



***Coast Guard Ninth District  
&  
Great Lakes Center of Expertise (GLCOE)***



***February 2022 Update***

*Briefing to Great Lakes Association of Science Ships  
Fleet Management & Science Support Meeting*



## Acquisition Directorate Research & Development Center

# Federal On-scene Coordinator (FOSC) Guide for Oil in Ice

Distribution Statement A: Approved for public release; distribution is unlimited.

March 2017



Homeland  
Security

## Oil in/under Ice: Current Status & Future Plans



- Three U. S. Coast Guard R & D studies conducted 2011-2014 in Straits of Mackinac, Lake Huron
- Studies culminated in 2017 Federal On-Scene Coordinator (FOSC) Guide for Oil in Ice
- Guide contains current best practices, technologies, knowledge base
- Coast Guard R & D on topic continues
- Report available at (or simply web search):

<https://homeport.uscg.mil/Lists/Content/Attachments/43701/USCG%20FOSC%20Guide%20-%20Oil%20in%20Ice.pdf>



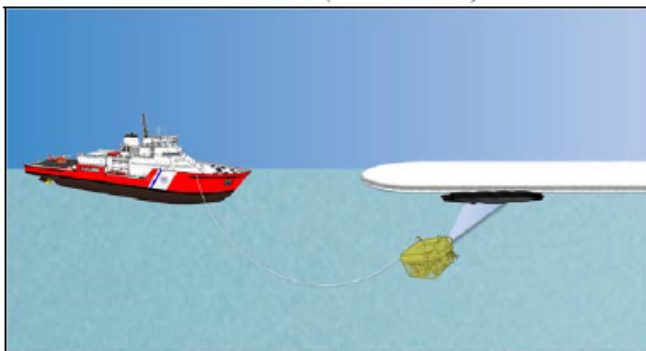
B.1.3 Remotely Operated Vehicle

This technique deploys a Remotely Operated Vehicle (ROV) near the ice edge to search for oil under the ice. It can also be used down a hole through the ice, if the ice is solid enough for personnel to be deployed on the ice. Potential sensors used include cameras, sonar, or fluorimeters. Most are configured in a looking-up position.

ROV in Process of Being Deployed



ROV Tactic (not to scale)



Deployment Considerations and Limitations

- Use of an ROV means that open water must be available during the full timeframe of the deployment to ensure successful recovery.
- Care needs to be taken to ensure that cables do not get tangled into propellers or bow thrusters. Cables may also be susceptible to damage from the ice. The cable should not be dragged on the bottom in shallow water.
- Bright sunlight can help or hinder upward-looking sensors, depending on the conditions. For thin ice, the ROV may need to be deployed at a deeper depth to reduce glare. Lights may be needed on overcast days and at night.
- The weight of the system may necessitate the use of a crane; so the vessel selected should have this capability.

- EXAMPLE -

Equipment and Personnel

EQUIPMENT	FUNCTION	PIECES	NO. STAFF/SHIFT	SET-UP TIME
Vessel	Working platform	1	2	#
ROV	Search	1	2	<30 minutes

# depends upon location





## B.2 CONTAINMENT AND RECOVERY

### B.2.1 Ice Edge Conditions

#### Ice Edge – Skimming

Mechanical containment and recovery near the ice edge requires safe and efficient operation of the equipment close to the ice. This tactic may involve skimmers deployed from a cutter or large vessel using a single davit or crane, deck-mounted excavator oil bucket/ boom assemblies, or similar configuration. The skimmers used will be the same as those for either open water or broken ice, depending on the conditions. Containment booms are deployed, when feasible, to intercept, control, and concentrate the oil. Most tactics usually focus on the use of two towing vessels; which permits maneuvering around ice floes. If the oil is in relatively open water but close to the ice edge, a boom vane may be used to control the end of the boom and help keep the boom from connecting with the ice without the use of a second vessel.

#### Deployment Considerations and Limitations

- The boom vane technology may suffer limitations if there is broken ice near the ice edge and/or ice coverage increases past a limiting point of boom vulnerability.
- Collisions with smaller pieces of ice in fast-moving waters may not be an immediate issue; but over time, they may accumulate in the containment system. This accumulation of ice within the boomed area would impart additional stresses on the system and may accelerate a failure mode.
- Operators should take special care in broken ice conditions as impacts by chunks of ice may damage, block, or interfere with the vanes; affecting control of the device and requiring suspension of operations until ice can be cleared.

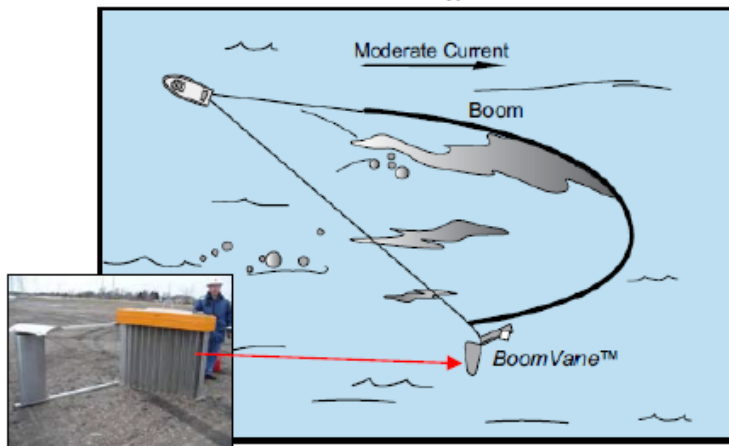
- EXAMPLE -

#### Equipment and Personnel

EQUIPMENT	FUNCTION	PIECES	NO. STAFF/SHIFT	SET-UP TIME
Operational Vessel	Working platform	1-2	2-4	1-2 hours#
Tugboat	Working platform	1	2-3	<1 hour
Boom and boom vane	Containment	1-2	2-4	< 1 hour
Skimmer	Recovery	1-2	2-4	< 1 hour

# depends upon equipment and conditions

Tactic Diagram



Source: STAR Manual





# Advancing UAS and AUV Capabilities to Characterize Water Column and Surface Oil in Ice Environments

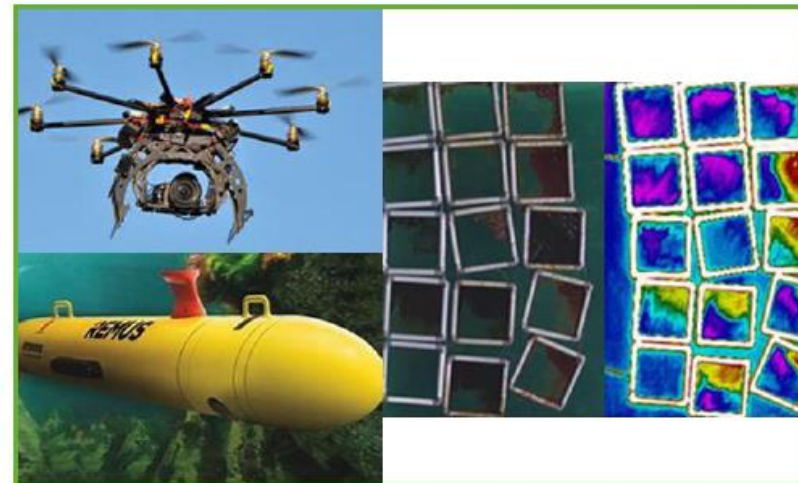
4711



**Mission Need:** Technologies to detect and characterize oil spills in ice environments.

## Objectives

- Coordinate and conduct multi-agency lab and field tests to gain better understanding of aerial and underwater sensor capability in characterizing oil on the surface or in the water column in ice conditions.
- Determine remote vehicle telemetry capability to transfer sensor data to on-scene responders or Incident Command as actionable information.



## Notes

- Oil Spill Liability Trust Fund funding.
- Partnerships with the Cold Regions Research and Engineering Laboratory (CRREL), Woods Hole Oceanographic Institute (WHOI), U.S. Department of Homeland Security (DHS) Science and Technology Directorate (S&T) Office of University Programs (OUP), National Oceanic and Atmospheric Administration's (NOAA) Office of Response and Restoration (OR&R), Bureau of Safety and Environmental Enforcement, and U.S. Environmental Protection Agency.

**Sponsor:** CG-MER

**Stakeholder(s):** CG-5RI, D1, D9, D17, ADAC, NOAA OR&R, WHOI, MBARI, DHS S&T OUP, UxS IPT

**RDC Research Lead:**  
Mr. Alexander Balsley, P.E.

**CG-926 Domain Lead:**  
Ms. Karin Messenger

**Anticipated Transition:** Product  
*Fielded Prototype*

## Project Timeline / Key Milestones

<b>Project Start:</b> 23 Jan 20	
Interagency Reimbursable Work Agreement with NOAA Complete	3 Jun 20 ✓
Phase 1: Unmanned Aircraft System (UAS)/Autonomous Underwater Vehicle (AUV) Tests at CRREL Complete	23 Apr 21 ✓
UAS and AUV Characterization of Oil in Ice; Laboratory Results And Way Ahead (Brief)	6 Jul 21 ✓ ★
UAS Characterization of Oil in Ice: Volumes I and II (Report)	Jan 22 ★
Field Exercise Planning Complete	Apr 22
Phase 2: UAS/AUV Systems Shore-Based Field Tests	Apr 22
Phase 2: UAS/AUV Systems Vessel-Based Field Tests	Aug 22
Data Schema for Data Export Complete	Oct 22
UAS/AUV Systems Field Exercise Integration (Report)	Mar 23 ★
<b>Project Completion:</b> Mar 23	



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January 2022



# Behavior of Diluted Bitumen (Dilbit) in Fresh Water

4204



**Mission Need:** Enhanced decision-making for response to dilbit spills in the fresh water environment.

## Objectives

- Provide the U.S. Coast Guard (CG) Federal On-Scene Coordinators with decision-making guidance as they relate to the fate and transport of dilbit in the freshwater environment.
- Study the behavior (density and weathering) and response tools of dilbit spills in the freshwater environment.



## Notes

- Supported by Great Lakes Restoration Initiative funding.
- Leverage CG Research and Development Center Project 4705: Oil Sands Products Spill Response.
- Collaborate with the International Institute for Sustainable Development's Experimental Lakes Area and U.S. Department of Energy labs.

**Sponsor:** CG-MER, D9

**Stakeholder(s):** EPA Great Lakes Nat'l Program Office/Pollution Response Office, LANT-54, NOAA

**RDC Research Lead:**  
Benedette Adewale, PhD

**CG-926 Domain Lead:**  
Ms. Karin Messenger

**Anticipated Transition:** Knowledge Product  
*Influence Tactics, Techniques, & Procedures*

## Project Timeline / Key Milestones

<b>Project Start:</b> 1 Oct 20	
Literature Review Complete	12 Feb 21 ✓
Literature Review – Diluted Bitumen in the Fresh Water Environment (Report)	23 Jun 21 ✓ ★
Dilbit Test Plan Complete	30 Sep 21 ✓
CRREL Dilbit Weathering Cold Weather Test Complete	30 Nov 21 ✓
CRREL Dilbit Weathering Warm Weather Test Complete	Jul 22
Dilbit Oil Analysis Complete	Sep 22
Guidance Document - Behavior of Diluted Bitumen in the Fresh Water Environment (Report)	Dec 22 ★
<b>Project Completion:</b> Dec 22	



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July 2021



# Freshwater In-Situ Oil Burn Research

47041



**Mission Need:** Improve In-Situ Burn (ISB) knowledge base to supplement oil spill response options.

## Objectives

- Evaluate best practices for operational use of ISB in multiple environments, including fresh water and areas with vegetation.
- Develop methods to conduct ISB smoke-plume monitoring that improve sampling accuracy and responder safety.
- Provide reference guidance for Federal On-Scene Coordinator and Regional Response Team (RRT) use.



## Notes

- Multiple funding sources including Oil Spill Liability Trust Fund and Great Lakes Restoration Initiative.
- Partner with academia and national labs to ensure result visibility and access.

**Sponsor:** EPA Great Lakes Nat'l Program Office, CG-MER

**Stakeholder(s):** CG-721, NSF, EPA, BSEE, D9, RRT5

**RDC Research Lead:**  
Benedette Adewale, PhD

**CG-926 Domain Lead:**  
Ms. Karin Messenger

**Anticipated Transition:** Knowledge Product  
*Influence Tactics, Techniques, & Procedures*

## Project Timeline / Key Milestones

<b>Project Start:</b> 1 Oct 18	
Mesoscale Freshwater Burns Complete	19 Jul 19 ✓
Large-scale Freshwater Burns Complete	25 Oct 19 ✓
<b>Freshwater In-Situ Oil Burning (Report)</b>	<b>16 Feb 21 ✓ ★</b>
Remote Air Monitoring Market Research Complete	17 Feb 21 ✓
Remote Air Monitoring Process Framework Complete	11 Mar 21 ✓
Test Plan for Remote Air Monitoring Complete	22 Apr 21 ✓
Air Monitoring During Freshwater ISB	28 Oct 21 ✓
<b>Freshwater In-Situ Burning Air Monitoring (Report)</b>	<b>May 22 ★</b>
<b>Project Completion:</b> May 22	



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# Emerging Pollution Response Technology Evaluation

1011



**Mission Need:** Understand the capability of emerging mechanical pollution-response technology.

## Objectives

- Conduct market research to identify new and emerging pollution response technologies.
- Conduct independent evaluation of select technologies using the U.S. Coast Guard's (CG) Oil Spill Response Technology Evaluation Process.
- Collaborate with other Federal agencies (Bureau of Safety and Environmental Enforcement (BSEE), Environmental Protection Agency, etc.) to conduct in-water testing of the most promising technologies.
- Provide feedback to equipment providers for consideration in advancing their technologies to enhance the nation's pollution response capability.
- Provide a knowledge product for Federal On-Scene Coordinator (FOSC) awareness of new technologies.



## Notes

- Oil Spill Liability Trust Fund funding.
- Partnership with BSEE.
- Possible use of Cooperative Research and Development Agreements.
- Opportunity to partner with Interagency Coordinating Committee for Oil Pollution Research (ICCOPR) members, Federal Laboratory Consortium members, and academic institutions involved in this area of research.

**Sponsor:** CG-MER

**Stakeholder(s):** ICCOPR, CG-721, District Response Advisory Teams, FOSCs, National Strike Force

**RDC Research Lead:**  
Mr. Alexander Balsley, P.E.

**CG-926 Domain Lead:**  
Ms. Karin Messenger

**Anticipated Transition:** Knowledge Product  
*Future Technology*

## Project Timeline / Key Milestones

<b>Project Start:</b> 1 Oct 21	
Priority Technologies Identified and Determined	Nov 21 ✓
Request for Information (RFI) Issued	Jan 22
RFI Responses Received	Mar 22
In-house Technology Evaluation Conducted	Jun 22
Technical Evaluation Team Review of Emerging Mechanical Technologies (Brief)	Jul 22 ★
Ohmsett Testing Complete	Oct 22
KDP: Meeting at Ohmsett with ICCOPR Members	Oct 22
Emerging Pollution Response Technology Evaluation Findings (Report)	Jul 23 ★
<b>Project Completion:</b> Jul 23	



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December 2021 3



# Coast Guard Remotely-Operated Vehicle – Low Cost (ROV-LC) Program



- Limited regional program in its first year – 10 units
- Conducting initial training & testing
- Intended for sub-surface oil and hazardous material detection, trajectory tracking, environmental impacts, damage assessments, etc.



Deep Trekker DTG-3

# Great Lakes Center of Expertise (GLCOE)

## *Background & Legislative Intent*



- 2018 Coast Guard Authorization Act directed establishment of GLCOE and directed it to:
  - research, analyze and address freshwater oil spill response research/knowledge gaps;
  - collaborate with academia and industry to develop and test cutting edge freshwater oil spill response techniques; and
  - train regional partners on incident management and oil spill response strategies
- The Act specified that GLCOE be located in close proximity to:
  - critical crude oil transportation infrastructure on Great Lakes, such as submerged pipelines, high traffic navigational locks; and
  - an institution of higher education with adequate aquatic research laboratory facilities and capabilities and expertise in Great Lakes aquatic ecology, environmental chemistry, fish and wildlife, and water resources



# Great Lakes Center of Expertise (GLCOE)

## *Planned Functions*



- Monitor and assess freshwater oil spill response technologies and the behavior and effects of oil spills in the Great Lakes
- Identify and seek to fill gaps in Great Lakes oil spill research
- Conduct research, development, testing, and evaluation for freshwater oil spill response equipment, technologies, and techniques to mitigate and respond to oil spills in the Great Lakes
- Educate and train Federal, State, Tribal and other regional first responders
- Work with academic and private sector response training centers to develop and standardize maritime oil spill response training and techniques for use on the Great Lakes

# Great Lakes Center of Expertise (GLCOE)

## *Integrated Freshwater Oil Spill Response Research Center*



### ***Lake Superior State University (LSSU) & NOAA Great Lakes Environmental Research Laboratory (GLERL)***

#### **Overview:**

- LSSU's new facility is dedicated to freshwater research and education on the St. Mary's River and is open to the public for visibility.
- LSSU is in close proximity to crude oil transportation infrastructure, submerged pipelines, and navigational locks.
- NOAA GLERL maximizes access to graduate and undergraduate universities, laboratory facilities, oil pipelines and infrastructure, other research capabilities, and easy access to an airport and transportation amenities.
- NOAA GLERL is a state of the art center designed for scientific research and interagency collaboration. The facility hosts key partners such as NOAA's National Ocean Service, Marine Sanctuary Program, National Marine Fisheries Service, Great Lakes Regional Collaboration Team, Great Lakes Sea Grant, and the International Association for Great Lakes Research. They are also a USCG R&D partner, and have an established cooperative with 33 universities throughout all of the Great Lakes.





# Great Lakes Center of Expertise (GLCOE)

## *Investing in Great Lakes Oil Spill Preparedness and Response Capabilities FY21 Spending Initiatives*



- Great Lakes ESI Map Updates (Lake Erie)
- GLCOE Site Visits
- Underwater ROV Purchase
- ESA Biological Evaluation
- Contract Support for Area Contingency Plan/  
Risk Analysis
- UAS Purchase
- NSF SORS/VOSS Equipment Movement
- NOAA GLERL R&D Projects \*\*\*



- \*\*\*
- 1) Evaluate NOAA's Operational Modeling Environment (GNOME) for Great Lakes freshwater environment.
  - 2) Incorporate Great Lakes Operational Forecasting System (GLOFS) surface currents forecasts into GNOME framework.
  - 3) Conduct research and potential impact on under-ice oil spill in Great Lakes.
  - 4) Assess long-term impacts to Great Lakes ecosystem.
  - 5) Evaluate use of autonomous underwater vehicles (AUV) or gliders for oil spill detection and clean up.
  - 6) Apply aerial drones and satellite remote sensing technology for monitoring of oil spill incidents/tracking.
  - 7) Coordinated workshops to communicate oil spill research, transition, and operational needs.

# Great Lakes Center of Expertise (GLCOE)

*Investing in Great Lakes Oil Spill Preparedness and Response Capabilities  
FY22 Spending Initiatives*



- **Detection of Oil in Ice with unmanned systems (NOAA OR&R/USCG RDC)**
- **Spills of Opportunity (NOAA OR&R)**
- **NOAA ERMA Enhancements (NOAA OR&R)**
- **Geographical Response System (GRS) Validation (D9/USCGA)**
- **Great Lakes Spill Response Capability and Gap Analysis (GDIT Contract)**
- **Assess/Enhance ROV Spill Response Capabilities (EPA/NOAA/USCG)**

