Quarterly Status Report FY 2024 – Quarter 1

U.S. Coast Guard
Great Lakes Oil Spill Center of Expertise

Table of Contents – GLCOE Project Portfolios

Great Lakes Modeling

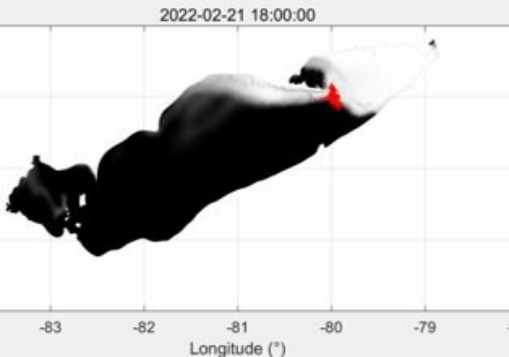## Theme Alignment: Preparedness

Objectives

- Evaluate General NOAA Operational Modeling Environment's (GNOME) performance as an oil spill trajectory model in the Great Lakes
- Incorporate the high-resolution Great Lakes Coastal Forecasting System into GNOME
- Convene workshop to discuss Great Lakes freshwater gaps
- Determine remedies for areas of GNOME underperformance

Notes

- Project initiation delayed until FY23
- Time step analysis conducted using experimental version Great Lakes Operational Forecasting System to inform time steps that are appropriate for GNOME simulations
- International Oil Spill Conference 2024 poster submitted

Above: USCG GLCOE Research & Gap Analysis Workshop at GLERL.

Below: Simulated Oil Spill Particles (red dots) in a hypothetical spill event in the ice-covered Lake Erie.

GLCOE Lead: Dr. Matt Alloy	**PI:** Dr. Ayumi Fujisaki-Manome	**Partners:** GLERL/CIGLR

Anticipated Outcome/Transition: GNOME improvements using Lake Erie as a validation area. Continuation and iteration with the other Great Lakes.

Project Timeline/Key Milestones

Period of Performance: 09 SEP 2021 - 31 MAR 2024

Identified GNOME underperformance area: shorelines and other edge/border areas.

Initiated efforts to remedy the above: Investigation and testing of new interpolation algorithm.

Initiated investigation to diffusion and uncertainty coefficients that match drifter data for Lake Erie.

Initiated metrics of measuring GNOME performance with drifter data for validation.

Presented preliminary oil in ice simulations at International Association for Great Lakes Research 2023 conference titled "*Modeling Study on Oil Spill Transport in the Great Lakes: Significant Ice Cover*".

Manuscript in preparation for peer-reviewed journal. – Song et al. "Modeling study on oil spill transport in the Great Lakes: Significant ice cover"

Drafted Great Lakes Modeling Summary of Effort Report.

Project Completion Date: 31 MAR 2024	**Percent Complete:** 90% (CIGLR)

Environmental Response Management Application (ERMA) Enhancements

Theme Alignment: Preparedness

Objectives

- FY22 – 1: Support Environmental Sensitivity Index (ESI) efforts in the Great Lakes region by adding two new atlases; the St. Mary's River and the St. Lawrence River. Integrated into ERMA TOC and Query tools. Update EPA Inland Sensitivity Atlases in ERMA.
- FY23 – 2: Support the identification and creation of a set of sensitive habitats/species layers in the ERMA Common Operating Picture (COP) throughout the Great Lakes. Expand the use of UAS and other remote sensing technologies (enhanced image support, upload and download). Bookmarks, Dashboard, and Security.

Notes

- No Cost Extension: 02/01/2023-08/31/2023
- Significant progress has been made on the Incident Command Structure (ICS) 232 Resources at Risk Report creation and will utilize a "fillable PDF" form customizable for each incident or planning effort
- Improve data search functionality; new Filter Tool for user customization and immediate filter display on maps and dashboards
- Zoom to data that has been selected
- Improvements to easily jump into bookmark views and see table of contents
- Continued leverage of Data Integration Visualization Exploration and Reporting (DIVER) and ERMA interoperability for upload/download/package creation

GLCOE Lead: CWO Joe Torcivia	**PI:** George Graettinger	**Partners:** NOAA OR&R

Anticipated Outcome/Transition:
Advancing ERMA

Period of Performance: 03 FEB 2022 – 31 MAY 2024

Project Timeline/Key Milestones

- Automate Resources at Risk ICS 232 RAR Report
- Four atlases added, others will be added when available
- Supported USCG Academy (USCGA) project
- Photograph ingest from Esri FieldMaps
- Updated IT and Infrastructure
- Training and Drill support for USCG exercise completed, tutorials made available
- ERMA Application version 5.2 released September 2023
- Finalize ERMA application testing (NOAA)
- Complete ICS-232 RAR form development and deployment (January 2024)
- Discuss options for additional development and future application of the USCGA approach for other areas of the Great Lakes and potentially to U.S. Navigable waters

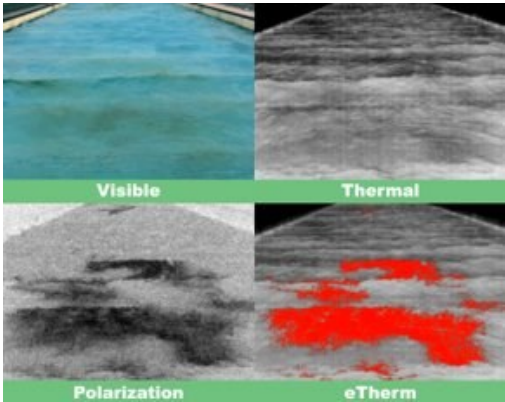| **Project Completion Date:** 31 MAY 2024	**Percent Complete:** 70%

Pyxis Oil spill Detection System (PODS)

Theme Alignment: Response

Objectives

- Assess oil detection technology: Purchased Pyxis camera and data analysis software.

Notes

- Indoor facilities will not work due to thermal shadows; looking to use Lake Superior State University's outdoors tank in both warm and cold conditions with ice.
- Currently working on testing scenarios and mounting design for the Pyxis, so evaluation can begin as soon as camera is in hand and personnel are fully trained in its operation and data analysis.

GLCOE Lead: Dr. Allie Snider	**PI:** Dr. David Wright

Partners: Heidi Purcell

Anticipated Outcome/Transition: Evaluate the Pyxis Long Wavelength Infrared High Definition (LWIR HD) 30Hz camera system's ability to detect oil in freshwater and ice-affected waters.

Project Timeline/Key Milestones

Period of Performance: 16 SEP 2022 – 31 MAR 2024

Literature review of additional types of oil detection technology, including Costal Dynamics Experiment (CODE) drifters to mimic oil transport for modeling applications. Provide report.

Determine best management practices for using Pyxis and conduct USCG field-based training.

Conduct USCG and responder field-based training to familiarize CG staff with the operations and recommended best practices for the use of PODS.

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Project Completion Date: 31 MAR 2024

Percent Complete: 20%

Info Portal

Theme Alignment: NA

Objectives

- Assess the GLCOE needs for a public-facing website for the public, stakeholders, USCG, GLCOE partners, and for general information dissemination.
- Interview possible users and assess similar websites to determine the functionalities desired.
- Produce a report of recommendations given several different scopes to the GLCOE.

Notes

- Two engagement specialists have been hired.
- Exploratory literature review has been conducted.
- Identified potential end-users to interview and created guidelines for the interviews.
- Next step is to conduct internal and external interviews.

Project Timeline/Key Milestones

Period of Performance: 12 SEP 2022 – 31 MAR 2024	
Project reallocation of effort. The focus is to generate a Report of Info Portal Recommendations.	
Initial draft of work plan revised to reflect refocusing of the project.	
Initial draft of user needs assessment interviewee list and interview questions.	
Project Completion Date: 31 MAR 2024	**Percent Complete:** 20%

GLCOE Lead: LTJG Ali Gates	**PI:** Dr. Riley Ravary	**Partners:** Dr. Ayumi Fujisaki-Manome

Anticipated Outcome/Transition: End-User surveys and interviews to produce base level website

Federal On-Scene Coordinator (FOSC) Ice Guide

Theme Alignment: Response

Objectives

- Consolidate key scientific elements into a report or guide for response to oil under ice.
- Research the differences in oil behavior in freshwater ice as opposed to saltwater ice.
- Identify local Oil Spill Removal Organizations (OSRO) to create a line of communication between GLCOE and local responders.
- Produce a printable FOSC job aid.

RPI RESEARCH PLANNING, INC.

Notes

- Research Planning Inc. (RPI) will be joining the project and will be producing the FOSC Guide.
- Performing literature search on the differences between oil behavior in freshwater ice and marine ice.
- Next steps: Meet regularly with RPI for coordination meetings & finalize list of local OSROs and their contact information.

Project Timeline/Key Milestones

Period of Performance: 22 SEP 2022 – 31 MAR 2024

Project has been initiated, several meetings with Subject Matter Experts (SMEs) and NOAA Scientific Support Coordinator (SSC) to give input into the guide's structure and content.
Steps have been taken by CIGLR to subcontract the guide to RPI (discussion held 12 Oct 2023)
RPI will come onboard in January w/ Kickoff Meeting in February.
Meet regularly with RPI to stay on track with the project deadline.

GLCOE Lead:	**PI:**	**Partners:**
CWO Joe Torcivia	Dr. David Wright	Heidi Purcell

Anticipated Outcome/Transition: RPI will produce a field guide for responses to oil under ice.

Project Completion Date: 31 MAR 2024	**Percent Complete:** 30%

Optimizing Unmanned Aircraft Systems (UAS)

Theme Alignment: Response

Objectives

- Advance the capabilities to develop and test oil spill response equipment, techniques and technologies to better respond o and evaluate impacts of oil spills in freshwater environments
- Draft written procedures for using USCG UAS systems
- Conduct USCG Pilot & responder field training

Notes

- Add addendum to USCGs small UAS Flight Operations Standard Operating Procedures – "Marine Environmental Response Oil Mission Guidelines"
- Course training materials are finalized and ready for delivery.
- Comparative analysis of Commercial Off The Shelf orthomosaic software packages.
- Final meetings will be held with USCG UAS pilots to discuss feedback and future recommendations.
- Final virtual project meeting by 31 DEC 2023.

GLCOE Lead: LTJG Ali Gates	**PI:** Dr. Lisa DiPinto

Partners: NOAA OR&R, WaterMapping Inc.

Anticipated Outcome/Transition: Consistent data collection that can be easily uploaded into DIVER/ERMA for supporting environmental response.

Project Timeline/Key Milestones

Period of Performance: 20 JUN 2022 – 29 SEP 2023

Develop draft written procedures for using USCG UAS to collect data in support of oil pollution events in the Great Lakes
Conduct USCG pilot and responder field-based training: Conducted July 2023
Develop final, detailed written procedures
Evaluate options for orthomosaic mapping offshore
Recommendations for moving forward for future USCG investments in uncrewed systems, including sensor/sampler/accessories for Remotely Operated Vehicles
Delayed deliverables due to oil spill in the Gulf of Mexico

Project Completion Date: 29 SEP 2023	**Percent Complete:** 95%

Great Lakes Oil in Ice

Theme Alignment: Response

Objectives

- Refine detection limits based on actual time in field
- Advance our understanding of the relationship between percentage of ice cover and thermal sensor-based oil thickness characterization
- Develop faster workflows to allow for production of mapping

Notes

- Preliminary results presented at 24 AUG 2023 quarterly meeting
- Conducted additional testing and analyses to determine "container effect" on test results
- Developed technique to overlay sensor, photographic, and UV oil images to determine sensor capabilities
- Determined impact of ice on oil thermal characteristics is limited to small area adjacent to ice.
- Final report will be delivered by 31 JAN 2024

GLCOE Lead: LTJG Ali Gates	**PI:** Dr. Lisa DiPinto	**Partners:** NOAA OR&R, WaterMapping Inc.

Anticipated Outcome/Transition: Improve UAS mapping workflows, understanding of relationship between ice cover/oil thickness characterization
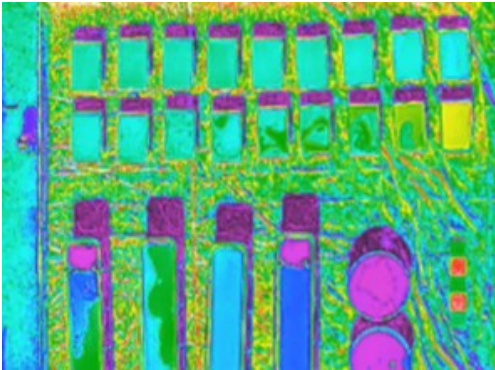
Project Timeline/Key Milestones

Period of Performance: 20 JUN 2024 – 29 SEP 2023

Completed shore-based field trials at Lake Superior State University (March 2023)
Completed drill of UAS operations in ice from a USCG vessel (March 2023)
Project report summarizing the testing and scientific findings, potentially suitable for peer reviewed publication is underway
Write up protocols for flying and characterizing ice cover for application during incidents, including data collection, intake and development of faster workflows
Delayed deliverables due to oil spill in the Gulf of Mexico

Project Completion Date: 29 SEP 2023	**Percent Complete:** 80%

Science of Disasters

Theme Alignment: Response

Objectives

- Providing a mechanism for the assessment of marine and freshwater oil spill response technologies, and the behavior and effects of oil spills in the Great Lakes
- Develop framework and establish contracts
- Execute contracts for deployment and application of technology

Notes

- Selected and prepared four technologies for deployment (MetOcean Stokes Drifters, ROV for Emergency Response, Sapidyne SCOUT biosensor, and Drifting Exposure and Effects Assessment Ring (DEEAR) bioassay system).
- Deployment of three technologies on recent Main Pass Oil Gathering (MPOG Co.) pipeline incident in the Gulf of Mexico.
- Testing and reporting on all four technologies in Santa Barbara in Spring/Summer of 2024 with funding from OR&R.

GLCOE Lead: CWO Joe Torcivia	**PI:** Dr. Lisa DiPinto	**Partners:** NOAA OR&R, UNH CRRC

Anticipated Outcome/Transition: Proof-of-concept of new technologies that could be beneficial during spills.
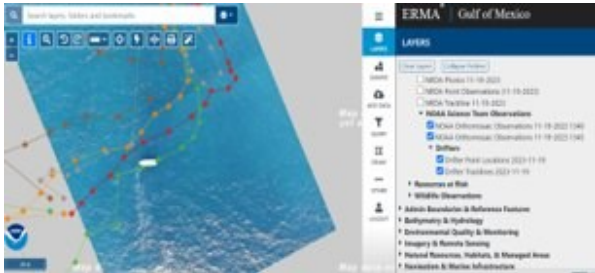
Project Timeline/Key Milestones

Period of Performance: 20 JUN 2022 – 29 SEP 2023

Develop framework, establish contracts, overall project administration:
Facilitated meetings with core team to develop framework, track progress with notes
List of preferred projects
Establish contracts with selected science teams
Execute contract for deployment during incident
Application of novel technologies on incidents
Project report describing testing and results from deployment with recommendations
Delayed deliverables due to oil spill in the Gulf of Mexico

Project Completion Date: 29 SEP 2023	**Percent Complete:** 90%

RAND Gap Analysis

Theme Alignment: Preparedness

Objectives

- Analyze current capabilities and capacity to respond to oil spills in the Great Lakes, enabling assessment of gaps, risks, and ways to mitigate them.
- This work will enable the Coast Guard and other stakeholders to be able to improve responses to potential oil spills in the Great Lakes in ways that reduce health, environmental, and economic risks.

Notes

- The GLCOE reviewed the draft report and created a feedback form that was sent back to RAND Corporation.
- Mr. Aaron Davenport presented the draft report to CG-5RI, CG-MER, and the GLCOE.
- Final Report will be submitted prior to 22 DEC 2023.

GLCOE Lead:	PI:	Partners:
LTJG Ali Gates	Aaron Davenport	N/A

Anticipated Outcome/Transition: Gap Analysis Final Report

FINAL BRIEFING

Great Lakes Oil-Spill Response Capabilities, Capacity, and Gaps

HSOAC
HOMELAND SECURITY
OPERATIONAL ANALYSIS CENTER

Aaron Davenport and Kate Anania | August 23, 2023

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Project Timeline/Key Milestones

Period of Performance: 22 SEP 2022 – 22 DEC 2023

Task 1 - Describe the scale and scope of the problem
Task 2 – Describe the oil-spill response capabilities and capacities of government agencies and private companies on both sides of the U.S. – Canadian border
Task 3 – Develop and analyze a series of scenarios to assess gaps in response capabilities and capacities
Task 4 – Analyze ways in which gaps can be mitigated

Project Completion Date: 22 DEC 2023 | **Percent Complete:** 95%

Theme Alignment: Preparedness

Objectives

- Support USCGA Cadets during a research-based summer internship program.
- Cadets will engage with GLCOE staff and other researchers (LSSU, partner agencies, etc.) to complete research projects relevant to the mandate of the GLCOE.
- Provide hands-on experience, networking, and learning opportunities to Cadets in the realm of Great Lakes oil spill research.

Notes

- Each year may look different for research projects as they will reflect Cadet interests, but it is intended that the project will provide background information to be used in future research or prototype of a use-inspired tool.
- Cadet Rylie Brick completed the inaugural internship in Summer 2023. The project focused on microbial ecology, assessing the community structure of native microbial communities in response to oil exposure.

GLCOE Lead: Dr. Allie Snider	**PI:** Dr. Deanna Bergondo	**Partners:** Lake Superior State University (LSSU)

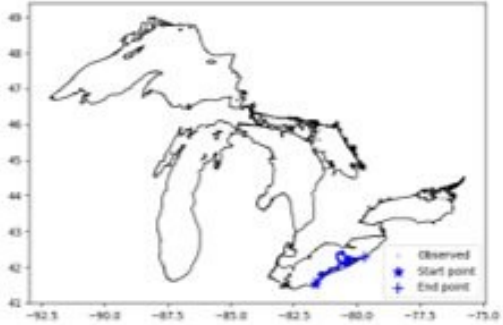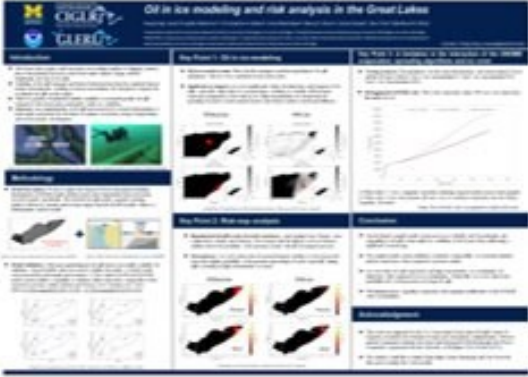**Anticipated Outcome/Transition:** Enhance collaboration with USCGA Cadets and staff.

Project Timeline/Key Milestones

Period of Performance: 04 MAY 2023 – 10 JUN 2023

Submit research ideas to USCGA for review.
Provide feedback to Academy Staff regarding number of students and cost analysis.
Attend International Association for Great Lakes Research (IAGLR)
Attend Central Michigan University Biological Station on Beaver Island, MI
Identify site sampling locations and collect sediment samples
Conduct oil exposure experiments
Sequence DNA at LSSU
Provide results to GLCOE to determine further research questions

Project Completion Date: 10 JUN 2023	**Percent Complete:** 100%

Enhancing Great Lakes Modeling

Theme Alignment: Preparedness

Objectives

- Enhance Web General NOAA Operational Modeling Environment (GNOME) interconnectivity with Environmental Response Management Application Common Operating Picture (ERMA COP) improvements.
- Facilitate modeling working groups
- Part 1: Broad Working Group
- Part 2: GNOME Evaluation

Notes

- Part 1: Met with NOAA modelers to discuss broader participation in modeling working group as many of the enhancements in modeling that would improve oil spill modeling in Great Lakes are from teams that are active at the national and international level.
- Part 2: Team has produced a poster for International Oil Spill Conference 2024

GLCOE Lead:	**PI:**	**Partners:**
Dr. Matt Alloy	Amy MacFadyen	Dr. Nancy Kinner

Anticipated Outcome/Transition: Enhance collaboration and communication on environmental and spill modeling efforts in the region.
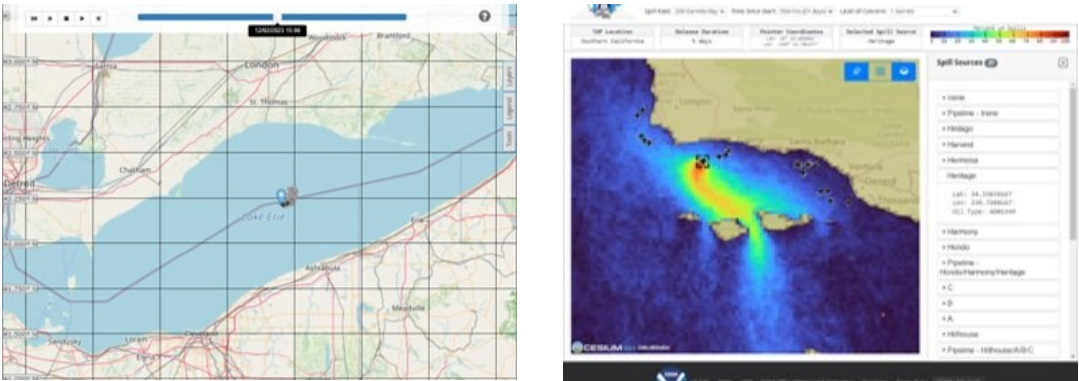
Project Timeline/Key Milestones

Period of Performance: 01 JUN 2023 – 31 MAY 2024

Monthly meetings with Yang Song updating the group and ending with action items for group members.
Members asked to formalize the challenges, achievements, and deliverables of this effort. Then to provide a list of the prospective next steps/goals of the effort to follow.

Project Completion Date: 31 MAY 2024	**Percent Complete:** 40%

Great Lakes Trajectory Analysis Planner (TAP)

Theme Alignment: Preparedness

Objectives

- Develop TAP for Lake Erie and further develop the online WebTAP viewer, including an option to output results in formats compatible with NOAA's ERMA (Environmental Response Management Application).

Notes

- Investigated options for long term archives of coupled ice-ocean hydrodynamic models as the Center for Operational Oceanographic Products and Services (CO-OPS) Lake Erie Operational Forecast System has not included a coupled ice model consistently.
- All files from 2017-2022 have been downloaded to NOAA and are ready to use in the model simulations
- Next Steps: Define source locations and spill types for Lake Erie; run multiple General NOAA Operational Modeling Environment model scenarios for each source.

Period of Performance: 01 JUN 2023 – 31 MAY 2024

Project Timeline/Key Milestones

Gather and transform wind, currents and ice data using long term datasets to be obtained from members of the Great Lakes Modeling working groups (e.g. GLERL, CIGLR institutions) for Lake Erie and the Great Lakes.
Research (with input from local sources) likely oil spill events in the area and use these to define spill sources and oil types for the GNOME trajectory runs.
Input the transformed winds and currents data into the GNOME trajectory model for the TAP runs.
Add code to TAP to output results in a GIS-compatible format (e.g. shapefiles) for ingest to ERMA or other Geographic Information Systems (GIS) (e.g. ArcPro).
Add the completed Lake Erie TAP to the NOAA WebTAP viewer, which can be found at https://tap.orr.noaa.gov.

GLCOE Lead: Dr. Allie Snider	**PI:** Amy MacFadyen, Chris Barker	**Partners:** NOAA POC: Lisa DiPinto

Anticipated Outcome/Transition: Completed Lake Erie TAP will be integrated into the NOAA WebTAP viewer.

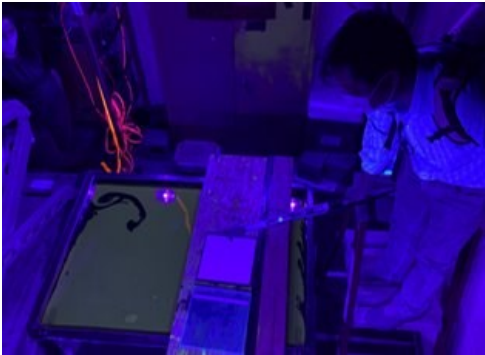| **Project Completion Date:** 31 MAY 2024	**Percent Complete:** 5%

Great Lakes Unmanned Aircraft Systems (GL UAS) Capacity Building

Theme Alignment: Response

Objectives

- Plan and conduct controlled testing for the development and validation of oil thickness algorithms.
  - This will be done with (1) GLERL's sensor and (2) up to 3 additional sensors at University of New Hampshire (UNH) in the high bay facility and an outdoor tank.
  - Multiple oil types will be tested in each experiment.
  - For the three additional sensors, other variables will be tested as well (temperature, thickness, etc.).

Notes

- USCG selected additional sensors to try to test (USCG small Unmanned Aerial Systems, Light Detection And Ranging (LiDAR), PODS, Polarimetric Imaging).
- Conducting hyperspectral testing at UNH outdoor facility in January 2024.
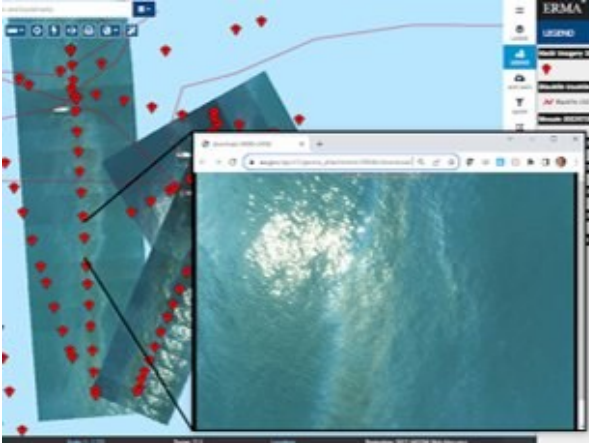- Coordinate with USCG for test dates, personnel, study design for sUAS.

GLCOE Lead: Dr. Allie Snider	**PI:** Dr. Lisa DiPinto	**Partners:** NOAA GLERL POC: David Wright

Anticipated Outcome/Transition: Technical reports that detail utility of each tested sensor for detecting oil

Project Timeline/Key Milestones

Period of Performance: 01 JUN 2023 – 31 MAY 2024

Bi-weekly or monthly virtual meetings with meeting notes and action items in a format to share with working group members.
Test plan for GLERL for 2 separate weeks of testing sensors at UNH
Brief (2-4 pp) technical report highlighting findings from GLERL's 2 weeks of UNH high bay laboratory experiments.
Test plans for 1 week of testing sensors and/or samplers at UNH for individual operators
Brief (2-4 pp) technical reports highlighting the findings from 1 week of testing individual operators (operators TBD by USCG) for up to 3 individual operators.

Project Completion Date: 31 MAY 2024	**Percent Complete:** 25%

Theme Alignment: Response

Objectives

- Job Aid: How to use small UAS (sUAS) to collect imagery during emergency response on shorelines and on water
- Job Aid: Data management, storage, and delivery
- Integrate training materials will be developed for the use of both job aids.

Notes

- Planning meeting on 10 OCT 2023 w/ participants from NOAA, USCG, and RPI.
- Conducted meeting at CLEANGULF regarding use of UAS at USCG and NOAA.
- Created detailed outline for 1st job aid that provides safety measures and guidance on how to use sUAS for specific response operations, including which sensors to use and when to use optional equipment.

Project Timeline/Key Milestones

Period of Performance: 01 JUN 2023 – 31 MAY 2024

Conduct meeting at CLEANGULF for UAS projects
Create outline for Job Aid #1
Planning meetings in December, January, & February to discuss progress on the 1st Job Aid.
First draft of Job Aid #1 by 15 MAR 2024

GLCOE Lead: CWO Joe Torcivia	**PI:** Dr. Lisa DiPinto	**Partners:** WaterMapping, Inc

Anticipated Outcome/Transition: Advance protocols and training for CG-7114 in oil response

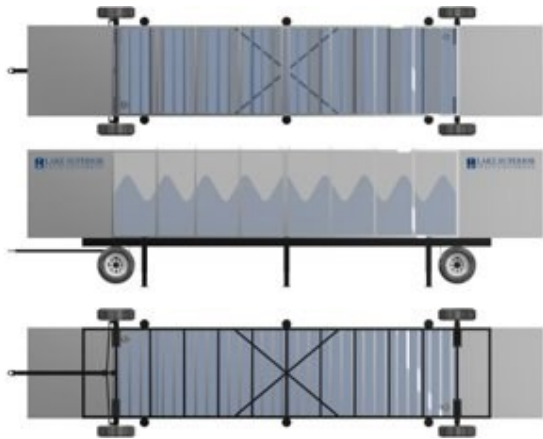| **Project Completion Date:** 31 MAY 2024	**Percent Complete:** 5%

GL Wave Tank & Storage Infrastructure

Theme Alignment: Preparedness, Response

Objectives

- Constructure of a new storage facility to provide enhanced infrastructure and capabilities for US and Canadian researchers within the Great Lakes to support research and response.
- Creation of a new and custom wave tank system (designed by SeaView Systems). The tank will be modular and be portable so that it can be moved outdoors to simulate environmental conditions that will strongly influence oil dynamics (e.g., photo-oxidation, ice development)

Notes

- Construction began in the Fall on the storage building; work will continue into the Winter.
- Preliminary design for wave tank is in hand; adjustments will be made and production will begin when design is finalized.
- Next Step: Wave tank design is scheduled for 14 DEC 2023.

| **GLCOE Lead:**
Dr. Allie Snider | **PI:**
Dr. Ashley Moerke | **Partners:**
NOAA: Dr. David Wright |

Anticipated Outcome/Transition: Enhance infrastructure and capabilities within the Great Lakes to evaluate technological developments under controlled, yet real-world conditions.

Project Timeline/Key Milestones

Period of Performance: 01 JUL 2023 – 30 JUN 2024

Design for wave tank has already been completed and secured from SeaView Systems
Construct facility to house wave tank (planning in progress with external funding)
Purchase tank construction materials
Build tank, complete plumbing to draw river water into tank system and circulate into Center for Freshwater Research and Education's (CFRE) existing water outflow system (within 6 months of SOW finalization)

| **Project Completion Date:** 30 JUN 2024 | **Percent Complete:** 40% |