Acquisition Directorate

Research & Development Center

Preliminary Results for Oil on the Bottom Detection Technologies

Freshwater Spills Conference

April 28-30, 2009, St Louis

RDC | Kurt Hansen (multiple other contributors)

Outline

Background
- Past Spills
- Past Research

Current Approach
- Contracting Approach
  - Request for Information (RFI)
  - Broad Agency Announcement (BAA)
- Vendors Selected

Testing and Results
- Proof of Concept Tests
- Prototype Tests
- Opportunity Tests

Future Efforts
- Recovery System

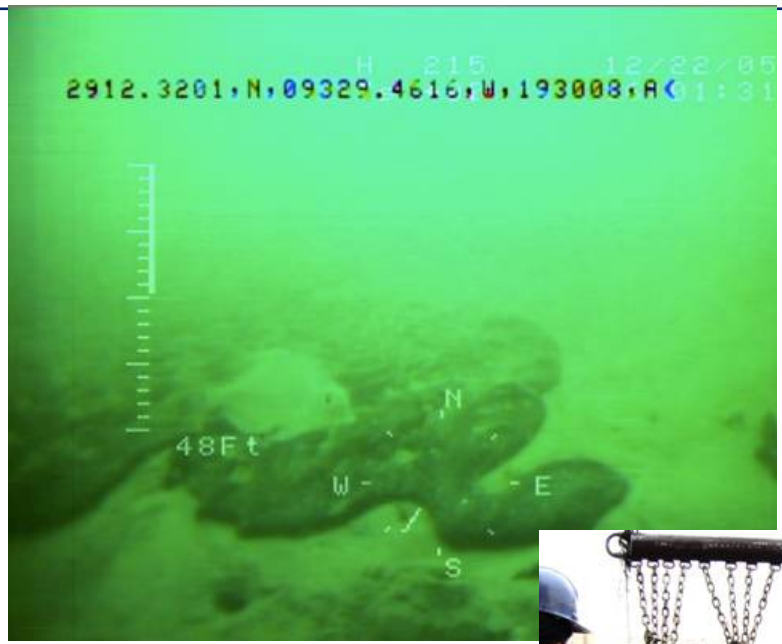
Significant Past Submerged Oil Spills

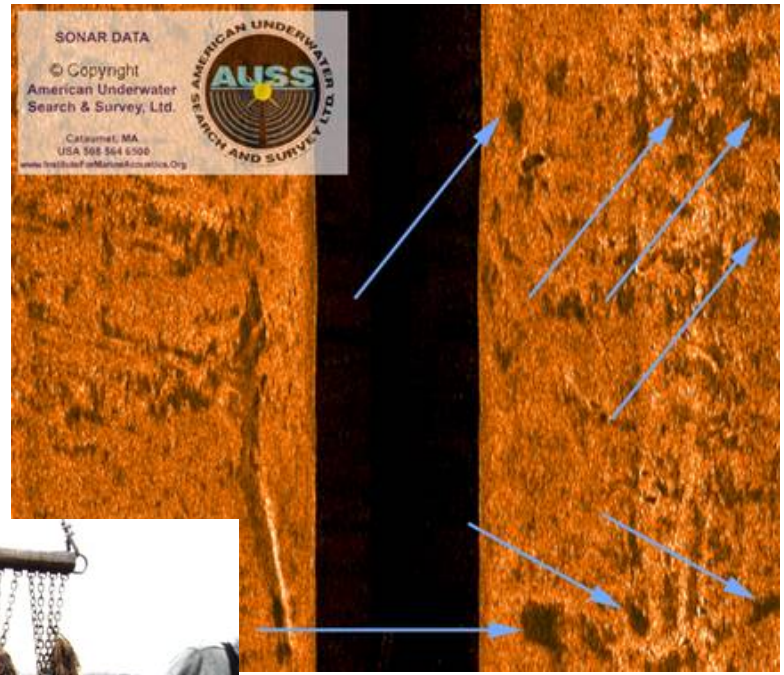
- T/V Haven, Italy, 1991 (still on bottom)
- T/B Berman, Puerto Rico, 1994 (in clear water and easy to track)
- M/V Prestige, Spain, 2002 awash floating oil did not permit use of IR, radar or other sensors (not even visual)
- M/T Athos I, Delaware Bay, 2004 (oil mixed with sand)
- Lake Wabamun, Canadian Railroad, Alberta, 2005 (in fresh water)
- DBL-152, Texas, 2005 (large spill, oil moved)

Recent Efforts

- 2002 IMO Research Forum on Heavy Oil
- CEDRE (France) evaluated sonar in drydock (2004)
- 2006 Coastal Response Research Center (CRRC) Workshop on Submerged Oil
- European Maritime Safety Agency Assessment Study in 2007
- CRRC ongoing projects with Environmental Canada and University of Miami
- Ongoing effort within IMO OPRC/HNS Working Group for Submerged Oils, headed by Italy
- UK Marine Safety Agency Assessment
- Manned Submersible-based system (MPC)

Current Submerged Oil Spills Technology





Broad Agency Announcement in 2007

Proof of Concept (POC): Primary Specifications

- **Detect oil with 80% certainty.**
- **Detect from at least 1 meter away.**
- **Geo-referenced to one meter.**
- **Provide at least hourly results.**
- **Water depths of up to 33.3 meters (100 feet)**

Broad Agency Announcement

For Prototype: Additional Requirements

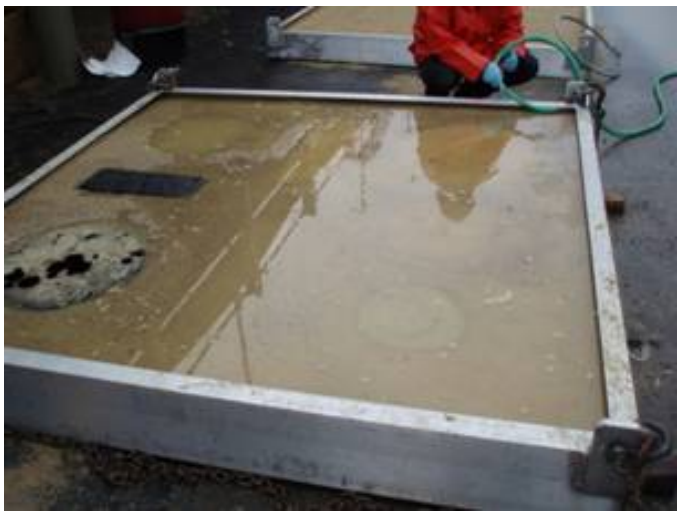
- Search a one square mile area in a 12 hour shift.
- Water currents of up to 1.5 knots.
- Operate in up to 5 foot seas.
- Operable during the day and night.
- Able to be set up within 6 hours..
- Capable of being deployed from a vessel of opportunity and a variety of other platforms

Received 9 proposals and funded 4

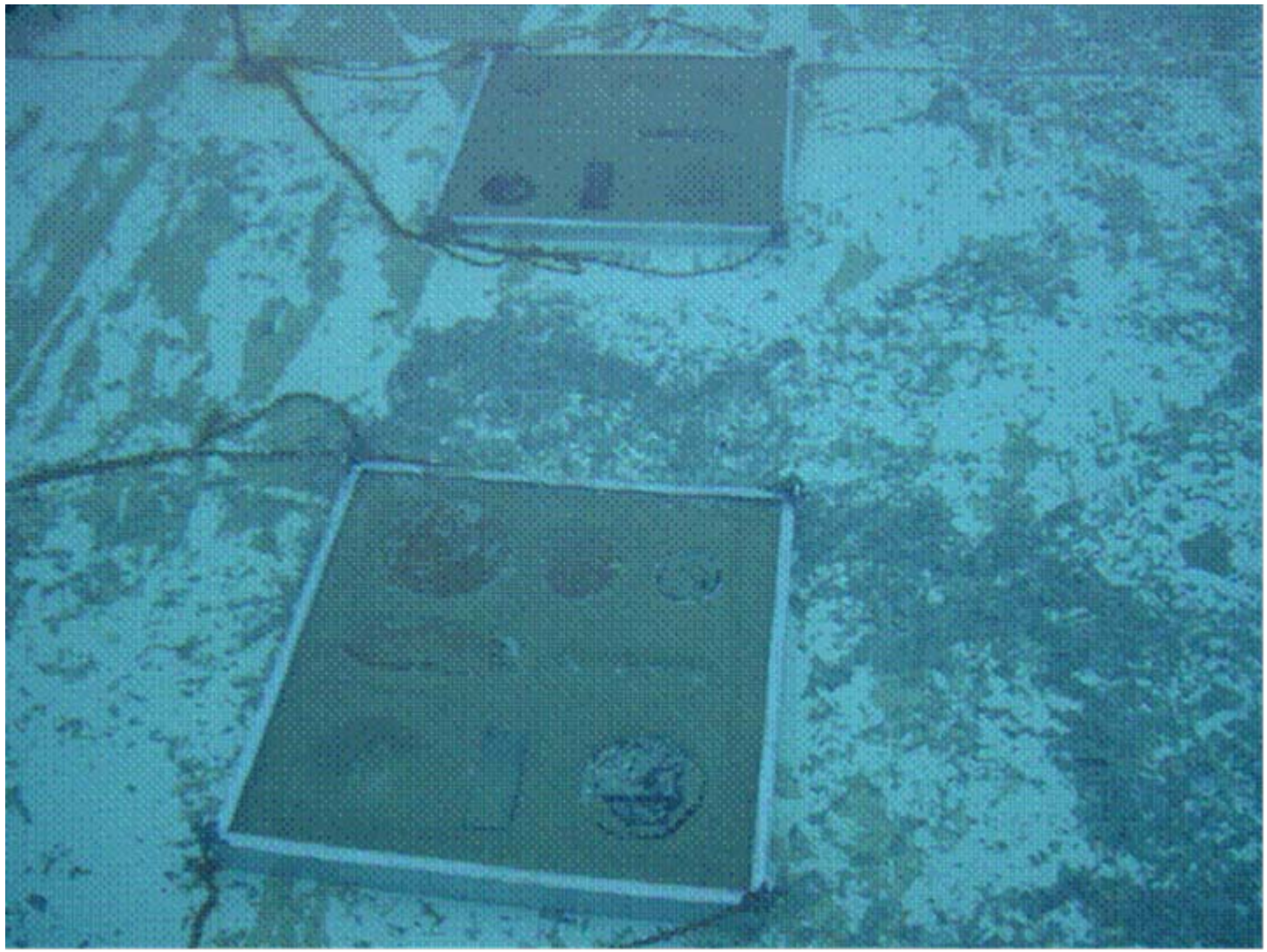
POC Testing at Ohmsett

Setup:

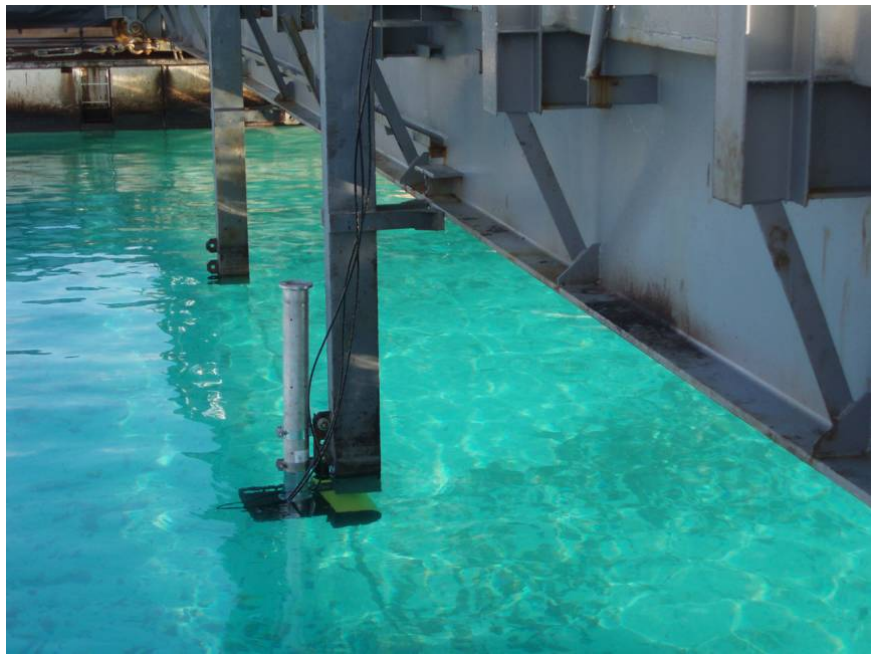
- **Two 8 foot by 8-foot trays**
- **Targets**
  - Two oils (No. 6 and Sundex) with barite and roofing tar (asphalt)
  - 1-2 feet in diameter
  - 2-4 inches deep
- **Construction Sand**
- **False Targets (depressions)**



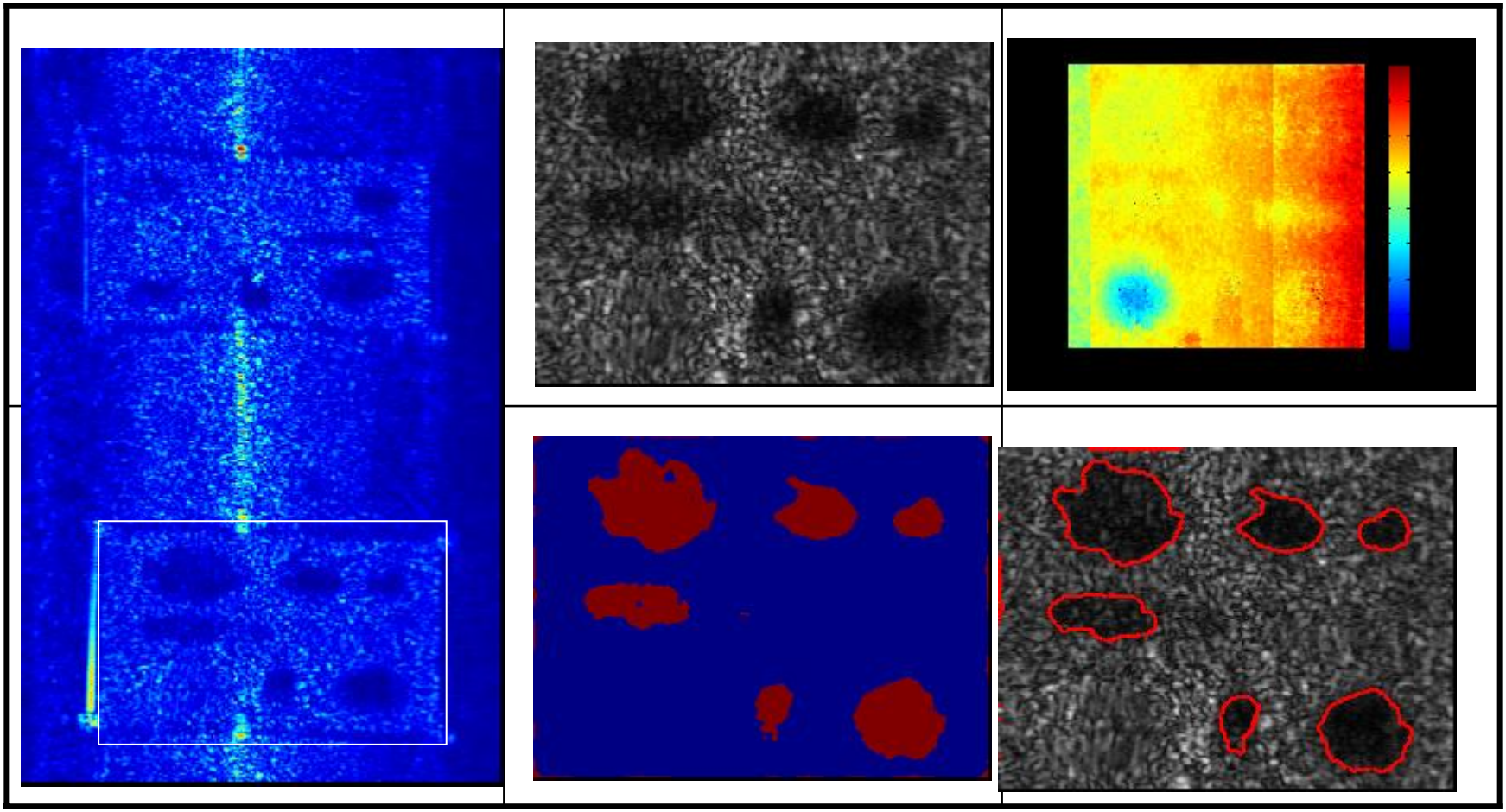
Target Trays (on bottom of Ohmsett Tank)



RESON – Multibeam sonar

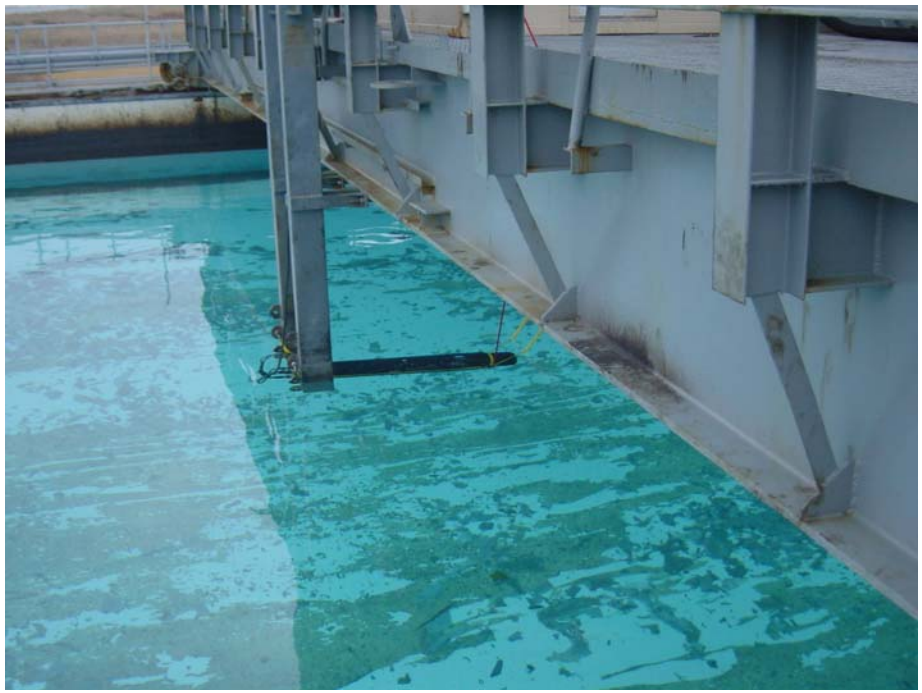


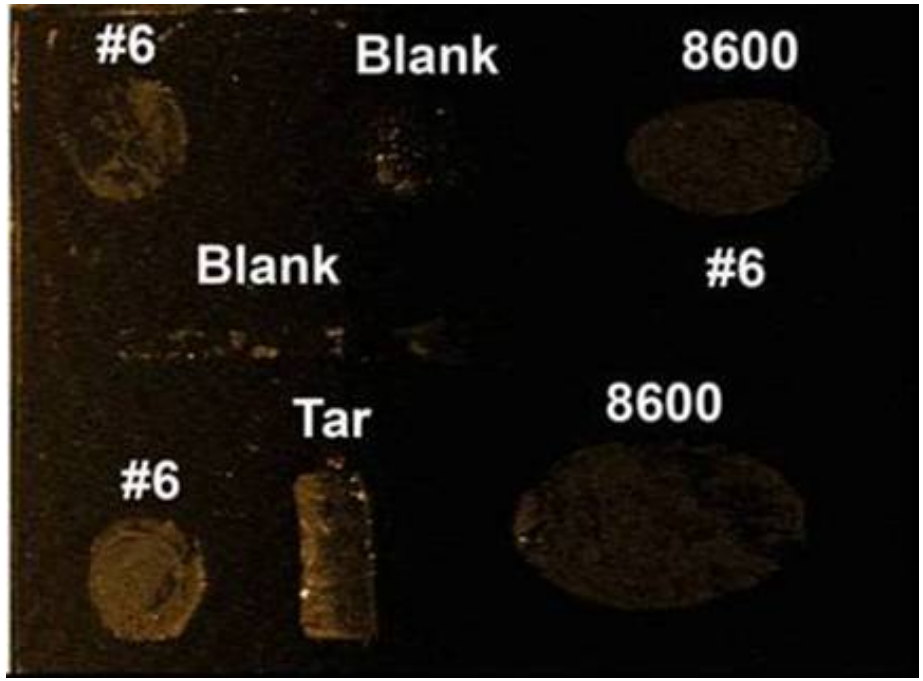
Results using RESON Sonar



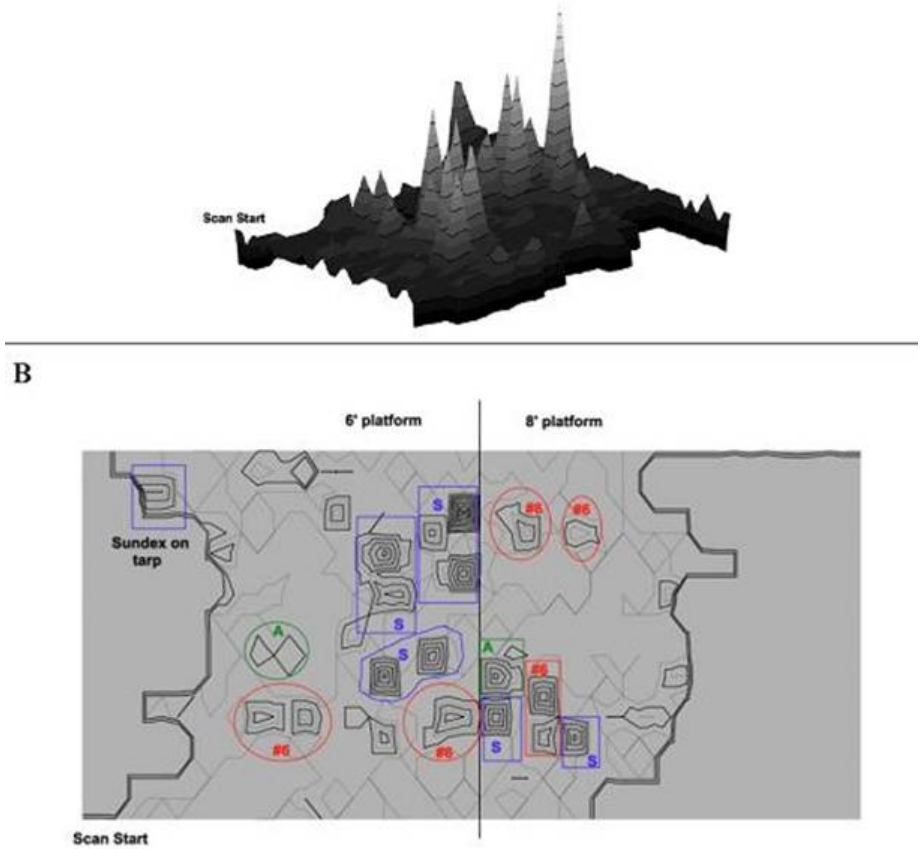
Eight-Inch Target Tray (B) RESON Data with Sonar on Top of Tray (Left Figure: raw data, Top Center: zoomed raw data for bottom tray, Top Right: echo sounder data on same area, Bottom Center: automated detections results, Bottom Right: automated detection overlaid on raw data)

SAIC System

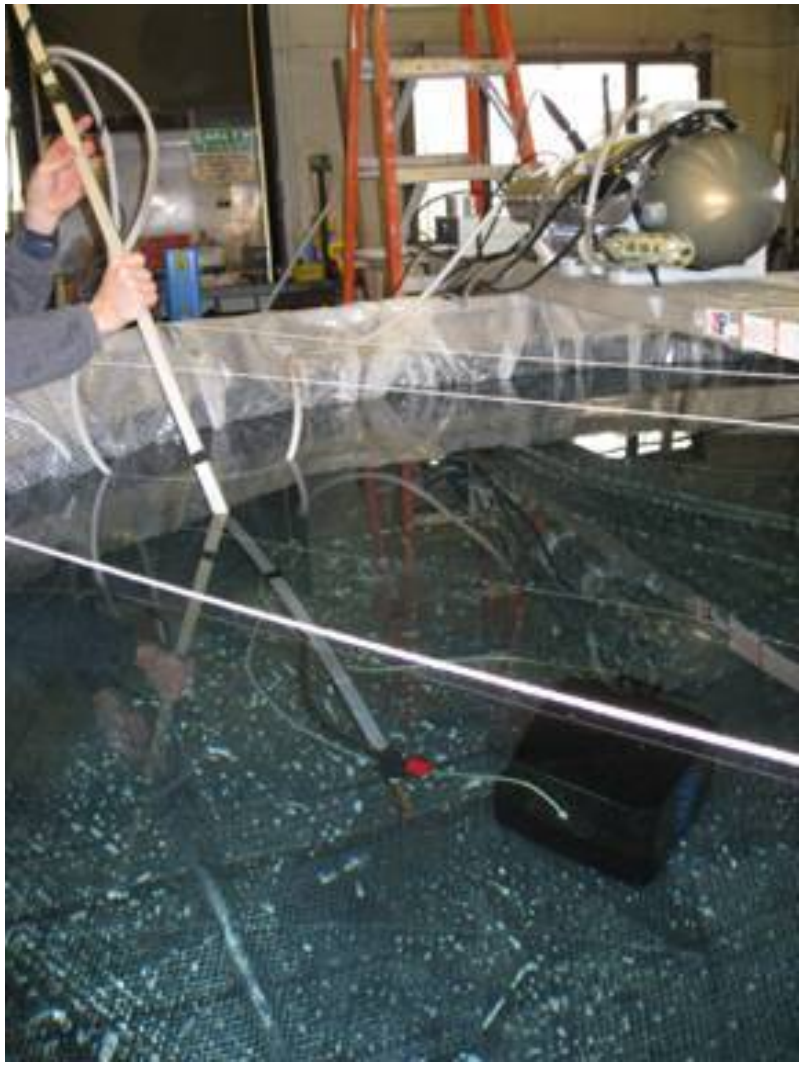


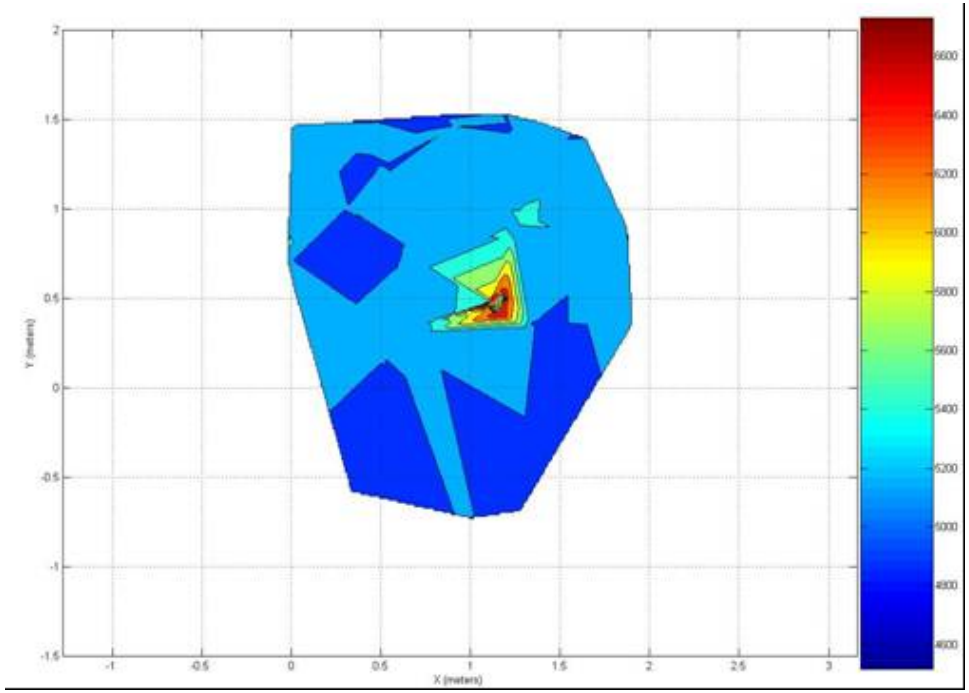


EIC Fluorescence Polarization



Woods Hole Oceanographic Real-Time Mass Spectrometer and Insitu Fluorometer





WHOI Data – RED values are higher concentrations

POC Results (Large X is fully compliant)

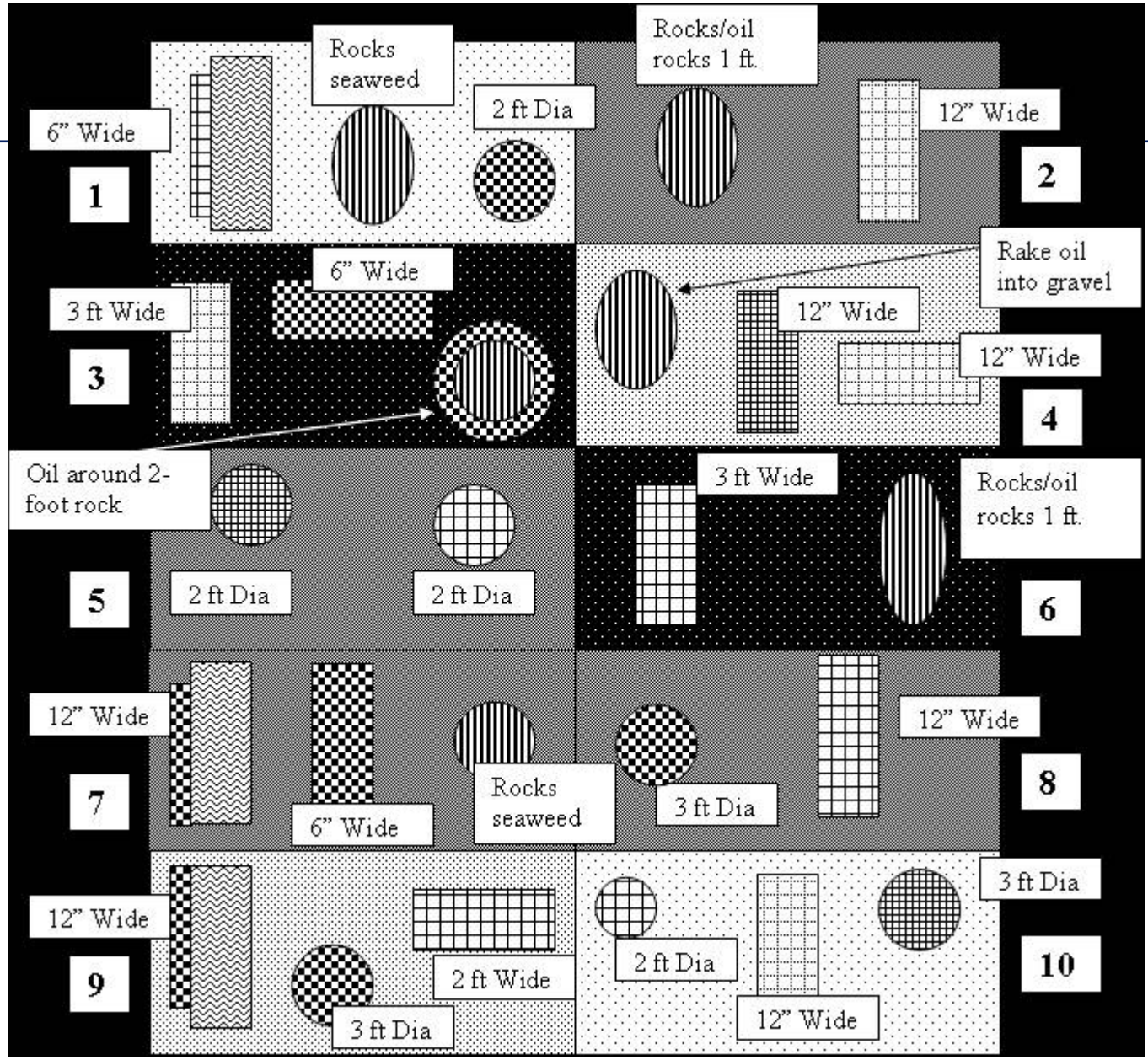
Requirement	RESON	SAIC	EIC	WHOI
Identification of heavy oil on sea floor (80% certainty)	X	x	X	x
Ability to detect oil on the sea floor from at least 1 meter away	X	x	X	
Georeference oil locations	x	X	X	X
Real time data	x	X	X	X
Operate in fresh and sea water conditions equally well	X	X	X	X
Operate up to 100 feet	X	X	x	X

All four systems located oil under the conditions that were given: clear water with a limited amount of turbidity or sand covering the oil.

Prototype Tests

- **RESON has the most potential for wide-area coverage.**
- **EIC has most potential for a small compact system that can be utilized in multiple methods**

- **Tested RESON and EIC at Ohmsett in January 12-31, 2009**
- **Other vendor's demonstrations**
  - Biosonics
  - CodaOctopus
  - SRI International
  - Megator Pumps



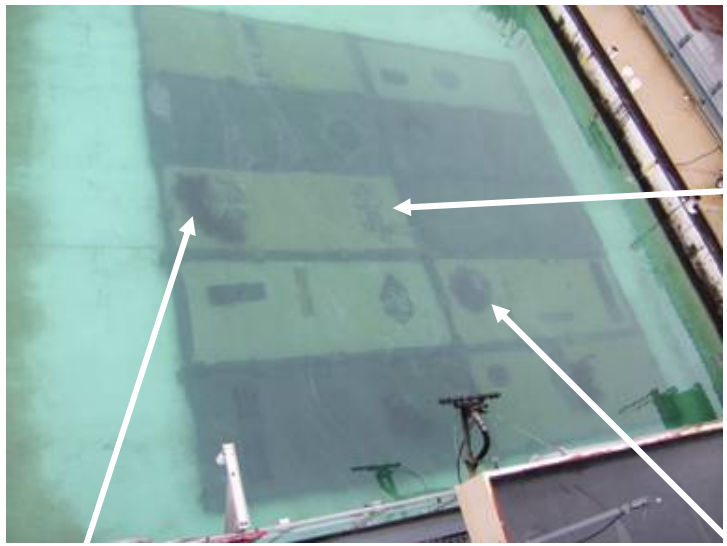
TRAY LAYOUT For 2009

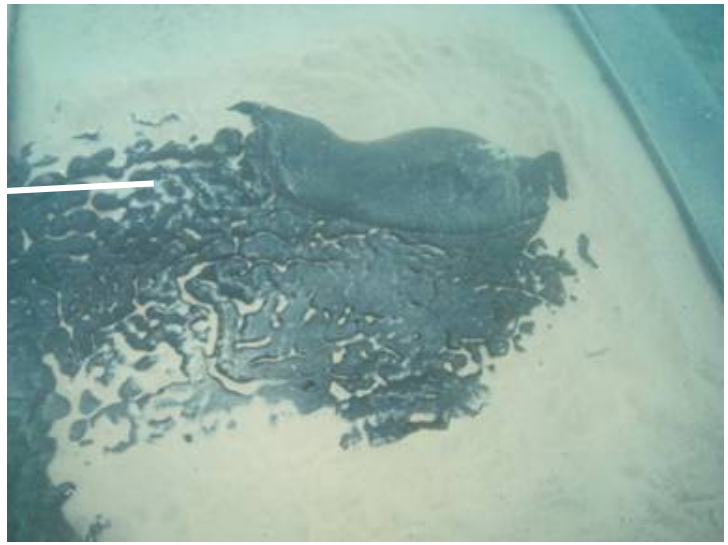
4 types of substrate

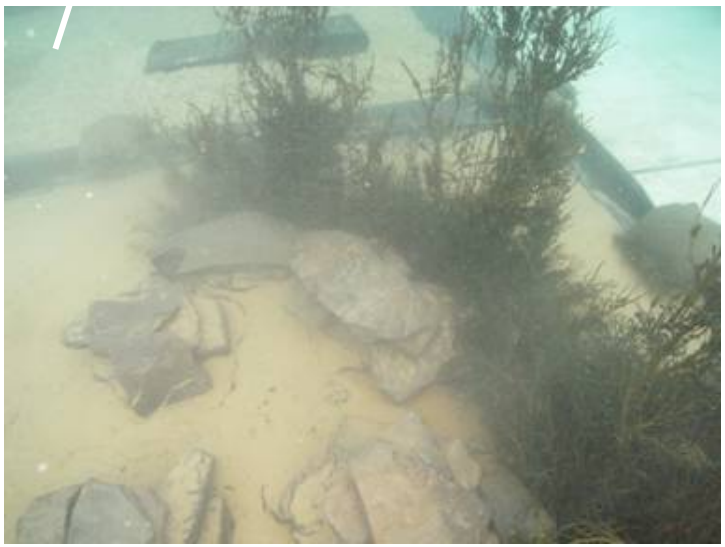
3 types of oil

Asphalt/roofing blocks

Tray Details

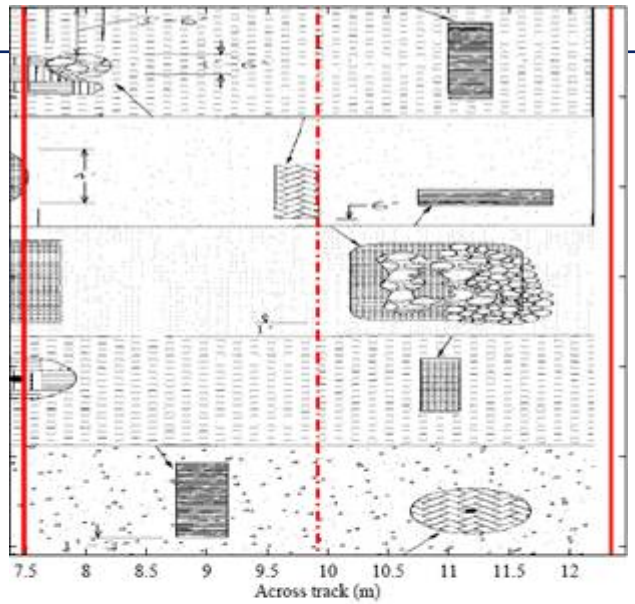




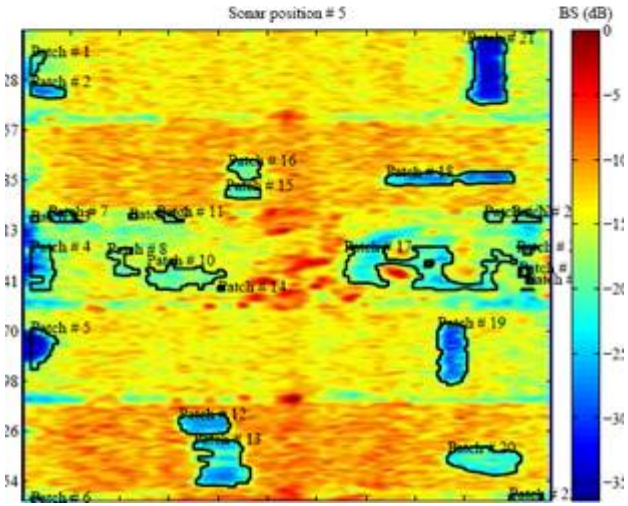


RESON Results

Position 4 (Example)



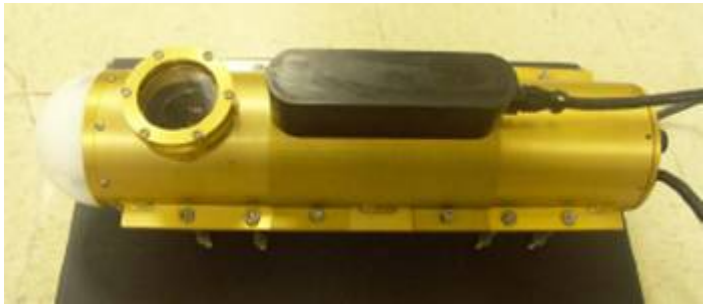
(a) Sketch of the survey area.

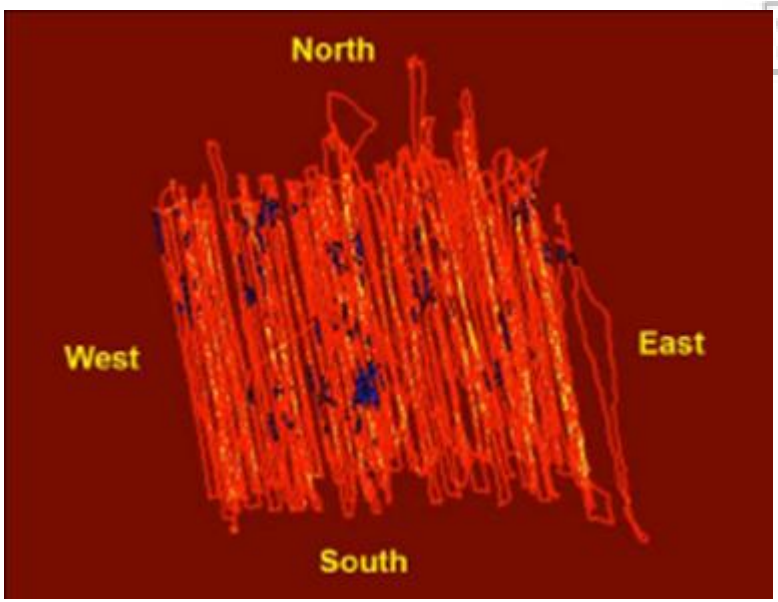


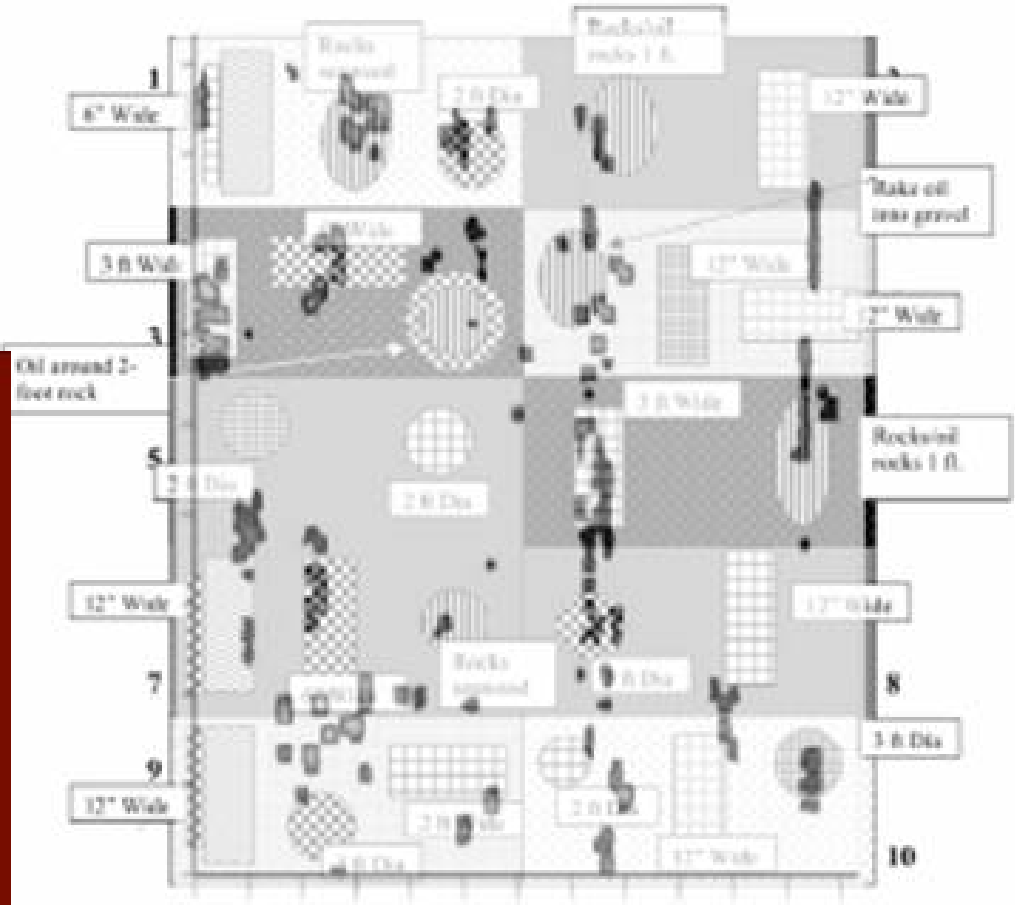
Using Area Detected as Measure

Average Detection Rate of 87%
Average False Alarm Rate of 24%

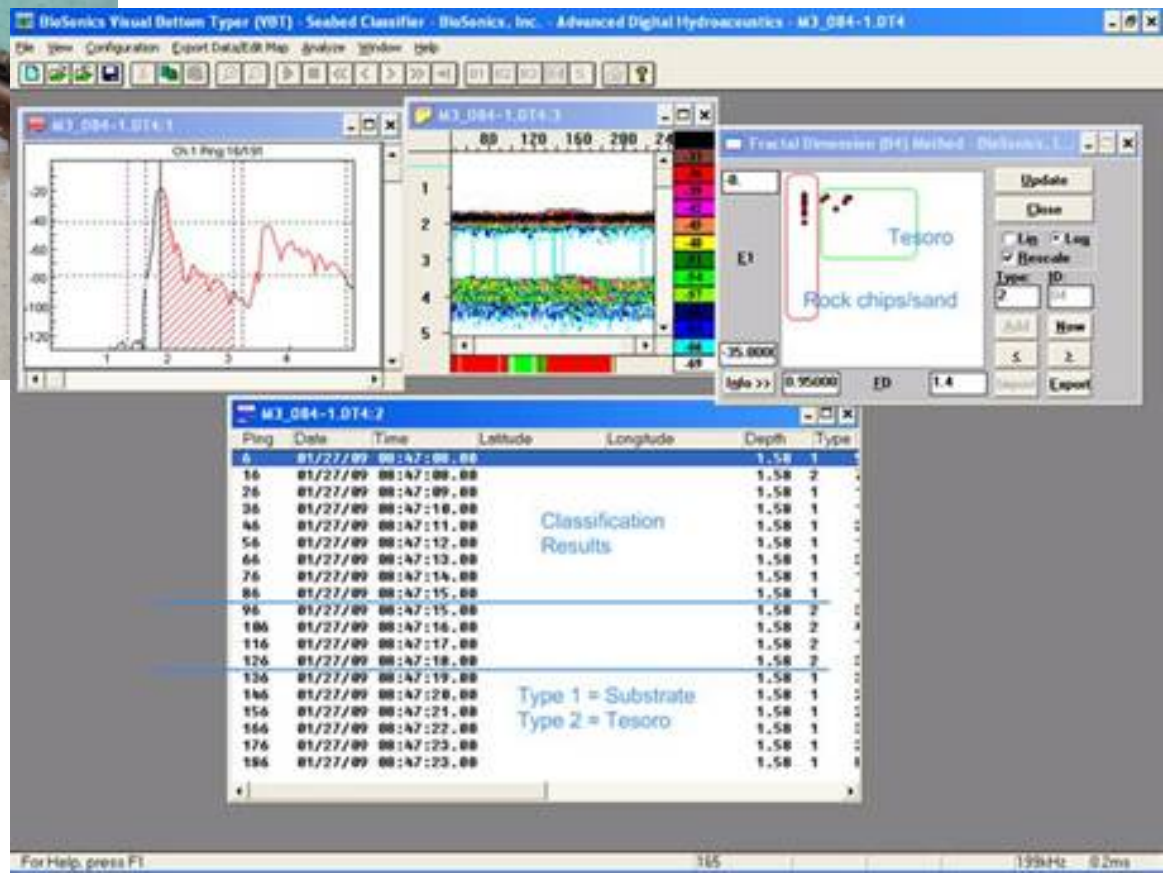
EIC Results –
GPS readings caused results to scatter.





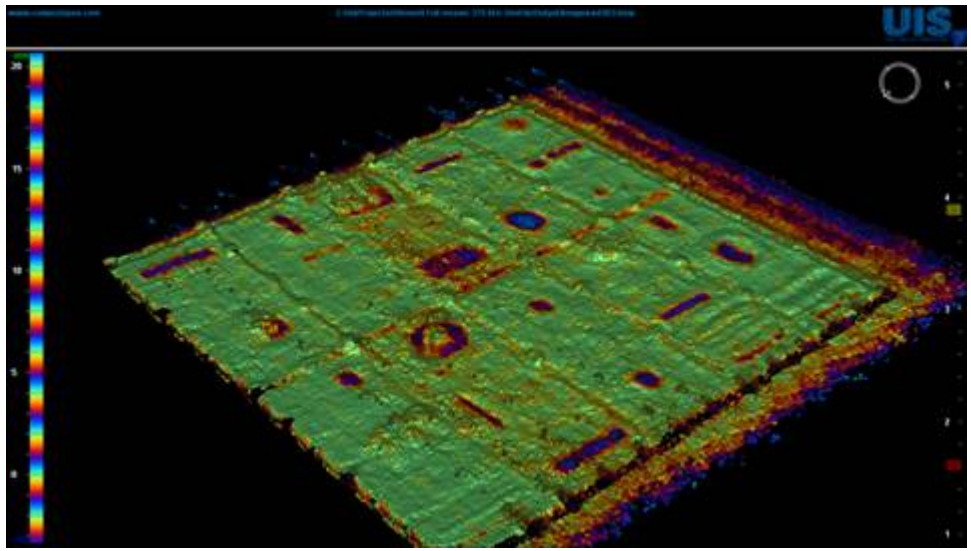


Biosonics Results



CodaOctopus Results

Sonar unit



Target Strength Data

SRI International (Real-Time Mass Spectrometry)

Prototype Requirements
(Large X is fully compliant)

Requirement	RESON	EIC	BioSonics	CodaOctopus
Identification of heavy oil on sea floor (80% certainty)	X	X	x	x
Ability to detect oil on the sea floor from at least 1 meter away	X	X	X	X
Geo-referenced to within 1 meter	x	x	x	x
Real time data	x	X	X	x
Able to provide data for all sea floor conditions	x	X	X	x
Search a one square mile area in a 12-hour shift	X	x	x	X
Water currents of up to 1.5 knots	X	X	X	X
Operate in up to 5 foot seas	X	X	X	X
Operable during the day and night	X	X	X	X
Able to be set up within 6 hours	X	X	X	X
Easily deployable and transportable	X	X	X	X
Capable of being deployed from a vessel of opportunity and a variety of other platforms	X	X	x	x

Detection Summary

- **Methods were successful in detecting oil in benign environment**
- **No one method that can cover 100% of area with no false alarms**
- **Resolution of results still an issue**
  - Easier if oil stays together
  - Random hits need to be correlated
- **Use of techniques in turbid water and very soft bottom also an issue**
- **Recommendations to FOSC**
  - Try to use simple approaches at first for safety
  - Understand limitation of new technologies
  - Compare other potential vendors specifications to requirements tested here

Total Recovery System development

Began planning for recovery integration efforts

- **Developed preliminary specifications**
- **Looking for input and partners from users**
- **Planning for BAA later this year**
  - Phase I: System design
    - Planned released is this summer
  - Phase II: Prototype Development
    - Testing in 2011

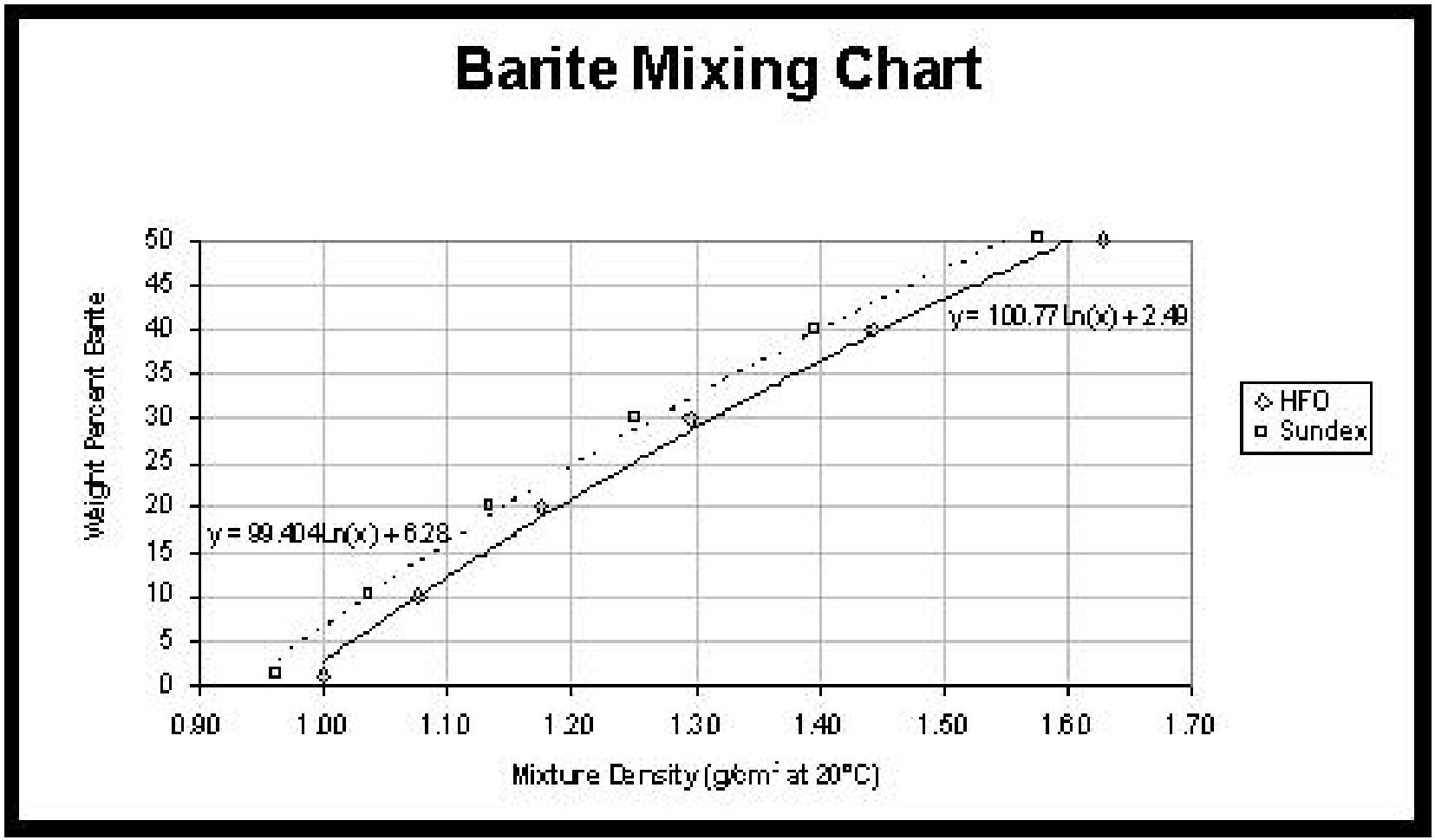
Questions

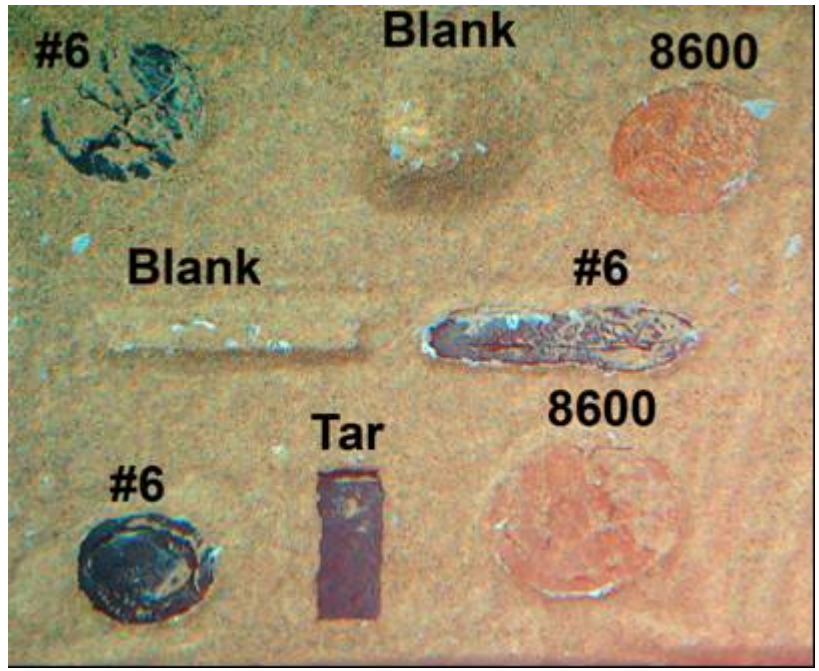
Non-Attribution Policy

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.

Backup Slides

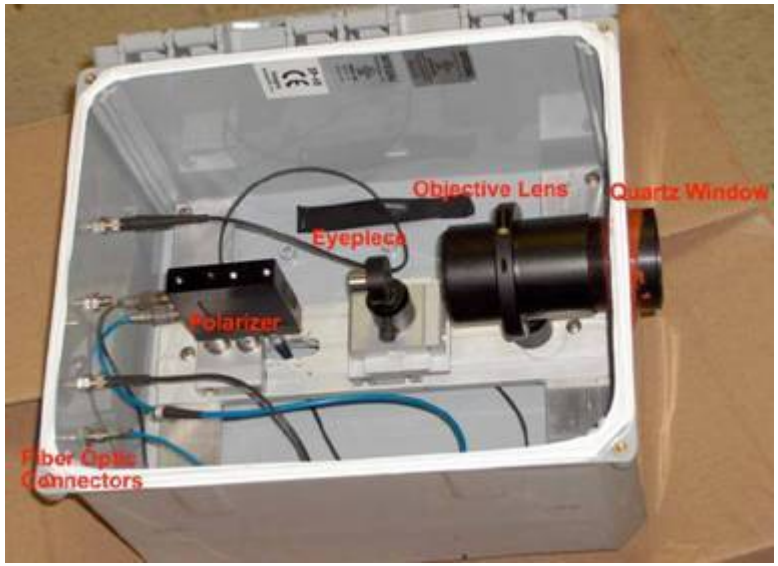
Barite Mixing (adding to oil to ensure oil stays down)





SAIC in Tow Body and Visual Results

Other Pictures

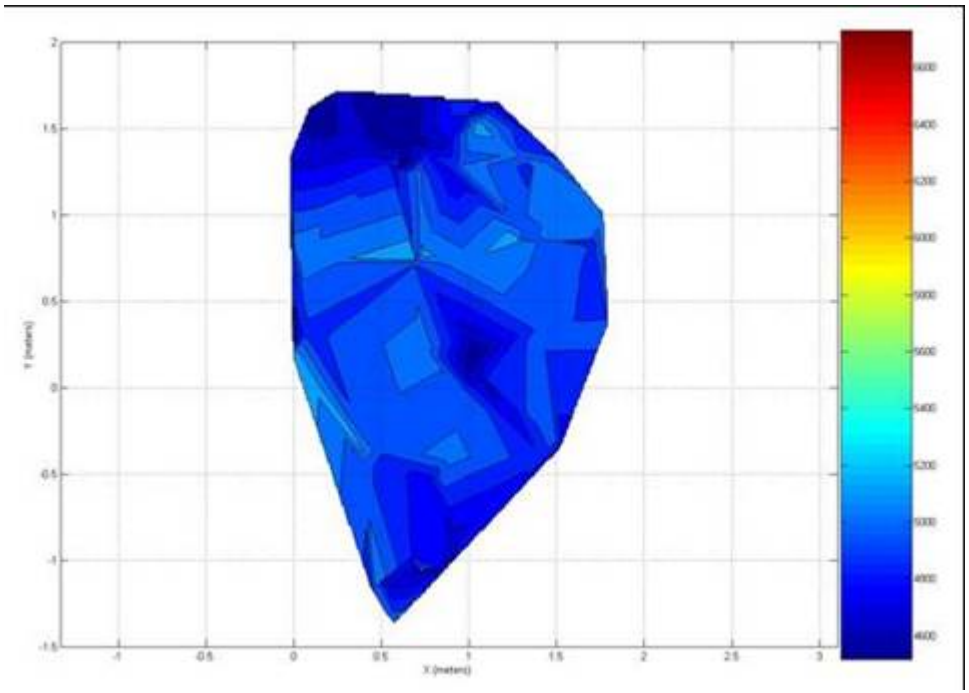


ELC probe

WHOI Units

Other Pictures

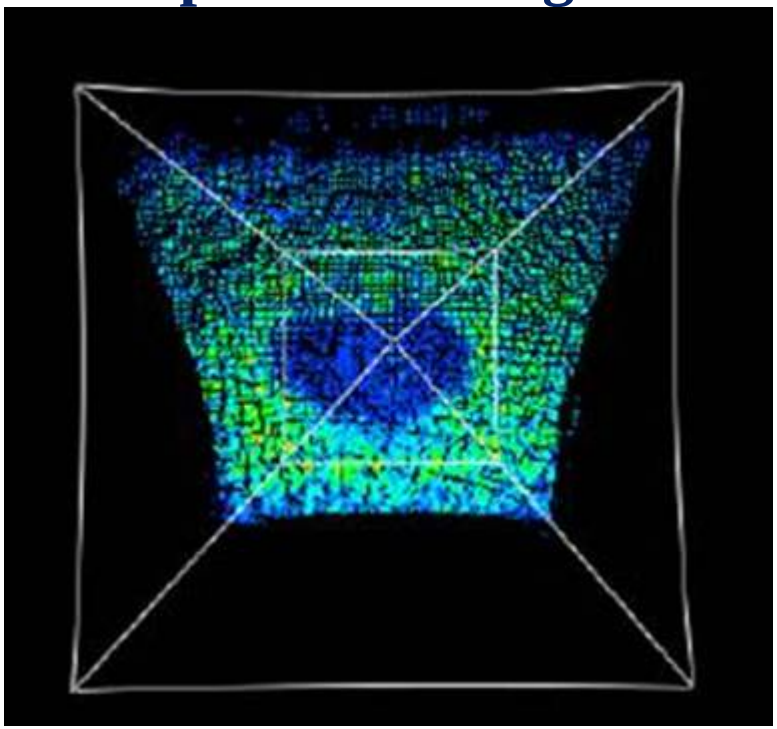
WHOI Background Data



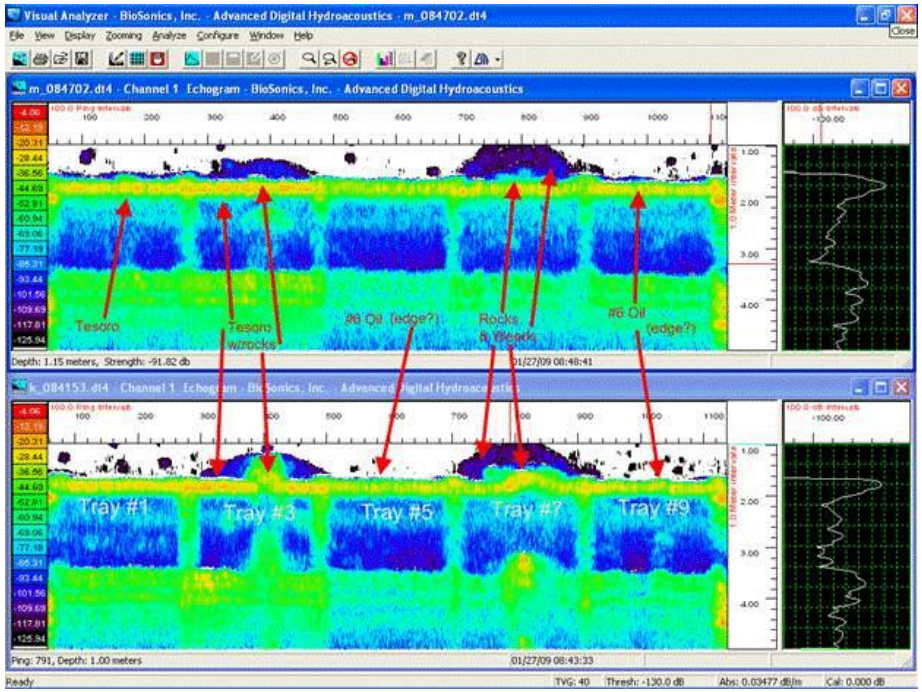
Oil Properties

	NO 6 Fuel	Tesoro Slurry	Sundex 8600
Density (g/ml @ 1C)	1.083	1.0626	1.071
Viscosity (cP @ 30.5F, -.8C))	700,000	80,000	550,000

Octopus Raw Image



Biosonics Raw Data



Megator Pump Results –
pumped one of the oils