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DERP WEBINAR

Underwater Munitions Response Technology

Kelly Dreyer, Office of the Deputy Assistant Secretary of War for Environmental Management and Restoration

John Jackson, U.S. Army Corps of Engineers

Kelly Enriquez, U.S. Army Corps of Engineers

Austin Geiser, Naval Facilities Engineering Systems Command and Expeditionary Warfare Center

Kyle Newman, Virginia Department of Environmental Quality

Webinar Rules

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- Please use the **Q&A** function if you have a content-related question during the webinar that you would like answered.
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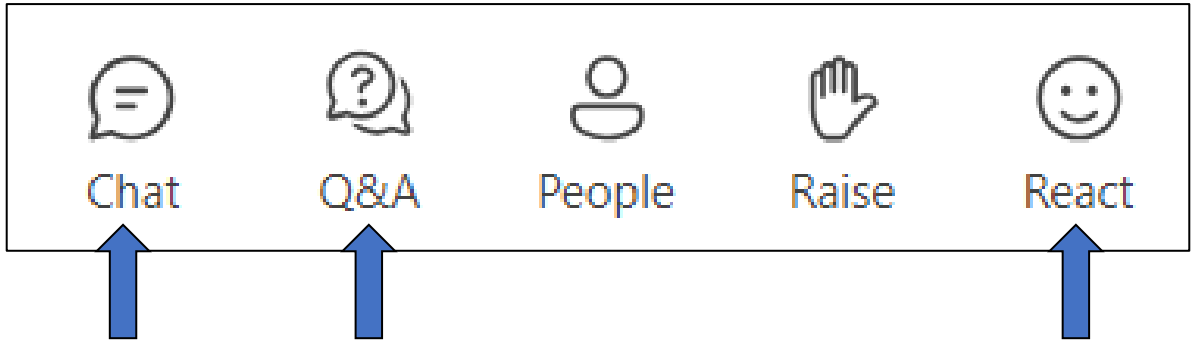


Agenda

- **Underwater Munitions Response Technology (UWMRT): Goals and Objectives** - John Jackson
- **Conceptual Site Models (CSMs)** - Kelly Enriquez and Austin Geiser
- **UWMRT: Types and Deployment** - John Jackson
- **Interstate Technology and Regulatory Council (ITRC) Underwater Munitions Response (MR) Team** - Kyle Newman
- **Wrap-up and Q&A** – All Presenters

Goals and Objectives of Underwater Munitions Response Teams

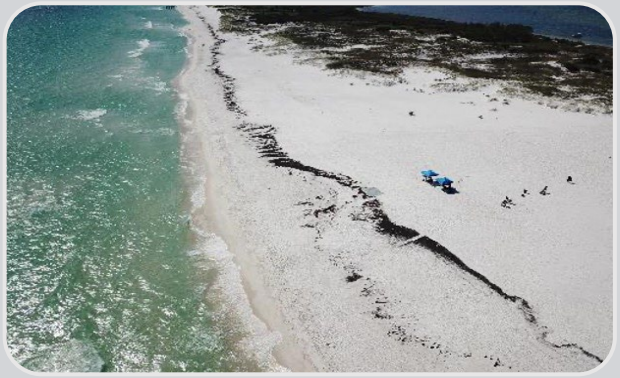
John Jackson

MR Program Manager

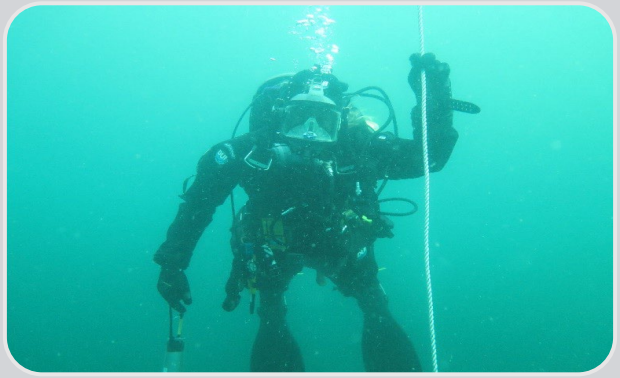
Strategic Environmental Research and Development Program and

Environmental Security Technology Certification Program (SERDP/ESTCP)

Challenge of an Underwater Environment



UXO remediation at underwater sites presents unique challenges for DoW compared to land-based sites.



The underwater environment restricts access and impacts the performance of established and emerging detection, classification, and localization (DCL) technologies.

Dynamic nature of sea conditions results in mobility of munitions and repeated burial.

DoW Goals and Objectives

DoW/ESTCP

- How do we transition underwater MR technology?
- How do we develop processes and quality control (read: Quality Assurance Project Plan) for underwater?

Services

- How do we contract underwater work?
- What are appropriate production assumptions?
- What technologies are ready for prime time?
- How do we manage uncertainty?

Stakeholders

- What's going on with our site?
- Standard Remedial Investigation (RI) concerns- nature, extent, risk?
- How can we minimize impact of investigation work to site users and receptors?
- How do we manage uncertainty?

Environmental Data Quality Workgroup (EDQW)/DoW Advanced Geophysical Classification Accreditation Program (DAGCAP)

- Is there a place for DAGCAP underwater?
- How do we accredit and validate in the underwater arena?
- What does "100%" mean?

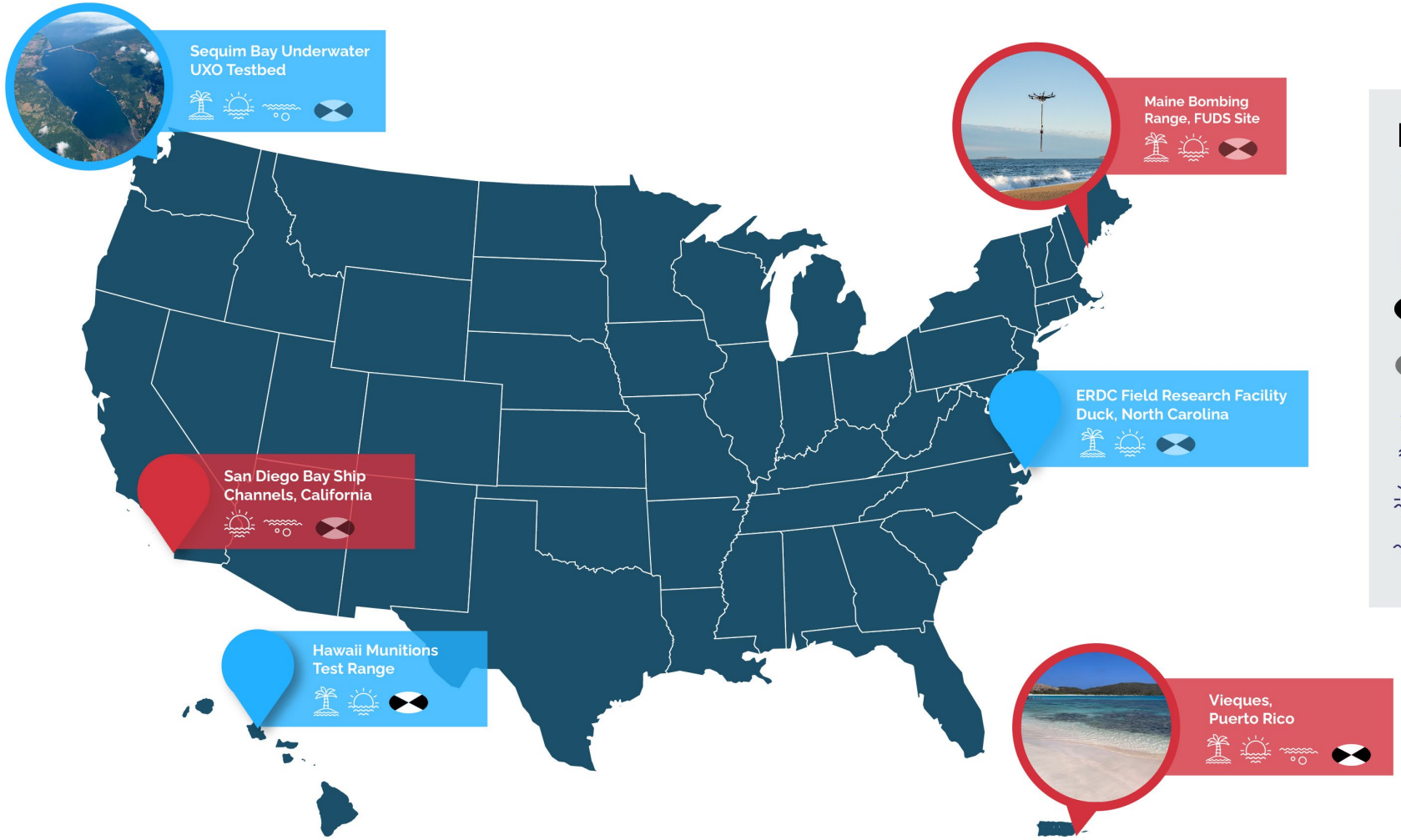
How is SERDP/ESTCP Managing this Objective?

- Bulk of MR program shifted to primarily ESTCP efforts
- ESTCP will focus on live site demonstrations and test bed projects with an emphasis on mature technologies nearing ready for commercial transition
- DoW Policy → Underwater MR Workgroup → ITRC Team
- Coordination with EDQW and DAGCAP

Planned Live Site Demonstrations

Maine Bombing Area	San Diego Bay	Vieques, Puerto Rico	Potential 4th Site
• Field work complete March 2026 • Formerly Used Defense Site; practice rocket range and potential burial • Surf zone; Typical sandy beach and dunes->~15 feet water depth • Mirroring process for RI • Nature and extent • Preliminary Characterization followed by Detailed Characterization	• Navy site with busy harbor and significant boat traffic; dredging channel • Mirroring process for Remedial Action (RA) • Size estimation primary component for classification • Information being collected to better inform dredging operations	• Navy site with multiple targets • Elements of both RI and RA • Information to inform cost estimates in Feasibility Study (FS) • Testing limits of technology	• Inland/freshwater (river?)

ESTCP MUNITIONS RESPONSE DEMONSTRATION AND LIVE SITES



LEGEND

- Demo Sites
- Live Sites
- High Water Clarity
- Slightly Turbid
- Nearshore
- Shallow Water
- Deep Water

Testbed Opportunities

- Sequim Bay, Washington (PNNL)
- Duck, North Carolina (ERDC)
- Hawai'i Test Bed (UH)

ITRC Underwater Munitions Group

- January 2025 – Group formed
- Subgroups:
  - Introduction
  - Planning/CSM
  - Quality
  - Technology
- October 2025 - Draft internal document
- November 2025 – Comment Resolution Meeting
- Originally planned completion at end of 2026. Extended team a year to include more SERDP/ESTCP lessons learned/case studies
  - Interim deliverables Fall of 2026
- **More later!**

Elements of an Underwater Conceptual Site Model

Kelly Enriquez

U.S. Army Corps of Engineers

What's Different from Land?

- **Dynamic Environment**
  - Waves / Currents / Tides
  - Burial / Mobility
  - Defining a Beach
- **Lack of Visibility**
  - Obstacles
  - Changing bathymetry
  - Vegetation
- **Positioning**
- **High Costs**

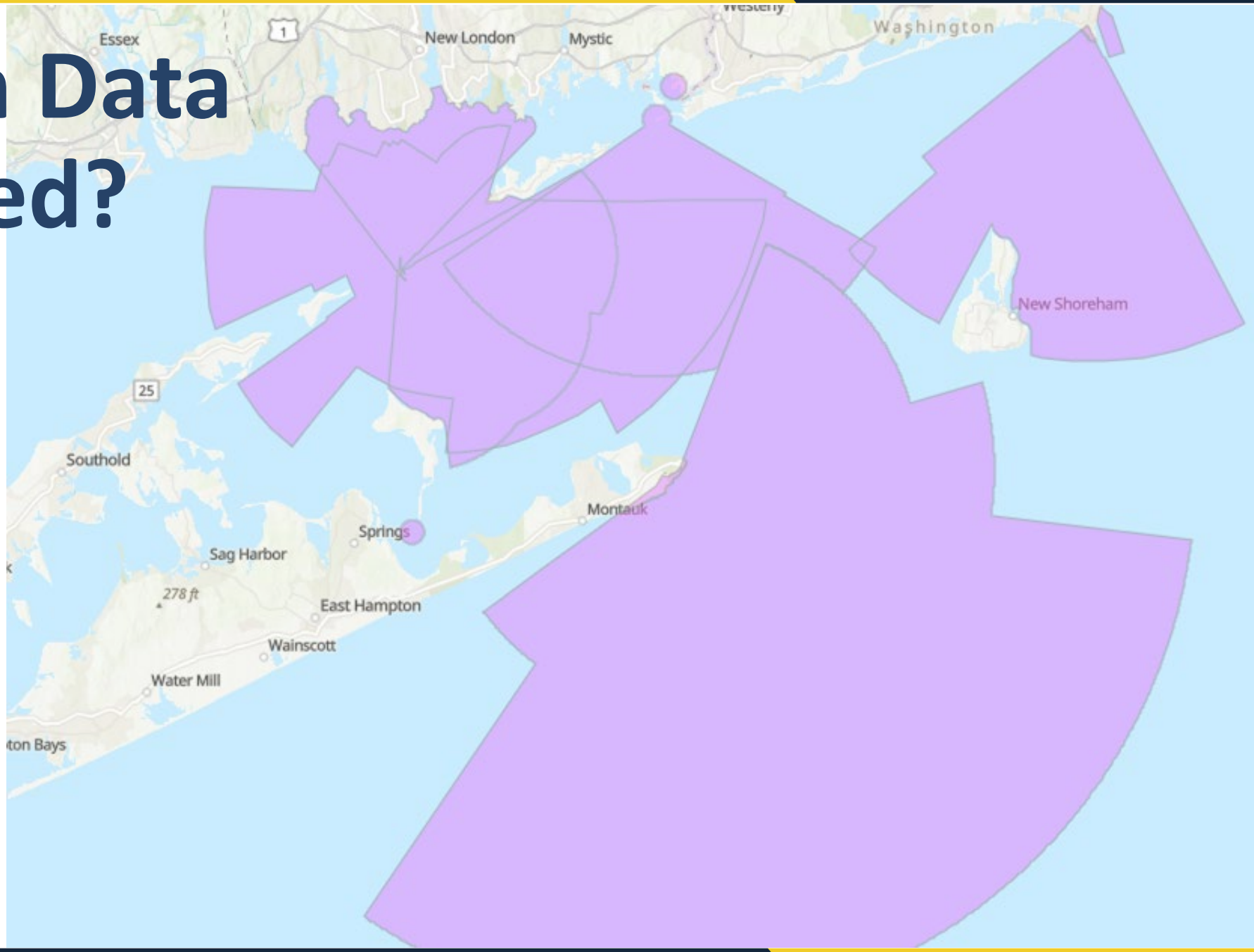
How Much Data Do We Need?

Site Inspection (SI) Phase

- Limitations on visual-only surveys
- Optical Sensors / Remotely Operated Vehicles
- Acoustic Sensors / Collect Detection / Classification Data?

RI Phase

- Due to high costs, potentially focus investigations based on land use
- Acoustic sensors can provide wider coverage



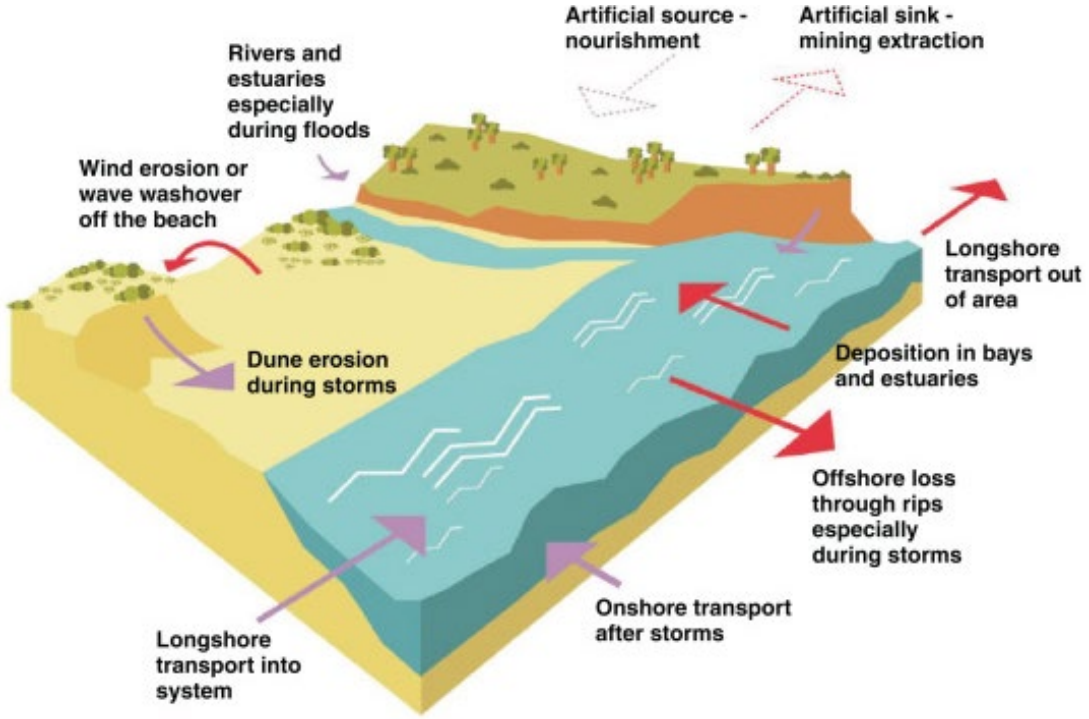
How Much Data Do We Need? (cont.)

RA Phase

- Do we need to do a physical removal?
- Do we need 100% coverage?
- Can we achieve 100% coverage?
- Can we manage in place?

Challenges Underwater

- Planning / Operating in Various Conditions
- Collecting Preliminary Information
  - Multi-Beam Bathymetry
  - Side-scan Sonar / Obstacles
  - Critical Habitats / Threatened and Endangered (T&E) Species
- Detection / Classification Data
  - Proximity to the water bottom
  - Positioning



Critical Data Needs

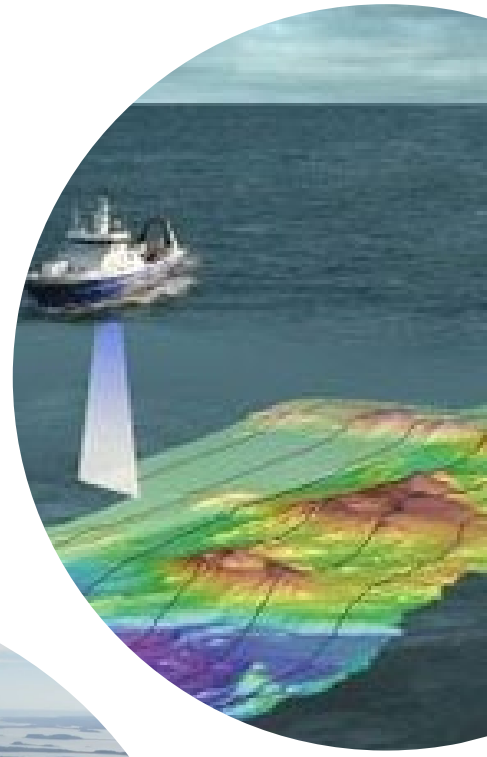
What kind of data do we need for a well-developed CSM?

What type of underwater site is it?

- Ocean, lake, river, canal, port/harbor, etc…
- Industrial area, recreational area

Preliminary site characterization

- Underwater bottom types
- Bathymetry
- Obstacles
- Visibility
- Waves / Currents / Tides
- Sensitive Habitats / T&E Species
- Nautical Charts



Critical Data Needs (cont.)

History of Military Use

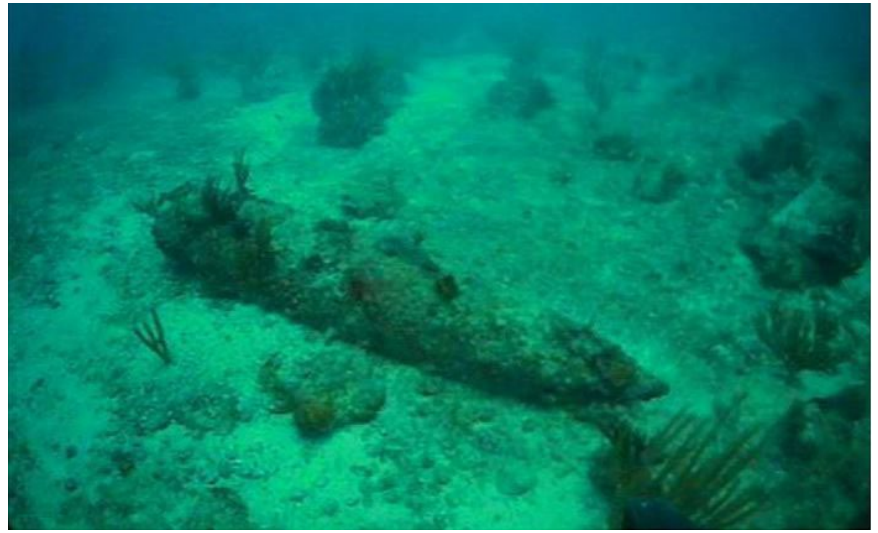
- Water Range
- Overshoots/Undershoots to Land Targets
- Dump Site

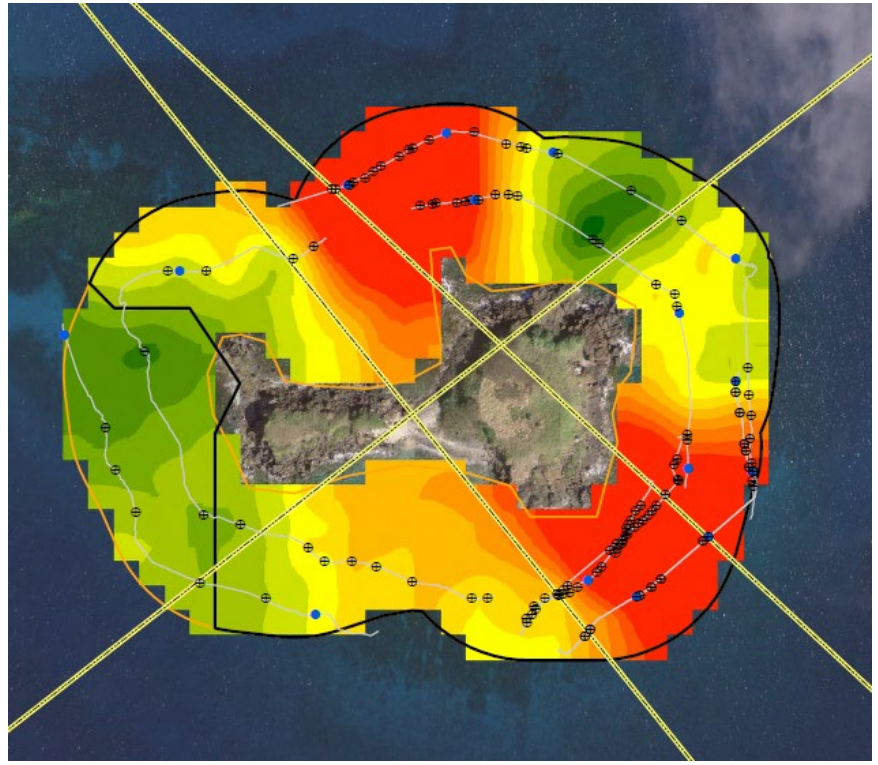
Munitions Detection / Classification

- Density
- Distribution
- Mobility / Burial

Investigation Results

- Munitions Types
- Sensitivity
- Depths





Land Use Data

Receptors

- Recreational
- Commercial / Maintenance / Construction
- Resource Management

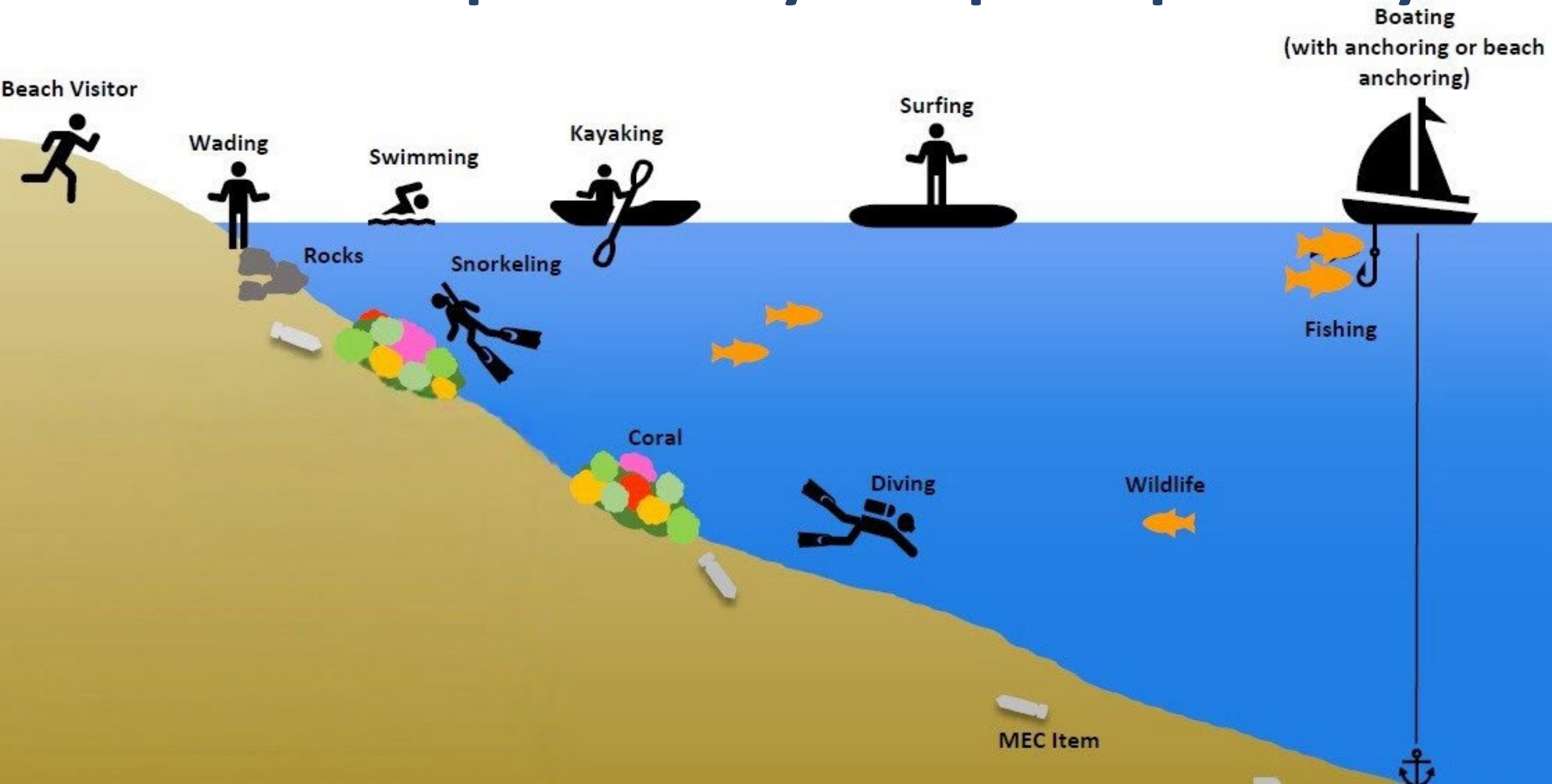
Activities

- Wading
- SCUBA/Snorkeling
- Anchoring
- Dredging
- Treasure Hunting
- Clamming / Fishing

Location

- Horizontal boundary
- Water Depth
- Subsurface Depth

Where is the potentially complete pathway?



Summary

- What challenges does the underwater site present?
- Identify additional data needs
- Plan appropriately
- Is land use information detailed enough?
- Is 100% coverage viable / necessary?

Kelly.D.Enriquez@usace.army.mil

Technology Overview

John Jackson

MR Program Manager

SERDP/ESTCP

Towed Electromagnetic Induction (EMI)

UltraTEM System

- Twelve receivers and four transmitters
- Tested at Sequim Bay, WA site (2021 Blind Test)

ESTCP MR19-5073, TPOC: Steve Billings, Black Tusk Geophysics

Marine Towed Array (MTA)

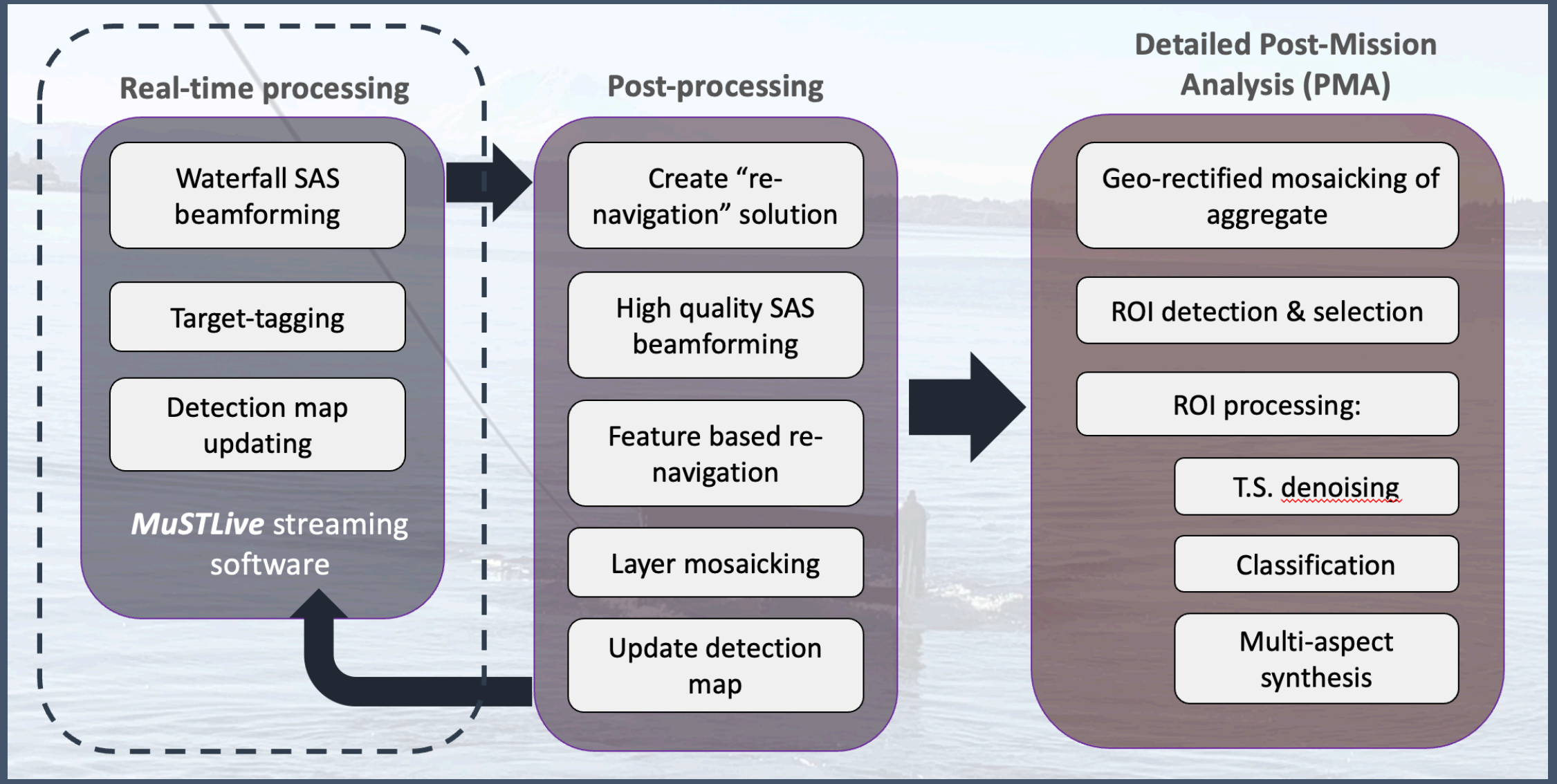
- 4.6 m wide; strong magnetomotive force (2.3xUltraTEM)
- Tested at multiple marine venues for UXO

ESTCP MR21-5066, TPOC: Dan Steinhurst, Nova Research

SONAR: Multi Sensor Towbody (MuST)

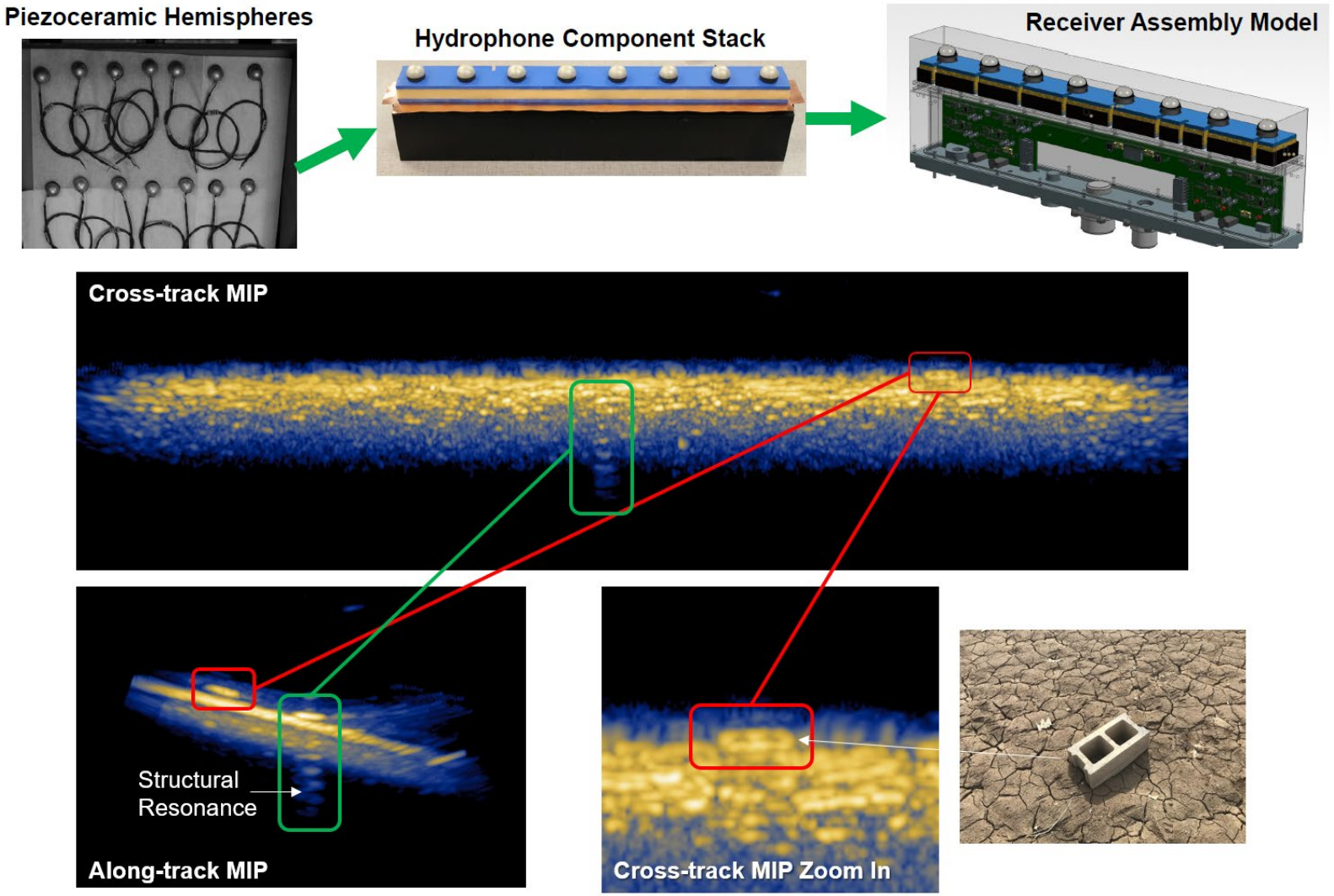
ESTCP MR23-7596, TPOC: Kevin Williams, UW APL

MuST Data Analysis Overview



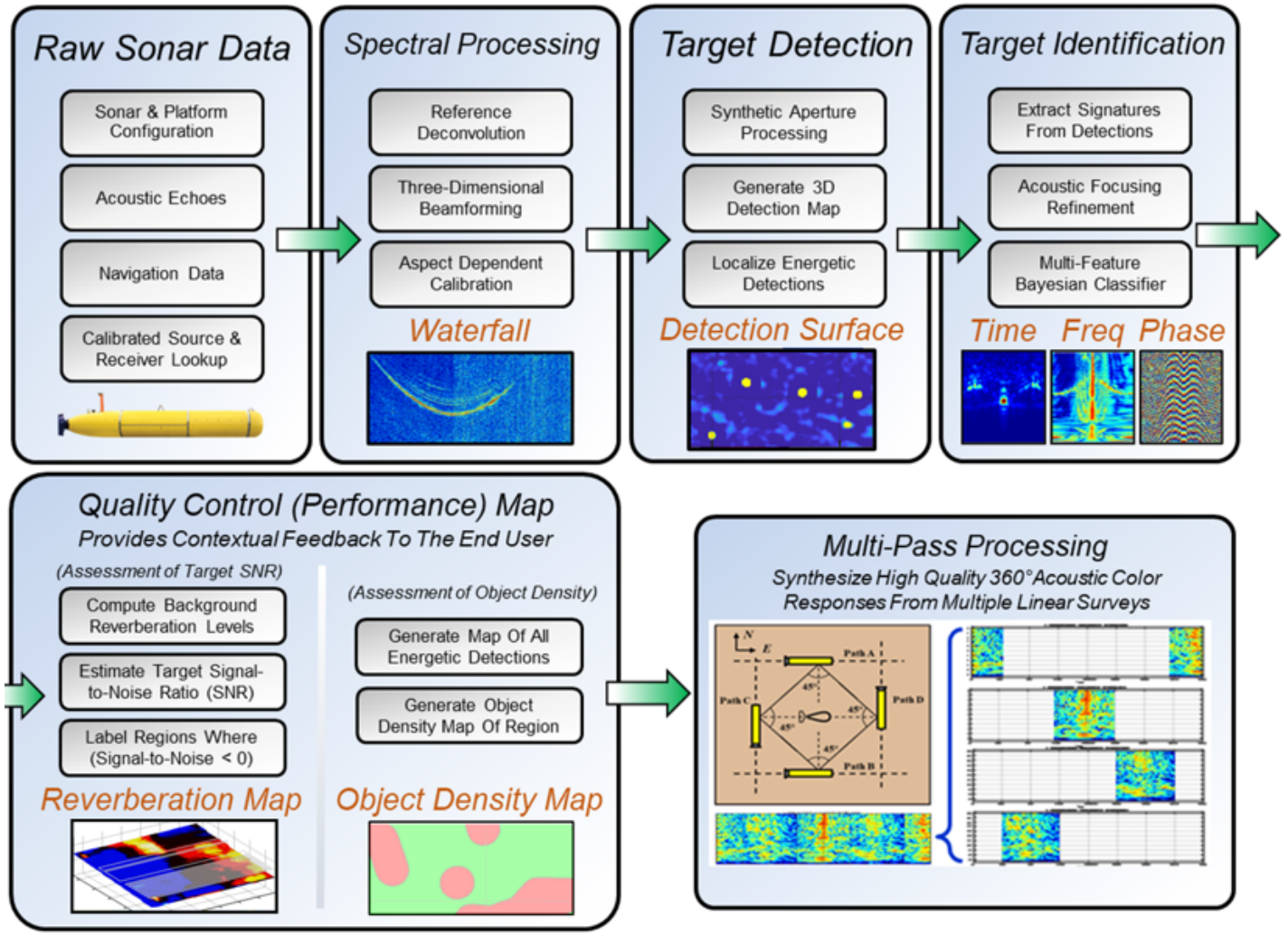
SONAR: Sediment Volume Search Sonar (SVSS)

ESTCP MR23-8364, TPOC: Dan Brown, Penn State

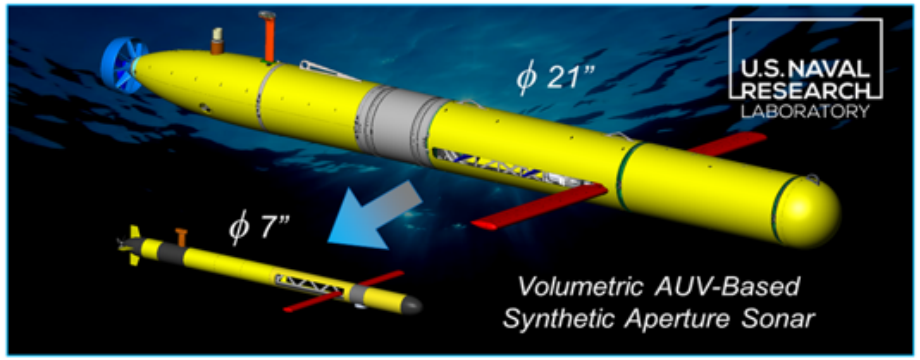


NRL Structural Acoustic SONAR

High-Level Processing Flow Diagram



AUV Based Structural Acoustic Sonar

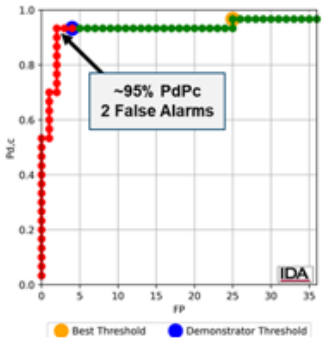


Sequim 2023 Blind Test Results

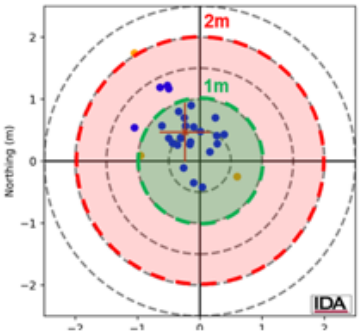
(Independently Assessed By IDA)

NRL Found UXO That Went Missing During Sequim 2023

Classification



Localization



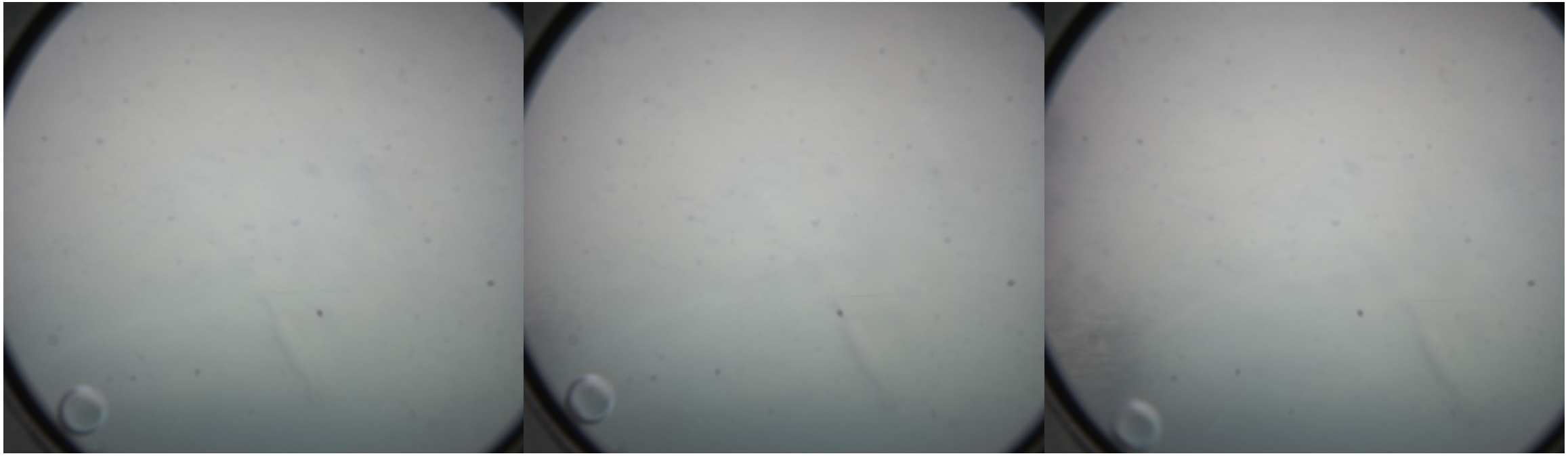
ESTCP MR23-7753, TPOC: Zach Waters, NRL

Optical Systems

MR23-9001 (Creare)

MR22-7964 (Orion)

Creare- Preliminary Results



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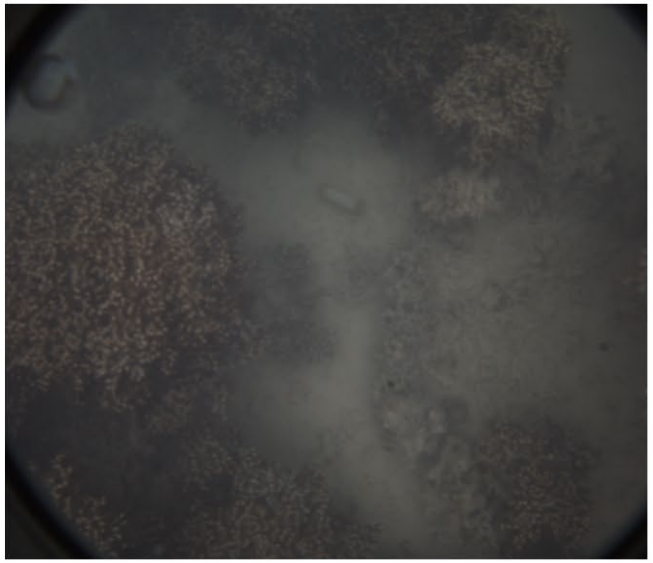
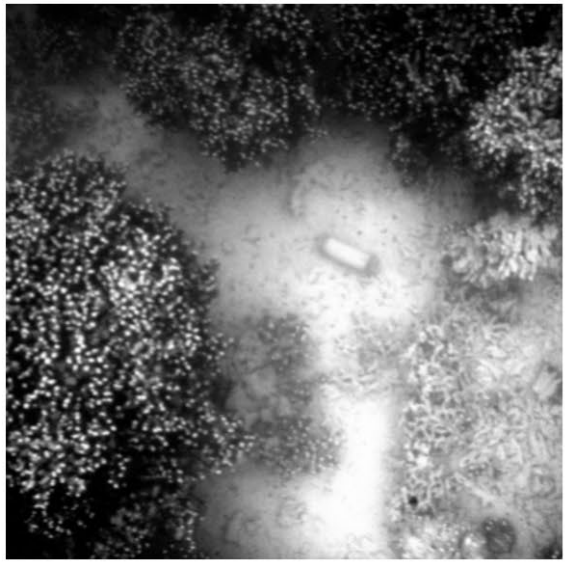
Creare- Preliminary Results

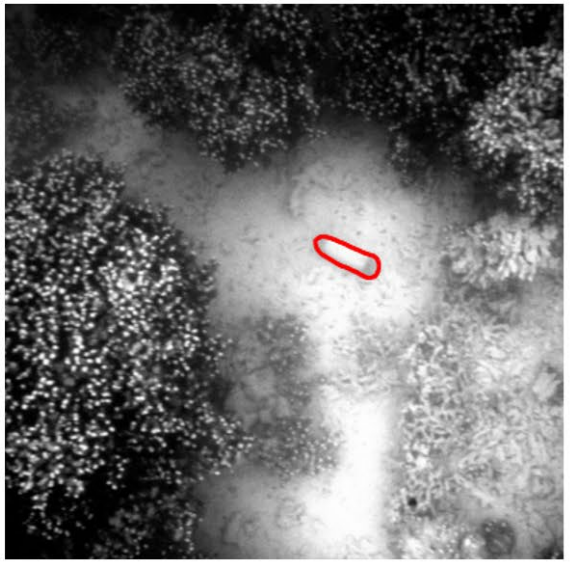
HQ Color Image



Processed Image



Munition Identification



Final Result

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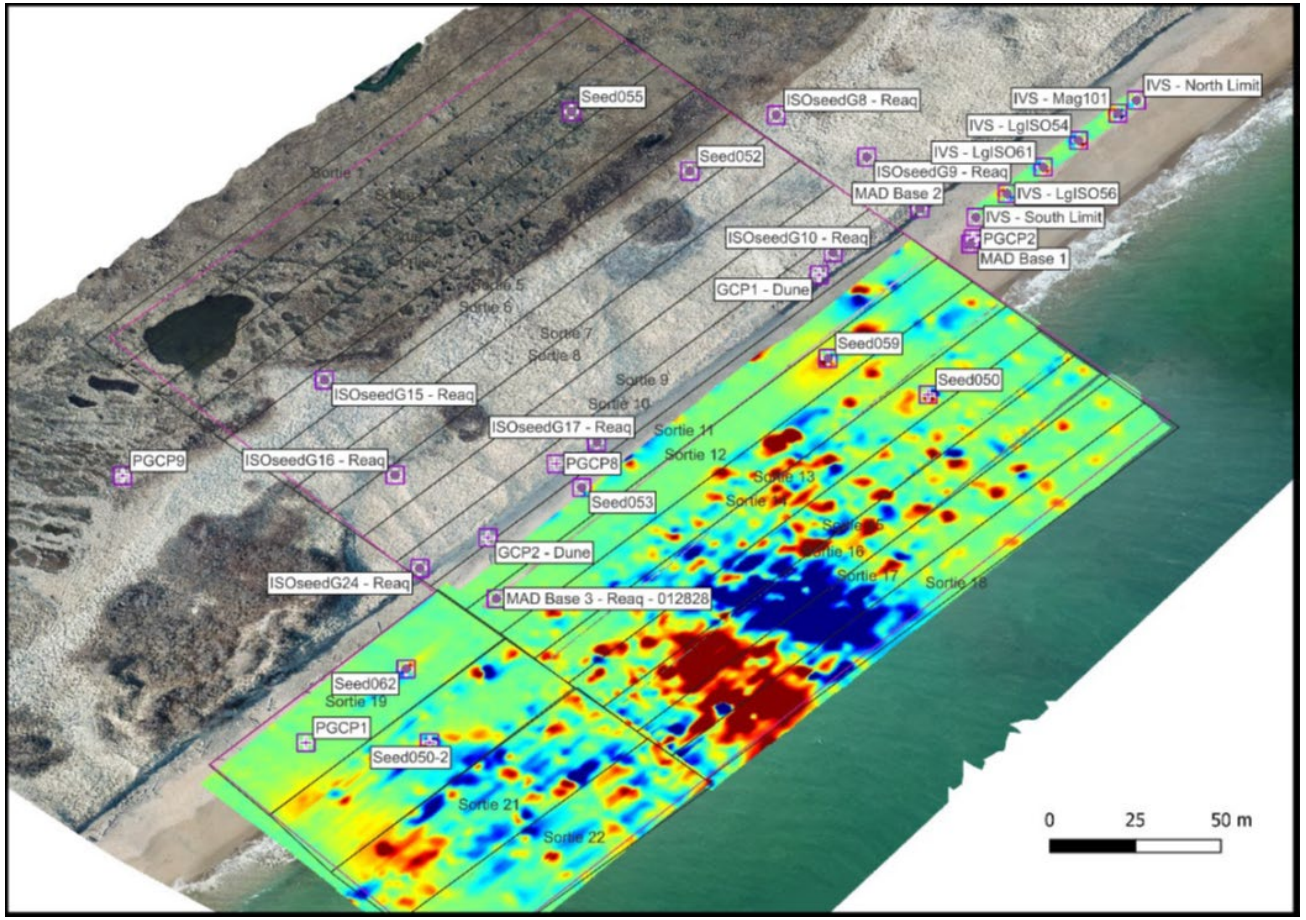
Mobility, Burial, and Other

- UnMES (many projects, currently NRL) and UXOMOB (MR21-1081, TPOC: Peter Menzel, Corvus Works)
  - Burial and Mobility modeling tools to help manage MR sites
  - Both forecasting and hindsight model capabilities
- Robust Prediction of Ordnance Depth of Burial (MR19-1277, TPOC: Stephan Bless, NYU)
- VIPER (MR23-7687, TPOC: Ed Braithwaite, NRL)
  - “Vibrocoring” approach to placing seeds
  - Minimize location errors due to placement
  - Minimize costs
- Mobility Measurement Units (MMU- TPOC: Carter Duval, NRL)
  - Acoustic pingers for “real-time” tracking of seed location

Maine Bombing Area-Drone Mag



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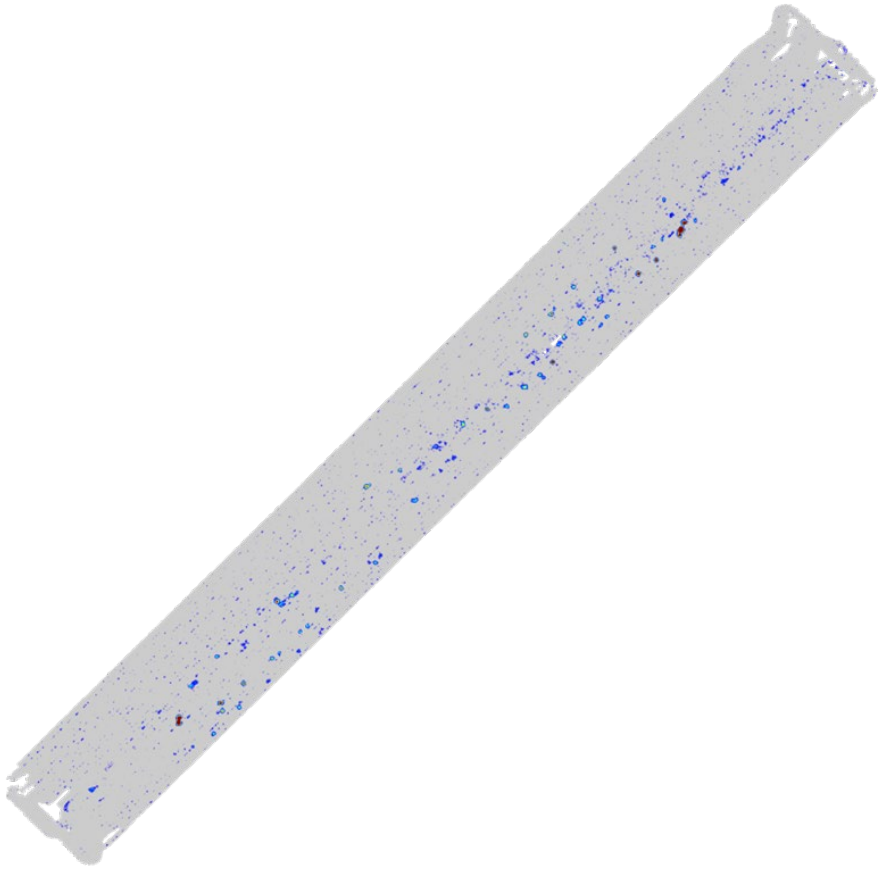
Maine Bombing Area- Crawler with AGC



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Known Gaps/Looking forward

- Saturated response areas
- Assessments and validation of various platforms
- Recovery and disposition of munitions
- Understanding and communication of limitations
  - Looking at you, ITRC!

ITRC Underwater Munitions Team

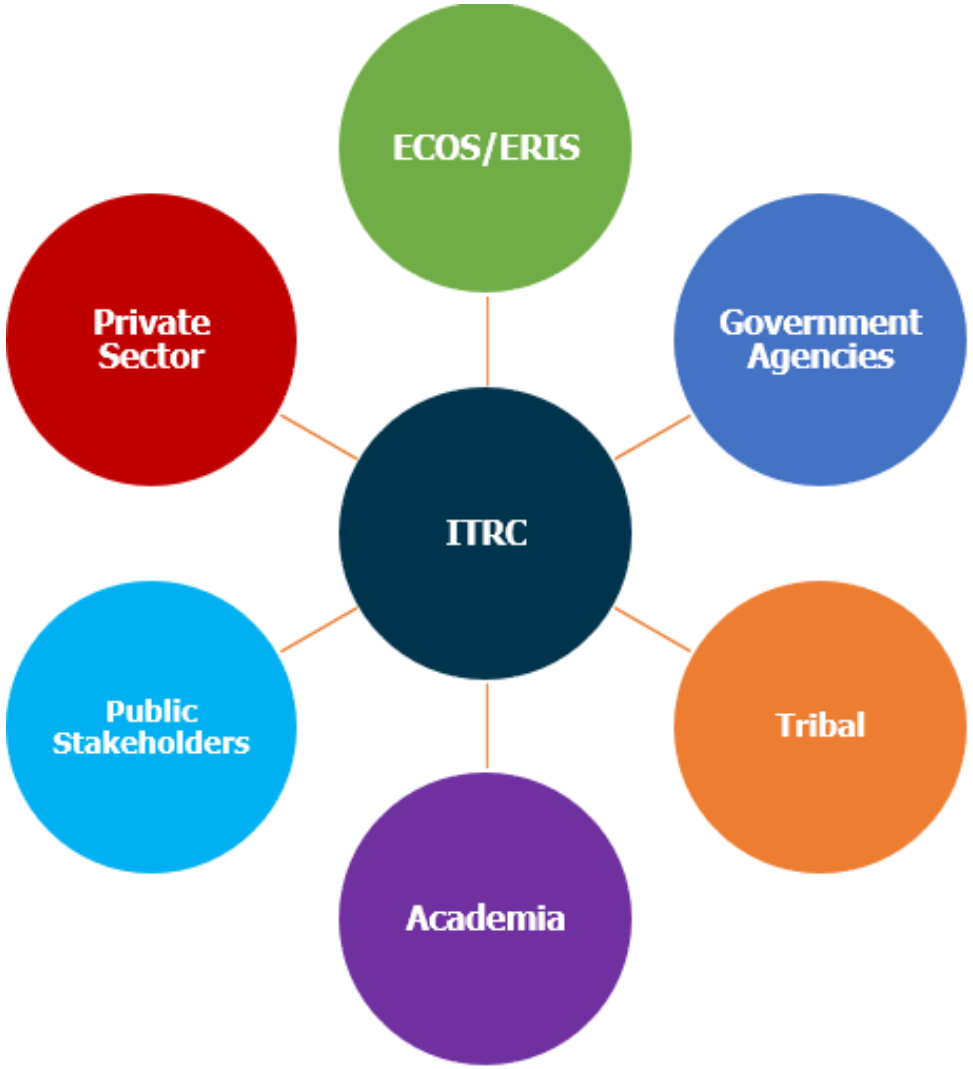
Kyle Newman

VA Department of Environmental Quality

ITRC Underwater Munitions Co-Lead

Who We Are

- National coalition created in 1995
- Program of the Environmental Research Institute of the States, a 501(c)3 education and research nonprofit affiliated with the Environmental Council of the States
- **Volunteer members** from state, federal and local government, Tribal stakeholders, private sector, academia, and public stakeholders



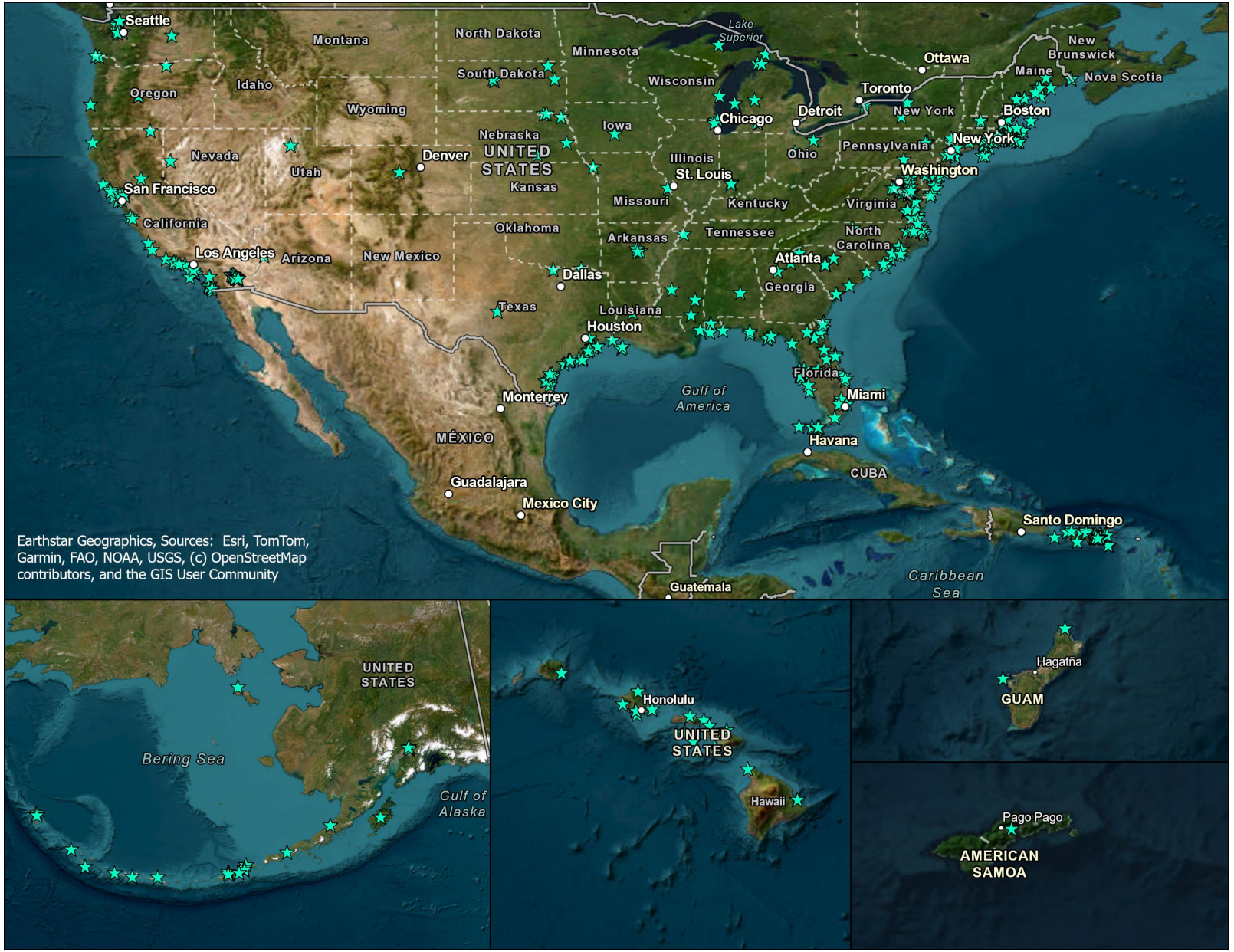
https://itrcweb.org/who-we-are/

ITRC

- Brings teams of regulators, industry, and other stakeholders together to develop technical guidance
- Utilizes a consensus-based approach
- Offers training on guidance and research topics
- Always accepting new members!
- www.itrcweb.org

Underwater Munitions Team

- Developing guidance for performing munitions investigations in various underwater environments
- Integrating data from ongoing SERDP/ESTCP technology demonstrations
- Identifying limitations around the environment, sensor technologies, and platforms
- **NOT** developing guidance to evaluate risks at underwater munitions sites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Public Exposures-

Real and more common than you think

Existing Frameworks for New Challenges

- Data Quality Objective (DQO) Process
  - What study questions need to be answered
  - How good do the data need to be to answer them?
  - How to address inherent uncertainties from both measurements and the environment?
  - The underwater environment requires particular consideration of the above

- MR QAPP
  - Plan to collect quality data specific to study questions
  - Spells out decision points and how the data are to be used
  - Incorporates DQOs and associated data quality requirements for the project

Products and Timelines

Appetizer Products (Release date: end of 2026)

- Underwater Munitions 101 Fact Sheet
  - Why we care
  - Challenges of the Underwater Environment
- Underwater Munitions 102 Fact Sheet
  - Overview of technologies and how they function

Main Course (Release date: end of 2027)

- Primary Guidance Document
  - Full technical guidance for planning and implementing investigations
  - Summary of current technology capabilities and limitations
  - Guidance for performing Quality Assurance/Quality Control with new technologies

Wrap-up and Q&A

Thank you!

Please fill out a brief survey here: https://forms.osi.office365.us/r/SYcZd38rbd