Acquisition Directorate

Research & Development Center

Update on Oil-in-Ice and Submerged oil Projects

RRT V meeting Columbus, OH 22 June, 2011

RDC | Kurt Hansen (UNCLAS)

Great Lakes Restoration Initiative (GLRI)

http://www.epa.gov/glnpo/glri/

Environmental Protection Agency-led, interagency Great Lakes restoration initiative, which will target the most significant problems in the region, including invasive aquatic species, non-point source pollution, and contaminated sediment

- Aquatic Nuisance Species
- Submerged Oil
- Oil in Ice

Outline

- Submerged Oil Project
- Oil-in-ice project
  - Great Lakes Restoration Initiative (GLRI)
  - Results from Workshops
  - Sault Ste Marie Demonstration
- Future

Submerged Oil Project - Overview

- **Completed Phase I to develop detection techniques**
  - Two selected were further evaluated during Deepwater Horizon
- **Completed first step for recovery system design**
  - 3 systems
- **Awarded contracts to build and test prototypes**
  - Tests scheduled for November
    - Alion Corp (working with Jacqui Michel of RPI)
    - Marine Pollution Control (based on manned submersible)
    - Oil Stop (working with Tornado Motion Technologies)

Phase II: Recovery Specifications

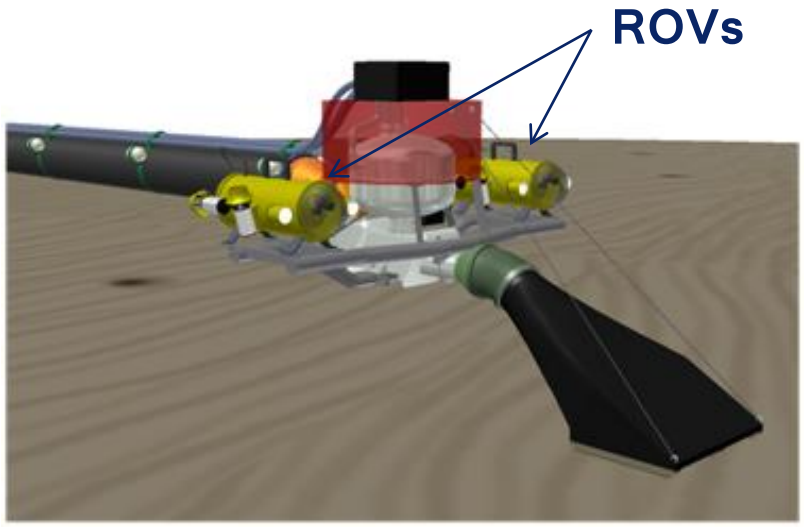
- Presence of heavy oil on the sea floor identified with 80% certainty
- Oil location geo-referenced to within 5 meters in accuracy
- Minimal dispersion of oil or bottom material into the water column
- Provides recovery for all sea floor conditions
- Operates in fresh and sea water conditions
- Operates in water depths of up to 200 feet
- Easy to operate and requires minimal training and maintenance

Recovery Specifications (cont'd)

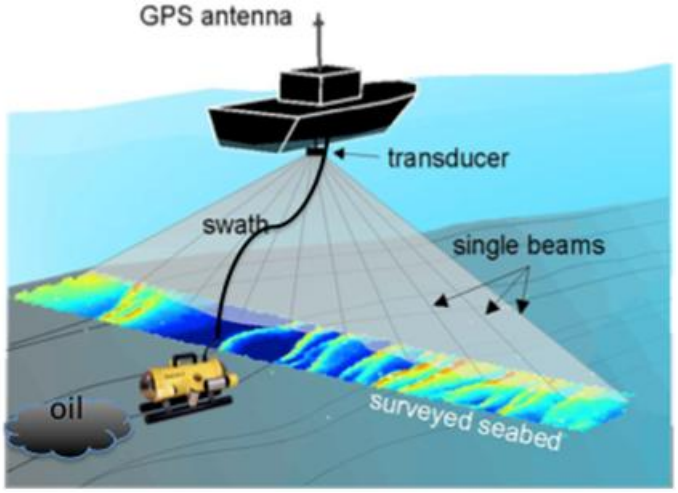
- Easily de-contaminated and durable
- Operates in water currents at the surface of up to 1.5 knots
- Deploys and operates in up to 5 foot seas
- Operable during the day and night
- Sets up within 12 hours of arriving on site
- Viscosity – Operates in the range of 2000-100,000 cSt
- Includes a decanting system that can handle the heavy or refloating oil
- Process to complete "polishing" the resultant water for disposal
- Minimal impacts to benthic resources

Alion

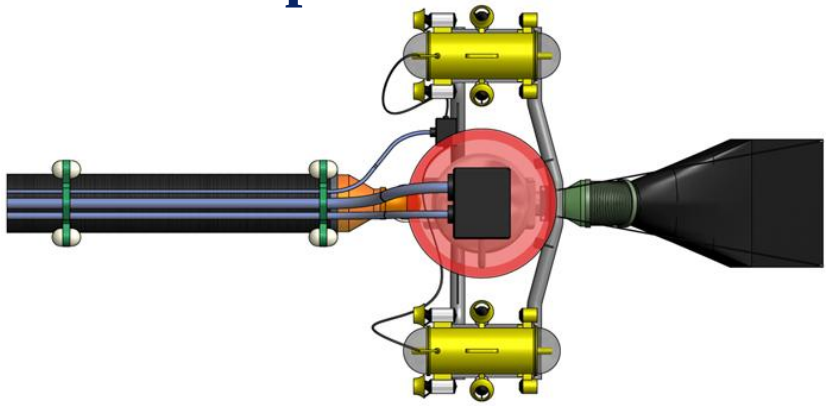
- **Lightweight system based on Remotely Operated Vehicles (ROV)**
- **Uses SONAR for detect**
- **Least developed concept**



Concept of Operations



Top View



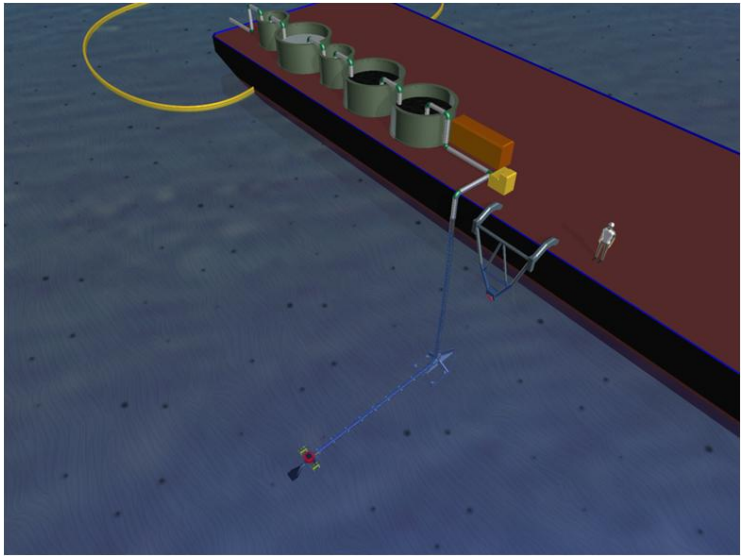
Alion - Trade-Offs

ROVs

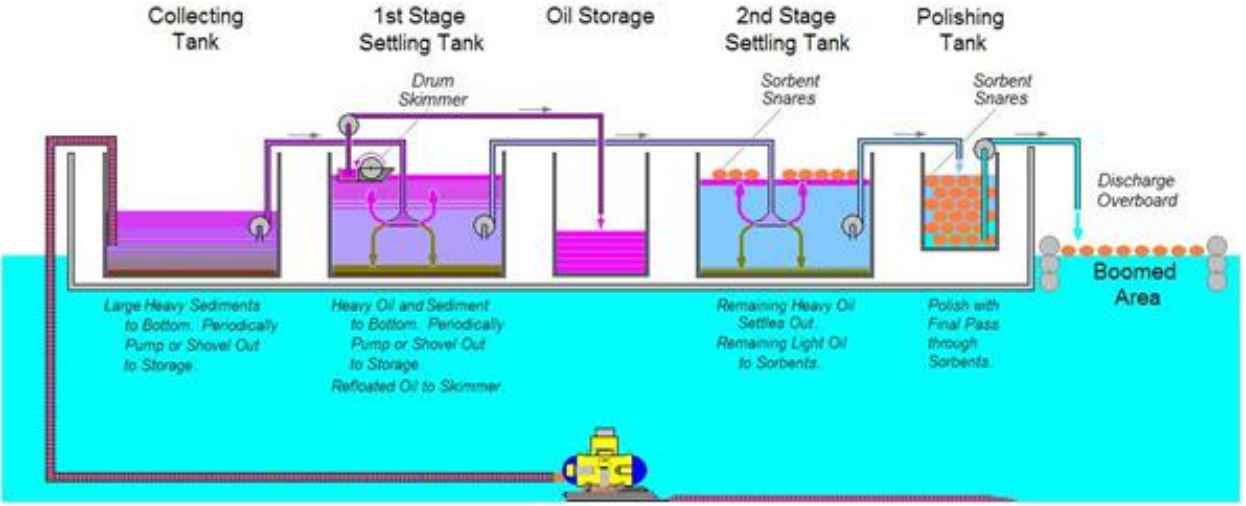
Pumps

Alion- Other Issues

Alternative Concept (on barge)

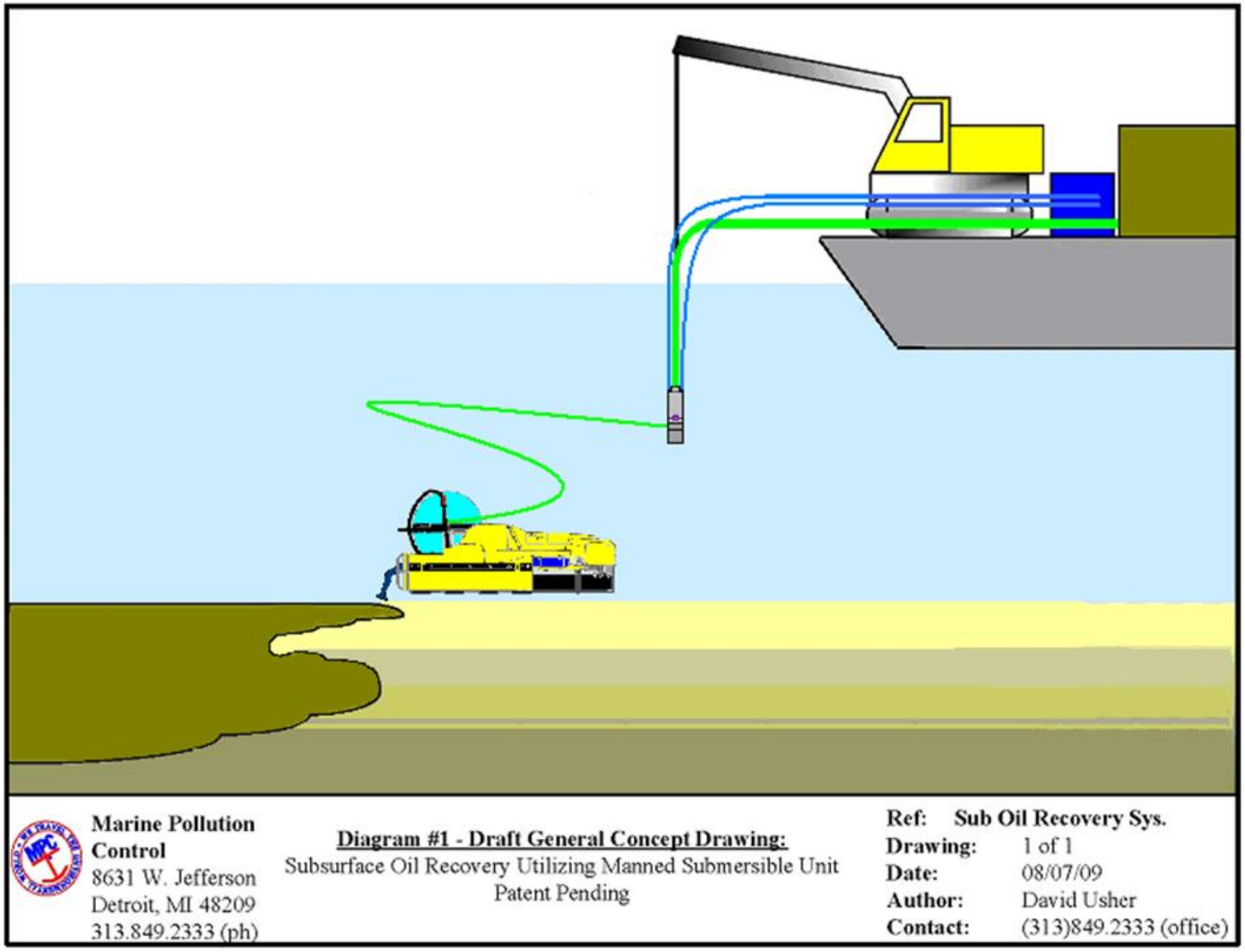


Decanting/Separation Design

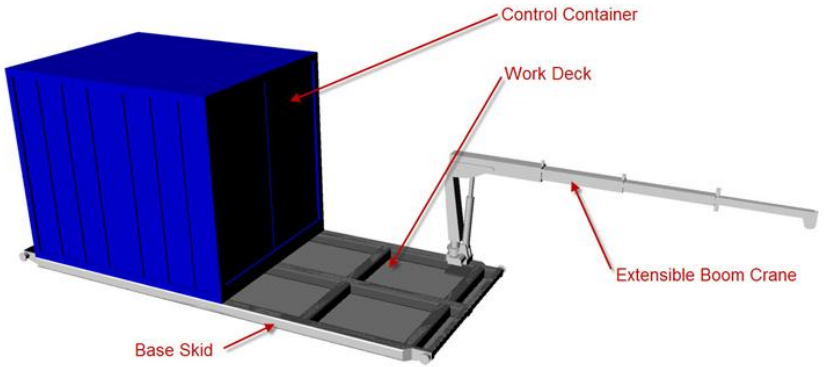


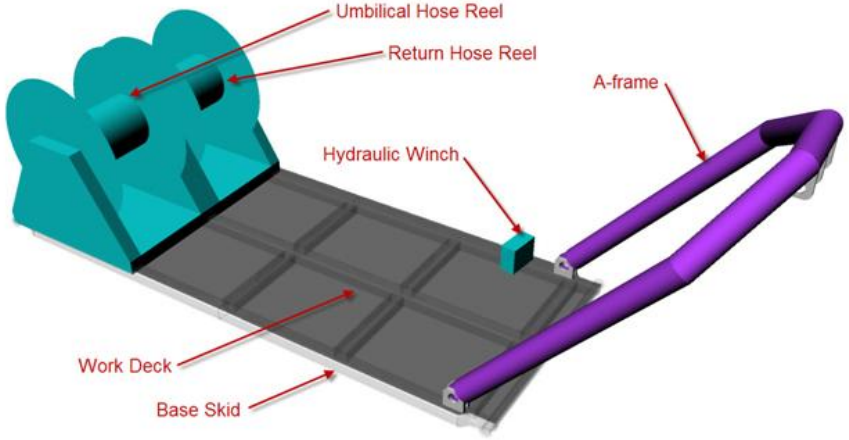
Marine Pollution Control

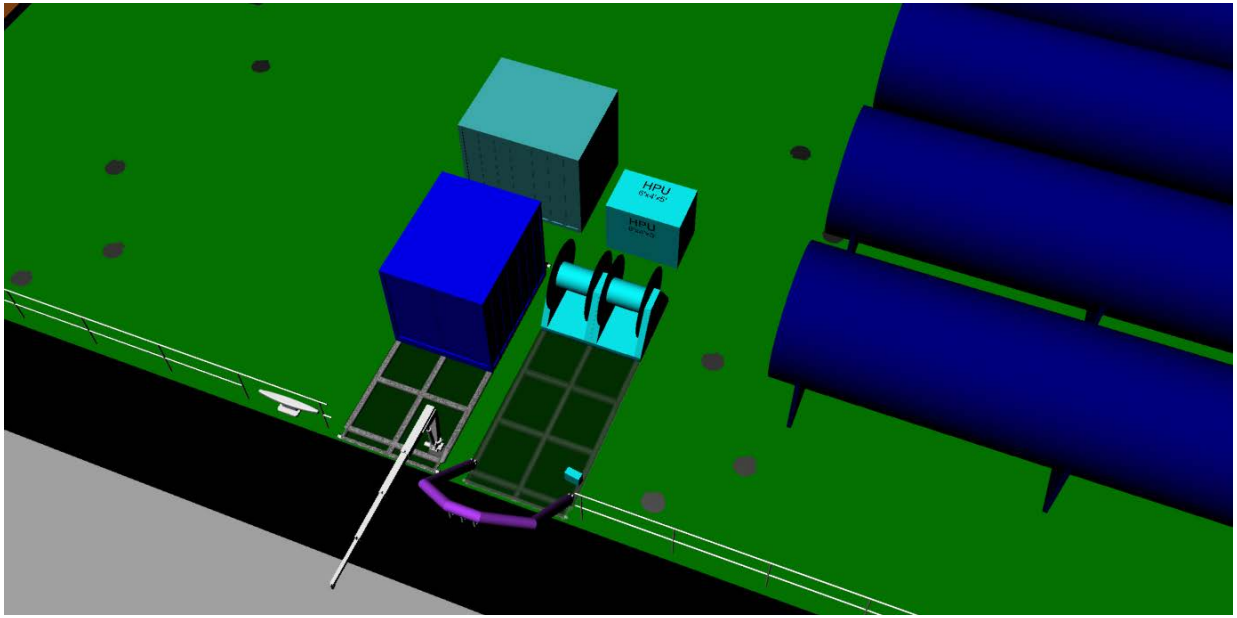
- **Based on existing manned submersible**
- **Uses sonar, EIC and visual for detection**



Marine Pollution Control
(control station and umbilical control concepts)







Components Available

Existing Submersible

Multi-degree of Freedom Robot Arm

Pump and debris control

Oil Stop

- Based on submersible dredge
- Uses visual for detection
- Weight reduction and increased depth capability needed

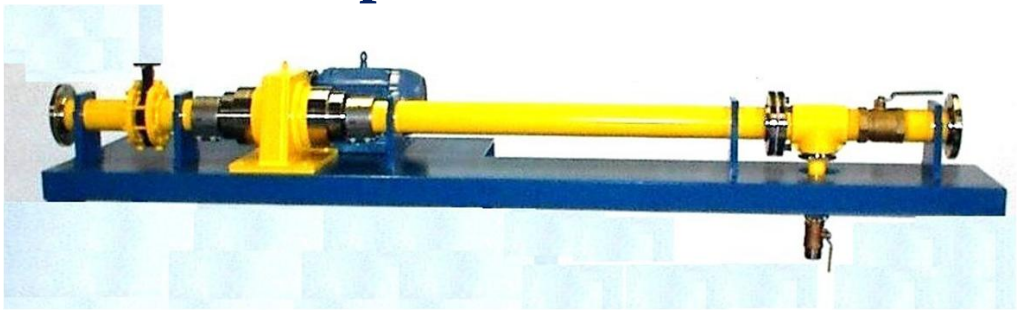
Eddy Pump

Existing Components

Typical frac tank

Conveyor Belt Skimmers

Voraxial Separator



Results

Systems selected as having unique capabilities

- **One is lightweight**
- **One can get deeper and stay longer (manned submersible)**
- **One could handle harsh wind/wave conditions**

Planned testing at Ohmsett in November, 2011

- **Due to 8-foot depth, there is a limit to testing especially for submerged crawler and manned submersible**
- **Modifications to systems to compensate**
- **Considering full field tests in FY2012 without oil (location TDB)**

Oil-in-ice Response

Arctic research started back in late 1960s early 1970s

RDC involved before Alaska pipeline built

Many other projects in US, Canada and International

- Some intentional spills

Multiple summaries / state-of-the-art papers since 2000

- Caught most of previous research
- Developed in guides including but not limited to:
  - EPPR from Arctic Council
  - STAR from State of Alaska
  - Alaska Clean Seas

Multiple Research Efforts by US and International organizations

RDC will not duplicate and select topics for FOSC support

RDC Approach for Arctic

Can we leverage vessels and logistics in Great Lakes to help develop responses in Arctic ?

Workshops to develop ideas and recommend priorities

- April 23, Anchorage AK
- August 25, Cleveland, OH

Participants provided state-of-the-art talks

- Brainstormed for ideas based on
  - Surveillance
  - Mitigation
  - Shoreline response

Alaska Workshop –April 23, 2010
(Surveillance)

	Great Lakes	Alaska
Test logistics of autonomous underwater vehicle (AUV)	X	
Test logistics of unmanned aerial vehicles		X
Test cross-boundary agreements	X	X
Demonstrate shipboard infrared (IR) and radar sensors		X
Update NOAA observer manuals		X
Evaluate synthetic aperture radar (SAR) satellite sensor		X
Test dogs	X (with oil)	X(with oil)
Evaluate IR		X (with oil)
Evaluate ice-tracking buoys		X(with oil)

Alaska Workshop – April 23, 2010
(Mitigation)

	Great Lakes	Alaska
Limits of Fireproof boom	X (w&wo oil)	X(w&wo oil)
Test open-apex	X(w&wo oil)	X(w&wo oil)
Provide Experience for Spill Responders	X(w&wo oil)	X(w&wo oil)
Ice Management	X (icebreaker)	X (barges, etc)
Existing Methods to Deploy Dispersants	X	X
Overflooding/rotting ice conditions	X	X
Test fixed-wing ISB ignition	X	X
Test Self-propelled skimmer	X	
Test fuzzy disc skimmers		X(with oil)

With and without oil – (w&wo oil)

Alaska Workshop – April 23, 2010
(Shoreline Response)

	Great Lakes	Alaska
Develop Shoreline Cleanup Assessment Technique (SCAT) Team outfitting	X	X
Evaluate Surf washing	X(w&wo oil)	X(w&wo oil)
Evaluate shoreline trenching	X	

With and without oil – (w&wo oil)

Great Lakes Workshop

Detection

- Use of Autonomous Underwater vehicles (AUV)
- Other sensors in fresh water (e.g. dogs)

Mitigation of Oil in the Water / in the Ice

- Test oil surrogates, if any
- Evaluate sorbents, booms, etc. in ice
- Ice management issues with icebreakers/ice strengthened vessels
- Ice capable response platforms and recovery equipment

  (that works on/in/under ice)

Shoreline Cleanup

- Evaluate shoreline contamination assessment team (SCAT) equipment, procedures, etc.
- Are other techniques (surf washing ,trenching) applicable or practical?

Recommended Exercise Hierarchy (from Alaska Workshop)

Phase 1 Detection and Shoreline Assessment Exercises
Test logistics of autonomous underwater vehicle (AUV) technology with different sensors
Test aircraft (e.g., Dash-7 oil surveillance plane, Twin Otter) and cross-boundary agreements
Exercise aerial unmanned vehicles (i.e., permitting, logistics, sensors, data transmission)
Demonstrate shipboard infrared (IR) and radar for detecting a target.
Verify NOAA manuals with overflights for ice conditions and false positives
Exercise dog sniffing for detecting oil under ice (e.g., ice thickness 2 – 6 ft)
Exercise ice tracking buoy
Test synthetic aperture radar (SAR) satellites for mapping ice composition and movement
Exercise assembling, outfitting, mobilizing, the safety of, and the communications plan for SCAT teams

Recommended Exercise Hierarchy (from Alaska Workshop)

Phase 2 Ice Management without Oil Exercises
Determine operational limitations of fireproof and/or ice strengthened conventional booms
Test concept of open apex
Test vessel based ice management in rivers and open water, using a z-drive ice breaker or other ice vessels
Exercise ice management using ice deflection booms, barges, tow boats and other ice-strengthened vessels.
Exercise existing methods to deploy dispersants
Test response platforms for use in over-flood and/or rotting ice conditions
Exercise fixed-wing *in situ* burn ignition after experimentation phase is complete

Recommended Exercise Hierarchy (from Alaska Workshop)

Phase 3 Deploy Experimental Equipment Exercises
Repeat Phases I and II
Test self-propelled tethered skimmer after experimental phase
Exercise fuzzy disc skimmers and grooved drum skimmers. Exercise surf washing (e.g., clay/oil flocculation, oil mineral aggregate (OMA)

Phase 4 Deploy Experimental Equipment Exercises
Determine operational limitations of fireproof and/or ice strengthened conventional booms

Implications

Overall Objective: How to Provide FOSC with enough details to make decisions and implement response

Equipment – many types are out there, will they work?

Training – is enough of the right type being supplied?

Detailed Operations Plan – are they fully developed?

Trade-Offs and benefits – documented and prioritized?

Develop a plan that steps through increasingly challenging exercises…workshops are one input into that plan.

Oil-in-Ice Exercise April 19-21
Sault Ste Marie, MI

Objective: To begin discussions about how to respond to oil-in-ice in broken and loose ice conditions.

- **Pick non-developmental equipment and evaluate for use in sub-zero temperatures**
- **Identify requirements for use on CG icebreakers**
- **Identify performance gaps with respect to equipment, logistics and support**
- **Results will feed into next exercise Winter, 2012**

Oil-in-Ice Exercise April 19-21
Sault Ste Marie, MI

Location : Sector Sault Ste Marie (alternate location was St Ignace)

Schedule:	**April 18**	**Travel Day**
	April 19	**AM Introductions and Presentations**
		PM Begin Setup
	April 20	**Demonstration of Equipment Pierside**
	April 21	**Continue Demonstration and Vessel underway**
	April 22	**Travel Day**

Sector Sault Ste Marie

Participants

CG R&D Center

CG Strike Force

Science Applications International Corp (support contractor)

Marine Pollution Control

Applied Fabrics

Elastec/American Marine

Mackinac Environmental

T&T Marine

Observers

Equipment

- **Heated Drum Skimmer**
- **Rope Mope Skimmer**
- **Boom Vane**
- **Herding Capability**
- **Fire Boom**

Heated Grooved Drum Skimmer

It also heats the oil in front of skimmer

Steam Generator

Steam Generator in Trailer

Portable Steam Generator

Rope Mop Skimmer

One of the main advantages of this device is that it does not pick up water because the 'rope' is made with an **oleophilic** material

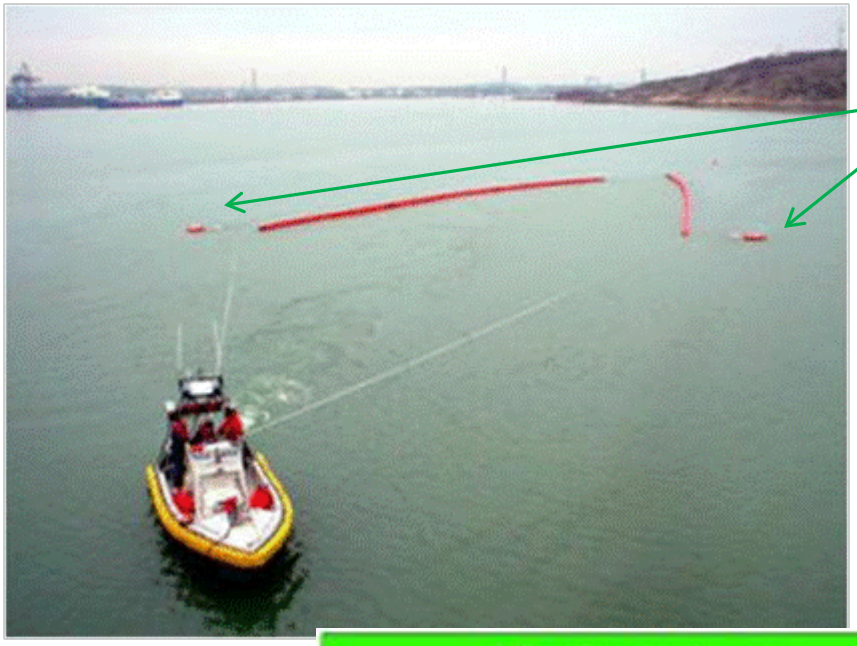
One example of a Rope Mop Skimmer deployment configuration

Simulating the In-Situ burning

Actual In-Situ burning in icy water conditions

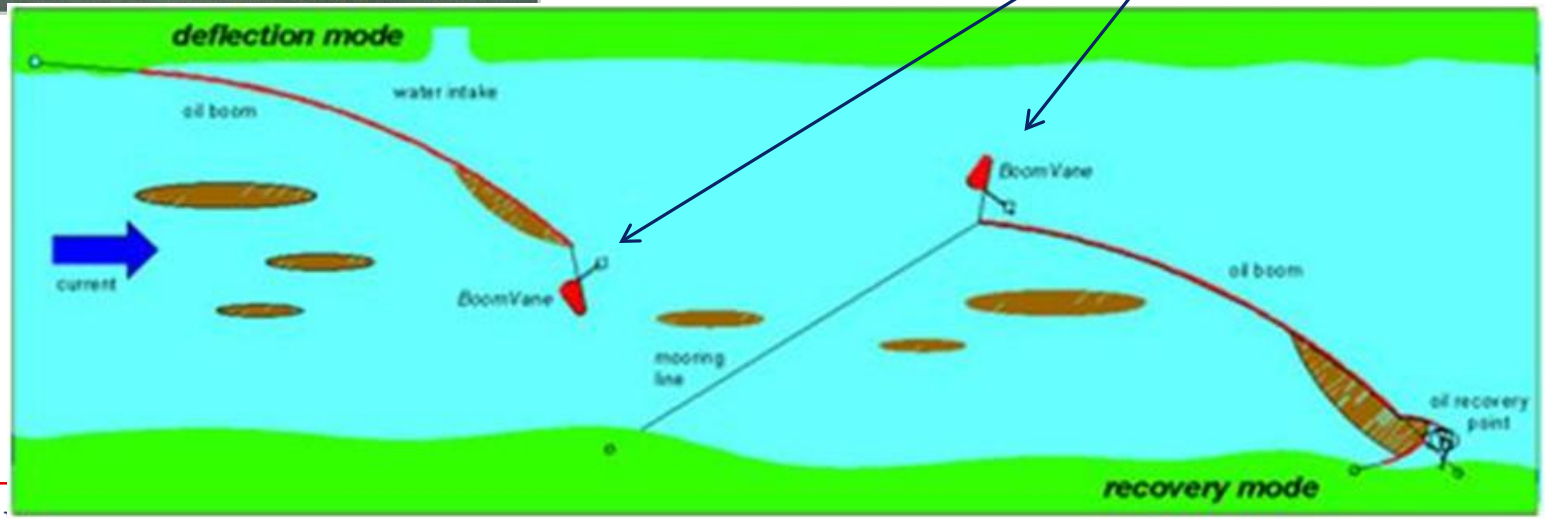
Using the Fire Hose to “Herd” the oil into the boom

Different deploying methods using Boom Vane



One Boat with two Vane Booms

Two Vane Booms with boom
Anchored to the shore



Boom Vane is very useful when another boat, or any boat for that matter, is not deployable.

Control string
(works like a kite to pull boom offshore)

Next Exercise: Winter 2012

Objective: Demonstrate current capability for oil spill response in broken ice in the Great Lakes. Apply lessons for other areas (northern US and Alaska).

Options (from ACPs)

- **Detroit (Operation Coal Shovel area)**
  - T/V Gemini?
  - Pipeline?
- **Lake Michigan (Operation Taconite area)**
  - WCD near Isle Royale (OCT-JAN?)
  - Bete Grise Bay
- **Other Locations?**

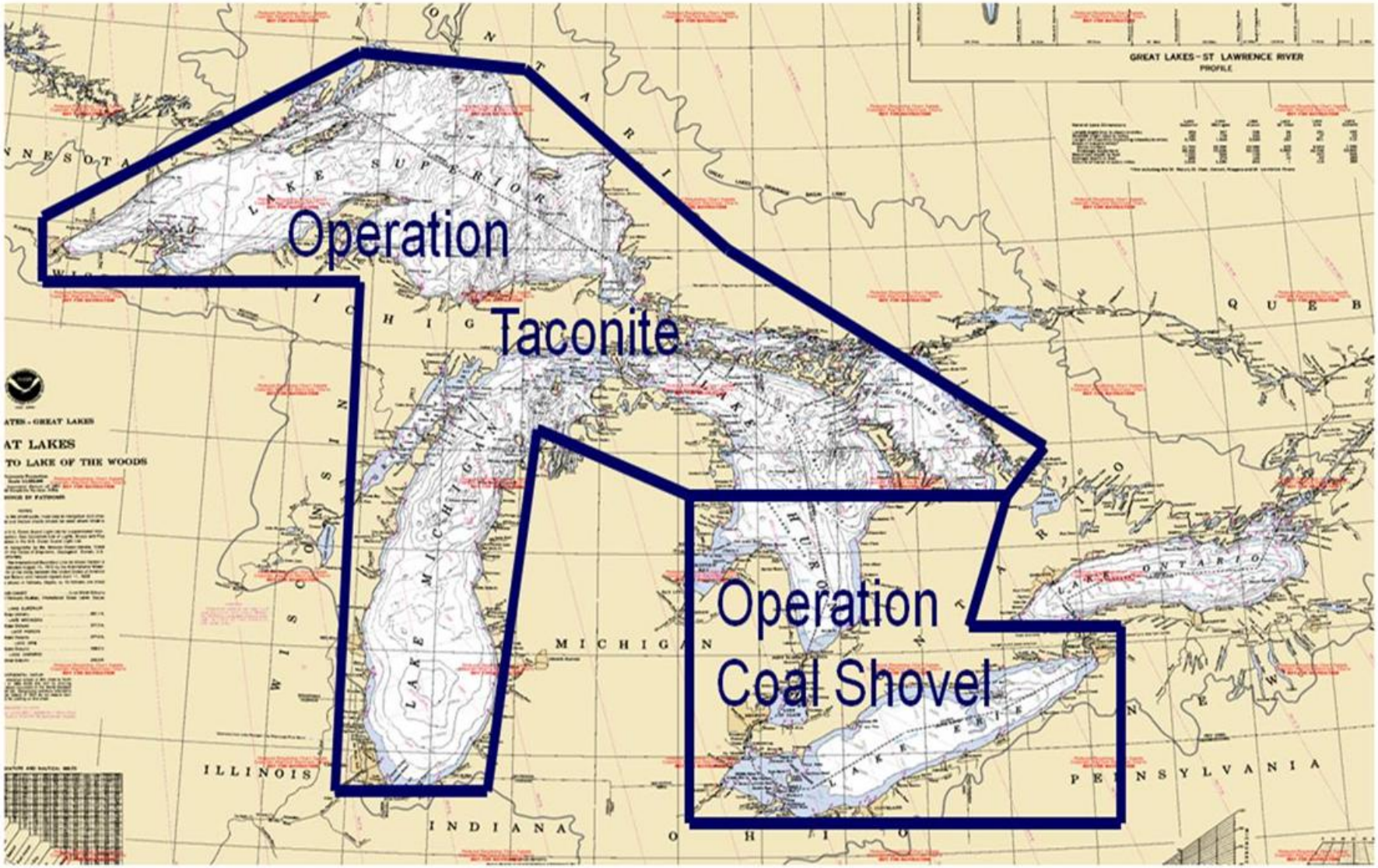
Schedule

- At freeze up
- Just before breakout

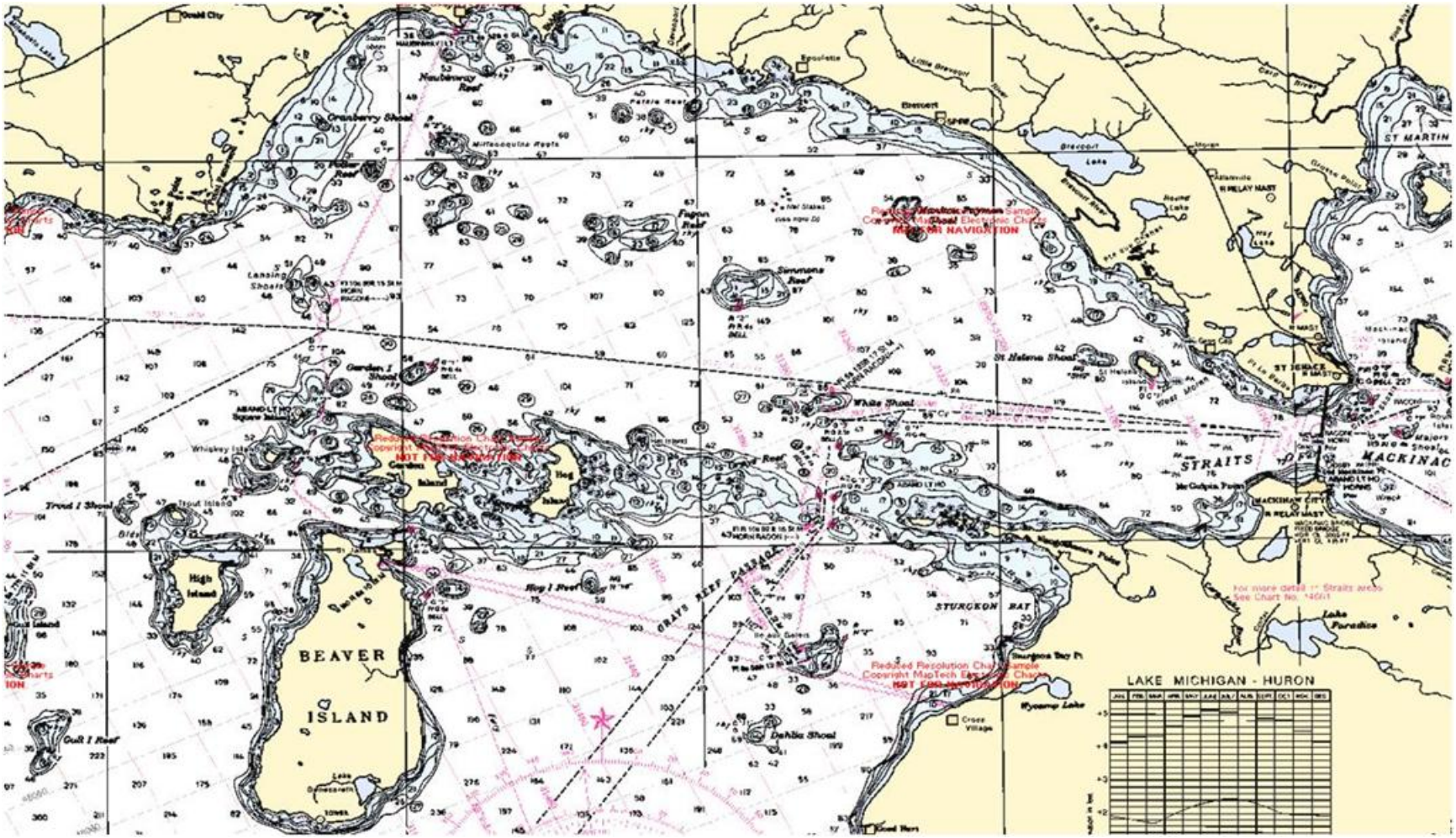
Participants

- US Coast Guard
- Canadian Coast Guard
- Environment Canada
- States and Provinces
- Local OSRO Responders
- Local tug Operators (ice strengthened?)

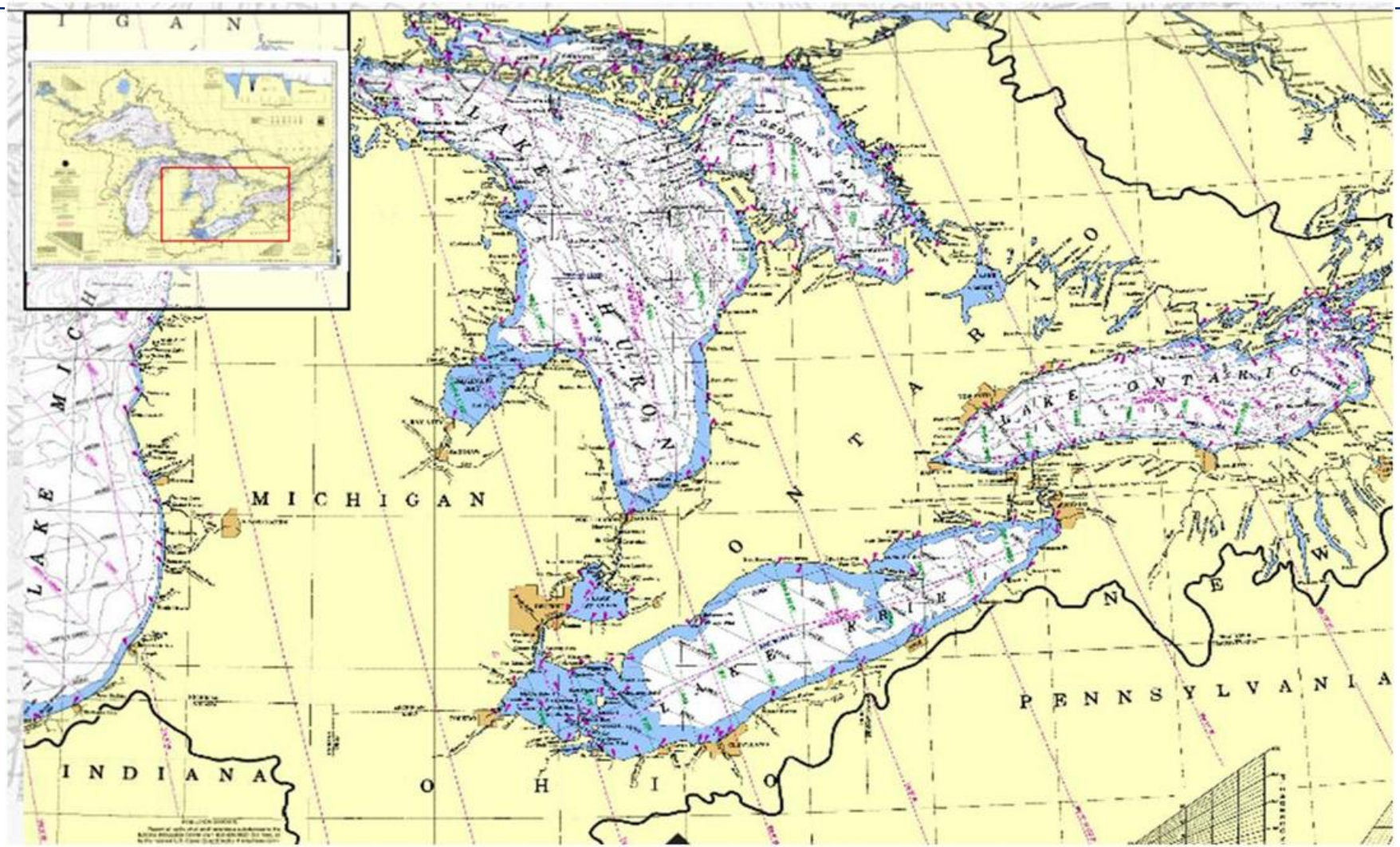
Great Lakes Icebreaking Regions



Western Straits of Mackinac



Operation Coal Shovel



Planning Committee

R&D Center

D9

- **DRAT**
- **DPW**
- **Planning staff**
- **Other**

Canada

- **Canadian Coast Guard**
- **Environment Canada**

States and Provinces

- **TBD**

Other RRT?

- **EPA**
- **NOAA**

Technologies

Coast Guard

- **SORS for ice mode**

Vendors

- **Skimmers**
- **Fire Boom**

Sensors

- **Ice radar?**
- **TBD**

Next Steps

Funding

- RDC can fund TONOs for planning and executions
- RDC funds OSROs
- RDC can fund fuel
- CG and CCG provide vessel time
- RDC may be able to fund State and Provinces TONOs

Schedule

- JUL-AUG First planning meeting
- OCT 1 Draft plan
- DEC 1 Commitments
- Exercise:??

NEED INPUT FROM RRT

Questions

Non-Attribution Policy

Opinions or assertions expressed in this paper are solely those of the author and do not necessarily represent the views of the U.S. Government. The use of manufacturer names and product names are included for descriptive purposes only and do not reflect endorsement by the author or the U. S. Coast Guard of any manufacturer or product.