Oil Spill Response Research & Renewable Energy Test Facility

The Ohmsett Gazette

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Ohmsett Celebrates 25 Years with BSEE

For 25 years, the U.S. Department of Interior's Bureau of Safety and Environmental Enforcement (formerly MMS) has managed the Ohmsett test facility as part of its oil spill research program ensuring the best and safest oil spill detection, containment and removal technologies are available to protect the U.S. coastal and ocean environments.

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

Look for our 25th Anniversary Timeline in the Spring issue of the Gazette where we will take you back in time to when Ohmsett lay abandoned, and how after a two-year $1.5 million restoration project, came back to life.

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Remote Systems that Track Skimmers and Wave Conditions During Operations

What if you could remotely track wave conditions during skimming operations? It could give you a better understanding of the environment in real-time during a spill incident and improve operations.

That is what AECOM of Gaithersburg, Maryland has set out to do. They recently developed a Geo-Referencing Identification (GRID) tagging system capable of long-term equipment tracking and equipped with a Wave Characterization Module (WCM). When mounted to a skimmer, the tagging system characterizes the motion of ocean waves, tracks the skimmer location, and transmits the information to the operators and to other personnel who may be at remote locations.

The Bureau of Safety and Environmental Enforcement funded the development of this project in order to advance the Technical Readiness Level of the

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A tagging system equipped with a wave characterization module is mounted to a skimmer to track the skimmer location and wave conditions during spill response operations.

Measuring Turbulent Wakes in Stratified Flows

As winds, temperatures, and tidal forces come together, they create the waves you see on the surface of the water. However, beneath the ocean surface, those same forces cause temperature and salinity variances that can cause changes in the water density with depth, i.e., stratification. When an object moves through a stratified flow field, it creates a turbulent wake.

For years, engineers in the field of fluid dynamics have studied wakes because they are a basic flow phenomenon associated with fluid flowing over an object or with the movement of an object through the water or air. Research has shown that the properties of wakes in stratified flows differ from those where stratification is not present.

A team from the Johns Hopkins University Applied Physics Laboratory (JHU/APL) led by Principal Scientist Dr. Alan Brandt, has been conducting an ongoing study to advance the understanding of turbulent wakes in stratified flows.

"Stratification also supports internal waves (i.e., waves beneath the surface) that cause mixing in the ocean and create additional drag on bodies," says Ken Kalumuck, JHU/APL principal scientist. "There is a well-known phenomenon called 'dead water' in areas, such as fiords, where fresh water flows out over salt water. A ship encountering this has a significant increase in drag due to its generating internal waves."

In order to further the understanding of the generation of large-scale wake turbulence relevant to ships and aircraft, JHU/APL conducted experiments in the controlled environment of the Ohmsett wave tank during the week of July 17, 2017. According to Kalumuck, of particular interest are high Reynolds number (Re) stratified wakes. The Reynolds number measures the ratio of inertial forces to viscous forces and is used to help predict flow patterns. As the Reynolds number increases, wakes become increasingly turbulent.

"The objective of the tests conducted this summer was to investigate the properties of the high-Re stratified turbulent wake of a towed sphere as a function of distance downstream," said Kalumuck. "These studies at Reynolds numbers 10^6 will provide insight into a regime of substantially higher Reynolds number than available from conventional laboratory studies and thus will be relevant to full-scale ocean processes."

During the experiments, the tank temperature was naturally vertically stratified due to solar heating at the surface. The main and auxiliary bridges were locked in tandem and moved at speeds up to 3 meters per second, giving desired Reynolds numbers greater than 10^6.

Stratified turbulent wake evolution data were collected by towing an 18-inch diameter sphere attached to the main bridge using a vertical sting. Velocity and temperature sensors were suspended on a rigid vertical frame on the linked auxiliary bridge that was positioned at various distances behind the main bridge. "Measurements of the turbulent velocity and temperature fields, and thus density field, were collected at various distances downstream of the sphere," said Kalumuck. "Three components of the turbulent velocity field were measured using four Nortek Vectrino Acoustic Doppler Velocimeters (ADVs) at four vertical locations. The temperature field was measured using an array of 12 fast-response thermistors that were also vertically spaced. The stratification (vertical temperature and salinity profiles in the tank) before and after each run was measured with a conductivity-temperature-depth probe."

"The data are currently being pro-

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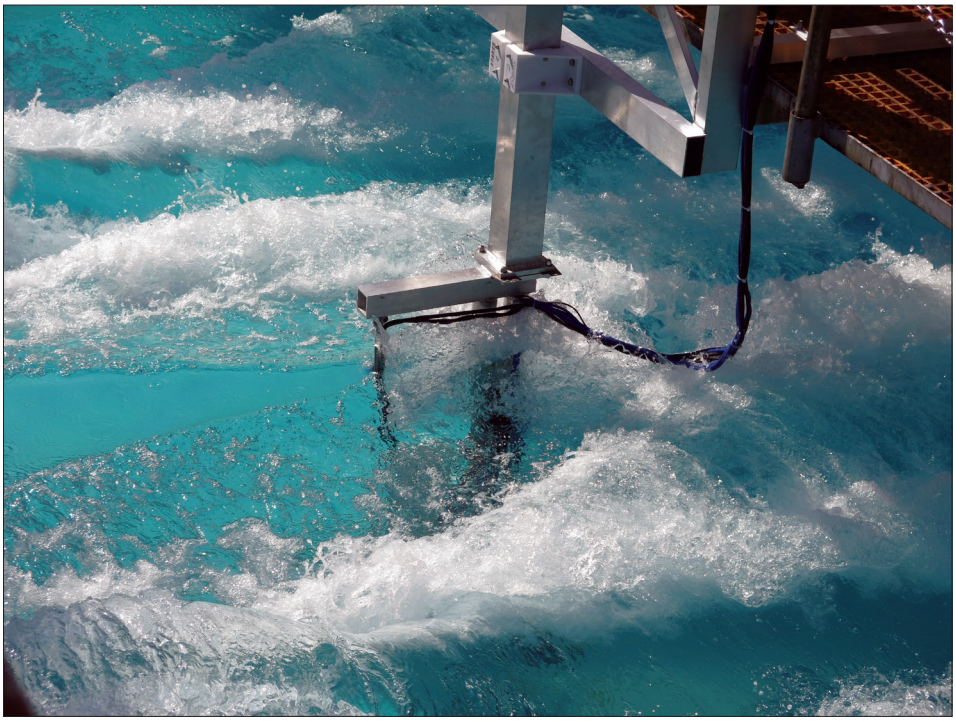


Researchers investigated the properties of the high Reynolds number stratified turbulent wake of a towed sphere as a function of distance downstream.

The Tale of Two Skimmers

It all started with the desire to increase mechanical recovery capacities along with the ability to recover oils with various viscosities. Elastec collaborated with the University of California's Bren School of Environmental Science and Management to develop the patented Grooved Oil Skimming Technology. Ten years ago, they applied the technology to their smooth drum skimmers and developed the Magnum 200.

After the Deepwater Horizon incident in 2010, Elastec added the Grooved Oil Skimming Technology to oleophilic discs and won the Wendy Schmidt Oil Cleanup X CHALLENGE. Since then, Elastec has applied its award winning grooved disc skimmer technology to a series of new skimmers. The latest is the X30 Grooved Disc Cassette prototype for the collection of light oils that can perform in stationery and advancing modes from the bow or the side of a vessel.

Technical representatives from Elastec came to Ohmsett in June to not only test the performance of the X30, but to determine the nameplate recovery rate and corresponding recovery efficiency of the Magnum 200.

According to Jeff Cantrell, CEO of Elastec, the objectives were to test the recovery rate and efficiency of the Elastec X30 Grooved Disc Cassette for light oil in advancing mode, up to two knots, and to determine its performance in high currents.

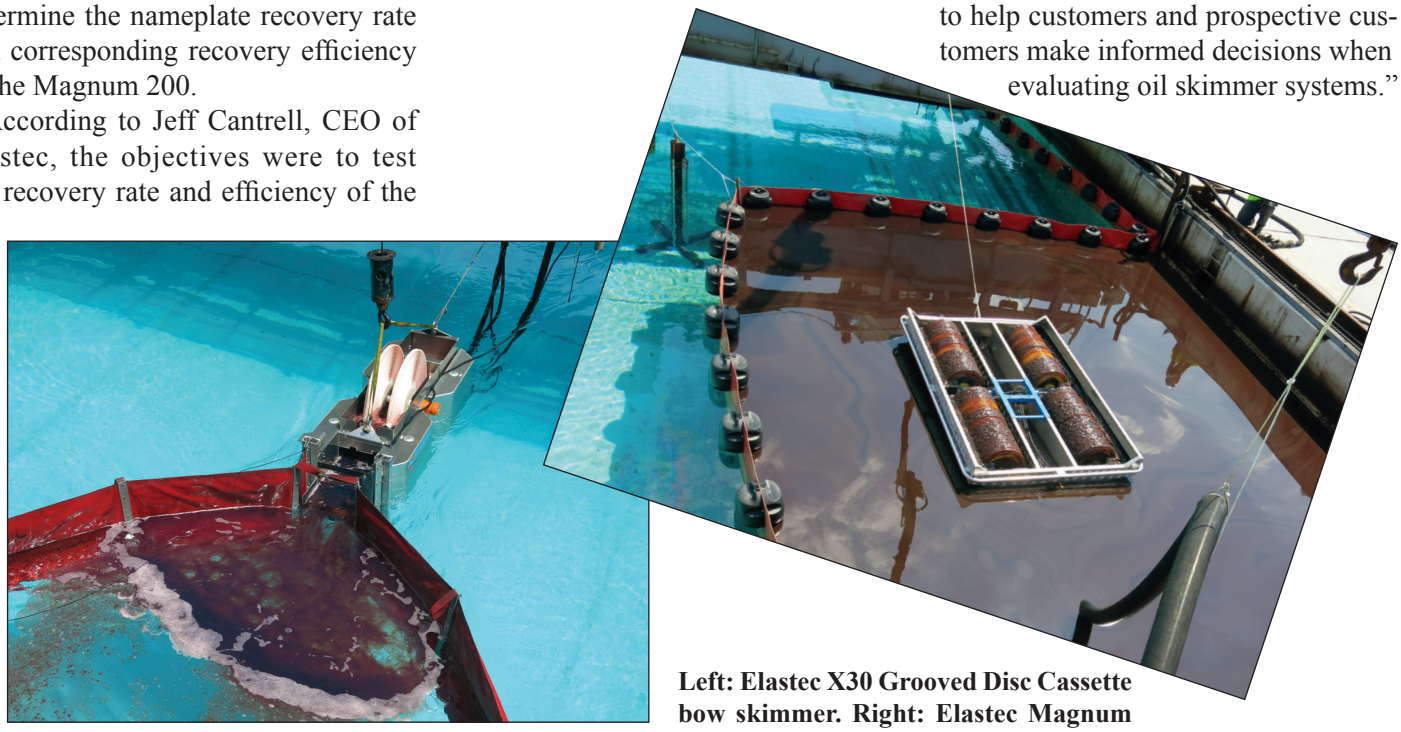
Fortunately for the Delaware Bay and River Cooperative, the X30 was found suitable as a possible addition to their skimmer inventory. "We wanted to take advantage of the Elastec's grooved disk technology that won the Wendy Schmidt Oil Cleanup X CHALLENGE," stated CEO Rich Gaudiosi. "Our bow collectors are brushes for heavier oils. With the increased transportation of lighter oils in our Area of Interest, we needed to add an advancing light oil skimmer to our inventory. The X30 is more efficient at recovering light oils than our current brush bow collector skimmer."

During the evaluation, the X30 bow skimmer was attached to the Ohmsett main bridge and towed in the tank. The Elastec team anxiously observed the oil flowing into the skimmer sump with the hope that the results were what they anticipated – a high recovery rate with very little water.

"We were very pleased with the results, considering the nature of light oils. They spread faster than heavier oils," said Cantrell. "The results verified our objective to develop a commercial X30 Grooved Disc Cassette as a light oil mechanical recovery option to augment heavy oil brush skimmers."

Additionally, tests were performed on the Magnum 200 drum skimmer according to the ASTM F2709 *Standard Test Method for Determining a Measured Nameplate Recovery Rate of Stationary Oil Skimmer Systems*. It was anticipated the skimmer could achieve a recovery rate in the 400 gpm range. Using an ASTM Category I oil, the skimming system was placed in a boomed area of the Ohmsett tank and evaluated during a series of three repeatable tests.

"Our objective with the Magnum 200 Grooved Drum skimmer was to verify that the nameplate claims we make are supported (or not supported) by conducting unbiased testing at Ohmsett," stated Cantrell. "Elastec funds the expense of the independent testing of our products to help customers and prospective customers make informed decisions when evaluating oil skimmer systems."



Left: Elastec X30 Grooved Disc Cassette bow skimmer. Right: Elastec Magnum 200 Grooved Drum skimmer.

Personnel Train in Common and Critical Tasks of Oil Spill Response

For more than 20 years, Ohmsett has partnered with Texas A&M National Spill Control School to offer hands-on Oil Spill Response Strategies and Tactics training for the response community. This year was no exception with two classes being held; one in May and one in August.

During the August 15-18 training session, 16 participants gathered to learn decision-making and responder skills essential for efficient oil spill response and recovery operations. The attendees represented personnel from the Canadian Coast Guard, U.S. Coast Guard, the Bureau of Safety and Environmental Enforcement, and CHS Laurel Refinery.

With the participants coming from different parts of the globe, the training program created an opportunity for continued discussions and achievements, while the attendees networked to maintain and enhance professional relationships within the response community.

Starting with classroom instruction, the focus was on recent developments in the science of oil spills and response operations. These included: current guidance on dispersants and surface cleaning agents; guidance on in-situ burning; special considerations in fast water response; and remote sensing.

"With the classroom instruction, I gained some lessons learned that I can apply on the job," said Pam McLaren, an environmental response specialist with the Canadian Coast Guard.

The participants then went out to the Ohmsett test basin where they observed oil behavior, containment strategies, and recovery demonstrations using various skimmers. The hands-on tank exercises provided them with the opportunity to take turns operating a skimmer to collect real oil from the test basin in both calm and harbor chop conditions.

Hands-on training included skimming operations and SCAT exercises.

"Through these exercises, not only do the students practice the removal of oil with mechanical recovery methods, they are also able to see how oil behaves and learn how to channel the oil for recovery," said John Delia, Ohmsett program manager.

"It was nice to see a skimmer used and have the opportunity to operate it in a controlled environment," stated Quinn Gallagher, environmental response specialist with the Canadian Coast Guard. "It was good to work with people who use the skimmers on a regular basis."

Additional hands-on training included a field trip. "We took the class to Horseshoe Cove at the Sandy Hook National Seashore where we conducted a Shoreline Cleanup Assessment Technique (SCAT) exercise," said Tony Wood, director of the National Spill Control School.

SCAT is a systematic method for surveying an affected shoreline after an oil spill, where teams make specific cleanup recommendations designed to meet cleanup goals and operational objectives. To mimic an impacted area, the trainers placed simulated tar patties along the shoreline where the participants conducted SCAT exercises.

"This training gives the students an opportunity to take what they have learned in the classroom, and apply those principles to an actual shoreline," said trainer Brian Bryant of Clean Harbors Cooperative. "They got a chance to investigate an impacted beach and document on SCAT forms all of the information needed to show where the oil is located and effectively assist in cleanup efforts."

"We had another successful Oil Spill Response Strategies and Tactics course. Attendees were able to enjoy some quality time with skimmers on the tank, conduct a field planning exercise, and some were even able to catch a night game between the Yankees and Mets in New York City," said Wood.

Training Builds Confidence and Competence

Clean Harbors Cooperative (CHC), located in Carteret, New Jersey, conducted hands-on spill response training at Ohmsett during the week of October 16, 2017 for its member organizations including the Phillips 66 Bayway Refinery Spill Response Team and the New Jersey Department of Environmental Protection.

With classroom instruction and hands-on exercises, the course provided the attendees with essential skills and knowledge for effective spill response operations.

The course consisted of classroom topics such as the Bayway Refinery's Tactical Response Plan, development of ICS-204's for Environmentally Sensitive Area protection strategies in the Arthur Kill waterway, booming and skimming operations, SCAT principles, past spills and lessons learned, response strategies, safe navigation, anchoring, and safety data sheet review.

Attendees honed their skills in heavy and light oils while operating a wide array of brush, disc, and drum skimmers.

"The training provided students with information on the latest applications of response technology, and provided a hands-on approach to learning response equipment and how to operate them in an actual spilled oil environment," said Dennis McCarthy, CHC manager.

Skimmer and Wave Tracking System

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system by demonstrating the capability of the GRID tagging system and the WCM in a simulated marine environment at Ohmsett.

"This project will enhance the latest generation of GRID technology and allow local oil spill responders to measure wave characteristics to finesse their skimming operations," said Karen Stone, BSEE oil spill response engineer. "It will also transmit data to incident commanders during spill operations to allow for real-time operational awareness."

The AECOM team, led by Ben Schreib, came to Ohmsett the week of September 5-8, 2017 to evaluate the GRID system mounted to a skimmer in wave conditions in the test basin. AECOM and their subcontractors, Midstream and Envigia, also developed a free-floating WCM-buoy to calculate local wave conditions.

During the evaluation, WCM/GRID tagging system was attached to a commercially available skimmer and two WCM-buoys to identify wave height, wavelength and period while subjected to varying wave conditions. Both the weir skimmer and the WCM-buoys were placed in the test basin and lightly tethered to the main bridge to prevent them from drifting into one another or the tank walls.

With the support of the Ohmsett technicians, the wave generator settings were programmed for each test to replicate a wide variety of wave conditions, and the beach system at the north end of the test basin was raised and lowered as required to generate regular waves as well as harbor chop conditions.

In order to collect comparative wave data, the two WCM buoys were operated separately in the same area as the skimmer. In addition, the team used a wave height reference pole with indices positioned near the skimmer for visual comparison of wave height for each test. Through a mesh network over WiFi, AECOM was able to communicate the skimmer position and wave information to a tablet with a custom-made user interface application and via satellite to a web-based GIS interface platform.

"We wanted to determine if the algorithms in the GRID units were accurately measuring wave conditions. Ohmsett has a pretty good sense of the exact wave height, length, and period, so we could compare the GRID units to reality," said Stone. "This will allow the AECOM engineers to incorporate a 'correction factor' during certain wave conditions to more accurately measure ocean conditions."

Recovering Oil as the Slick Diminishes

In a continued series of experiments for obtaining basic research data on skimmer performance, the Bureau of Safety and Environmental Enforcement (BSEE) conducted a diminishing slick thickness test in July 2017. The objective was to evaluate the performance of a self-adjusting weir skimmer for oil recovery rates and oil recovery efficiencies while recovering oil from incrementally thinner slicks. The previous test series focused on oleophilic type skimmers; however since the weir type skimmer is widely used, this assessment was of interest to BSEE.

The test was conducted using the guidelines of the ASTM F2709 *Standard Test Method for Determining a Measured Nameplate Recovery Rate of Stationary Oil Skimming Systems*. This standard specifies testing in an initial three inches of oil to provide near ideal conditions for skimming in order to establish baseline performance data. However, in actual oil spill response operations, it cannot be assumed that a skimmer will be recovering in a three-inch thick slick. In many cases, it is likely a skimmer would operate in a thinner thickness.

"It is important to understand how a skimmer's performance is affected when operating as slick thickness diminishes," says Kristi McKinney, an engineer for the Oil Spill Preparedness Division of BSEE.

Data was collected using a DESMI TERMITE skimmer which provides a lightweight package that can skim and transfer oils with a wide range of viscosity. The weir depth automatically adjusts to match the discharge rate of the offload pump or the rate at which the product is being removed from the skimmer hopper. This design allows the operator to optimize recovery efficiency at varying slick thicknesses for all flow rates.

In this test series, the TERMITE recovery rate and efficiency was quantified per ASTM F2709 guidelines while recovering from 3 to 2 inches of oil. "For the study, recovery rate was considered the dependent test parameter and valid for corresponding recovery efficiencies at or above 70%," states Dave DeVitis, test director at Ohmsett. "Performance tests in thinner slicks included thicknesses of 2, 1, ½ and ¼ inches during which the slicks were replenished and maintained at a constant thickness. Resultantly the data obtained provided a recovery rate versus slick thickness curve."

This data along with the results previously obtained during the oleophilic skimmer tests will be available on www.BSEE.gov under research project 1072. A master list of research projects conducted by BSEE can be found on https://www.bsee.gov/what-we-do/oil-spill-preparedness/oil-spill-response-research/master-list-of-oil-spill-research.

During the diminishing slick thickness test, the skimmer recovery rate and efficiency was quantified using the ASTM F2709 guidelines while recovering from 3 to 2 inches of oil. Performance tests in thinner slicks included thicknesses of 2, 1, ½ and ¼ inches.

Turbulent Wakes

Continued from page 2

cessed and analyzed to provide insight into the evolution of the stratified wakes as a function of the distance downstream of the towed sphere. Depending on findings, additional testing may be conducted," Kalumuck commented. "It is hoped that the results will provide better understanding of the phenomena as well as data against which to benchmark numerical models."

This study was supported by the Office of Naval Research Turbulence and Stratified Wakes Program.

Local Students Tour Ohmsett

A group of students from the Vision Program at Middletown High School in New Jersey visited Ohmsett on June 1, 2017 to gain an understanding of the various opportunities in the trades that are available to those who are not pursuing college studies.

Ohmsett Health and Safety Specialist, Rich Naples guided the students through a tour of the facility which included the Oil/Water Chemistry Lab, High Bay workshop area, wave generator, the filtration building, and the control tower. He explained the different types of work the staff performs in support of the operation and maintainence of the facility, as well as the testing, training and research programs.

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

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.....Dave DeVitis, Alan Guarino

National Science Bowl Team Learns About Oil Spills

On August 18, 2017 four talented students from the Marshfield Wisconsin High School who competed in the National Ocean Science Bowl toured Ohmsett. The team came in 2nd place out of 392 high school teams, representing 33 states, competing to test their knowledge of ocean-related topics.

During the facility tour, they learned about the capabilities and the variety of tests performed at Ohmsett. The tour included demonstrations of how technology such as skimmers and dispersants are used by oil spill responders during recovery operations, and how we generate various types of waves used during testing.

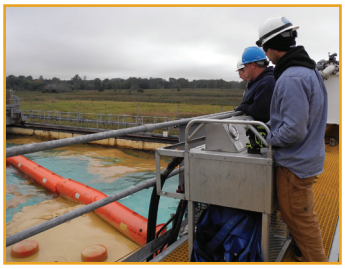
Oil Spill Response Strategies & Tactics Training

May 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:
May 14-17, 2018
8:00 a.m. - 5:00 p.m.

Where:
Ohmsett
Leonardo, NJ USA

Register Today!
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Phone: 732-866-7286

Ohmsett

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