Alternative Oil Spill Response Technology: Results from the *Deepwater Horizon* Response

Michael J. Cortez, Manager of Oil Spill Response Technology, and **Hunter G. Rowe,** Deputy Manager of Oil Spill Response Technology, BP's Crisis & Continuity Management/Safety & Operational Risk Group

Oil spill response technology progressed significantly as a result of innovations and experience gained during the *Deepwater Horizon* response in the Gulf of Mexico in 2010, particularly in areas related to surveillance, controlled in-situ burning, booming, skimming, mechanical oil/water separation, and sand cleaning. During the response, the Alternative Response Technology (ART) team, under the direction of the Unified Area Command, screened approximately 43,000 spill response technology ideas submitted by the public. The ART team's work was done alongside, and consistent with, the US federally directed Interagency Alternative Technology Assessment Program.

The ART team field tested or evaluated in detail about 100 of the 43,000 ideas, resulting in at least 45 ideas being recommended for use in response operations. The successful ideas are listed in **Table 1.**

Of significance was the number of ideas that came from other industries and were adapted to spill response needs. For instance, the team field-tested at least 10 sand cleaners for beach cleanup, and the most notable was the Sand Shark (**Fig. 1**), a technology that was adapted from the road maintenance industry (material loader). The Sand Shark could clean a mile of beach per day, using its sifting process, down to a depth of approximately 12 in.

Another successful sand-cleaning technology was the Gravely Rapid E Sand Cleaner. The Chicago-area Gravely Co., which makes industrial lawn mowers, had adapted its technology into a one-person sand-cleaning machine that could get in and out of hard-to-access beach areas for cleanup. Its use was proposed by a distributor in Illinois, who saw the larger sand-cleaning

TABLE 1—ALTERNATIVE RESPONSE TECHNOLOGY SUCCESSES
Ideas recommended for use by responders

OFFSHORE

- Controlled In-Situ Burning [Spiltec]: Extended, field-scale implementation of in-situ burning techniques previously planned and practiced only on a limited basis.
- Laser Fluorometer Submerged Oil Detection [EIC Laboratories with funding from the US Coast Guard]: Uses laser fluorescence polarization to detect nonfloating oil.
- Coda Octopus 3D Sonar [US Coast Guard R&D]: In conjunction with EIC's Laser Fluorometer, uses proprietary underwater sonar technology for detecting nonfloating oil.
- Side Scan Sonar [Fairweather Science]: Calibration and use of side scan sonar to detect nonfloating oil.
- Acoustic Doppler Current Profiler [T&T Marine]: Calibration and use of ADCP to detect nonfloating oil.
- Big Gulp Skimmer [LAO Services]: Barge equipped with wide weir skimmer and settling tanks for high-volume open water oil skimming.
- Wave Glider [Liquid Robotics]: Autonomous, self-propelled, remotely steered vehicle with capability to carry a wide range of monitoring instruments.

NEAR SHORE

- Tar Ball Net [Tobu Services]: Modified shrimp net for capturing tar balls.
- V2 Vyper Platform [Vyper Adams]: Four-wheel drive vehicle with superior stability and light footprint, for use in sensitive beach and shallow water operations.
- Parachute Surf Skimmer [Helen Synergy Group]: Hand-deployed pond/pool skimmer adapted for use in recovering shallow water tar balls.
- Helicopter Boom Removal [Various sources]: Use of helicopter and grapple to vertically retrieve boom stranded in sensitive shoreline areas [e.g., marsh].
- Yates Boom Cleaner [Yates Construction]: Use of dishwasherlike assembly line transport and spray system to streamline used boom cleaning operations [improved cleaning rate].
- Boom Blaster [Gulf Coast Environmental Resources]: Use of car wash concept [cleaner, spray, brushes] to streamline used boom cleaning operations [improved cleaning rate and reduced manpower].
- Opflex Buoyant Open-Cell Foam [Cellect Plastics]: Bouyant polyolefin foam with high absorbency; reusable and available in multiple forms [pad, boom, pom pom, etc.].
- Low-Pressure Marsh Flusher [Core 4 – KEBAWK Group]: Barge equipped with low-pressure water wand for gently irrigating marsh areas to mobilize oil for recovery.
- Truxor Amphibious Tool Carrier [Megator]: Versatile, trailerable amphibious vehicle capable of tool transport, skimming operations, raking, pumping, and other uses.
- Water Curtain [D02E Wastewater Treatment]: Use of directed aeration pumps to create water positive flow barrier for protection of inland waterway from advancing floating oil without impeding vessel ingress/egress.
- Oil/Water Separation [Ocean Therapy Solutions]: High-volume centrifugal oil/water separator.
- "HOSS" Heavy Oil Skimming System [VOO Captain Gerry Matherne]: Custom-designed frame and netting device deployed from the vessel for highly efficient tar ball recovery.
- X-Tex Silt Barrier Fence [UltraTech] and Eco-Barrier Fence [Trinity Industrial Services]: Hydrophilic textile material installed as in-water "fences" to stop and divert oil approaching shorlines.

Alternative Response Technology API Study-Progressing Learnings

Michael J. Cortez
BP America-Oil Spill Technology Manager
RRT-3 Presentation- November 6, 2013

API Alternative Response Technology Working Group Report

- Commissioned by API as part of its Sept 2010 JITF Study
  - *Capture learnings from Macondo Incident*
  - *Propose ARTES enhancements based on the learnings*
- Team composition: ARTES team members from Macondo (USCG, OSPR, Obrien's, various OSR consultants, BP) along with NOAA, EPA and other industry entities
- Kicked off study in Dec 2011; completed and endorsed July 2013
- Proposed RRT & NRT presentations for late 2013 to review the conclusions & recommendations
- Request RRT-3 Endorsement of proposed changes to ICS

Macondo experience

- 120,00+ total submissions
- Multiple technical reviews required
- Conventional & non-conventional ideas submitted
- Submissions via phone, fax, e:mail, internet, walk-up
- From 100 countries in 88 languages
- Multiple submission channels (PIERS, EPA, IATAP, LABOEC)
- Multiple Incident Command Posts and a Unified Area Command
- Seek out Operational needs
- Field Tested 100 new technologies; 45 were proved and implemented
- Limited exposure within Planning cycle increased testing logistics difficulties

Alternative Response Technology Overview

Oil Spill Risk Management WMU-IMO Conf.
March 7-9, 2011 Malmo, Sweden

Michael J. Cortez
Gulf Coast Restoration Organization

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List of Recommended Items (Successes)

Offshore

- Laser Fluorometer Submerged Oil Detection (Oscar)
- Coda Octopus for Submerged Oil Detection
- Big Gulp Skimmer

Near Shore

- Tarball Net and Test Net
- V2 Vyper Platform for Marsh and Shallow Water Skimming
- Parachute Surf Skimmer
- Helicopter Boom Removal
- Yates Boom Cleaner
- Boom Blaster (Boom Cleaning Machine)
- Opflex Buoyant Open-cell Foam
- Low Pressure Marsh Flusher
- Amphibious Tool Carrier (Truxor DM 5000)
- Water Curtain (DO2E Wastewater Treatment)
- Oil/Water Separation: Ocean Therapy Solutions
- Bio Based Absorbent (Nature's Broom) – oil cleaning on beach/marshes
- Bio Based Absorbent (Nature's Broom) – decon/cleaning procedures
- Heavy Oil Skimming System (HOSS)
- Silt Barrier Fence (X-Tex®)
- Eco-Barrier Trinity Fence
- RAT (Rapid Attack Tactic) for Skimming

Onshore

- Bio Energy Gasifier
- Green Earth Sand Cleaner
- Petromax Sand Wash
- M-I SWACO Sand Cleaning
- STS-101 Solids Washing
- Eco-Oil Vortex (Beach Sand Washer)
- Gravely Sand Cleaner
- Ergonomic Beach Cleaning Tool (EZ-Zacks)
- Sand Shark 3000 LeeBoy for Beach Cleaning
- Ozzies OPP-200 for Beach Cleaning
- Beach Tech 2000 & 3000 for Beach Cleaning
- Cherrington 4600 & 5000 for Beach Cleaning
- RECOVERIT from GOLF Energy Service
- Clean Beach Technologies, Inc (Beach Restoration System™)
- Chemstation Degreaser
- Biomass Based Sorbent (Show Me Energy)
- Field Analytical Methods (SiteLab Corporation)
- REUSE recycling

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2. BP Has Shared Spill Response Innovations and Lessons Learned.

BP has proactively shared innovations and lessons learned from the Response with others to advance spill response capabilities. During the Response, BP actively engaged with stakeholders to provide information about Response tools and techniques. BP engaged the community through meetings, the internet, community outreach centers, state and local officials, and other channels. BP shared information with its Unified Command partners, including through weekly technology updates.[56] The ART team also prepared a Final Report documenting its work, which they provided to the Unified Command.[57]

BP also took the initiative to share spill response innovations and learnings from the Response with those outside of the Unified Command. BP prepared and published a report, titled *Deepwater Horizon Containment and Response: Harnessing Capabilities and Lessons Learned*, documenting the advancements and lessons learned during the Response.[58] BP representatives traveled around the world, making dozens of presentations to industry groups, governments, and others about learnings from the Response.[59] BP representatives also took lead

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54 VanHaverbeke Report at 17.

55 Lubchenco et al., *Science in Support of the Deepwater Horizon Response*, (Ex. 12500) at 6; *Alternative Oil Spill Response Technology*.

56 *See, e.g.*, ART Updates (HCG904-003788; EPE082-007079; HCE912-003408; US_PP_USCG2_1916822; US_PP_NOAA146389).

57 *ART Program Final Report*; 6/10/10 J. Best Email to Coast Guard personnel (HCG952-003603).

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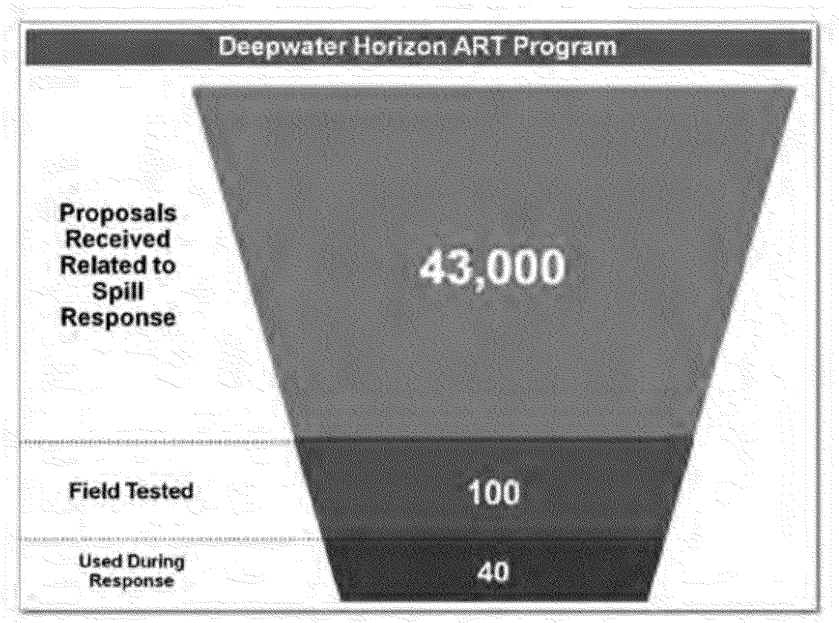

Figure 2: *Deepwater Horizon* ART Program By the Numbers

The Unified Command implemented spill response technologies identified through the ART Program for use in off-shore, near shore and shoreline operations during the Response, as summarized below.

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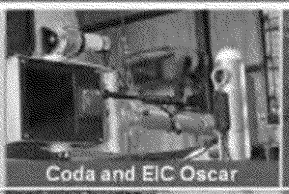
Alternative Response Technology Innovations

Offshore

- Laser Fluorometer Submerged Oil Detection
- Coda Octopus 3D Sonar
- Side Scan Sonar
- Acoustic Doppler Current Profiler
- Big Gulp Skimmer
- Wave Glider

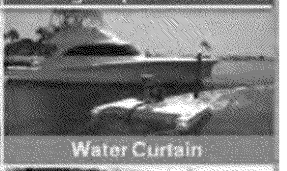

Coda and EIC Oscar

Big Gulp Skimmer

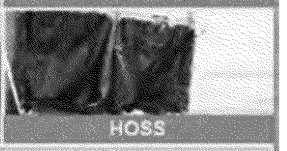
Near Shore

- Tar Ball Net
- V2 Vyper Platform
- Parachute Surf Skimmer
- Helicopter Boom Removal
- Yates Boom Cleaner
- Boom Blaster
- Opflex Buoyant Open-Cell Foam
- Water Curtain
- Low-Pressure Marsh Flusher
- Truxor Amphibious Tool Carrier
- Oil/Water Separation
- "HOSS" Heavy Oil Skimming System
- X-Tex Silt Barrier Fence and Eco-Barrier Fence

Boom Blaster

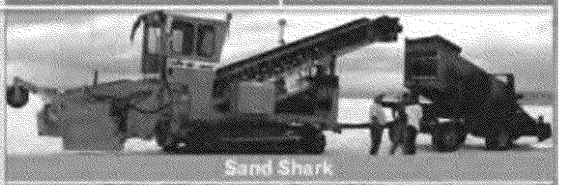

Water Curtain

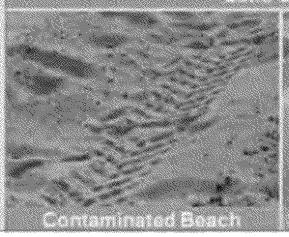
X-Tex Silt Barrier


HOSS

Onshore

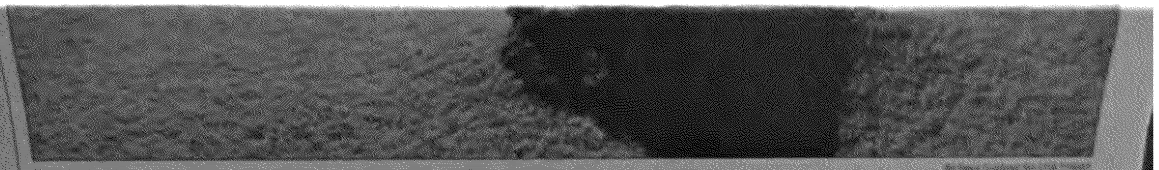
- Reflectance Spectrometer
- Bio Energy Gasifier
- Booms to Bumpers
- Soft Boom Recycling
- Tar Balls to Asphalt
- Green Earth Sand Cleaner
- Petromax Sand Wash
- M-I SWACO Sand Cleaning
- STS-101 Solids Washing
- Vortex Beach Sand Washer
- Big Green Sand Machine
- Gravely Sand Cleaner and Barber Sand Man
- EZ-Zacks Ergonomic Beach Cleaning Tool
- Sand Shark
- Ozzies OPP-200
- Beach Tech 2000, 2800 & 3000 for Beach Cleaning
- Cherrington 4600 & 5000 for Beach Cleaning
- RECOVERIT
- Beach Restoration System
- ChemStation "7248" Degreaser


Sand Shark


Contaminated Beach

Sand Shark Cleaned Beach

USA Today Business Section Cover – Nov 2010



On the beach: Tar balls are scattered on Horn Island off the Mississippi coast. During the oil spill, BP got thousands of ideas for containing and cleaning up oil.

Ideas poured in for BP oil spill cleanup

No magic bullets, but tactics that worked could improve industry's response next time

By Julie Schmit
USA TODAY

HOUSTON — As oil spewed from the BP well in the Gulf of Mexico last summer, so did ideas on how to stop it and clean it up.

BP received about 123,000 ideas, 80,000 of which had to do with plugging the leak and 43,000 on ways to clean up the oil. The ideas came in crayon from 9-year-old boys, in shaky handwriting from 90-year-old men and from scientists, inventors and engineers — even actor Kevin Costner.

Workable: Scott Smith of Cellect Technologies shows his oil-absorbing Opflex foam.

Cover story

Most of the ideas weren't workable: freeze the well into submission or bury it in a nuclear explosion. Many of the ideas had already been tried or discarded. Some of the ideas would've created other problems: dump popcorn from airplanes to soak up oil but create a tasty toxic treat for marine life.

But more than 100 ideas were good enough to

Please see COVER STORY next page ▸

Yahoo to start spreading the news in different way

Site launches exclusive work of contributors on Tuesday

By David Lieberman
USA TODAY

Yahoo became one of the Web's most popular news sources by aggregating and featuring other people's journalism. On Tuesday, it will take its

Yahoo did not renew deals to sell Associated Content's stories to outside news organizations, including Reuters, Scripps and Fox News. The work will appear only on Yahoo, including its home page, Yahoo News, Yahoo Finance and Yahoo Sports.

The change will "deepen our engagement with the millions of people who visit us every day and provide new opportunities for creative con-

such a vast audience "is not something that exists (elsewhere) on the Web today," says Luke Beatty, Yahoo's general manager.

About a third of contributors are paid modestly upfront or collect fees based on the number of people who access their work. Others forgo payment to share views or interests with a large audience.

Will contributors stick with a Ya-

Contributors have expressed "some hesitation" about the change, says Sabah Karimi, author of The AC Source Book. But the concerns should pass, she says, if they attract bigger audiences — and, as a result, collect more money.

She expects "more exposure for all of us." The company has told contributors that it will recommend more targeted topics, easing up on evergreen topics such as holiday baking.

DATE: September 1, 2010 9:42:04 AM CDT

Specialized foam takes on new role in Gulf cleanup

A polyolefin foam used in the medical and construction fields has taken on a new role as a powerful tool in BP's Gulf response efforts to remove oil from the water, shorelines, and marshes. The foam, called Opflex, allows water to flow through, but attracts and traps oil. It can be made in various shapes, including in pads to mop up oil from coastal marshes and in sausage-like rolls for deployment as offshore booms.

Scott Smith, chief executive officer of Cellect Plastics, the maker of Opflex, sees great potential for the product in oil cleanup and other water treatment applications that go beyond its original uses in the medical and construction fields.

"The advantage of Opflex is that it's buoyant open-cell foam that repels water while absorbing oil," says Smith. "It is 70% lighter than conventional booms, costs a fraction of conventional material, is biodegradable, and is highly efficient — absorbing 60 pounds of oil with a 12-foot boom."

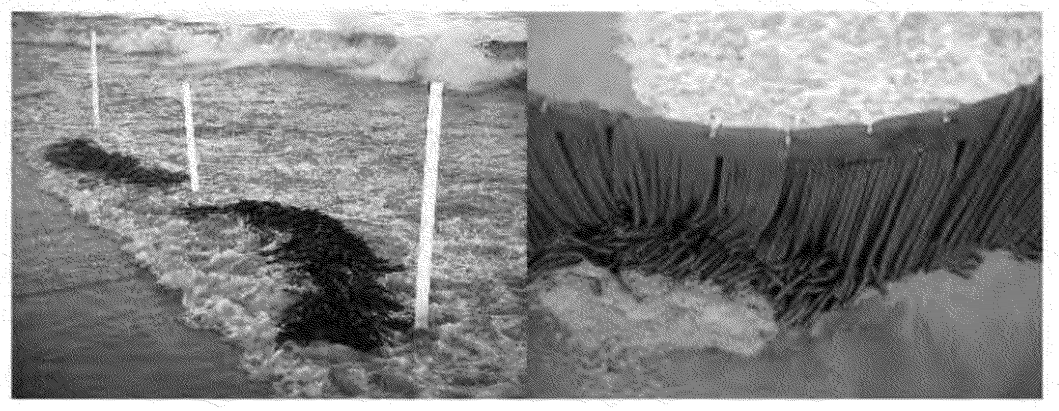
"It's better than good," says Larry Hooper, who formerly served as captain of a charter fishing boat and now is providing BP with logistics support. "I've used it out in the ocean and the old-type booms can't come close to matching its performance."

Ken Rice has used Opflex-based pads in cleanup operations in the North Pass marshes of South Louisiana. "People love it once they get their hands on it," he says.

Another key feature is reusability. "Unlike conventional pads, which are considered hazardous waste after absorbing oil and must be disposed of in accordance with various government regulations, Opflex can be reused up to 100 times," says David Kinnaird, who led the first BP response team to evaluate the material.

Various methods for extracting the oil from the foam include using centrifuges or wringers similar to those on old-fashioned washing machines. After Opflex has collected the oil, the foam can be wrung out into a suitable container.

Early in the Gulf response, Kinnaird was impressed by a product demonstration of Opflex and contacted Lou Weltzer, who was stationed in the Critical Resources Unit in New Orleans with responsibility for evaluating cleanup materials. After receiving his own product demonstration, Weltzer placed an order for a truckload of the material. Subsequent orders from BP total about two million square feet. Weltzer also began contacting associates at other locations to spread awareness of Opflex's capabilities. Since the experience with BP, Smith has received an order from the Chinese government to assist in the Dalian Oil Port cleanup, as well as a range of other cleanup operations throughout the country, which continues to solidify Opflex's role as a new and effective method for oil spill cleanup.



Open-Cell Elastomeric Foam

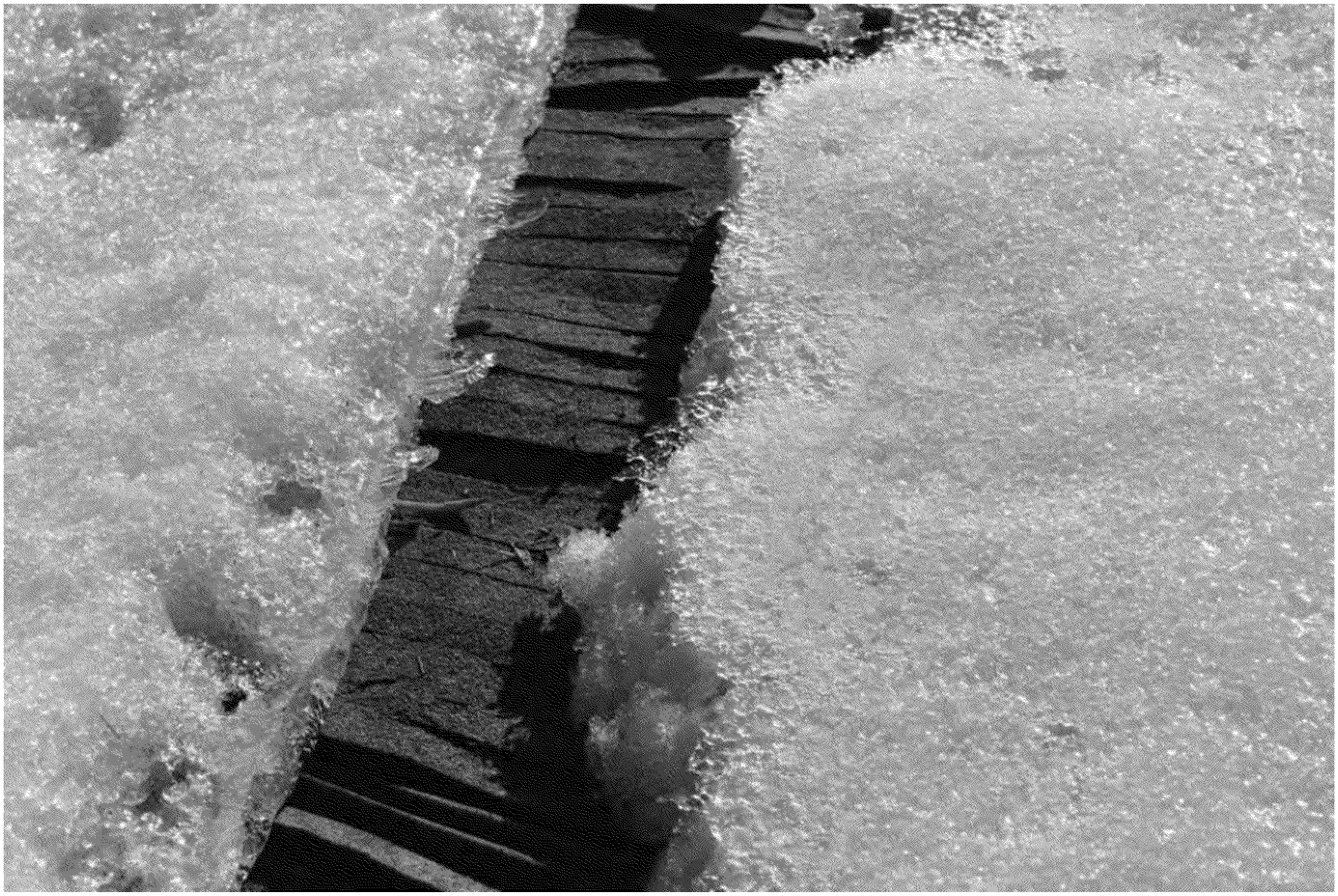
Successfully Deployed by BP America in 2010

Waquoit Bay Cape Cod – UMASS Boston – Sep 2014

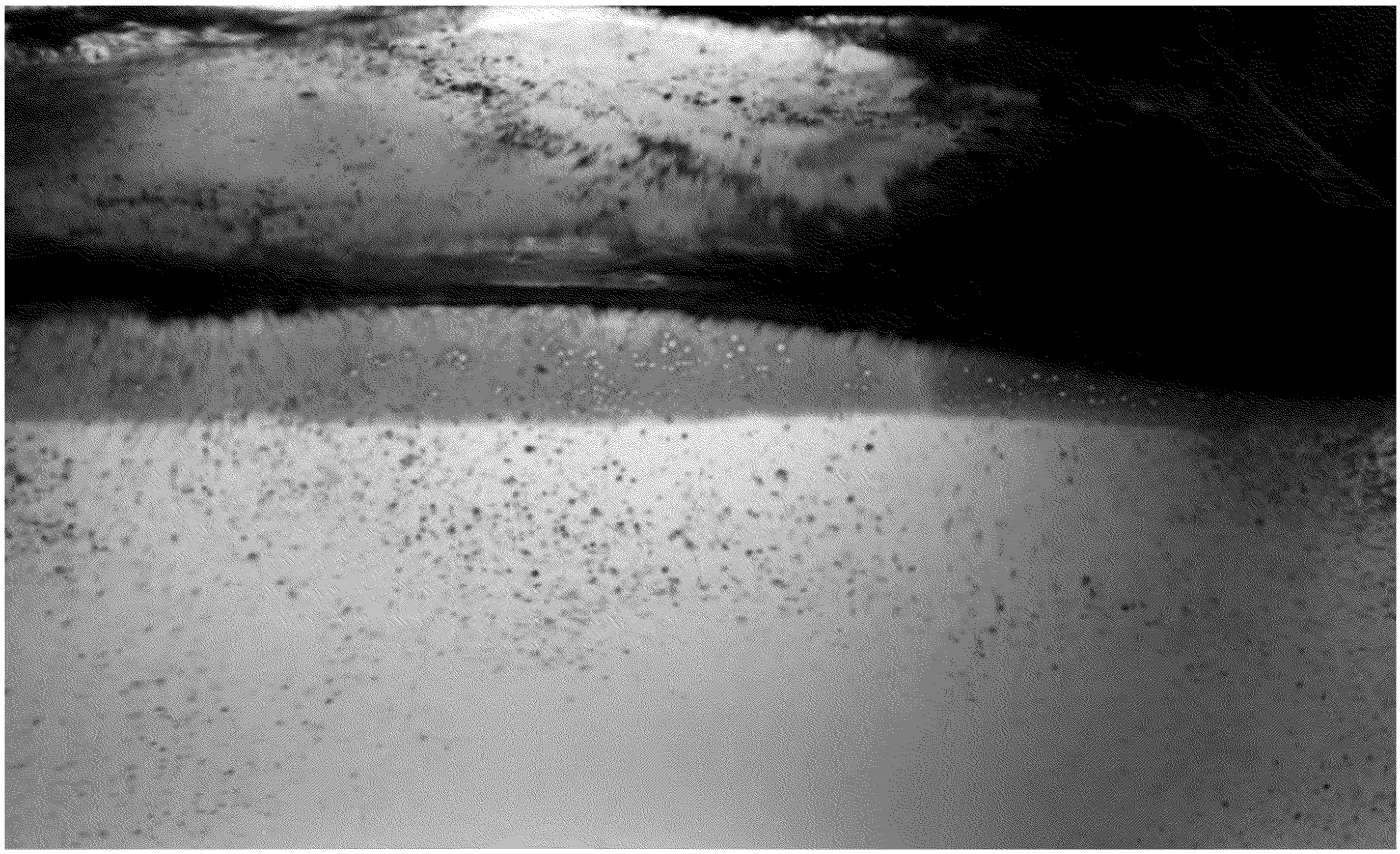
Waquoit Bay Cape Cod – UMASS Boston – Sep 2014

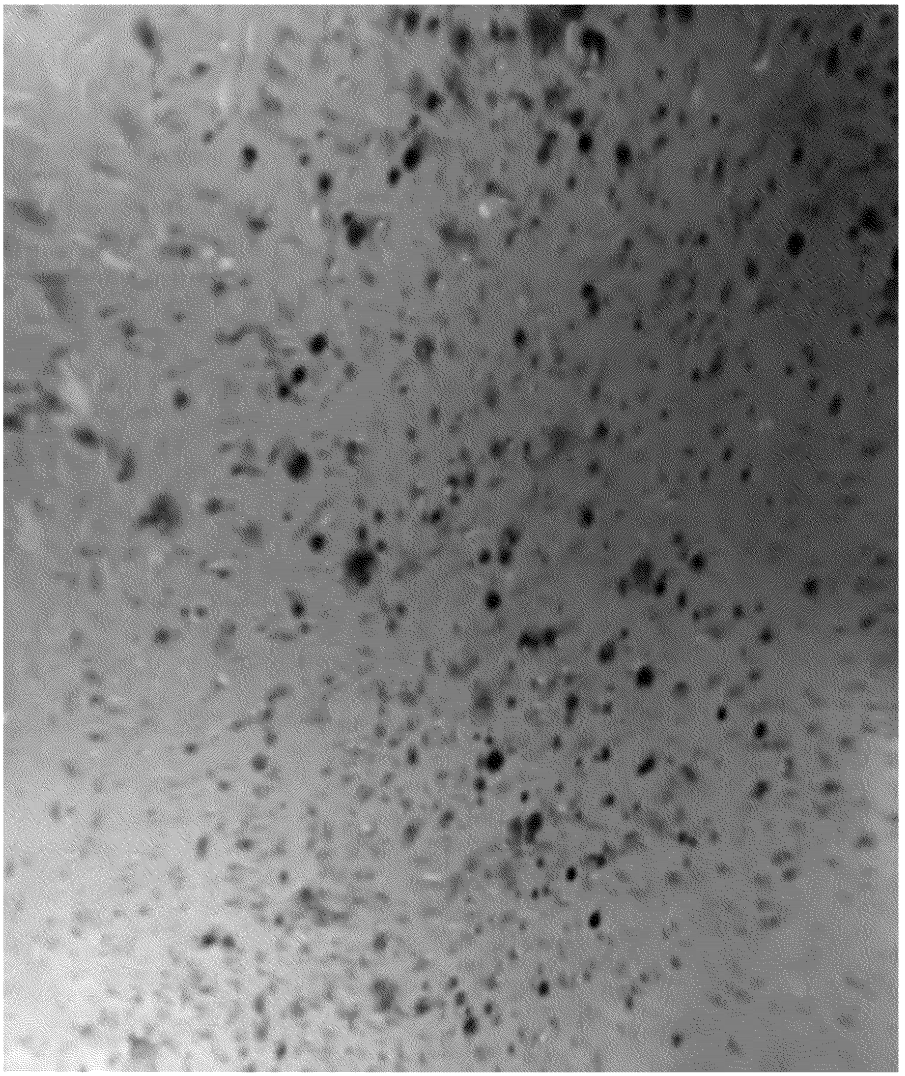
Waquoit Bay Cape Cod – UMASS Boston – Mar 2015

Waquoit Bay Cape Cod – UMASS Boston – Mar 2015

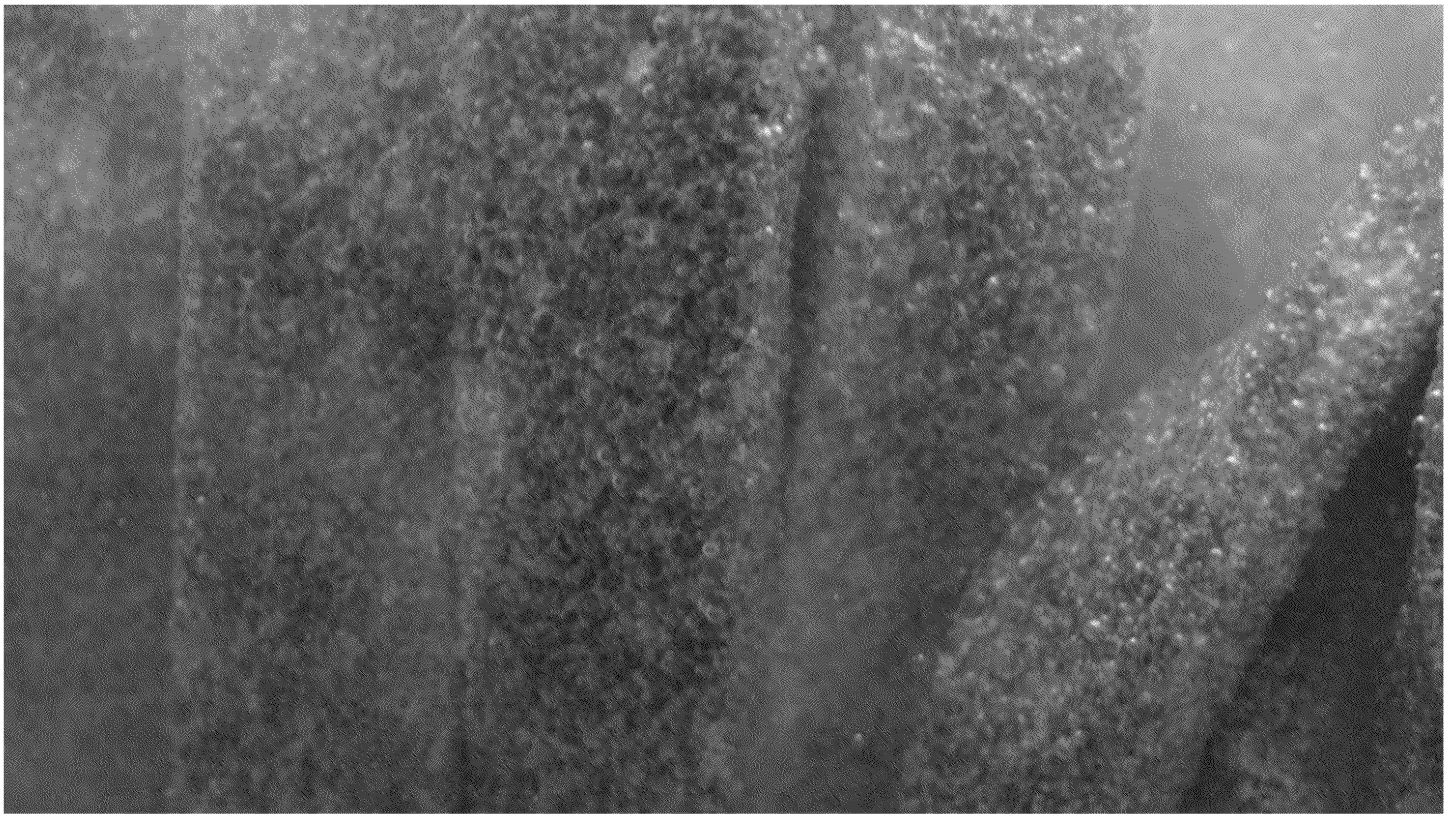


Testing with Corexit / Diluted Bitumen / Bakken Oil





Open-Cell Elastomeric Foam Tested with Corexit



Open-Cell Elastomeric Foam Tested with Corexit

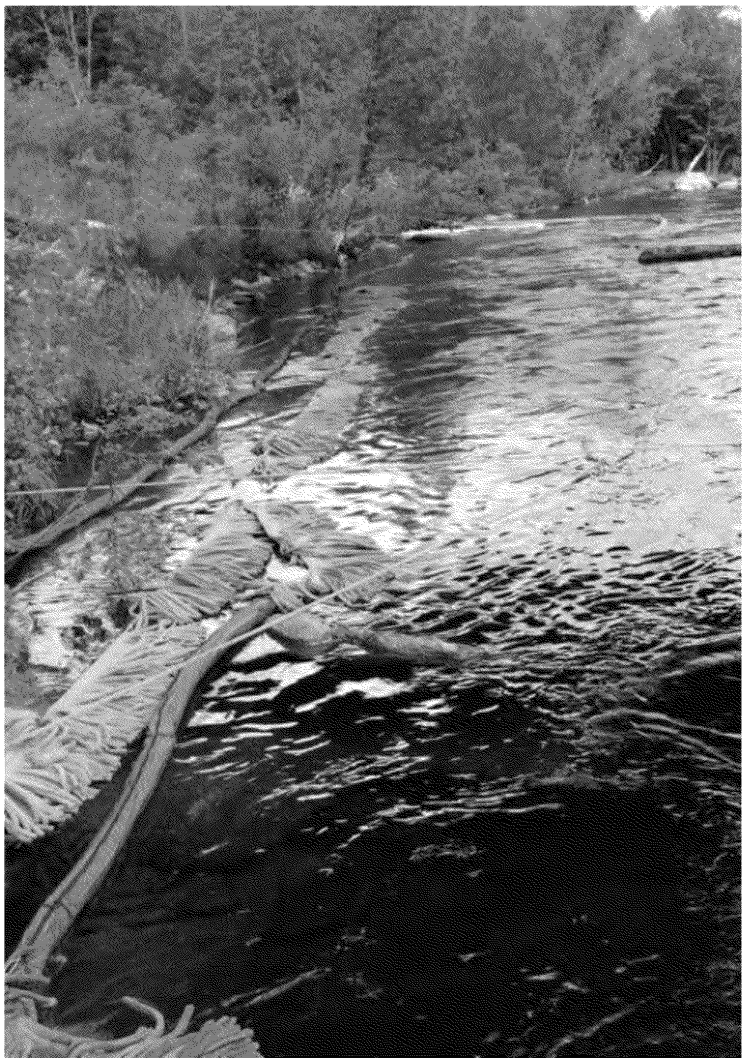
OHMSETT – Dispersed Oil – Water Column Test - Nov 2014

Lac-Megantic - Bakken Oil Train Incident - Jul 2013

Lac-Megantic - Bakken Oil Train Incident - Jul 2013

EPA-R5-2017-008527_0000393

80 Miles of Shoreline Per Day can be Quickly Deployed to Protect Downstream Ecosystems, but proper planning must be done in advance of the incidents.



Aliceville AL - Bakken Oil Train Incident - Nov 2013

Aliceville AL - Bakken Oil Train Incident – Nov 2013

Aliceville AL - Bakken Oil Incident – Jan 2014

Galveston TX – Barge Fuel Incident – Mar 2014

Galveston TX- Barge Fuel Incident – Mar 2014

Galveston TX- Barge Fuel Incident – Mar 2014

Galveston TX- Barge Fuel Incident – Mar 2014

Gowanus Canal – Brooklyn NY

OHMSETT – Nov 2014

OHMSETT – Nov 2014

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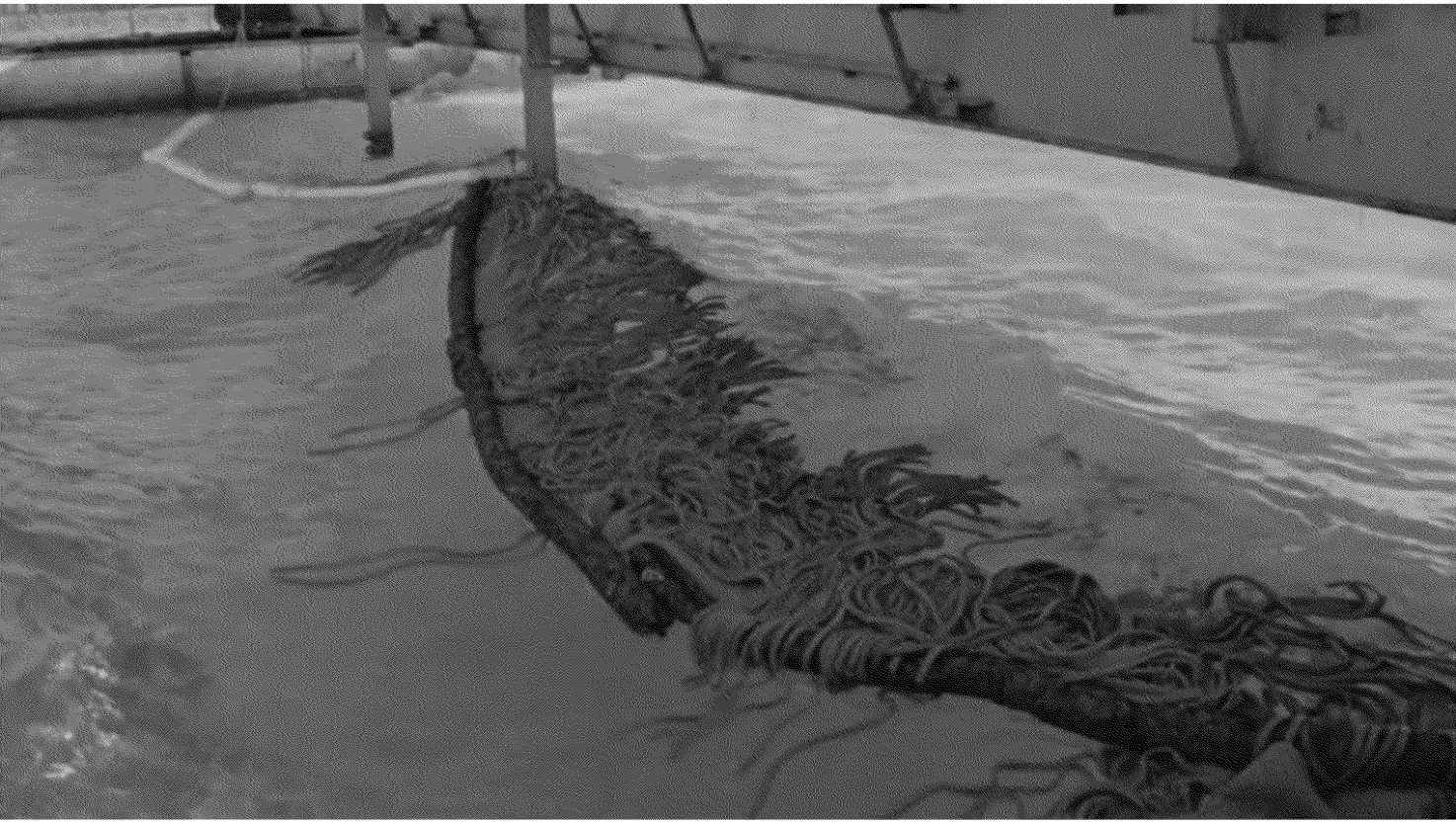

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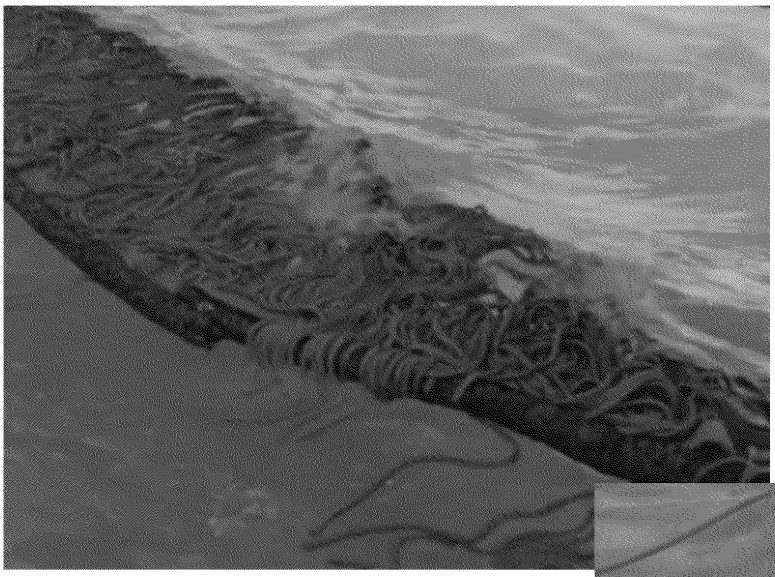

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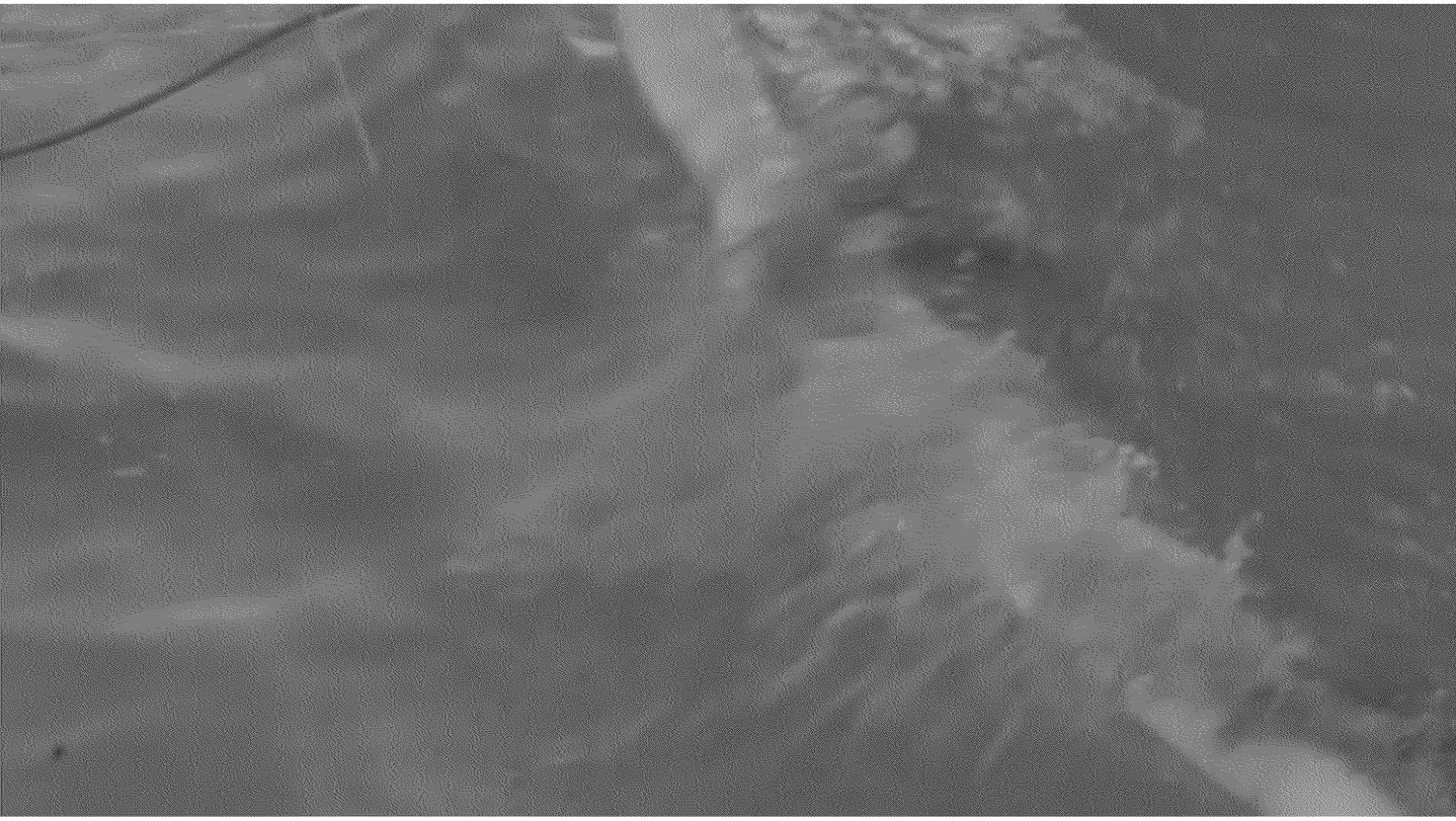

OHMSETT – Nov 2014

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