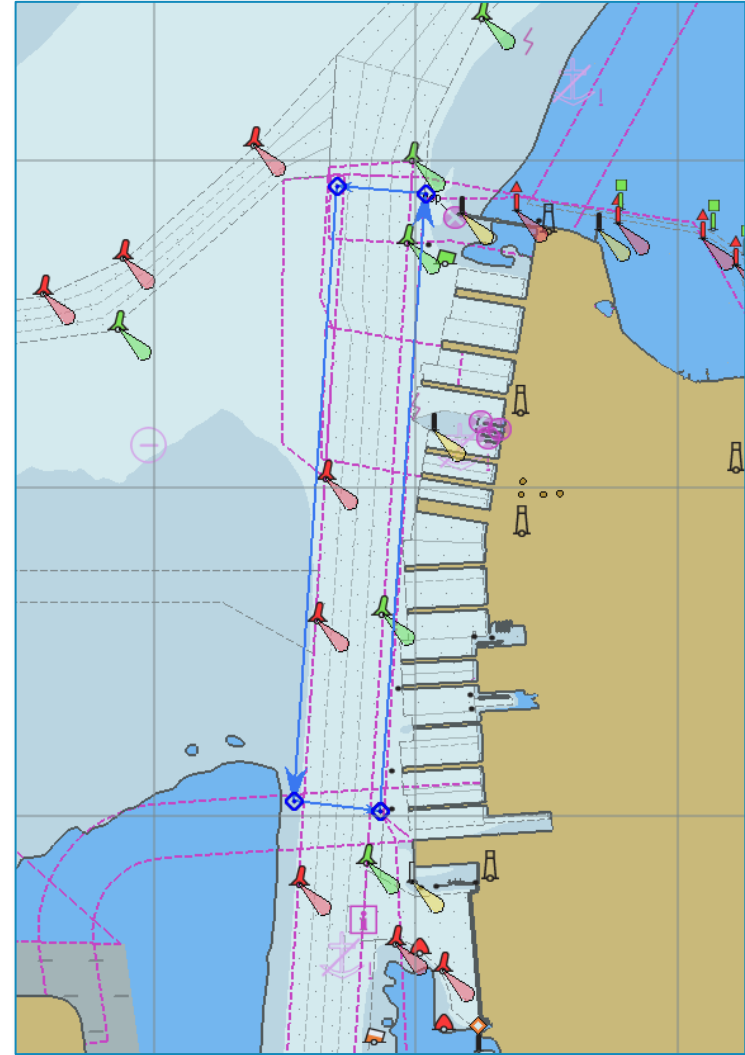
ASV in a Box

- System can fit in a standard ISO 20' container (TEU)

- Container doubles as the operations center, workshop, and shoreside antenna mounts

- Self-contained system as required
  - Diesel generator for on-board power (portable fuel tanks to be re-filled locally)
  - Deployable environmental conditioning when operating as the operations center
  - No requirements for outside services

- Outside interfaces
  - Internet (either local landline, cellular hotspot, or satellite)
  - Shore power
  - Telecommunications (RF, cellular, local telcom)

- Self-unloading container truck required for local movement

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We are looking for:

Potential Customers who need our vehicles

More R&D opportunities that we can utilize our marine engineering, design, autonomous, AI and ML experience to solve major problems

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