



Evaluation of Sensor Technologies at the Hawai'i Maritime Test Range Complex

MR24-B3-8219

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Applied Research Laboratory at the University of Hawai'i

In Progress Review Meeting

AUGUST 2025

Project Team



- **Margo Edwards** (UH; Principal Investigator)
- Martine Bissonnette (ARL at UH; Technical Program Manager)
- Kainani Santos (ARL at UH; Engineer)
- Carter DuVal (Naval Research Laboratory; Consultant)

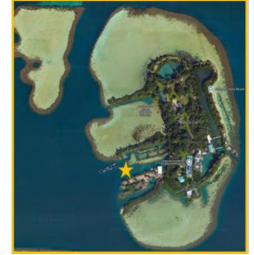
Bottom Line Up Front

- Two technologies will be tested at the HI_MTRC
- Permission from regulators to deploy surrogates and conduct demonstrations granted
- Inert munitions and ISO procured
- Demonstration plan submitted
- Geolocation tool designed and tested



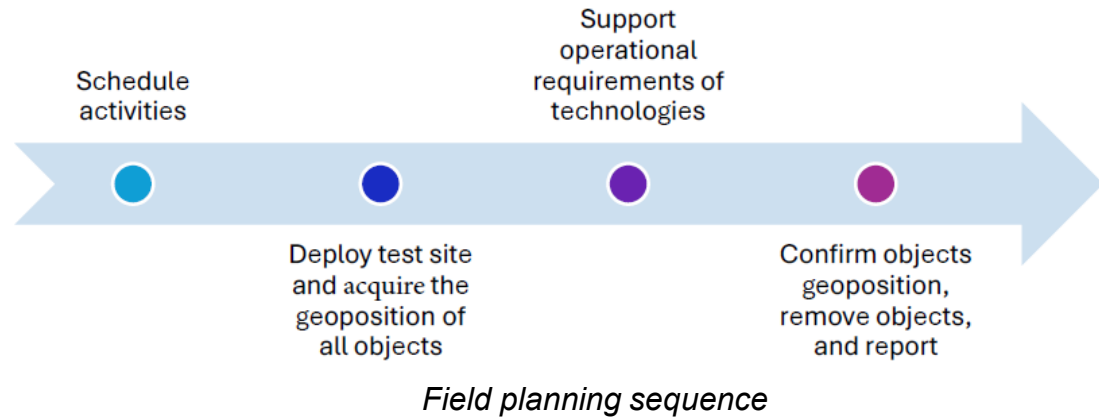
Site Description

- Site selected following January 2025 site visit:
Moku o Lo'e in Kāne'ōhe Bay (aka Coconut Island)



Technical Approach

- Provide a demonstration site for evaluating and comparing the efficacy of MEC detection tools.
 - Obtain necessary permits
 - Acquire surrogates
 - Characterize range
 - Test field equipment



Technologies to be Tested at HI_MTRC

- **Orion EDGE™** (formerly **LiteWave**) is a small-scale LiDAR that will be mounted under an uncrewed aerial vehicle (UAV) to provide three-dimensional imagery of an underwater scene.
 - SERDP MR18-1459, ESTCP MR22-7371 and participation in ARL at UH project ESTCP MR20-5292.
 - ARL at UH to provide the UAV and pilot.
- **Creare Optical Munitions Detector (OMD)** will be integrated with an uncrewed surface vehicle (USV) [the WAM-V 8] and use LiDAR to survey the seabed.
 - ESTCP MR23-3644.
 - ARL at UH to assist in the integration of the OMD and operate the USV.



Permitting

- UAV operations permit: can be obtained in real-time through HIMB.
- Department of Land and Natural Resources (DLNR): data collection and research don't require permitting for placement of objects on the seafloor if the duration of the placement is <30 days and results in negligible ground disturbance.
- NOAA
 - Endangered Species Act (ESA) : [response] "...we concur with your conclusions that the proposed action is not likely to adversely affect Central North Pacific green sea turtles, endangered hawksbill sea turtles, endangered Hawaiian monk seals, or designated Hawaiian monk seal critical habitat."
 - Essential Fish Habitats (EFH): [response] "...the proposed action may have adverse effects on EFH, but these adverse effects will be temporary and minimized through the implementation of Best Management Practices (BMPs)."

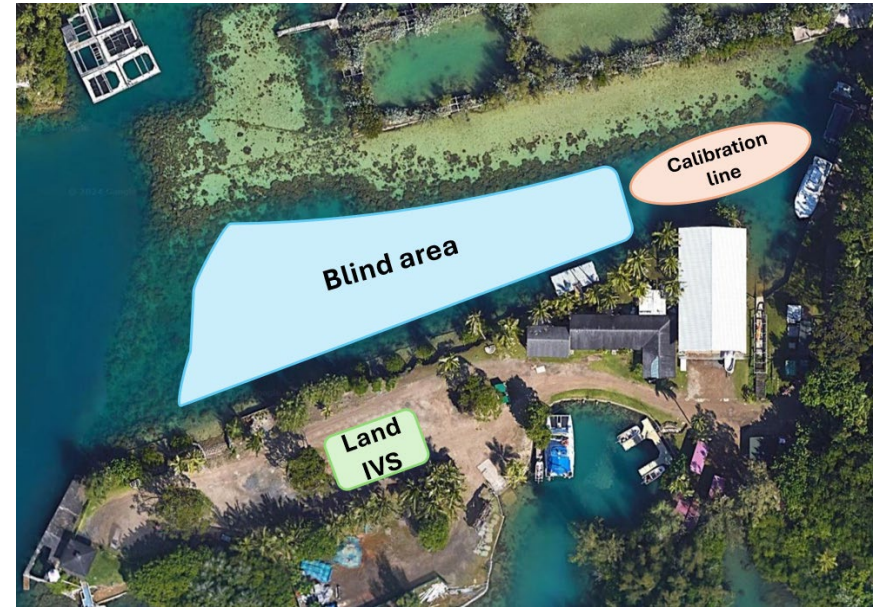
Best Management Practices

- Daily and regular ESA-listed marine species surveys, halt work if species enter operational area.
- No intentional interaction with any ESA-listed marine species.
- All deployed objects will be manually lowered to the seafloor in a controlled manner to minimize turbidity and shall be free of pollutants
- Halt of work during adverse weather and tidal/flow conditions.
- Laser safety goggles to be worn by personnel working in the action area during laser operation and laser warning signs will be posted.
- Fuel, waste materials, trash and debris will be kept away from the marine environment and any pollution incident will be cleaned up.



Operational Area

- Operational area: 3125 m²
- Water depth: 0-5 meters



XCaliper

- Positively buoyant sensor platform equipped with an RTK-GNSS module, an onboard IMU, and a microcontroller; glides along a 6-18-foot pole to remain positioned at the sea surface.
- Placed near the center of the object for 60-120 seconds, which allows messages to be relayed using a radio-frequency antenna to the ground station where the geoposition will be recorded.



Site Characterization

- Turbidity measurements were obtained using a YSI water quality meter. Measurements at ~3.5 meters (m) depth were about 4.6 Nephelometric Turbidity Units (FNU) while other measurements at depths <3 m were <2 FNU.
- Video imagery was acquired to generate a photomosaic of the seafloor.



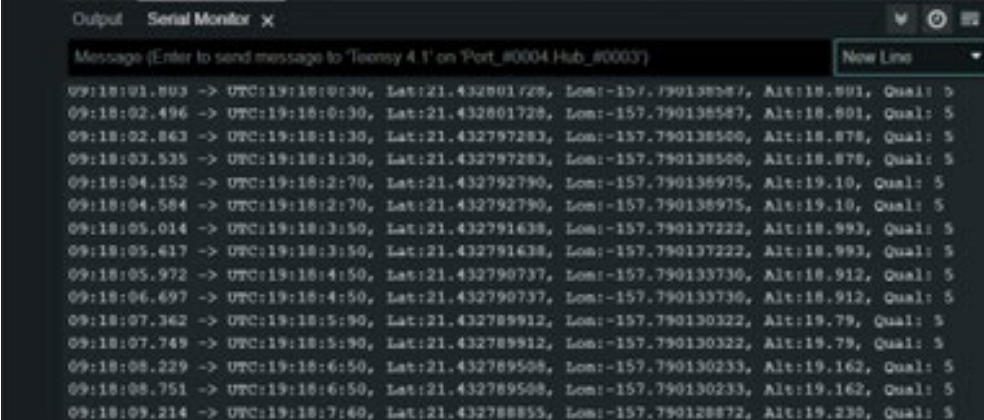
Additional measurements

- A compass will be used to acquire and confirm object orientation relative to the North.
- 3-5 objects will be equipped with Next Generation IMUs (NGIMU) from x-io Technologies (work in collaboration with Naval Research Laboratory), which has datalogging capabilities and will provide movement information post field work.



Geoposition Data Acquisition

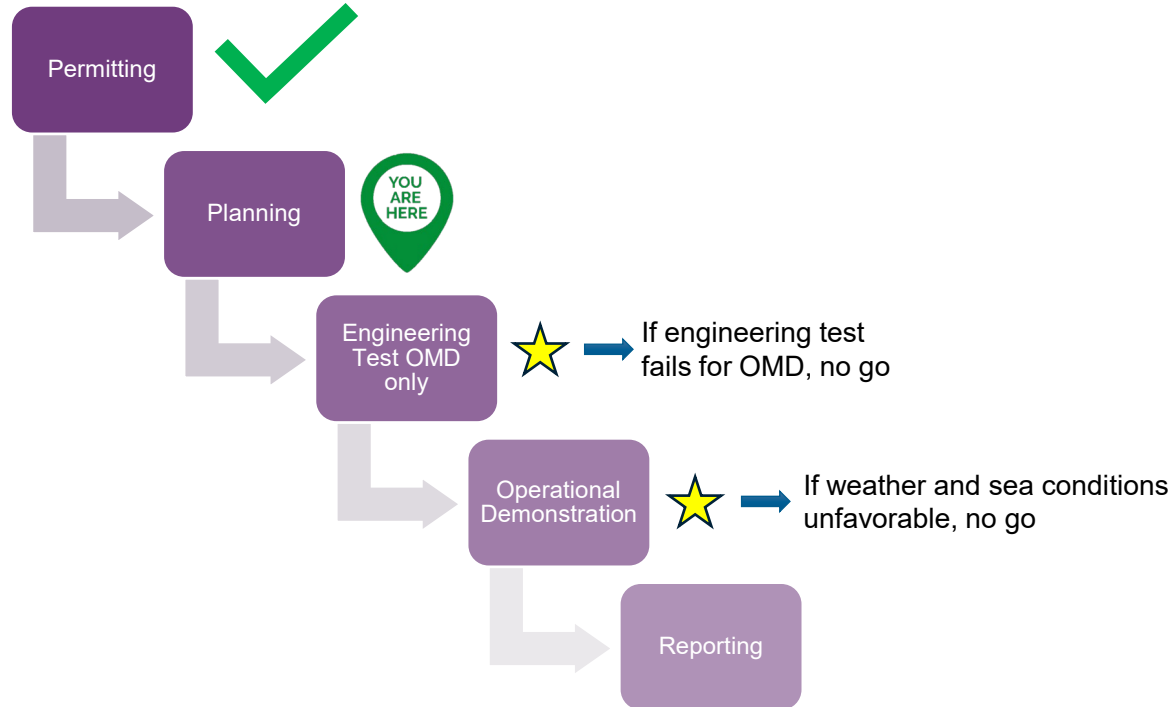
- During the range deployment
- After the first technology demonstration.
- Approximately 10% of the objects will be geopositioned again prior to the demonstration of the second technology. If difference is >0.5 m, all objects will be remeasured.
- At the time of objects removal from range.



The screenshot shows a 'Serial Monitor' window with a message input field at the top and a 'New Line' button. Below the input field, a continuous stream of geolocation data is displayed. Each line represents a data point with a timestamp, a directional indicator, and a series of coordinates and quality metrics.

```
09:18:01.803 -> UTC:19:18:0:30, Lat:21.432801728, Lon:-157.790138587, Alt:18.881, Qual: 5
09:18:02.496 -> UTC:19:18:0:30, Lat:21.432801728, Lon:-157.790138587, Alt:18.881, Qual: 5
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09:18:03.535 -> UTC:19:18:1:30, Lat:21.432797283, Lon:-157.790138500, Alt:18.878, Qual: 5
09:18:04.152 -> UTC:19:18:2:70, Lat:21.432792790, Lon:-157.790138975, Alt:19.10, Qual: 5
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09:18:05.972 -> UTC:19:18:4:50, Lat:21.432790737, Lon:-157.790133730, Alt:18.912, Qual: 5
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Technical Approach: Overview



Qualitative Performance Objectives

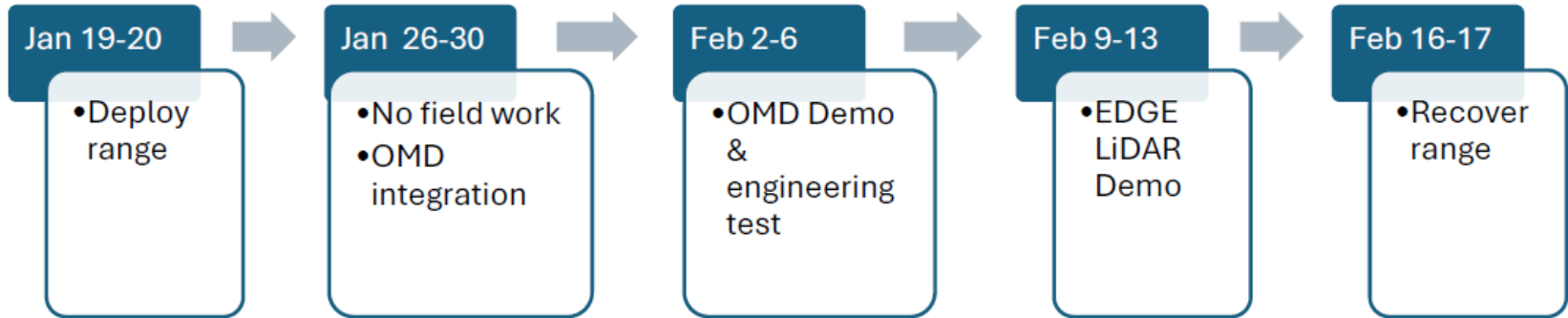
Performance Objective	Metric	Data Required	Success Criteria
Selection of test site(s)	Must work for technology.	Environmental settings, site area, and ease of access.	Sandy, muddy or coralline setting; less than five meters (m) water depth; low sea state. Access to support vessels.
Test site(s) characterization	Must be able to acquire environmental and geo-position data.	Geophysical site characterization including but not limited to bathymetry, sediment type, turbidity, and oceanographic conditions.	Successful collation of available historic data and collection of pertinent geophysical data.
Deployment of test site	Rapid setup of test site and acquisition of geolocation data for all deployed objects.	Geolocation data of deployed and recovered objects.	Quick site deployment and fast recovery of all objects at the end of the demonstration.

Results to Date

- Test site selection confirmed.
- Permitting hurdle cleared.
- Inert munitions and ISOs procured.
- Geopositioning methodology developed and field tested.
- Test characterization underway.
- Demonstration plan submitted for feedback.
- Tentative schedule shared with performers.

Issues

- No issues are anticipated for the range deployment and logistics preparation.



Next Steps

- Have regular discussions with the team to ensure the demonstration can take place according to schedule.
- Demonstration plan to be finalized Fall 2025.
- Coordination with Creare to share hardware/guidance for WAM-V 8 integration.
- Geoposition data and field notes to be provided within one month after the demonstration.
- Final report to include performance objectives results and performers feedback to be provided by June 2026.

Technology Transfer

- ARL at UH will continue to share information with parties interested in potentially testing their technology at HI_MTRC, via presentation at key conferences, technology fact sheets, and videos.
- ARL at UH will collaborate with managers at other test sites to produce a set of best practices and lessons learned, for use by other demonstration sites. That information may be conveyed using guidance documents and training workshops.

BACKUP MATERIAL

These charts are required and will be used by the Program Office but may not be presented.

MR24-B3-8219: Evaluation of Sensor Technologies at the Hawai'i Maritime Test Range Complex (HI_MTRC)

Performers: Applied Research Laboratory at the University of Hawai'i

Technology Focus

- *Rapidly deployable test range to assess MEC-detection technologies*

Demonstration Site

- *Moku o Lo'e in Kāne'ohe Bay, HI*

Demonstration Objectives

- *Range deployment and recovery is accomplished quickly. Accurate geolocation of all objects is achieved within one meter.*

Project Progress and Results

- *Permission to operate was obtained and demonstration plan and required equipment procured.*

Implementation Status

- *After the upcoming demonstration, other performers may use the HI_MTRC to test their technology.*



Plain Language Summary

- This project will enable rapid evaluation of technologies in shallow water.
- The issue is ensuring that it is challenging for detection technologies to record the exact location of the objects at test sites. HI_MTRC will provide a range with accurately recorded position of each object.
- The ability to rapidly deploy test sites at different locations will allow to test newly developed technologies and assess their efficacy.

Action Items

- Using the SERDP and ESTCP Management System (SEMS) as the source, list all ESTCP Review Committee/ Program Office action items (verbatim) assigned over the past year, and any open action items from earlier years. Provide a response as appropriate.

NOTE: Include only if required.

N/A

Impact to DoD Mission

- The Program Office wants to convey the significance of your research to DoD leadership, Congress, and the broader community.
 - What's the most impactful thing that's happened since the last time you presented your work to us?
 - Why is this important?
 - How is your project advancing DoD capabilities?
 - Include high quality images

Publications

- N/A

Literature Cited

- N/A

Acronym List

- ARL at UH: Applied Research Laboratory at the University of Hawai'i
- DLNR: Department of Land and Natural Resources
- EFH: Essential Fish Habitats
- ESA: Endangered Species Act
- IMU: inertial measurement unit
- FNU: Nephelometric Turbidity Units
- HI_MTRC: Hawai'i Maritime Test Range Complex
- ISO: industry standard objects
- IVS: instrument verification strip
- MEC: munitions and explosives of concern
- NOAA: National Oceanographic and Atmospheric Administration
- OMD: Optical Munitions Detector
- RTK-GNSS: real-time kinematic global navigation satellite system
- TOI: target of interest
- UAV: uncrewed aerial vehicle
- UH: University of Hawai'i
- USV: uncrewed surface vehicle
- WAM-V 8: 8-foot Wave Adaptive Modular Vehicle