

The Ohmsett Gazette

The National Oil Spill Response Research & Renewable Energy Test Facility

Quasi-Natural Oil Weathering Protocol

The Ohmsett facility has specific capabilities to test how weathering changes oil's behavior in the aftermath of an oil spill.

Last September, BSEE Response Research Branch Chief Karen Stone and Ohmsett Senior Test Engineer Alan Guarino refined the protocol for quasi-natural weathering in the Ohmsett tank in collaboration with a combined academic and multi-agency study spearheaded by the Rural Planning Services (RPS) Ocean Science Group of Rhode Island. The goal of the project was to standardize oil weathering studies across an array of laboratories.

Natural weathering is the change in physicochemical properties of oil when it is spilled in water and exposed to natural processes such as solar irradiance, wind, and water chemistry. An emulsion occurs when water is suspended in an oil phase, often in the presence of an emulsifier, preventing the droplets from destabilizing, coalescing, and separating.

What's Inside

- 02 MC20 Oil Delivery
- 03 Simulating Arctic Conditions
- 06 Instrumentation Enhancements
- 07 New Ohmsett Website



Booms and water management tools allow for testing of multiple oils on the tank simultaneously.

Guarino explained the significance of studying weathering effects. “The longer [the oil] is out on the water, the more it changes, and usually those changes are not to the benefit of oil recovery or oil spill mitigation.”

The Ohmsett wave tank provides a unique venue to study oil weathering in realistic outdoor conditions.

The BSEE–Ohmsett team developed a quasi-natural weathering protocol based on Ohmsett wave-generating capabilities. Aliquots of three different crude oils were placed inside the Ohmsett tank with floating oil containment booms separating each oil type in different segments. The barriers were effective at confining the oil and allowed the oil to be exposed to the sun,

wind, and waves for extended periods of time.

“This tank affords the opportunity to do things on a more realistic scale, using waves that we can engineer in saltwater,” Guarino said. “And it’s outdoors and exposed to the elements.”

Continued on page 2.

Ohmsett Provides a Unique Venue to Study Oil Weathering

- Employs realistic outdoor conditions
- Tests how weathering can change oil's behavior in the aftermath of an oil spill

Continued from page 1.

Ohmsett staff can control oil type, wave form, and limited features of the tank, but the wind direction, UV radiation (changing if it is cloudy), temperature, and other natural phenomenon are observed but not controlled in this testing environment.

The weathering protocol was executed over a period of six to eight days, depending on the oil. During this time, meteorological conditions were measured including solar irradiance, wind speed and direction, air and water temperature, barometric pressure, relative humidity, and precipitation. The oil slicks on the surface of the water were

exposed to monitored waves for a period from 15 to 17 total hours.

Among the consequences of weathering are changes to the oil's viscosity, as well as its appearance, density, and other attributes. Viscosity is a measure of the resistance of a fluid to deformation by either shear stress or tensile stress.

Mississippi Canyon Oil Delivered to Ohmsett

Ten thousand gallons of Mississippi Canyon 20 (MC20) crude oil were delivered to Ohmsett in late April. The oil was captured from an active oil spill that was a consequence of Hurricane Ivan, which caused an underwater mudslide in 2004 that destroyed a Taylor Energy oil platform at the Mississippi Canyon 20 site in the Gulf of Mexico. The result was the longest ongoing offshore oil spill in history.

BSEE partnered with the Couvillion Group, the firm in charge of the oil spill cleanup since November 2018, for the collection and delivery of MC20 oil for research at Ohmsett. Ergon, the Couvillion Group's partner logistics company, transported the oil from Louisiana to the Ohmsett facility in New Jersey for delivery the week of April 21.

The physicochemical characteristics of MC20 oil as a mid-grade, sweet Louisiana crude oil make it a valuable addition to the Ohmsett oil inventory.

In preparation for the delivery of the MC20 oil, two ISO tank containers were purchased. The "ISOtainers" each have the capacity to hold approximately 6,600 gallons of oil. These ISOtainers were positioned in a spill containment area adjacent to the existing tank farm on site.



Staff fill two ISO tank containers at Ohmsett with 10,000 gallons of Mississippi Canyon (MC20) oil. The oil was provided to BSEE by the Couvillion Group.

According to Ohmsett Operations Manager Anthony Logothetis the oil will aid research in developing proper response methods for similar oil spills.

Ohmsett offers the unique opportunity to intentionally spill crude oil in a testing

environment that mimics ocean processes. MC20 is just one of the many crude oils that Ohmsett keeps in its oil inventory.

After the successful delivery of the MC20 oil in April, the Ohmsett staff is working with a laboratory to characterize the oil's chemical and physical properties.



The MC20 oil is now stored in two ISO tank containers that are in the secondary containment adjacent to the Ohmsett tank.

Ohmsett Receives MC20 Oil Captured from Active Oil Spill

- Unique physicochemical characteristics of MC20 oil make it valuable for testing
- Aids research in developing proper response methods for similar oil spills

Simulating Arctic Conditions at Ohmsett

Evaluation of oil recovery techniques in broken ice is one of the unique capabilities at the Ohmsett facility; however, the process of generating controlled ice fields has been historically labor intensive.

The objective of this project was to develop a system that could economically manufacture, meter by meter, 20-cm thick ice blocks that would be used to prepare a brash ice field for testing.

Len Zabilansky was the Principal Engineer of the “Enhancements to Ohmsett’s Testing Capabilities in a Drift Ice Environment” project. Grant Coolbaugh was the Project Manager with Kristi McKinny as the Project Manager and Contracting Officer’s Representative (COR) from the Bureau

Ohmsett Ice-Making Capabilities Simulate Arctic Conditions

- Utilizes a safe and efficient methodology to freeze ice blocks
- Evaluates oil mitigation techniques in ice-infested water

of Safety and Environmental Enforcement (BSEE).

“The project objective was to develop a safe and efficient methodology to freeze ice blocks to create the ice field for evaluating oil mitigation techniques in ice infested water,” Zabilansky said.

The first step was freezing the meter-by-meter ice blocks used to create the ice field. To accomplish this, custom 1-meter by 1-meter bins of high-density polyethylene (HDPE) were manufactured using a thermal vacuum forming process. The bins were tested and found durable enough to handle the weight and temperatures of freshwater ice.

The bins were filled with water that was prechilled using refrigerated glycol in a shell and tube heat exchanger to reduce the chiller refrigeration load. A stacking system was also designed to fit in refrigerated Conex boxes.

After the freezing process, the ice was moved into the Ohmsett tank. A single stack of frozen blocks was inverted using a pallet inverter to allow the ice bins to be lifted off the ice block and the individual block to be loaded on the lifting system.

“The goal of the enhancement was to move a stack of five blocks of ice into the tank in less than a five-minute cycle,” Zabilansky said.

The lifting system was loaded with five ice blocks and raised into position.



Oil flows through a simulated ice field formed from the manufactured ice.

Once at elevation, a tailgate was lowered to allow the ice to glide down into the tank.

A single operator with multiple remotes controlled the lifting system while monitoring the ice management process for safety and efficiency.

Standard Operating Procedures (SOPs) and Job Hazard Analysis (JHA) were created as part of this project to ensure future use of the system is within necessary operational and safety parameters.



New ice-making capabilities at Ohmsett provide a method to create reproducible ice fields that simulate arctic conditions. In this photo, ice blocks slide down the lifting system and into the tank.



WHERE WILL YOUR TECHNOLOGY TAKE YOU?

Prototyping is an important step in new product development for blue technology and marine energy devices. Whether you want to explore new designs or refine existing technologies, Ohmsett can assist in testing for maximum results in survivability, autonomous operation, maneuverability, and sensor integration.

In the relatively controlled and repeatable test environment of the outdoor wave tank, developers have access to expertise and tools for scaling new technology and validating engineering expectations under varying flow, position, and load conditions.

Facility

- ◆ Controlled reproducible conditions
- ◆ Test protocol development
- ◆ HD underwater video/viewing capabilities
- ◆ 32-channel National Instruments LabVIEW DAQ
- ◆ Onsite fabrication/workshop
- ◆ Welders
- ◆ Meteorological station
- ◆ Onsite divers

Wave-making Capabilities

- ◆ Programmable flap travel and frequency
- ◆ Wave spectrum capable
- ◆ Wave heights range: 5 to 76 cm
- ◆ Wave period range: 1.3 to 5.5 seconds
(Combinations of these parameters follow a sliding scale dictated by the mechanical limits of the wave generator. Spectral forms result from reflected energy and are transient.)
- ◆ Wave-damping beach system

Sensors and Instrumentation

- ◆ Acoustic and capacitance wave height sensors
- ◆ Pressure transducers
- ◆ Acoustic ranging
- ◆ Acoustic Doppler velocimeter
- ◆ Interfacial/surface tensiometer: Fisher Model 20
- ◆ In-situ fluorometry
- ◆ Particle size distribution (laser and optical)
- ◆ Load and strain gauges
- ◆ Torquemeter
- ◆ Surface thermal imaging
- ◆ UV spectrophotometer: Scilogex UV1000
- ◆ Accelerometers
- ◆ Viscometer: HAAKE VTiQ Air
- ◆ Coulometric Karl Fischer titrator: Metrohm 917
- ◆ Densimeter: D4 Mettler Toledo
- ◆ pH/ion meter: Metrohm 781
- ◆ Remotely operated vehicles: Deep Trekker and Video Ray

Wave Tank

- ◆ 203.3 meters (667 feet) long
- ◆ 19.8 meters (65 feet) wide
- ◆ 3.4 meters (11 feet) deep; 2.4 meters (8 feet) nominal operating water depth
- ◆ 9.8 million liters (2.5 million gallons) of water maintained at near open ocean salinity (28 to 35 ppt)
- ◆ Tow bridge speeds up to 3.1 meters/sec (6 knots)
- ◆ Indexed drive system
- ◆ Three equipment/instrumentation tow bridges

Contact

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Ohmsett is managed by the U.S. Department of the Interior's Bureau of Safety and Environmental Enforcement (BSEE) and operated through a contract with Applied Research Associates, Inc. (ARA).

Ohmsett – Basic Specifications	
Overseeing Organization	U.S. Department of the Interior’s Bureau of Safety and Environmental Enforcement
Hydrodynamic Testing Facility Type	Tow Tank, Wave Basin
Length (m)	203.3
Beam (m)	19.8
Depth (m)	2.44
Water Type	Saltwater
Cost (per day)	Varies; contact 732.866.7183
Special Physical Features	Accommodates full and meso-scale equipment under a realistic sea environment, multiple traveling bridges, underwater video, computer-controlled bridge and wave generator settings, onsite fabrication, viewing windows, scuba diver support, test equipment integration support.
Towing Capabilities	
Towing Capabilities	Yes (± 0.005 m/s)
Maximum Velocity (m/s)	3.1
Length of Effective Tow (m)	160
Wave-making Capabilities	
Wave-making Capabilities	Yes
Wave Height Range	5 cm to 76 cm Combinations of these parameters follow a sliding scale that is dictated by the mechanical limits of the wave generator. Spectral forms result from reflected energy and are transient.
Wave Period Range (sec)	1.3 to 5.5
Wave Maker Description	Dual bottom hinged flaps; independent hydraulic drive
Programmable	Yes: menu driven/user defined
Wave Making	Programmable flap travel and frequency; wave spectrum capable
Wave Direction	Uni-directional
Simulated Beach	Yes
Description of Beach	Downstream lift and diffuse; retractable
Control and Data Acquisition	
Description	National Instruments LabView
Number of channels	32-channel analog and digital inputs
Bandwidth (kHz)	DC level
Cameras	Yes
Number of Color Cameras	3
Camera Types	Underwater full-pan, tilt, zoom with data overlay
Available Sensors	Acceleration, flow, turbulence, velocity, force, temperature; others by request
Test Services	
Test Services	Yes
Utility Services Available	480 VAC, 3Ph; municipal water; steam; ice and chilling capability
On-site Fabrication Capability/Equipment	On-site fabrication/workshop; contracted local machine and fabrication
Special Characteristics	
Specializations, Capabilities, and Key Facility Attributes Not Covered Elsewhere	Available Sensors: Wave height; in-situ fluorometry; in-situ laser particle size distribution. Underwater ROVs, underwater acoustic and sonar instrumentation. Specialized characteristics: Hazardous materials operations. Deck cranes and contracted crane services.

Ohmsett Instrumentation Enhancements

Last October, Applied Research Associates Project Leader Brian Zadler spearheaded a series of critical enhancements to the Ohmsett facility's instrumentation, significantly elevating its capabilities and aligning with the latest IT security requirements. These upgrades include cutting-edge datalogging hardware, high-resolution cameras, and advanced control software, all designed to enhance the customer experience and streamline operations.

Key instrumentation system upgrades and the benefits include the following.

High-Resolution Camera System:

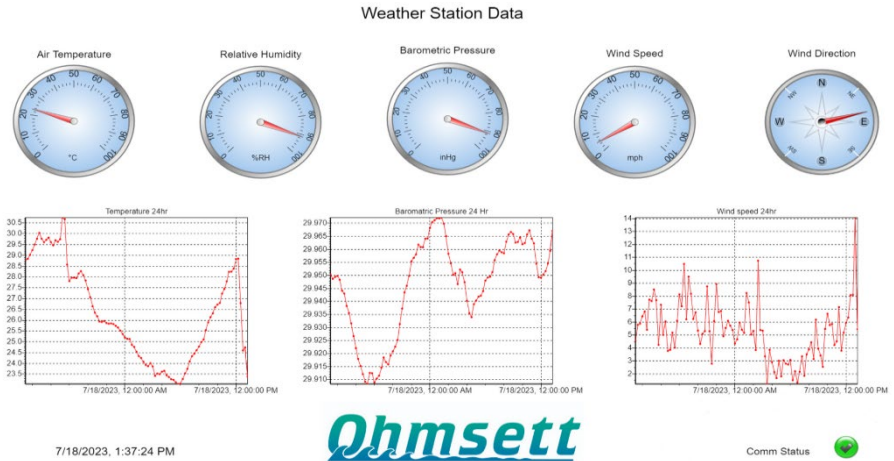
The installation of 13 high-resolution cameras at key locations across the tank marks a significant improvement in facility monitoring. Positioned strategically (six on the bridge house, two on the wave generator building, and five on the tower building), these cameras offer unparalleled clarity and coverage for viewing tests.

Real-Time Viewing: Customers can now view live footage of oil recovery tests and other trials directly from the tower or office building, provided IT access is arranged. This feature enables customers to witness experiments as they happen, providing a transparent and immersive experience.

Enhanced Safety and Efficiency: With live views of critical infrastructure, such as wave generation flaps and bridge cable spools, customers can be assured of operational safety. Any issues can be quickly identified and addressed, minimizing downtime and ensuring that tests are conducted smoothly.

Web-Based Software Viewer: This new software provides real-time updates on weather and tank conditions through kiosk displays located around the facility. Customers benefit from:

Immediate Access to Data: The software allows customers to monitor environmental conditions and operational metrics in real-time. This transparency ensures that customers can make informed decisions based on the latest data, enhancing their confidence in the testing process.



Realtime weather data is collected and displayed throughout the Ohmsett facility. This information provides a quick look at current conditions and a source of data to support outdoor experimentation.

Comprehensive Documentation:

All camera footage and environmental data are continuously logged to a secure on-site server. Customers receive this data along with test results and other documentation, offering a complete view of tests and facilitating thorough analysis of results.

Operational and Maintenance

Insights: The new camera system also aids Ohmsett staff in maintaining equipment and managing operations more effectively.

Efficient Troubleshooting: In the event of equipment malfunctions, staff can use live video feeds and recorded footage to quickly diagnose and resolve issues. This efficiency translates into fewer disruptions for customers and a smoother testing experience.

Future enhancements to the Ohmsett instrumentation system will include the following.

Additional Temperature Sensors:

Planned upgrades include adding temperature sensors to complement existing level sensors in the oil tanks. This addition will optimize oil transfer operations, further improving the precision and efficiency of testing procedures.

In-Line Water Monitoring Port:

An upcoming enhancement involves installing a water monitoring port on the tank recirculation line. This feature will

allow for real-time monitoring of parameters such as water height, salinity, and turbidity, providing customers with even more detailed insights into tank conditions.

Overall, these upgrades are designed to provide Ohmsett's customers with a more interactive, transparent, and efficient testing experience. The enhanced monitoring capabilities and real-time data access ensure that customers can track their tests closely, make informed decisions, and receive comprehensive documentation, all contributing to a superior and more reliable service.

Ohmsett Instrumentation Upgrades

- Includes new datalogging hardware, high-resolution cameras, and control software
- Provides real-time viewing of weather and tank conditions
- Improves the customer experience
- Delivers additional operations and maintenance information to Ohmsett staff

Ohmsett Website Modernization

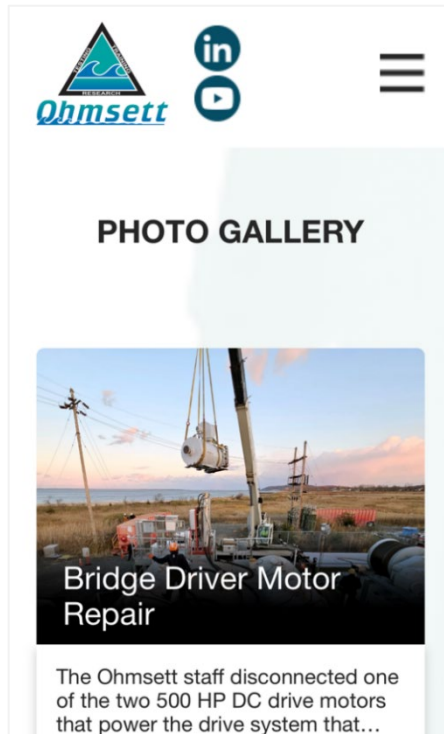
Last fall, ARA Software Engineer Dale Baker and BSEE Representative Ann Slaughter led the modernization of the Ohmsett website, upgrading it from an outdated HTML site to a versatile Drupal CMS site. This critical update enhances content and visual appeal, integrates Governmental information technology compliance, and provides more streamlined content management.

With the redesign, the Ohmsett website offers a more professional, modern look with a picture slideshow of the facility, links to the Ohmsett LinkedIn profile and YouTube playlist, and easy access to contact information, visitor forms, and published documents.

As previously mentioned, the website was designed in Drupal, favored by organizations such as NASA, which offers strong accessibility and security features that are crucial for the Ohmsett website under the Bureau of Safety and Environment Enforcement.

“With the new Drupal design, the site is future-proof,” Baker said. “Content updates, such as images and text, no longer require developers, making maintenance easier for all staff.”

The previous file-upload process was complex and required trained developers. Uploading files is now streamlined, allowing a broader range of staff to manage and update the site efficiently. Additionally, Drupal’s ongoing updates mean the site can easily adapt and expand with new features.



The new website is now compatible with mobile device browsers.

In addition, we are excited to announce that Ohmsett is also in the planning phases for a new archival video and document database that will be accessible through the website, providing even more resources for visitors.

Explore the enhanced Ohmsett website and stay tuned for the upcoming archival database at <https://ohmsett.bsee.gov>.



The Ohmsett Gazette is published biannually to update our readers on testing, training, and research activities at the facility.

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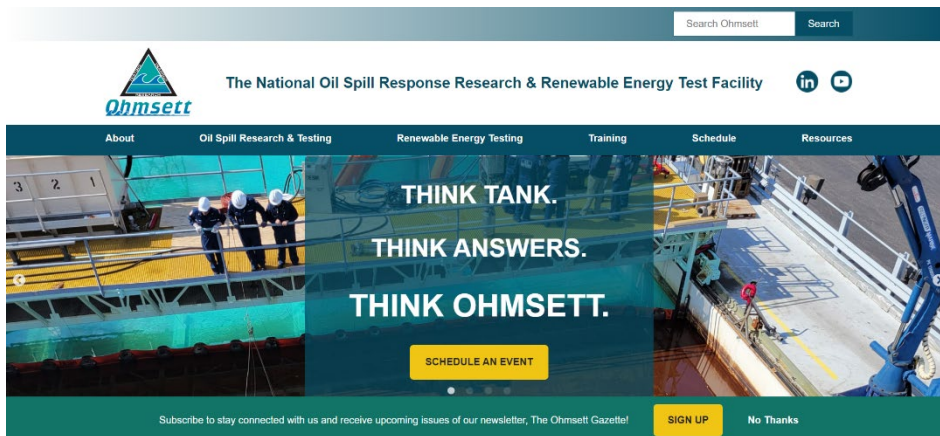
For more information on testing, training, and research opportunities, visit us at

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The newly updated Ohmsett website provides customers easy access to the scheduling calendar, facility contacts, and recent papers and presentations on oil spill research.

Prototype Testing Solutions

Think Tank. Think Answers. Think Ohmsett!

Prototyping is an important step in new product development for oil spill technology, marine energy systems, and blue technology. Whether it is to explore new designs or refine existing technologies, Ohmsett can assist in testing for maximum results in performance, survivability, autonomous operation, maneuverability, and sensor integration.

In the relatively controlled and repeatable test environment of the outdoor wave tank, developers have access to expertise and tools for scaling new technology and validating engineering expectations under varying flow, position, and load conditions.

- Full-scale testing with oil
- Skimming systems
- Containment boom & barriers
- Sensors
- Wave energy converters
- Protocol development
- Controlled marine environment
- Accurate and reliable results



We're here to support your testing and training needs. Call today to schedule your project! 732-866-7183.

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