Acquisition Directorate

Research & Development Center

Submerged Oil Recovery Systems and Recommendations

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Outline

Submerged Oil – Background

- **Past R&D Related Efforts**

Project at USCG RDC

- **Detection Prototype Test Results**
- **Recovery System Development**
  - Designed, built and tested 3 systems
- **Information for FOSC**
  - Detection
  - Recovery including Decanting
  - Net Environmental Benefit (NEBA)
  - Other Impacts

Detection and Recovery Issues

Highlights since National Academy of Science (USA) Report in 1999

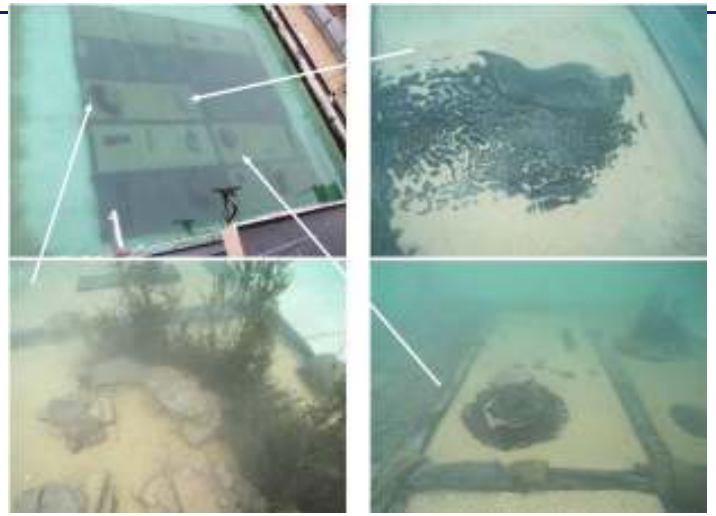
- Third R&D Forum on High Density Oil Spill Response
  11-13 March 2002, Brest, France
- Workshop at Coastal Response Research Center, New Hampshire, USA in 2007
- Michel Review paper in 2008.
- Assessment by UK Maritime and Coastguard Agency (MCA) in 2008
- Current guideline being developed under Marine and Environmental Protection Committee (MEPC) of International Maritime Organization (IMO).
- Operational Experience in Deepwater Horizon and Enbridge Pipeline Spills
- Other enhancements since firefighting/salvage regulations started

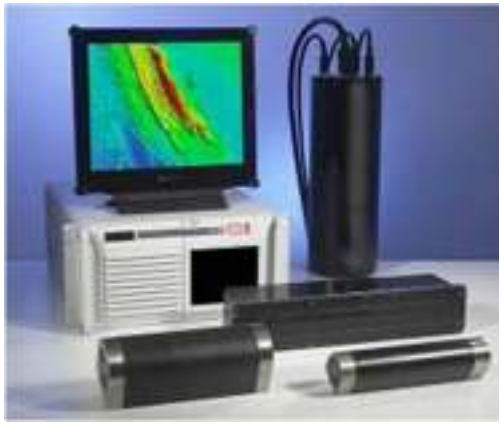
USCG R&D Center Efforts

First Addressed Detection
(Hansen Interspill 2009, Hansen et. al. Final Report 2009)

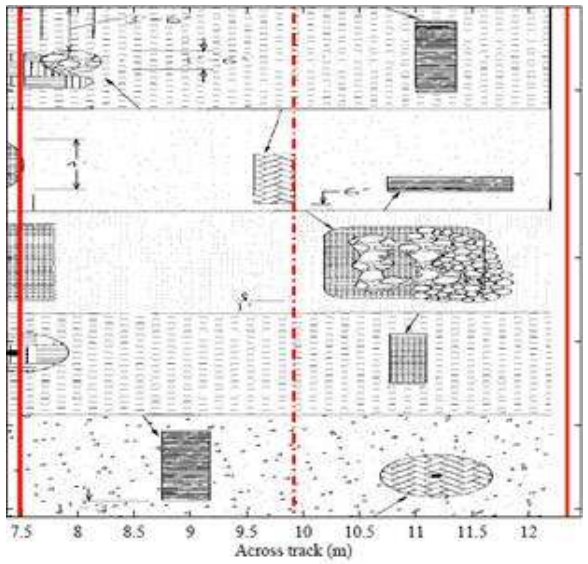
Two phases:

- **Concepts (4 vendors)**
- **Prototype Design and build (2 vendors and 2 companies on own funding) (Hansen et.al Interspill 2012)**
  - RESON Sonar – developed to learn
  - EIC Laboratories (MA) – laser fluorometer

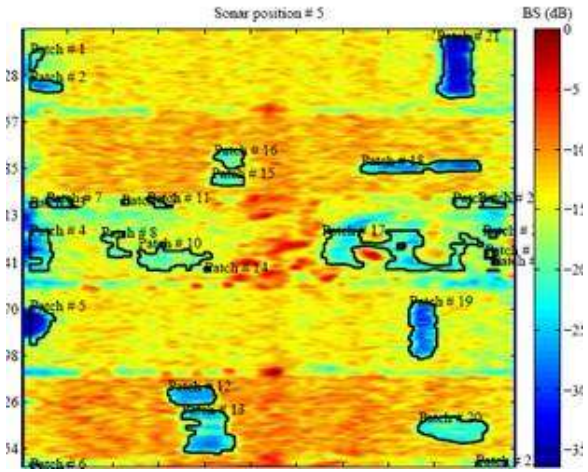




Detection Results (sonar and LF)



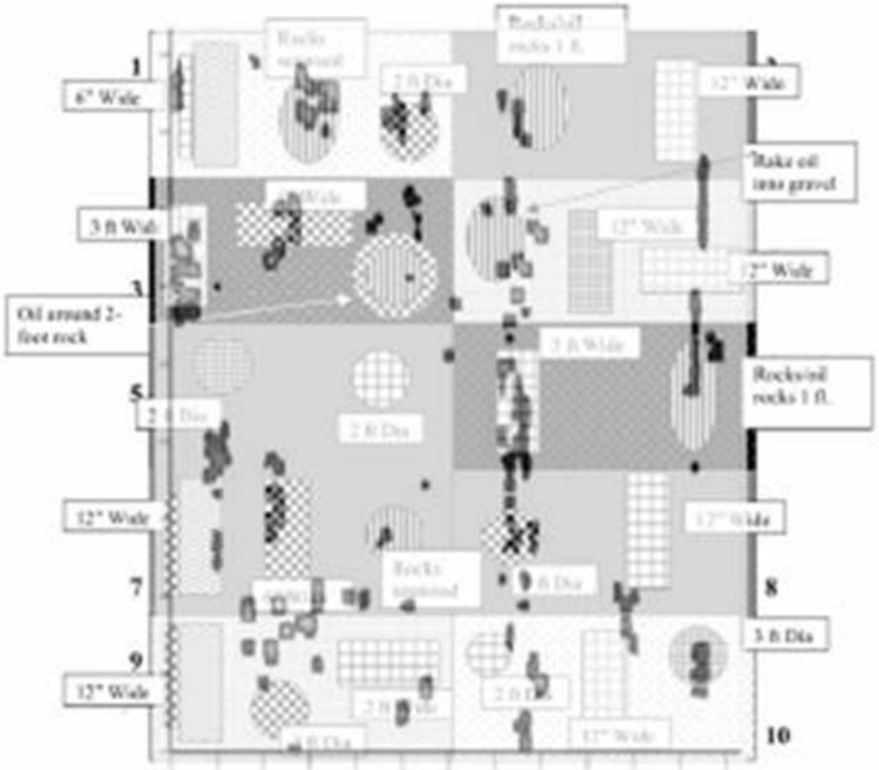
(a) Sketch of the survey area.



Using Area Detected as Measure

Average Detection Rate of 87%

Average False Ala Rate of 24%



Recovery Development Approach

Developed Recovery Specifications – Three Phases

- **Design (Hansen et. al. IOSC 2011)**
- **Prototype Build and Test (Hansen Interspill 2012)**
- **Field tests**

Three contracts:

- **Alion Science and Technology Corporation**
- **Marine Pollution Control**
- **Oil Stop Division of American Pollution Control**

Ohmsett Trays for Recovery Tests

Three Oil Types:

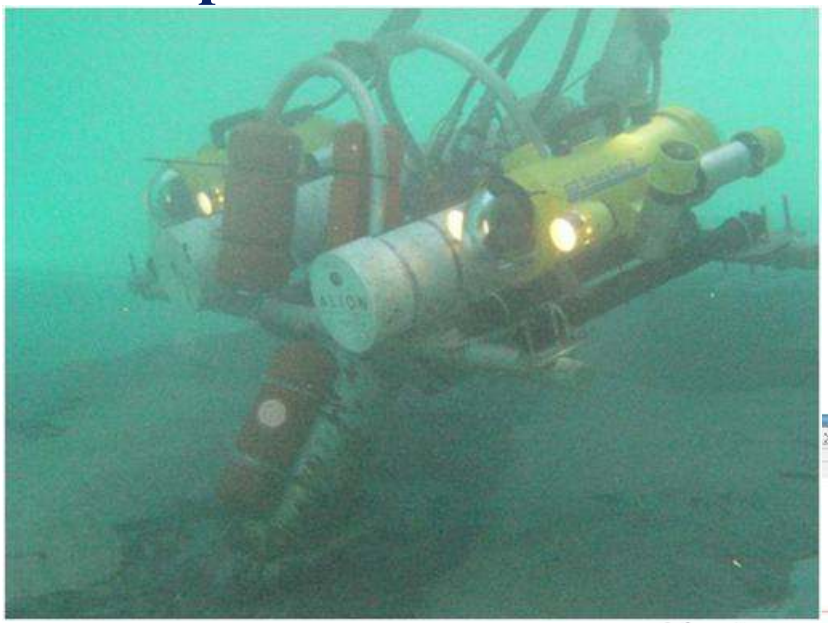
- **Viscosity 50,000-180.000 cSt**

Two Sands:

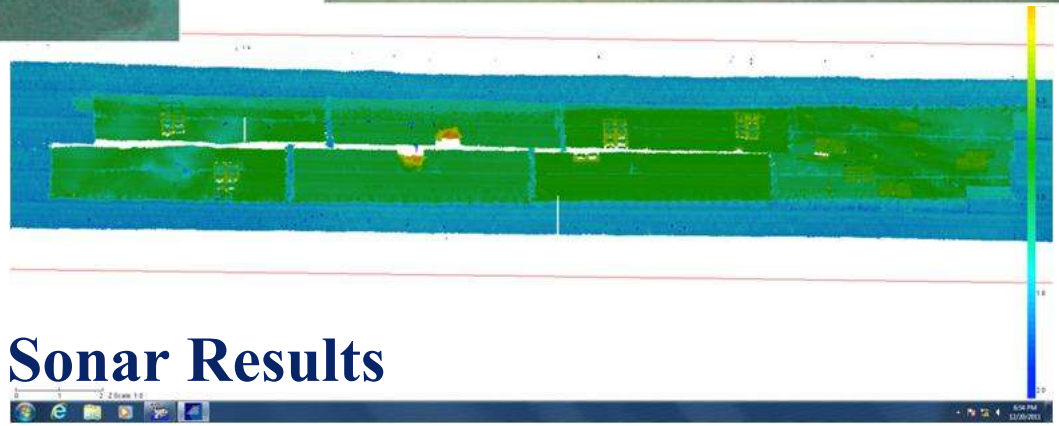
- **Course and fine**
- **Not packed**

Alion – Ohmsett Testing

In Operation

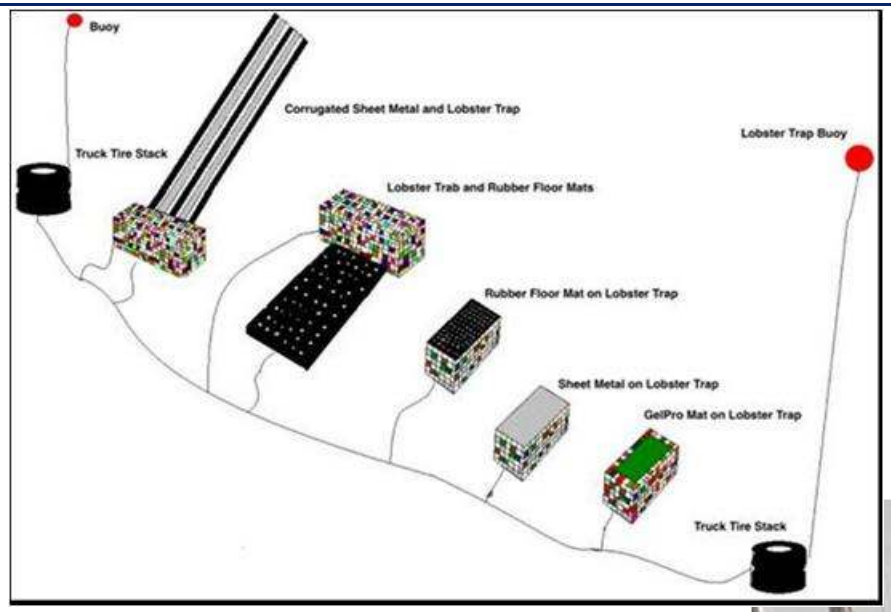


Close up of Nozzle



Sonar Results

Alion Field Test and Final Configuration



Targets

Final Configuration

MPC Components Available

Multi-degree of Freedom Robot Arm

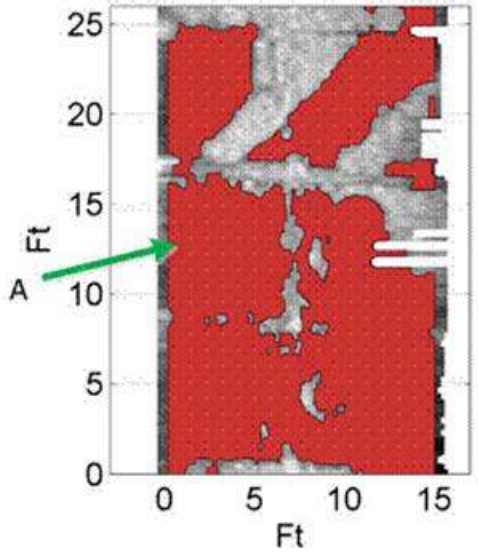
Pump and debris control

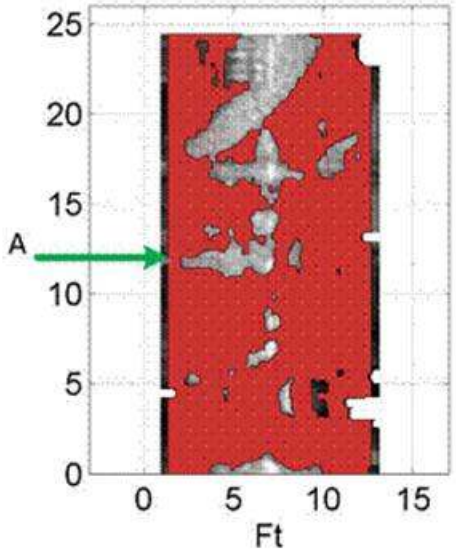
MPC Test Rig Assembling at Ohmsett

MPC Ohmsett Results (oil and sonar)

View of Tray

Sonar Data (Oil removed in right figure)





MPC – Ohmsett Testing

Filter System Between Tanks

Heating elements

Oil Stop Design

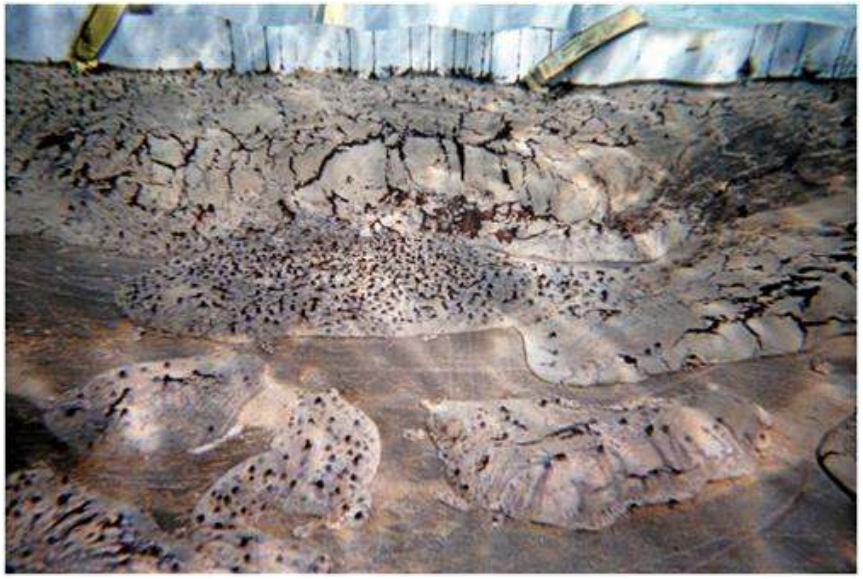
- Based on submersible dredge
- Uses visual for detection
- Weight reduction and increased depth capability needed

Eddy Pump

Oil stop Testing at Ohmsett
(Excavator and tanks)

Initial Configuration

Views of Operations



Oil Stop Field test

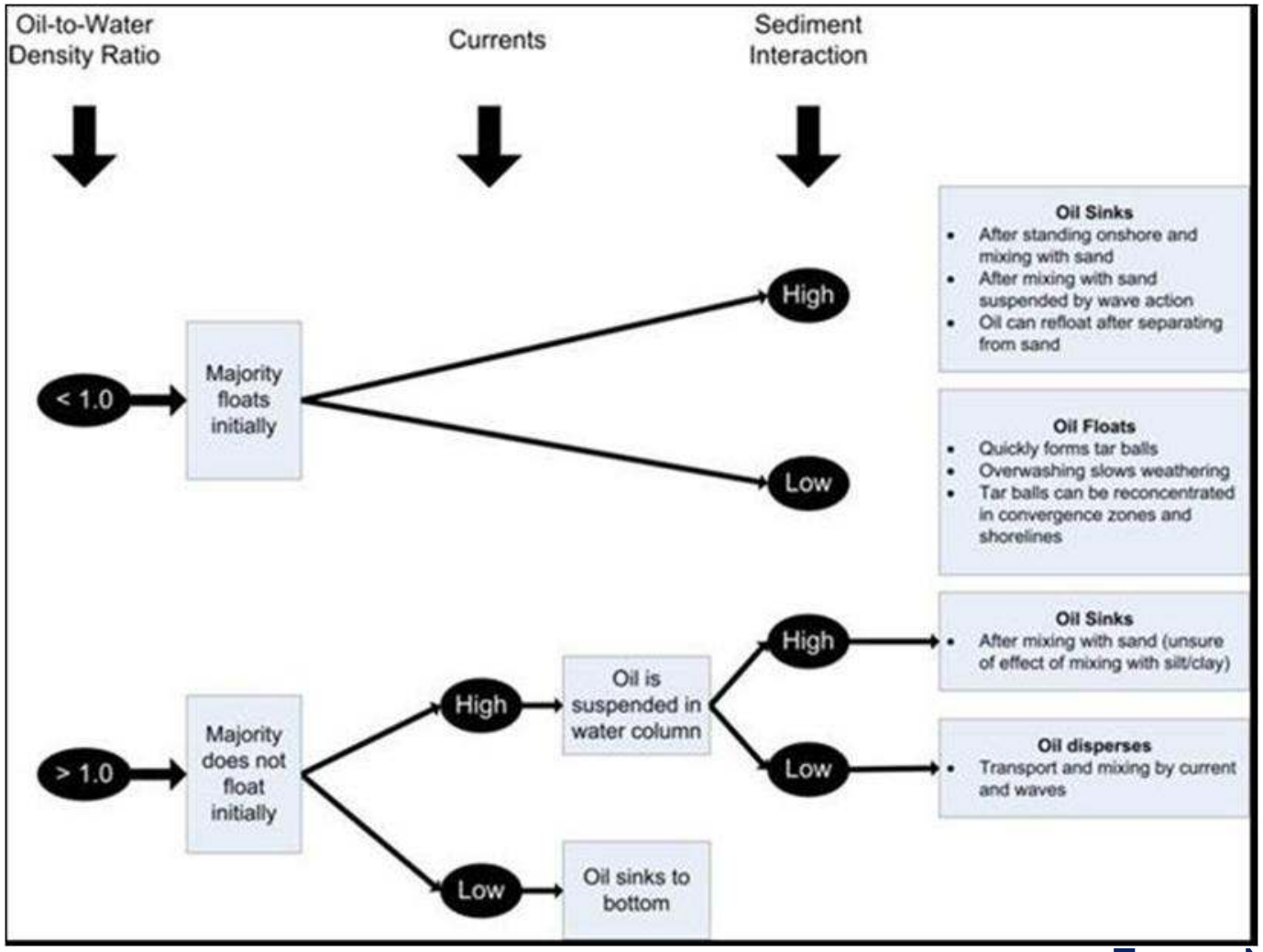
Submerged Oil Results

Systems selected as having unique capabilities but need more work to decrease amount of water/silt collected:

- **One is lightweight; ROV may need more power and intake nozzle may need to be smaller.**
- **One can get deeper and stay longer; (manned submersible) but may have high operational requirements**
- **One could handle harsh wind/wave conditions but large operation requirements and environmental impact**

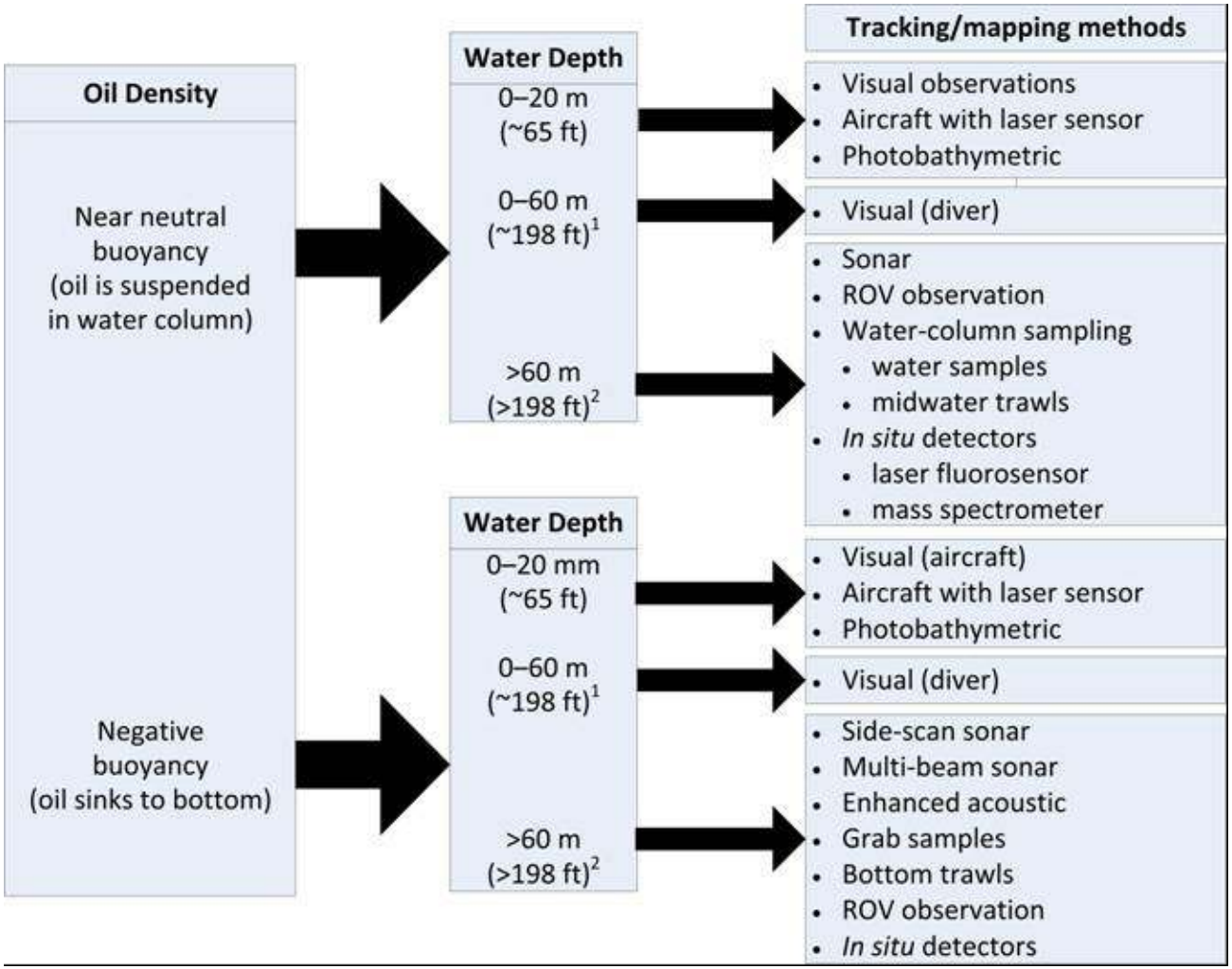
Configuration of system can vary with spill

Federal On-Scene Commanders Information

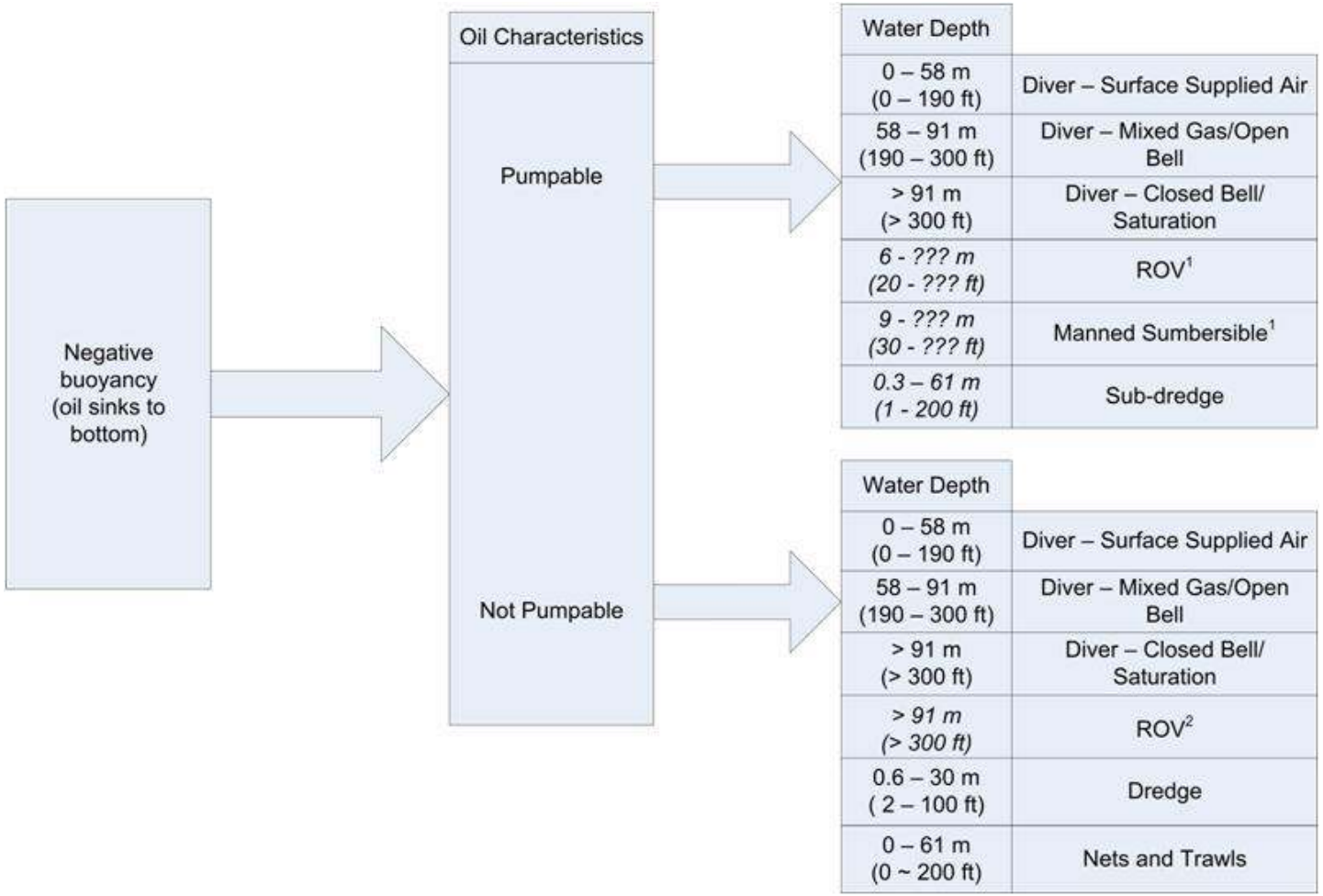


From NAS 1999

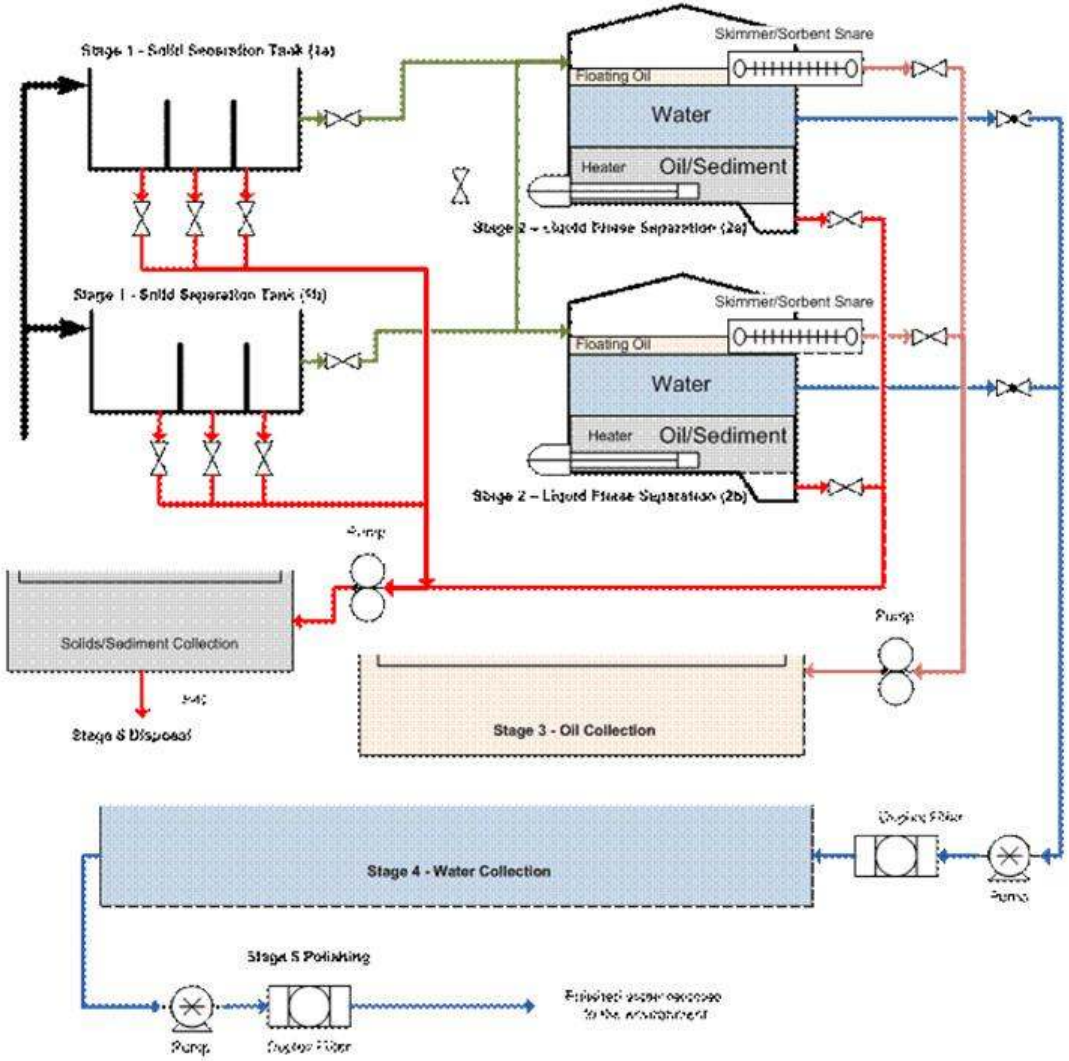
Detection Methods



Recovery Options



Decanting Configuration



NEBA – What is different about the bottom?

Ecological Sensitivity –Bottom types will range from the most ecologically sensitive to the less important such as rocky substrate, sand, and mud.

Persistence of Oil on the Bottom – The persistence of oil on the bottom depends on the permeability/porosity of substrate, the oil's density and the adhesion properties of the oil.

Proximity of Sensitive Resources – As with surface spills, it is important to consider the locations where the oil might be transported.

Threatened and Endangered Species – Threatened and endangered species that are located in the area under consideration are usually identified on the ESI maps.

Historic/Archeological Resources – Archeological and historic resources that are known are identified on the ESI maps but some may not.

Safety Hazards – Safety hazards such as electrical cables, underwater pipelines, and unexploded ordinance should be indicated on navigation charts.

Impacts

Manual Removal by Divers –The technique is slow but damage to the local environment is minimized.

Diver or ROV Directed Bottom Vacuuming/Pumping –Significant quantities of water, sediment, and marine organisms can be removed.

Bottom Nets and Trawls – The damage can be serious as they can disrupt or destroy bottom habitat and capture organisms.

Dredging –Most thorough method of removing oil from the bottom, but also the most intrusive and damaging. May mobilize contaminants in the bottom sediments.

Capping – Used where removal is impractical or would only spread the contamination.

No Action –Considered when the impact of the oil appears minimal in relation to the habitat disruption and marine organism mortality associated with removal.

Recommendations for Recovery Methods

	Manual Removal	Directed Vacuuming	Bottom Net/Trawl	Dredging	Capping
Coral Reef					
Sea Grass Beds					
Kelp Forest					
Rocky Bottom					
Sand					
Mud					

Recommended
Provisional
Not Recommended

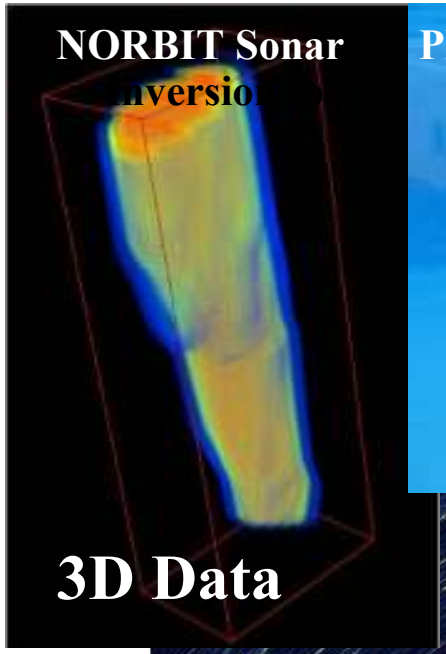
Specific Spill Issues

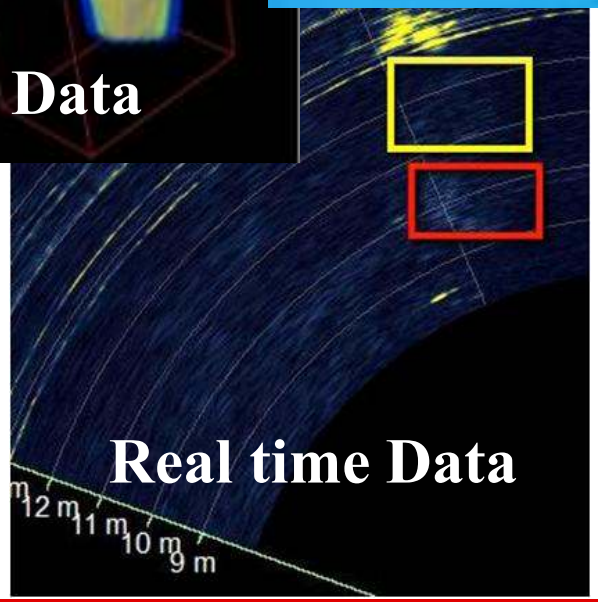
Urgency of Cleanup - How quickly must the submerged/sunken oil be removed from the environment?

Acceptable Impact for Short-Term Removal– What is the level of environmental impact that can be accepted in effectively and expeditiously removing the oil from the bottom?

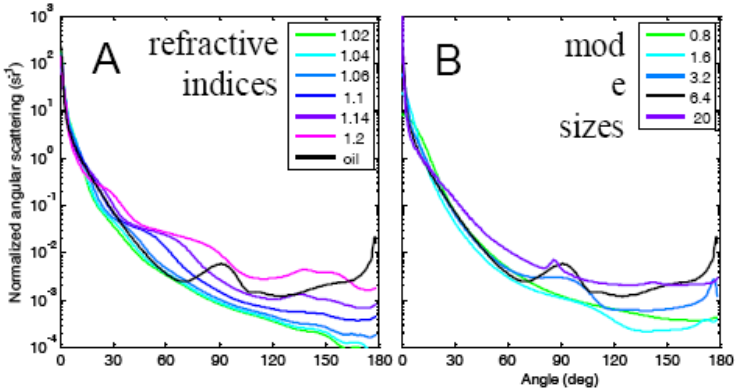
Acceptable Impact of Delayed Removal or No Action – Is it more environmentally beneficial in the long run to employ a less damaging cleanup technique or simply leave the oil for natural biodegradation?

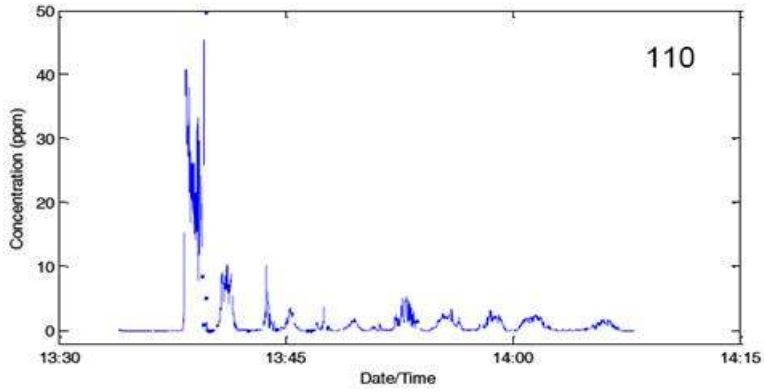
Oil in Water Column – Two systems tested at Ohmsett, December 2013: initial results encouraging





WET Labs - Wide-angle-scattering Detect Oil in Water (WINDOW)





with BSEE Funding - Mitigation next

Next Steps – For FOSCs to consider

- **Monitoring results from Deepwater Horizon and Enbridge Pipeline (Michigan, USA, heavy oil in river system) with mixed sand and oil**
- **Comparison of operational costs with divers for specific spill scenarios**
- **Trade offs**
  - Pump capabilities
  - Water injection
  - Operation Limits
  - Distance from Support Functions

Oil Sands Product Project starting late FY14

Questions?

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