BSEE
Oil Spill Preparedness Division
Response Research Branch

Suzanne Chang

February 27, 2017

"To promote safety, protect the environment and conserve resources offshore through vigorous regulatory oversight and enforcement."

BSEE Mission Statement

“To promote safety, protect the environment and conserve resources offshore through vigorous regulatory oversight and enforcement.”

BSEE Oil Spill Preparedness Division

OSPD Overview

Response Research Branch

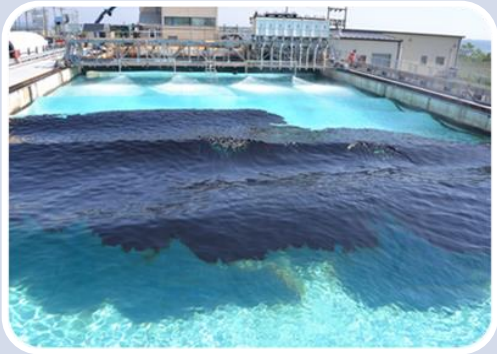
- Oversee Ohmsett facility in NJ (National Oil Spill Response Research and Renewable Energy Test Facility)
- Oil spill response research (OSRR)
- Participate in interagency outreach

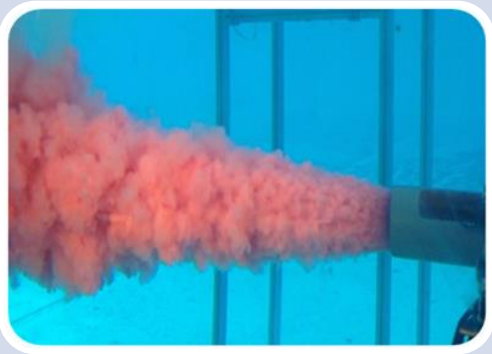
Preparedness Verification Branch

- Approve oil spill response plans
- Conduct equipment verifications
- Conduct unannounced exercises

BSEE Oil Spill Preparedness Division

Oil Spill Response Research (OSRR)





R&D Projects

- 200+ projects
- FY16-$7.5M
- FY17*-$10.2M
- 38 on-going
- 4 under peer review

**anticipated*

Focus areas

- Detection
- Containment
- Treatment
- Recovery and cleanup
- Improving methods
- Advancing technologies

Cooperative effort

- Funding and expertise
- Research partners
  - Government agencies
  - Industry
  - Academia

BSEE Oil Spill Response Research

Where We Research

- National Oil Spill Response Research & Renewable Energy Test Facility-Ohmsett (BSEE)
- Joint Maritime Testing Facility (USCG/Naval Research Lab)
- Cold Regions Research and Engineering Lab (US Army Corps Engineers)
- National Labs (DOE)
  - Pacific Northwest National Lab
  - National Energy Technology Lab
- Academia
- Research Entities

BSEE Oil Spill Preparedness Division

Oil Spill Response Research

- Mechanical Containment/Recovery
- Dispersants
- Herding
- *In Situ* Burning
- Remote Sensing
- Decision Making Strategies

BSEE OSRR - Mechanical Recovery

Development of an Autonomous Oil Skimmer

BSEE OSRR #1037

- Alion Science and Technology Corp.
- PI: Dr. Gregory Johnson
- Completed: June 2016

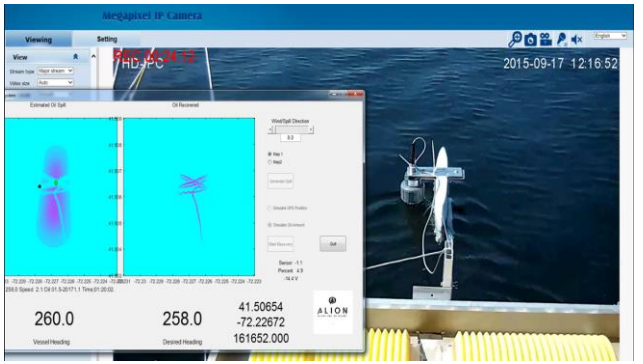
Objective: Develop a navigation sensor and computer control system to direct a variety of skimmers and vessels to autonomously maneuver and skim oil. Automatically track and report progress and performance.

Highlights:

Testing of sensors conducted at Ohmsett;

- Oil thickness sensors
- Oil recovery efficiency sensor

Autonomous maneuvering tested at Gardner Lake (CT)



BSEE OSRR - Herding

Multifunctional Herding-Sorbent Agents for Use in Icy Water

BSEE OSRR #1071

- Pacific Northwest National Laboratory (PNNL)
- PI: Dr. George Bonheyo
- Estimated Completion: May 2017

Objective: Develop material treatments to enhance herding and sorbent effect of sawdust, reduce absorption of water, and delay sinking. Materials tested under icy conditions, in small scale burn studies and for bioremediation potential.

Highlights:

- Initial testing in Sequim, WA.
- Final testing conducted at the USCG Joint Maritime Test Facility in Mobile, AL in Oct 2016.

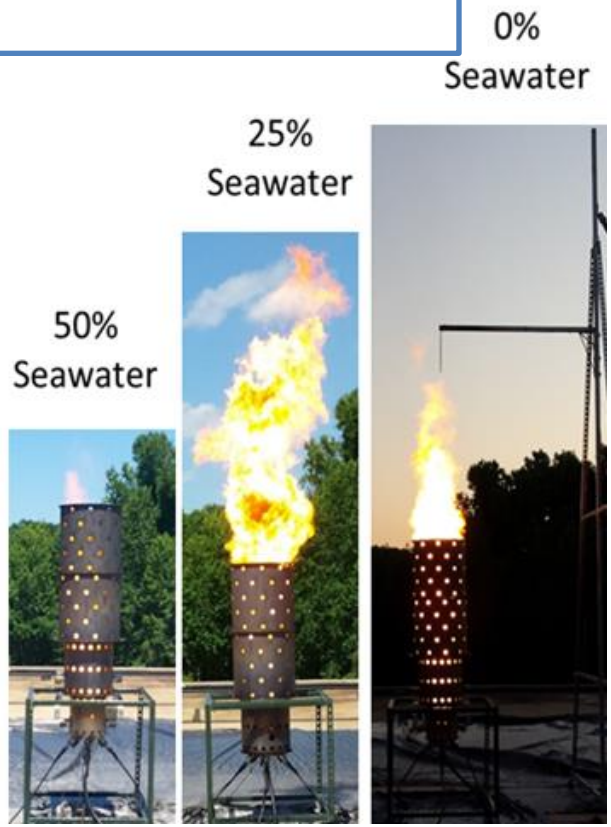
BSEE OSRR - *In Situ* Burning

Development of a Low-Emission Spray Combustor for Emulsified Crude Oil

BSEE OSRR #1061

- Naval Research Laboratory (NRL)
- PI: Dr. Steve Tuttle
- Completed: November 2016

Objective: Builds off the proof-of-concept project (BSEE OSRR #1012). Advances the development of a low-emission, low pressure atomization and combustion process for emulsified crude oil. Develops and refines the performance of a quarter and half-scale flow atomizer spray burner.



Highlights:
Successfully tested
- Sub-scale (25%)
- Engineering-scale (50%)

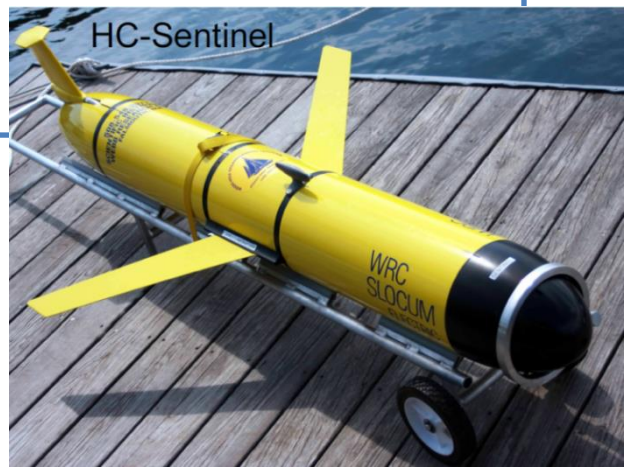
Full scale yet to be developed

BSEE OSRR - Remote Sensing

HC-Sentinel: AUV Glider for High Endurance Subsea Hydrocarbon Detection

BSEE OSRR #1041

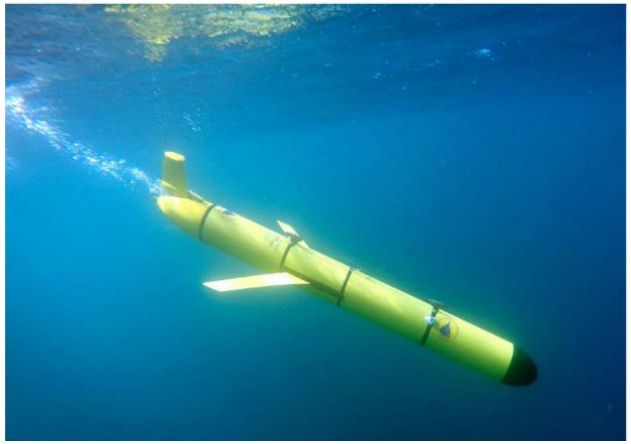
- Woods Hole Oceanographic Institution (WHOI)
- PI: Dr. Richard Camilli
- Estimated Completion: May 2017



Objective: Develop and test in-situ mass spectrometer payload that operates on an autonomous underwater vehicle (AUV) glider for real-time subsea hydrocarbon detection and classification. Designed to operate for long-term subsea inspection, monitoring, and incident response.

Highlights:

- Tested in Santa Barbara, CA
- Generate a hydrocarbon concentration map



BSEE OSRR - Remote Sensing

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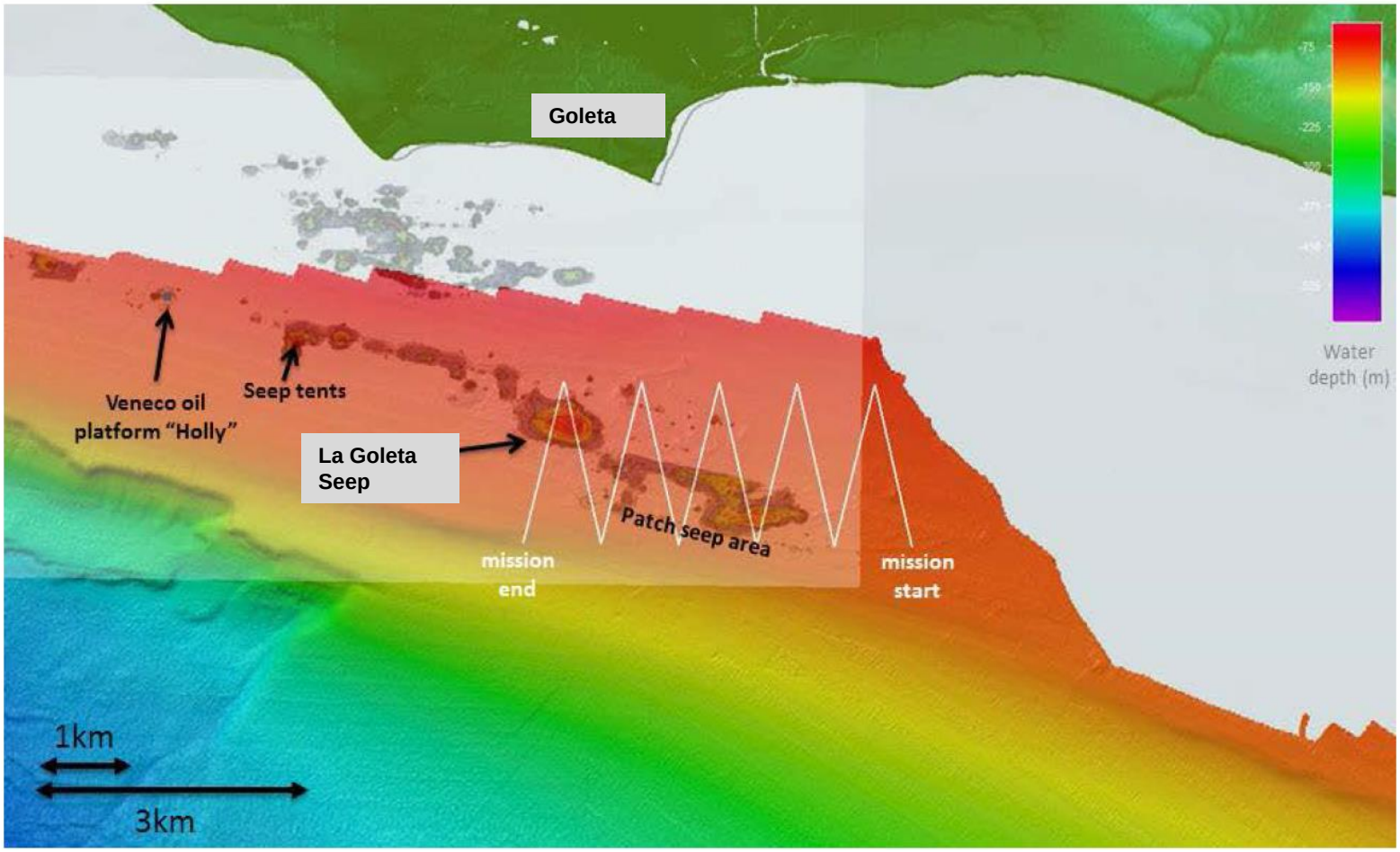

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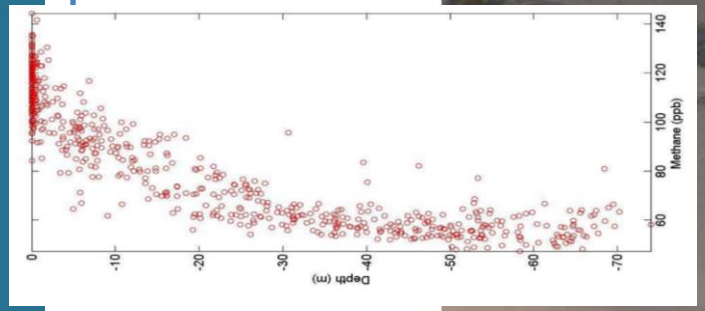
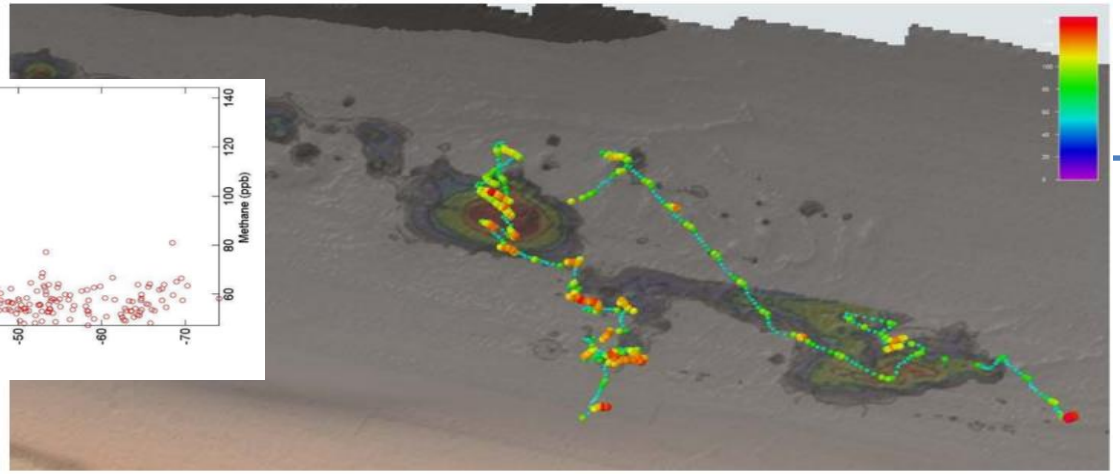
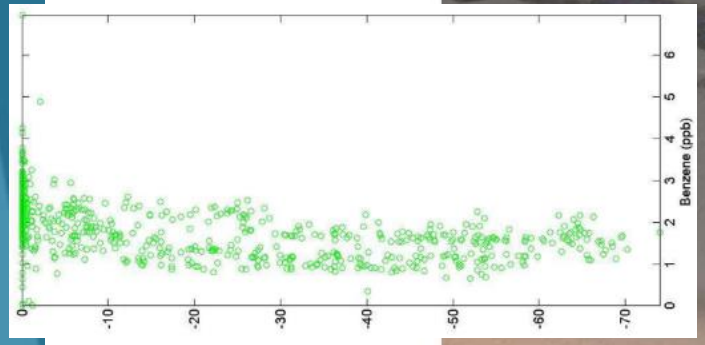
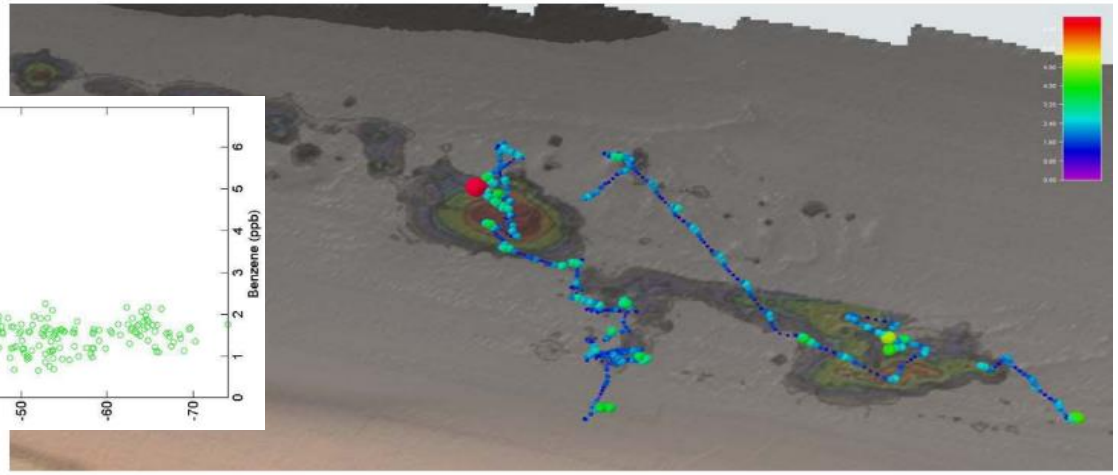




Methane





Benzene

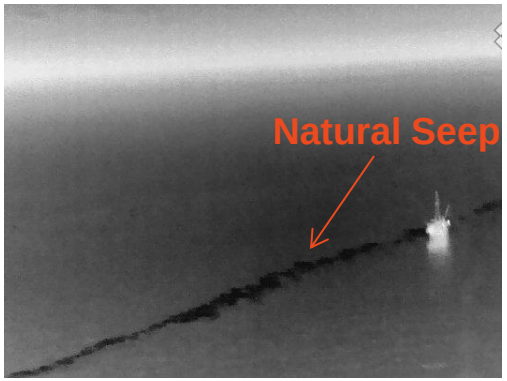
BSEE OSRR - Remote Sensing

Enhanced Oil Spill Detection Sensors in Low-light Environments

BSEE OSRR #1013

- U.S. Army Research Development and Engineering Command (RDECOM)
- PI: Mark Walters
- Estimated Completion: Fall 2017

Objective: Enhance current methods to detect oil in a low-light marine environment. Current methods rely heavily on time-delayed aerial remote sensing technologies or visual observation. RDECOM will test, evaluate, and demonstrate new or alternative hardware/technology;



Platform Holly

Highlights:

- Initial testing using manned aircraft.
- Testing at Ohmsett with the new (miniaturized) sensor payload in April and August of 2017.

BSEE OSRR - Decision Making Support Tools

Technology Readiness Level (TRL) Definitions for Oil Spill Response Technologies and Equipment

BSEE OSSR #1042

- Applied Research Associates
- PI: Dr. Paul Panetta
- Completed: January 2016

Objective: Establish a uniform and objective means to determine the level of maturity of a new technology.

Highlights:

- Correlates various testing facilities with spill environments and conditions.

BSEE Oil Spill Response TRL Summary	
BASIC TECHNOLOGY RESEARCH	
TRL 1	Basic principles observed or reported
TRL 2	Concept and speculative application formulated
TRL 3	Proof of concept demonstrated
TECHNOLOGY ADVANCEMENT/DEMONSTRATION	
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BSEE OSRR - Decision Making Support Tools

Technology Readiness Level (TRL) Definitions for Oil Spill Response Technologies and Equipment

BSEE OSSR #1042

Spill Environment / Condition	Test Facility												
	CRRC	CRREL	CEDRE	JMTF	Ohmsett	Penn State	Poker Flats	SERF	SINTEF	SL Ross	SwRI	VIMS/ARA	WPI
Aerial							✓						
Surface Wave Tank (< 1 m)			✓	✓	✓			✓		✓			
Shallow Subsurface (<10 m)	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓
Mid-depth Subsurface (10 m to 1800 m)						✓					✓		
Deepsea (>1800 m)						✓					✓		
Arctic/Ice		✓			✓		✓	✓	✓	✓			
ISB		✓		✓			✓			✓		✓	✓

CRRC: The Coastal Response Research Center
CRREL: The Cold Regions Research and Engineering Laboratory
CEDRE: The Center of Documentation, Research and Experimental on Accidental Water Pollution
JMTF: The Joint Maritime Test Facility
SERF: The Sea-ice Environmental Research Facility
SwRI: Southwest Research Institute
VIMS/ARA: Virginia Institute of Marine Science/Applied Research Associates
WPI: Worcester Polytechnic Institute

BSEE OSRR - Dispersants

Assessment of Dispersant Effectiveness Using Ultrasound to Measure Oil Droplet Particle Size Distribution

BSEE OSRR #697

- Applied Research Associates (ARA), Inc.
- PI: Dr. Paul Panetta
- Completed: February 2013

Objective: Proof-of-concept project to develop a novel ultrasonic scatter method to measure the droplet size of dispersed oil to monitor the efficacy of subsea dispersant application.

Highlights: Acoustic signals respond to changes in oil droplet sizes.

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Photographs of dispersant being applied to the Deepwater Horizon plume using three different methods. The dispersant is the white fluid being sprayed onto the brown oil.

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BSEE OSRR - Dispersants

Subsea Chemical Dispersant Research

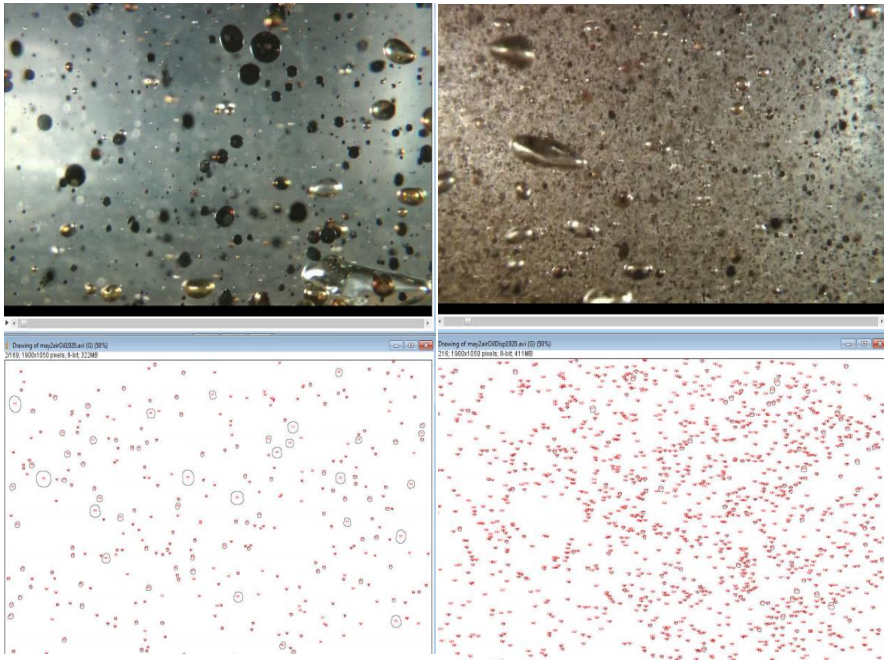
BSEE OSRR #1003

- S.L. Ross Environmental Research and Applied Research Associates (ARA) Inc.
- PI: Mr. Randy Belore and Dr. Paul Panetta
- Completed: September 2014

Objective: Advance the knowledge in chemical dispersant use when injected into a subsea oil/gas release by developing test techniques for a representative creation; Determine dispersant effectiveness in the presence of natural gas.

Highlights:

- Small scale bench testing evaluated measurement techniques and natural gas effects on dispersion.
- Large scale testing expanded on oil and gas flow rates and dispersant to oil ratios.



Pre-dispersant Post-dispersant

BSEE OSRR - Dispersants

Acoustic Assessment of Subsea Chemical Dispersant Efficacy

BSEE OSRR #1002

- Applied Research Associates (ARA), Inc.
- PI: Dr. Paul Panetta
- Completed: September 2014

Objective: Build off the previous proof-of-concept project to develop acoustic techniques to measure droplet size distribution for subsea release of crude oil and dispersants in the presence of natural gas. Identify specific frequency ranges for improving the monitoring of dispersant effectiveness.

Highlights:

- Significant step in developing *in situ* methods for measuring oil droplet size using acoustic scattering.
- Collected a broad spectrum of data on several key oils over a wide range of percent dispersions.

BSEE OSRR - Dispersants

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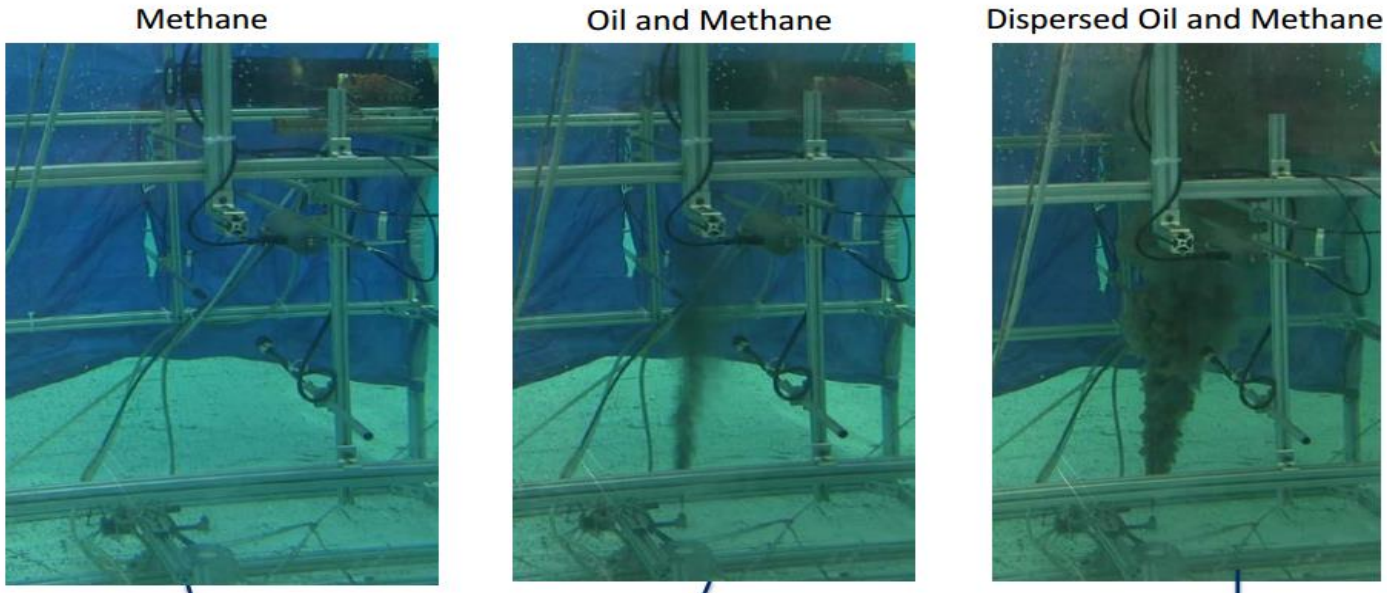

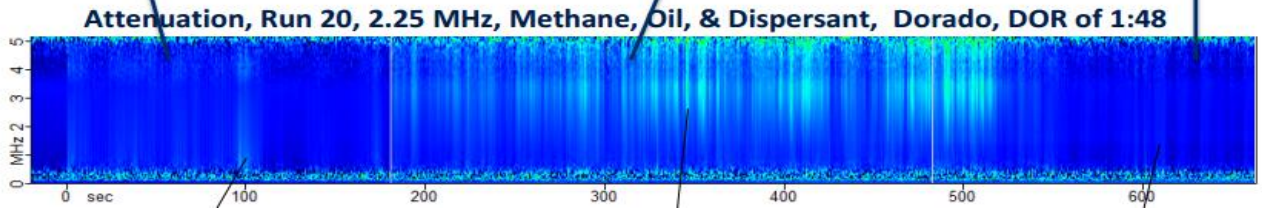

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BSEE OSRR - Remote Sensing

Development of Acoustic Methods to Measure Oil Droplet Size & Slick Thickness on ROV & AUV Platforms

BSEE OSRR #1065

- Applied Research Associates (ARA), Inc.
- PI: Dr. Paul Panetta
- Estimated Completion: May 2017

Objective: Develop and test acoustic techniques and sensors on free-swimming platforms [Remotely Operated Vehicles (ROVs) and Autonomous Underwater Vehicles (AUVs)] for field applications to measure:

(a) slick thickness on the water surface

(b) oil droplet size at the well head

Intended to assist subsea dispersant applications.

Highlights:

Final testing at Ohmsett in February 2017

BSEE OSRR - Remote Sensing

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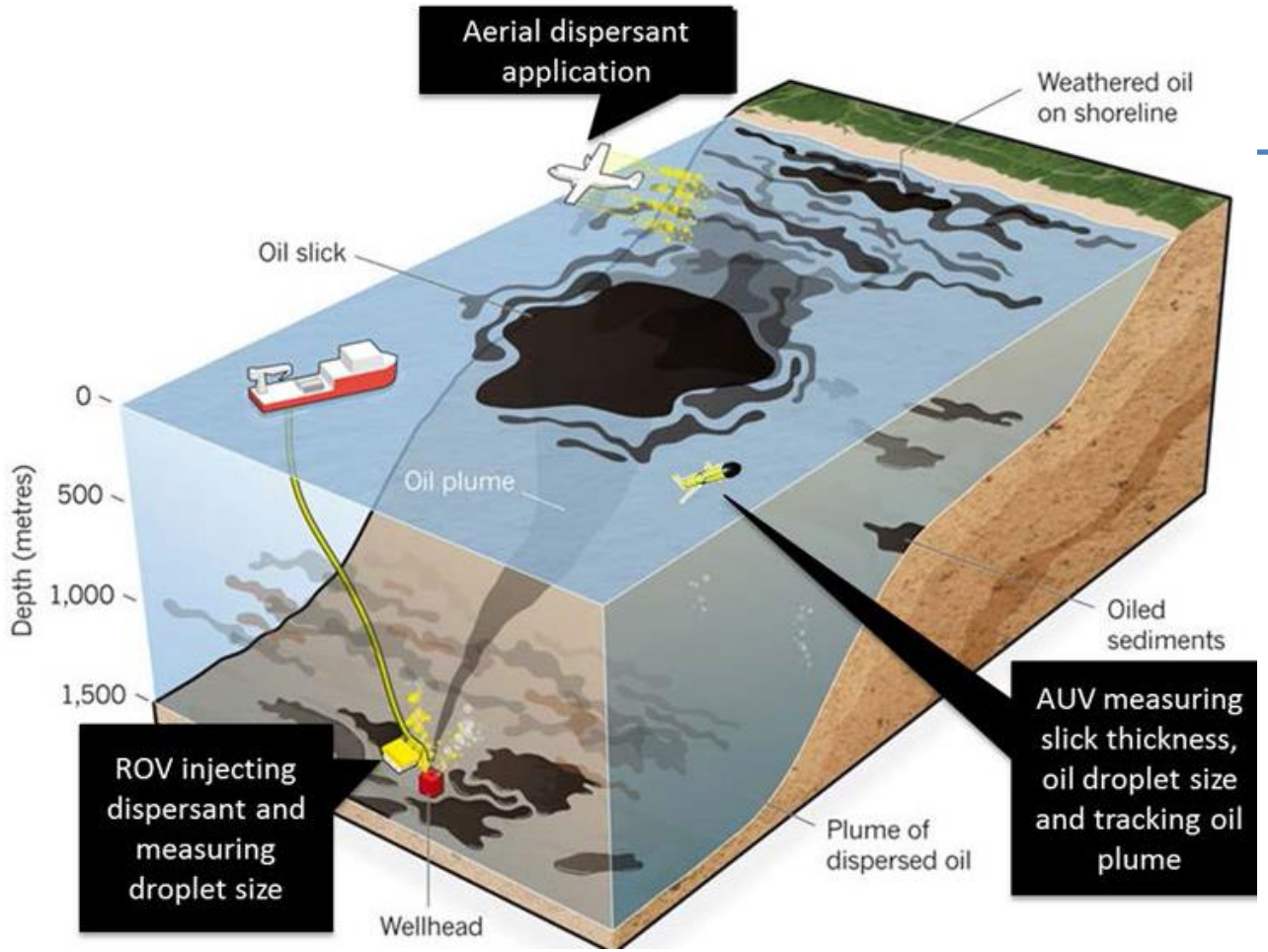

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BSEE OSRR - Decision Making Support Tools

Development of a ROV Deployed Video Analysis Tool for Rapid Measurement of Submerged Oil and Gas Leaks

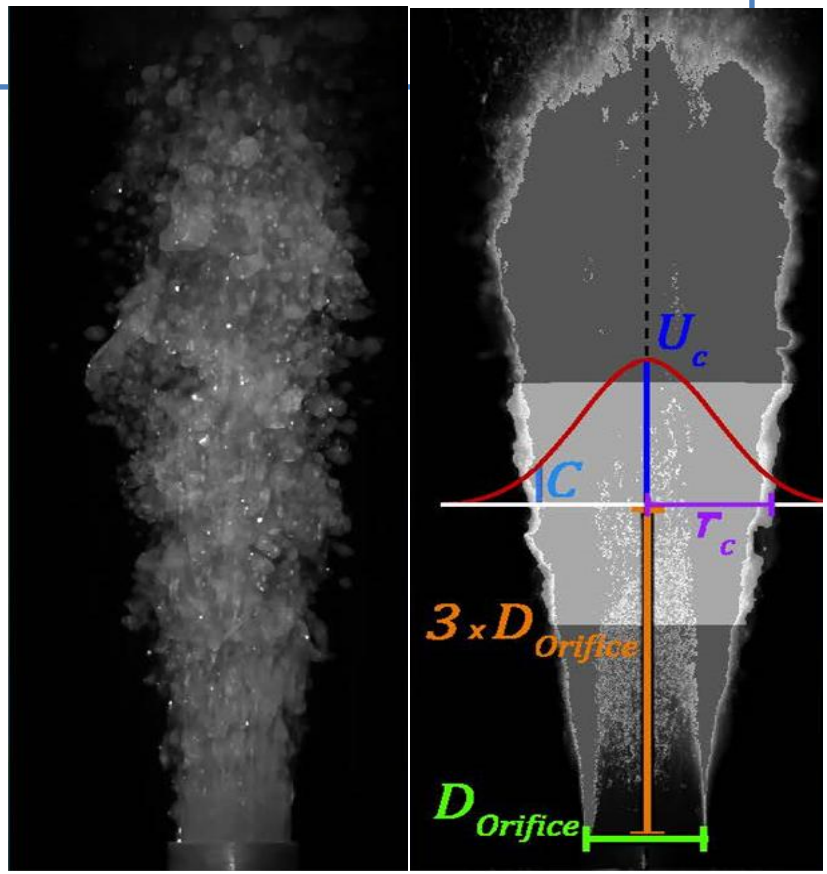
BSEE OSRR #1027

- National Energy Technology Laboratory (NETL)
- PI: Frank Shaffer
- Completed: May 2016

Objective: Develop a video based method and associate algorithms for calculating flow rates of subsea oil and gas leaks and blowouts.

Highlights:

- Small scale, high res oil jet experiments were conducted at University of California at Berkley
- Tested at Ohmsett in October 2014



BSEE OSRR - Decision Making Support Tools

Development of a Real-time Monitoring Protocol for Assessing VOC Impacts on Response and Cleanup Workers' Safety During Dispersant Operations

BSEE OSRR #1006

- Louisiana State University
- PI: Edward Overton
- Completed: 2014

Objective: Develop real-time and passive monitoring protocols to effectively determine the impact of dispersant use and VOC release, in both surface and subsurface applications, on oil spill response worker safety.

Highlights:

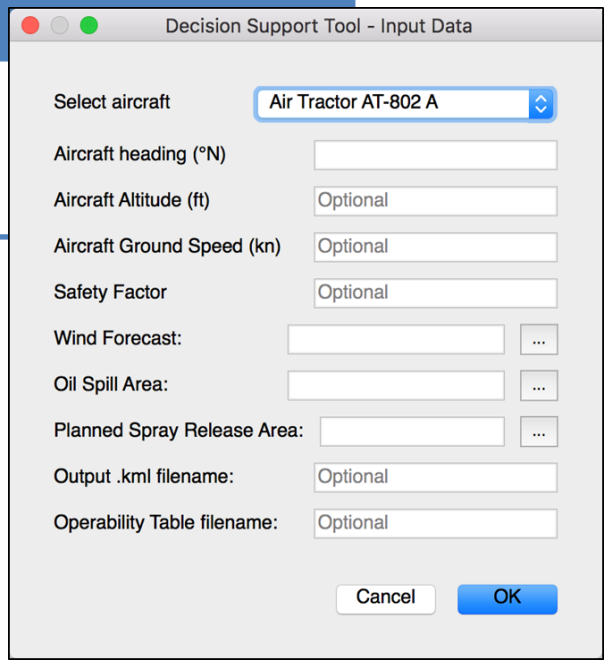
- Minimum sensitivity of 0.5 ppm benzene for performance criteria of air monitoring.
- Air sampling every 5 minutes during testing.

BSEE OSRR - Decision Making Support Tools

Developing an Innovative Dispersant Spray Drift Model

BSEE OSRR #1070

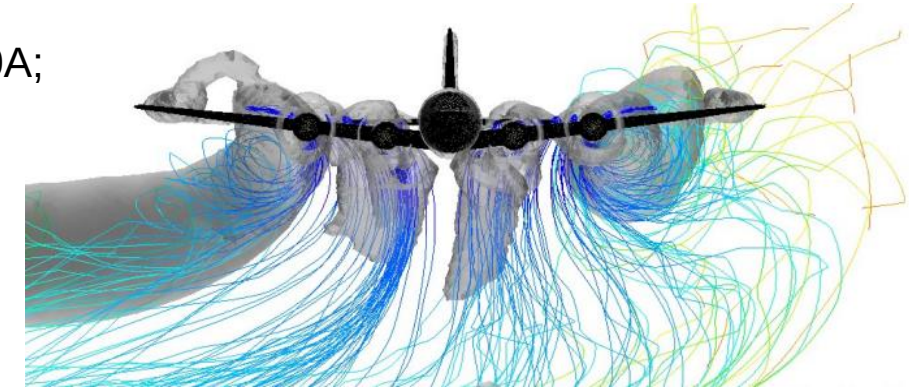
- AMOG Consulting, Inc.
- PI: Stuart Wales
- Completed: September 2016



Objective: Develop a software tool to identify operability windows and establish exclusion zones based on the maximum extent of dispersant spray. Results from computational fluid dynamics models of the forces acting on dispersants being sprayed from four commonly used aircraft model feed the decision support tool.

Highlights:

- Lockheed Martin C-130A;
- Air Tractor AT-802A;
- Douglas DC-3;
- Douglas DC-4.



BSEE OSRR – Remote Sensing

Deepwater Horizon Lessons Learned - Methodology and Operational Tools to Assess Future Oil Spills

BSEE OSRR #1079

- NOAA
- PI: George Graettinger
- Estimated Completion: September 2017

Objective: Validate and quantify the capabilities of various remote sensing systems and sensors for detecting and characterizing oil. Monitor and measure oil slicks in the marine environment.

Highlights:
Initial testing at Ohmsett with various sensors in July 2016

Offshore testing conducted at MC-20 in November 2016

BSEE Oil Spill Response Research

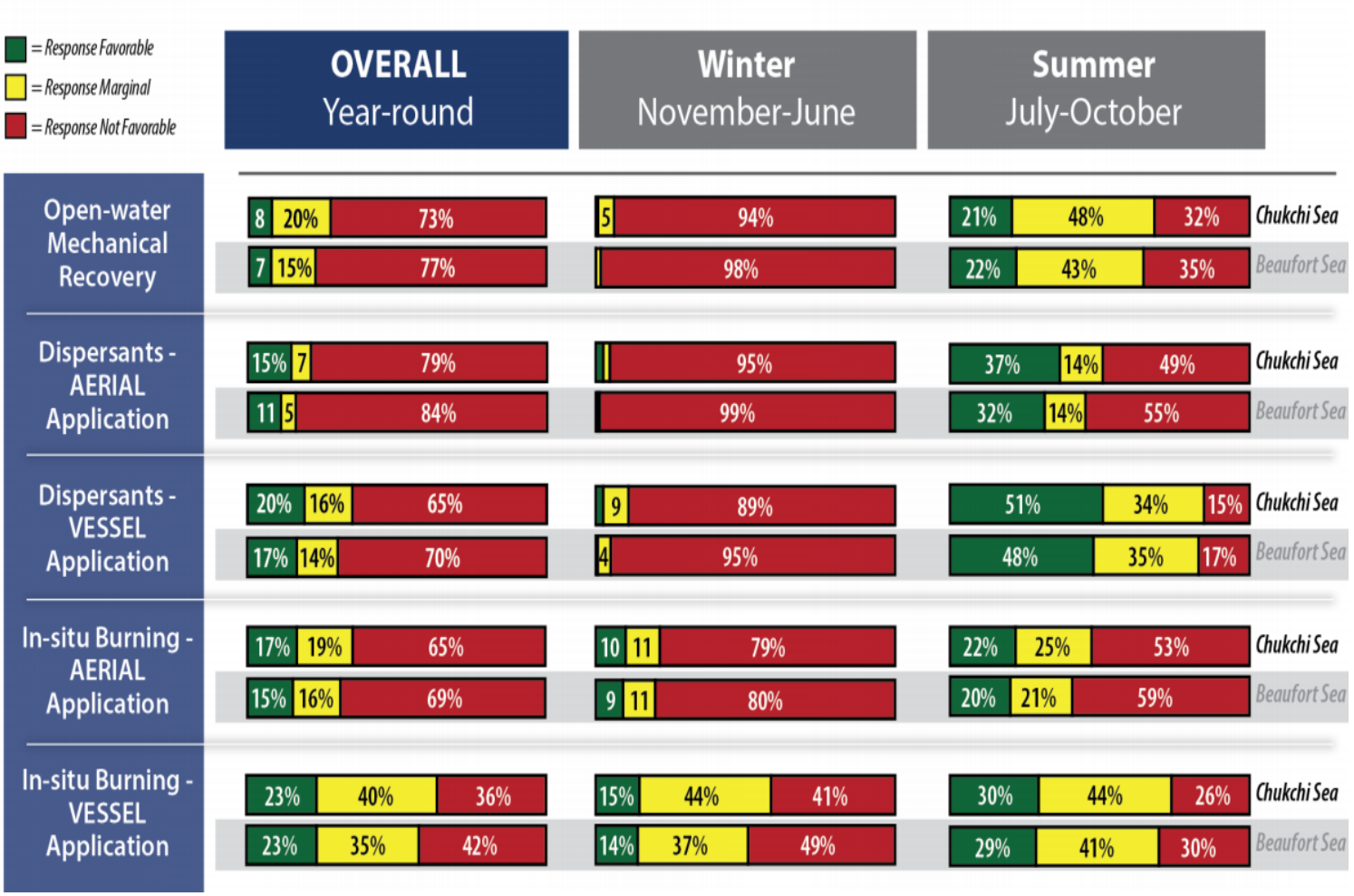
Other Research Projects

- Arctic
  - Estimating an Oil Spill Response Gap for the Arctic Ocean (BSEE OSRR #1022)
  - Testing of Skimmer Hoses and Hose Couplings under Simulated Arctic Conditions (BSEE OSRR #1026)
  - Geographic Referencing Identification (GRID) Tagging of Oil under Ice (BSEE OSRR #1050/51)

BSEE Oil Spill Response Research

Other Research Projects

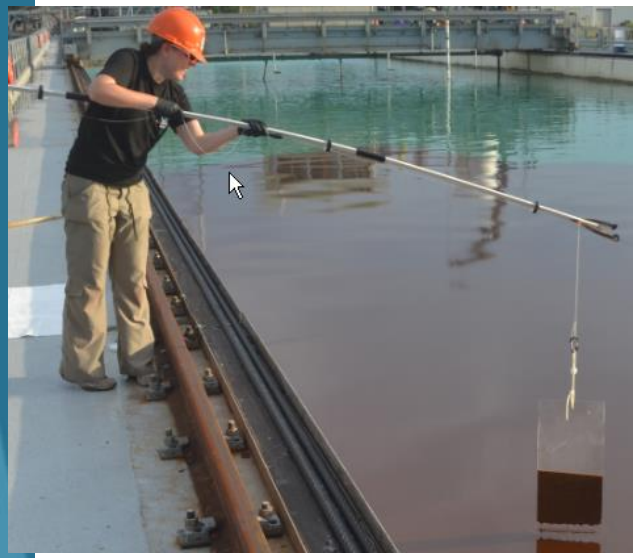
- Arctic

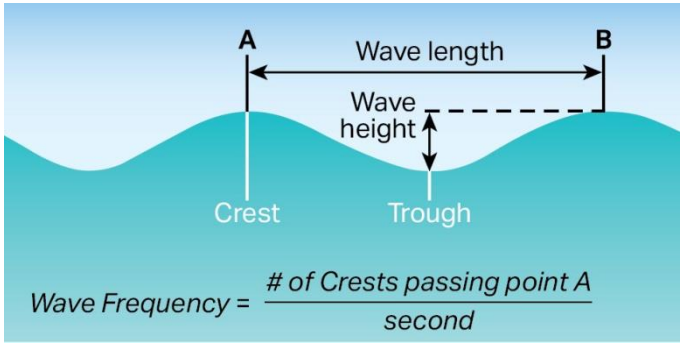


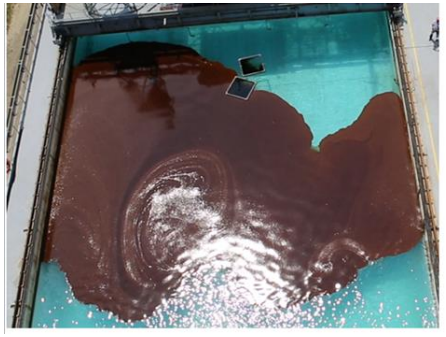
BSEE Oil Spill Response Research

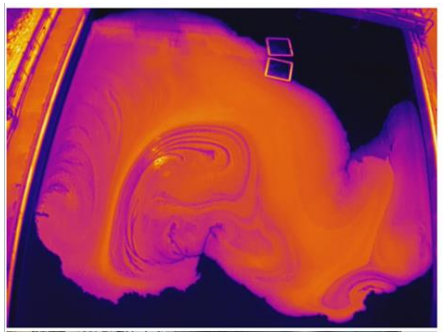
Other Research Projects

- Other
  - Gulf of Mexico Oil Spill Response Viability Analysis (BSEE OSRR #1077)
  - Equipping GRIDs with Accelerometers to Measure Ocean Wave Characteristics (BSEE OSRR #1080)
  - Environmentally Benign Oil Simulants to Mimic the Behavior of Oil Droplets in the Ocean (BSEE OSRR #1029)





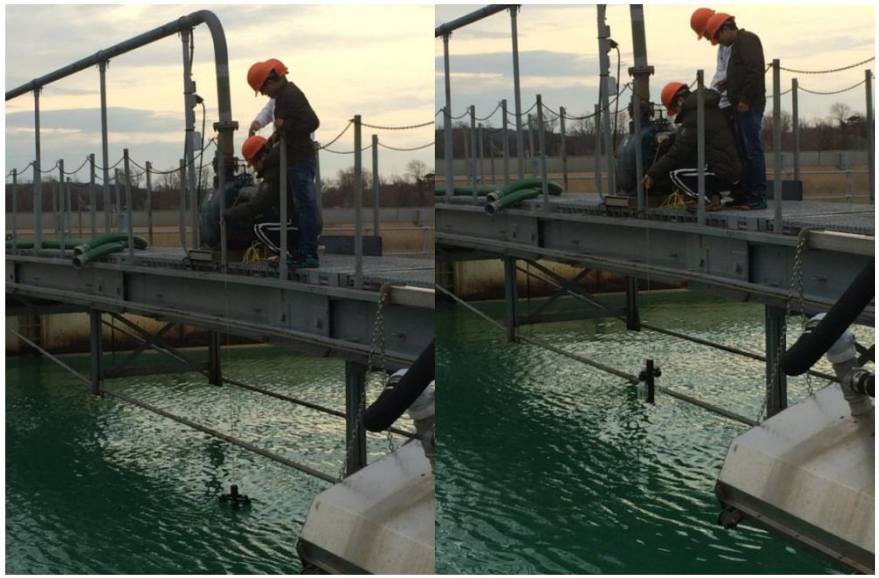


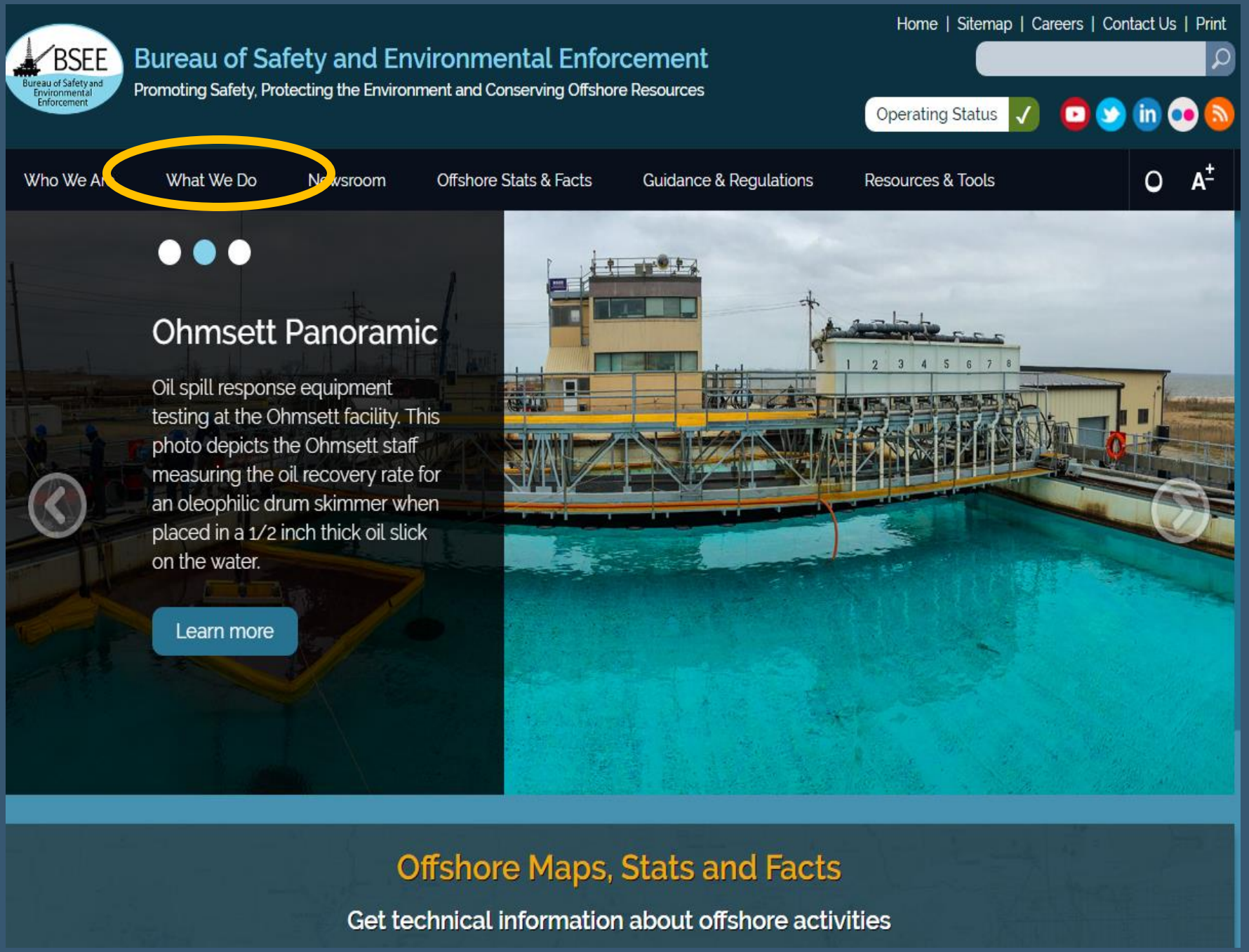


BSEE Oil Spill Response Research

Ohmsett Specific

- Ohmsett Optimization Projects
  - Solidifying the Scientific Capabilities of Ohmsett - Wave Hydrodynamics (BSEE OSRR #1045)
  - Solidifying the Scientific Capabilities of Ohmsett - Effect of Ambient Chemical Levels (BSEE OSRR #1044)
  - Characterizing Wave-Induced Mixing Energy in Ohmsett Wave Basin for Dispersant Effectiveness Testing (BSEE OSRR #1059)




BSEE
Bureau of Safety and Environmental Enforcement
Bureau of Safety and Environmental Enforcement
Promoting Safety, Protecting the Environment and Conserving Offshore Resources
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Operating Status
Who We Are
What We Do
Newsroom
Offshore Stats & Facts
Guidance & Regulations
Resources & Tools
Ohmsett Panoramic
Oil spill response equipment testing at the Ohmsett facility. This photo depicts the Ohmsett staff measuring the oil recovery rate for an oleophilic drum skimmer when placed in a 1/2 inch thick oil slick on the water.
Learn more
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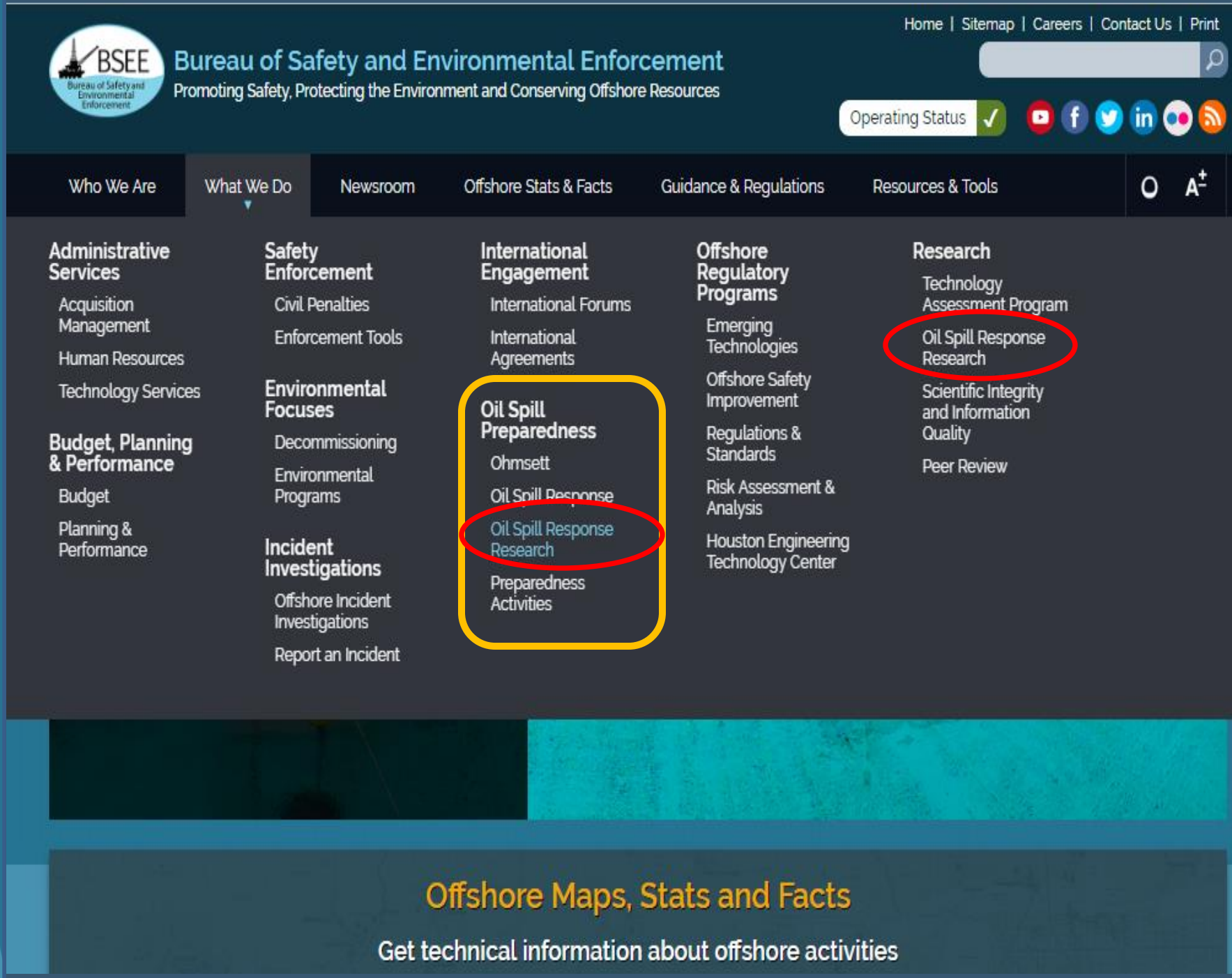
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BSEE actively researches and evaluates current and emerging technologies for operations ranging from the drilling of oil and gas exploration wells to the removal of platforms and related infrastructure in an ongoing effort to reduce risks across all offshore operations.

Oil Spill Response Research | Technology Assessment Program | Technology Collaborations

Oil Spill Response Research (OSRR)

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For more than 25 years, BSEE (and former organizations) have aggressively maintained a comprehensive, long-term research program dedicated to improving oil spill response options. The major focus of the program is to improve the methods and technologies used for oil spill detection, containment, treatment, recovery and cleanup. The OSRR program is a cooperative effort bringing together funding and expertise from research partners in government agencies, industry and the international community.

OSRD's Response Research Branch (RRB) manages the funding for numerous research projects chosen to meet selected major topics each year. White Papers and research proposals are solicited through a Broad Agency Announcement (BAA) that is published on the Federal Business Opportunities website at www.fbo.gov.

The RRB also manages Ohmsett, the National Oil Spill Response Research Test Facility, located in Leonardo, New Jersey. Ohmsett is the largest outdoor saltwater wave/tow tank facility in North America. Ohmsett allows full-scale oil spill response testing, training and research with oil in a realistic marine environment. For more information visit the Ohmsett Website.

Master List of Oil Spill Response Research (OSRR) Projects

Click on the categories below to bring up more information on our efforts in the subject area	
Arctic Oil Spill Response	Behavior of Oil
Chemical Treating Agents	Decision-Making Support Tools
In Situ Burning of Oil	Mechanical Containment
Ohmsett	Remote Sensing
Master List of Oil Spill Response Research (OSRR) Projects	

1041	HC-Sentinel: An AUV Glider for High Endurance Subsea Hydrocarbon Detection	Woods Hole Oceanographic Institution
1040	Distributed Chemical Sensing for Sub-surface Oil Spill Sensing	University of Houston
1039	Oil Leak Detections with a Combined Fluorescence Polarization Instrument and a Wide Band MultiBeam Sonar	EIC Laboratories, Inc. and Norbit US, Ltd.
1038	Biodegradation and Toxicity Following Dispersant Usage in a Cold, Stratified, Deep Sea Setting	Pacific Northwest National Laboratory (PNNL)
1037	Development of an Autonomous Oil Skimmer (AOS)	Alion Science and Technology Corporation
1036	Burning of Crude Oil in Ice Cavities - II	Worcester Polytechnic Institute (WPI)
1035	Improved In-Situ Burning for Offshore Use	US Coast Guard Research & Development Center
1034	Temporary Oil Spill Storage and Recovery in Alaskan Arctic Using Petrogel Technology	The Pennsylvania State University
1033	Mitigation of Oil in the Water Column: Phase I - Design	US Coast Guard Research & Development Center
1032	Permitting the Use of Oil Spill Simulants: Identifying Options and Building Consesus	Nuka Research and Planning Group, LLC
1031	Innovative Technology Enhancements for Measuring Test Parameters at Ohmsett	MAR, Inc
1030	Research to Support the Prediction of Effectiveness of Dispersant Use in the U.S. Beaufort and Chukchi Seas	SL Ross

OSRR-1037-Development of an Autonomous Oil Skimmer (AOS)

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Progress Date	7/19/2016
Category	Remote Sensing Mechanical Containment and Recovery
Project Initiation Date	6/13/2016
Performing Activity	Alion Science and Technology Corporation
Principal Investigator	Dr. Gregory Johnson
Contracting Agency	Bureau of Safety and Environmental Enforcement
Estimated Completion Date	6/30/2016
Description	The goal of this project was to develop a strap-on navigation, sensor, and computer control system that could be used to direct a variety of commercial off the shelf (COTS) skimmers and vessels to autonomously maneuver and skim the oil from a given area with automatic tracking and reporting of progress and performance. This autonomous oil skimmer (AOS) system consisted of a commercial of the shelf (COTS) skimmer and vessel, a COTS autopilot system, a high precision navigation package, oil thickness and recovery efficiency sensors, and a custom computer algorithm. This system was designed to monitor the thickness of the oil being skimmed in real time and track oil thickness versus position as it was skimming. Based on the oil thickness gradients, the tracking algorithm directed the vessel/skimmer to head in the direction of thickest oil concentration. As oil was recovered, statistics on oil thickness and oil recovery rate as a function of position were tabulated for real time performance monitoring. During this effort Alion developed a proof of concept prototype that was tested at the Ohmsett facility as well as at their facility.
Latest progress update	The project is complete and all deliverables have been received. The final report is posted below.
Status	Completed
Date research completed	6/30/2016
Associated Attachments	1037AA

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“To promote safety, protect the environment and conserve resources offshore through vigorous regulatory oversight and enforcement.”