Oil Spill Response Research & Renewable Energy Test Facility

The Ohmsett Gazette

Leonardo, New Jersey | Testing · Training · Research | Spring 2018

25 Years of Testing and Training Milestones

As the U.S. Department of the Interior Bureau of Safety and Environmental Enforcement (BSEE) celebrates its quarter century oversight of the Ohmsett facility, we will take a look back at how the facility has changed during the last 25 years.

Starting out testing booms and skimmers, Ohmsett is now the test bed of some of the most innovative spill technologies: skimming vessels, sorbents, dispersants, sunken oil, neutrally buoyant plumes, herders, oil in ice recovery, remote sensing, remotely operated vehicle (ROV)/autonomous underwater vehicle (AUV) slick measurements, oil vs. ice coverage, and many other proprietary innovations.

The Ohmsett facility was built in the early 1970s as a joint endeavor with the U.S. Environmental Protection Agency and the U.S. Coast Guard. From 1974-1987 the facility was used extensively by the EPA, USCG, and the Minerals Management Service (now BSEE), U.S. Navy, and Environment Canada to test a wide range of spill control equipment and systems. As interest in oil spill response technology waned in the late 1980s, the EPA closed the facility in September 1988 and transferred the buildings and equipment to the Navy.

Soon after in March 1989, the Exxon Valdez tanker ran aground in Alaska's Prince William Sound causing one of the largest oil spills in U.S. History. The difficulties responders encountered during cleanup efforts underscored the need for Ohmsett's unique capabilities and the re-opening was mandated by the Oil Pollution Act of 1990. In April 1990, the Minerals Management Service initiated the restoration of Ohmsett with the Navy for use of the facility and embarked on a two-year $1.5 million restoration project.

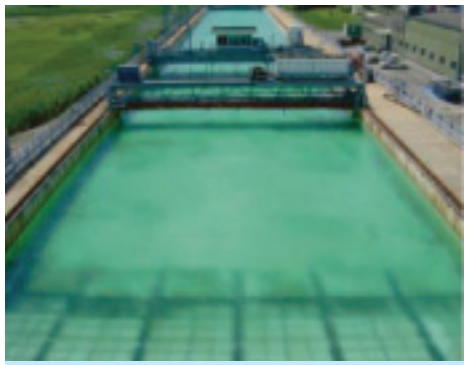
In this issue of the Gazette, we will take a look through time in a photographic retrospective from when Ohmsett lay abandoned, to the restoration project, and how it came back to life.

What's Inside

The Ohmsett tank was abandoned for two years until 1990 when MMS started a two-year, $1.5 million restoration program.

During the 25 years of BSEE oversight, the Ohmsett facility has been a test bed for innovative technologies for oil spill response.

Ohmsett Testing and Training Milestones: 1



1992

Ohmsett reopens after a two-year renovation of the facility.

1994

Ohmsett studies the effects of the clearance between test basin side walls and booms during testing procedures.

1997

Ohmsett's computer data collection systems are upgraded.

Facility Buildings and test basin undergo major refurbishments.

USCG and Texas A&M National Spill Control School classes are offered for the first time.

1998

A first for Ohmsett. The staff evaluates the oil containment pumping systems on the USCG cutter Juniper and provides training with oil for the Juniper crew.

The first issue of the Ohmsett Gazette is published.

1999

Ohmsett evaluates a fire blanket using a new propane burn system.

Ohmsett staff plan, organize, and implement the first USCG oil spill responder training program.

200

ASTM F-20 Co approves a new standard guide, by Ohmsett sta evaluation of oi performance in environments.

Ohmsett conduc dispersant effe test.

1992 - 2006

For the first time, Ohmsett conducts winter testing with the MORICE skimmer. The MORICE is designed to recover oil in ice infested waters.

Six manufacturers test their skimmers to the new EDRC protocol developed by Ohmsett engineers and the U.S. Coast Guard.

Installation of a new U.S. Filter water filtration unit to accommodate the facilities rigorous research and testing needs.

Ohmsett staff conducts a comprehensive wave field study.

A new on-site oil/water lab for oil analysis is completed.

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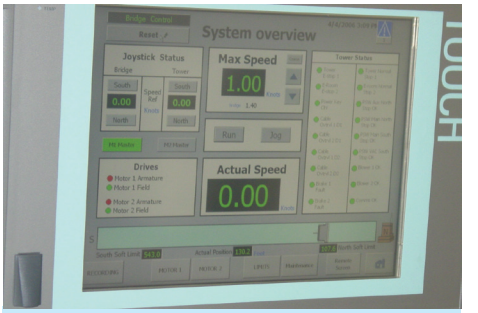
Creation and installation of powdered activated carbon treatment system to remove dissolved dispersant from the test basin water.



Ohmsett gets a new bridge drive system, with a new Programmable Logic Controller and a Human Machine Interface.

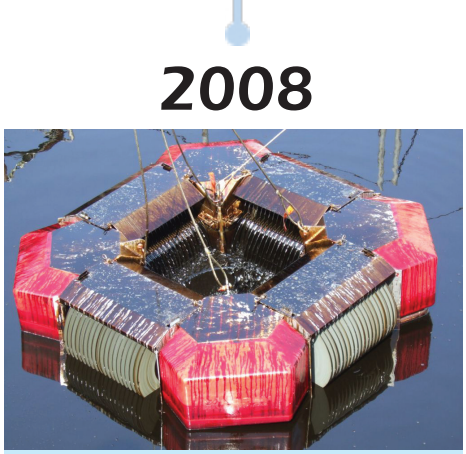
Ohmsett Testing and Training Milestones: 2

2007

The USCG R&D Center conducts the first ever subsurface oil detection technology at Ohmsett.

Construction begins on a new building for equipment and hazmat storage.

2008



A private company performs the largest volume skimming systems tests ever conducted at Ohmsett.

2009

Ohmsett's wave generator is outfitted with computer controlled hydraulic cylinders.

Ohmsett starts offering Marine Hydokinetic testing.

The first skimmer is tested using the newly adopted ASTM F2709 Standard Test Method for Determining Nameplate Recovery Rate of Stationary Oil Skimmer Systems.

2010

CNN shoots a feature segment about Ohmsett.

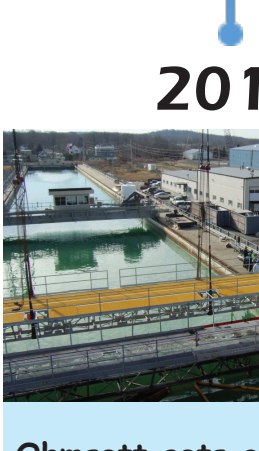
The new Ohmsett website is unveiled.

2011

Ohmsett hosts the Wendy Schmidt $1.4 million Oil Spill Cleanup X CHALLENGE competition.

MMS becomes BSEE.

201



Ohmsett gets a Auxiliary Bridge

The facility sus damage during H Sandy.

2007-2017

BSEE conducts skimmer testing in simulated Arctic conditions during Ice Month.

Discovery Channel Canada films skimmer testing.

BSEE researches the skimmer of the future, an autonomous skimmer system to optimize recovery operations.

BSEE and the USCG R&D Center test an ice management system for recovering oil in ice infested water.

US EPA studies the risks of responding to a Bakken crude oil spill at Ohmsett.

BSEE sponsors research for remote systems that track skimmers and wave conditions in real-time during a spill.

2013

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2017

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2014

BSEE conducts cold water dispersant comparison research.

Ohmsett staff develops a new test method to replicate neutrally buoyant oils in the water column. USCG R&D Center tests prototype systems to detect submerged plumes.

NPR features Ohmsett.

2016

BSEE and NOAA hold a joint study of oil slicks and emulsions using remote sensing. Ohmsett staff created the largest emulsion ever on the tank.

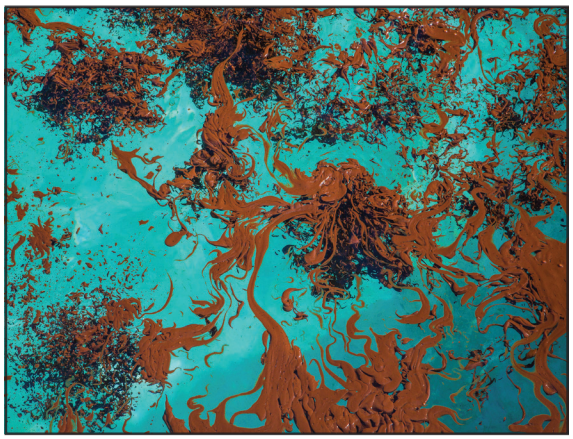
Creation of Stable Saltwater-in-oil Emulsions

In 2017 the Bureau of Safety and Environmental Enforcement (BSEE) and the Ohmsett staff initiated a project to expand the capability to produce and store stable, consistent saltwater-in-oil emulsions. These surrogate emulsions could then be used either immediately, or stored for later studies to determine their characteristics during marine oil spills. This work has culminated in the initiation of a formalized protocol, or Standard Operating Procedure (SOP) for producing stable water-in-oil emulsions at the Ohmsett facility.

In May and June 2016, during a related but separate study at Ohmsett, the staff created a large scale emulsified oil slick under simulated natural but controlled conditions. They released 400 gallons of Hoover Off-Shore Oil Pipeline System (HOOPS) crude oil on the test tank surface for weathering in saltwater during natural outdoor meteorological conditions, with UV exposure and evaporation. After four days, the staff started waves in the tank to create the shear and mixing energies necessary to affect emulsification of the oil. This emulsion was then used for a BSEE and National Oceanic and Atmospheric Administration (NOAA) funded remote sensing study of oil slicks and emulsions (Ohmsett Gazette, Fall/Winter 2016).

"The emulsions were successfully created to satisfy the needs of the remote sensing project; however the emulsions quickly destabilized and broke apart once wave energy ceased," said Alan Guarino, test engineer at Ohmsett.

BSEE and Ohmsett used the experience gained during the NOAA test program to advance the ability to create and store emulsions. Initial work took place in August 2017 where the staff subjected fresh HOOPS to long-term mechanically enhanced exposure to natural sunlight on saltwater. They monitored ambient weather conditions, relevant physical properties of the weathering oil, and operational data. "Approximately 32 gallons of weathered and UV photo-oxidized HOOPS was recovered and stored for use in subsequent emulsification experimentation," Guarino said.



Creating a stable and workable water-in-oil emulsion culminated in the initiation of a formalized protocol at Ohmsett.

In January and February 2018, the final phase of the test focused on drum-scale batch emulsification of the previously stored 32 gallons of HOOPS. The weathered HOOPS was mechanically mixed with test tank saltwater to produce two 16-gallon batches of emulsions. The batches were then stored for 30 days to demonstrate relative stability, one at ambient temperature in the warehouse; the other in a refrigerated container maintained at approximately 34° F (1.1° C).

"At the end of the 30-day storage period, only the chilled batch remained acceptable as a stable and workable emulsion," stated Guarino. "It was subsequently discharged onto the Ohmsett test tank, subjected to varying surface conditions, and observed for appearance, stability, and basic physical properties."

While the test series was based on HOOPS crude oil and one-time trials, it represents the baseline for the protocol. "This could lead to further proofing and refinement of the protocol; and an extension of the protocol to other oils," said Guarino.

Ohmsett Advocate Retires

Over the years Kurt Hansen, project manager for Oil Spill Prevention & Response at the U.S. Coast Guard Research and Development Center (RDC), has been a strong advocate of the Ohmsett facility. With 25 years and countless R&D projects behind him, Kurt retired from the USCG in March 2018.

Kurt first began his career with the USCG R&D Center in 1993 conducting research for marine inspections of vessels in New Orleans and the Great Lakes, performed operational test and evaluations of the new 47-foot motor life boats, and risk-based decision making for commercial vessels. In 1998 he was asked to help with conducting oil spill research because of his master's degree area of study. "My master's thesis was 'An Interactive Computer Model for Oil Spill Training' completed at the University of Rhode Island with the founders of Applied Science Associates [an environmental numerical modeling firm]," said Kurt. "I started in the R&D Center conducting oil spill research based partly on my knowledge of oil spill behavior and also due to the previous experts' planned retirement."

His oil spill research led to him conducting numerous projects at the Ohmsett facility. "My first project was in 1998 conducting tests on four fire booms, to see if they could still hold oil after being subjected to a burn test," commented Kurt. "I conducted all of the RDCs tests at Ohmsett from 1998-2012; and then alternated with Alex Balsley [project manager, USCG R&D Center] since then." The projects ranged from testing fast water response techniques, pumping systems, skimming systems, and a sample collection buoy; to

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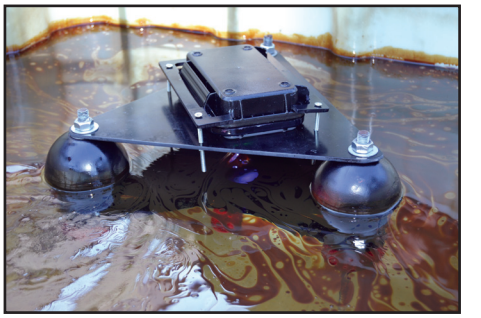
Sensors Measure Oil Thickness

Over the years much research has been conducted to develop the most innovative and efficient technologies for cleaning up oil spills. During work on a previous research project, engineers with the Bureau of Safety and Environmental Enforcement's (BSEE) Oil Spill Preparedness Division, Response Research Branch identified a technology gap in spill response. "It became evident that there was not a commercially available technology that could accurately measure oil thickness," remarked Kristi McKinney, a BSEE engineer.

In response to this technology gap, BSEE initiated a project to develop a sensor capable of measuring the thickness of various crude and refined oils on water and wirelessly communicating thickness information in near real-time. "The sensor was envisioned to be mounted to a skimmer, in the apex of a boom, or deployed from a vessel in the area of an oil skimming operation to give the responder immediate information as to whether or not the oil was thick enough to effectively recover," said McKinney. "It could also be used in a test environment to verify oil thickness."



A capacitive oil thickness sensor and a LED-based sensor, were tested to assess the ability of each prototype to accurately measure oil thickness.

To develop this technology, the American University of Beirut was contracted to design and fabricate a prototype which would be tested at Ohmsett. AUB engineers ended up developing two different sensors: a capacitive oil thickness sensor and a LED-based oil thickness sensor. Each was designed to measure a different range of thickness. The LED based sensor measures very thin oil layers with a range of 100um to 3mm. The capacitive sensor measures a range of 3mm to 100mm. The upper range limit of the capacitive sensor can be increased as desired.

The tests that took place during the week of November 27, 2017 were designed to assess the ability of these prototypes to accurately measure oil thickness. Each sensor was tested in multiple oil types and thicknesses in varying conditions including static and dynamic environments.

"The capacitive sensor is a contact sensor that uses an array of electrodes to measure the capacitance of the oil/water/air layers that it contacts as it is dipped into the fluid layer or as it moves through the fluid, as it might while mounted to a skimmer," explains McKinney. "The sensor uses this data to determine the location of each interface and from this, can calculate oil thickness. Because it is only locating interfaces, it does not require calibration for specific oil/water type." The prototype underwent three rigorous tests: dipping, forward moving mounted to the main bridge, and mounted to a skimmer while being subjected to wave conditions.

"The capacitive sensor tests at Ohmsett have demonstrated that it can operate without on-site calibration, for different types of oils, while being dragged, with waves and under different environmental conditions," commented Imad H. Elhajj, professor at AUB, Department of Electrical and Computer Engineering. "Accuracies under different conditions were of the order of the sensor resolution, which is very promising."

The LED sensor is a free-floating sensor that uses light absorption analysis to measure very thin layers of oil floating on the water surface with high resolution (up to a thickness of a few millimeters). According to McKinney, this sensor could be used to determine the presence of and measure the thickness of an oil sheen. This sensor does require calibration for oil type. It was tested using two oils, diesel and fresh HOOPS crude in both static and wave conditions.

"The LED based sensor tests have demonstrated that it can operate for different types of oils, while free-floating, with waves and under different environmental conditions, but requires calibration for the specific type of oil used," said Elhajj. "Conclusions about accuracies under different conditions were challenging to reach because of the difficulty of obtaining a ground truth at micro meter thicknesses. Both sensors have demonstrated great potential but there still exists several improvements."

The next steps in the development process will be for AUB to complete their data analysis and final report. "Based on the results we will determine how to move forward with further development of one or both of these technologies," commented McKinney.

Advocate Retires

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the evaluation of sunken oil detection and recovery equipment, suspended oil detection, and an ice management system.

And what are some of the highlights from his work with Ohmsett? "The first time evaluating fire booms that had been previously burned at a test facility in Mobile, Alabama. Another would be the several times the Ohmsett staff constructed a sea floor on the bottom of the tank to test detection and recovery of non-floating oils. At least one of the products we tested has been commercialized and was the cover feature in the January 2018 issue of Ocean News & Technology Magazine."

"Kurt always challenges the manufactures and researchers to advance innovations and capabilities within the industry. He has pushed many aspects of all projects to the limits – with a smile!" said Dave DeVitis, Test Director at Ohmsett. "We'll miss his enthusiasm and openness in research projects; but not the mess he leaves behind!"

The Ohmsett staff wishes Kurt all the best and hopes he enjoys every minute of retirement.

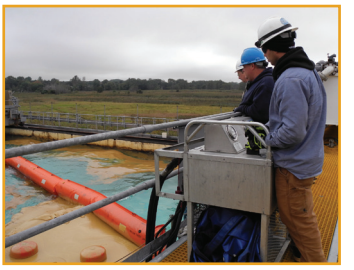
Oil Spill Response Strategies & Tactics Training

August 14-17, 2018

Ohmsett, in partnership with Texas A&M National Spill Control School, offers the hands-on training course you can't afford to miss! You will learn the strategies and tactics for successful spill response operations.

Course Topics:

- Fates & effects of spilled oil
- Oil skimmer & containment boom selection, use & recovery strategies
- Factors affecting oil spill movement
- Incident Command System (ICS)
- Shoreline Characterization (Introduction to SCAT)
- River & tidal inlet strategies
- Responder safety
- Hands-on skimmer operations
- And more!



When:
August 14-17, 2018
8:00 a.m. - 4:00 p.m.

Where:
Ohmsett
Leonardo, NJ USA

Register Today!
www.ohmsett.com

Phone: 732-866-7286

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The Ohmsett Gazette is published biannually by Ohmsett - The National Oil Spill Response Research & Renewable Energy Test Facility to update our readers on the facility's activities.

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