



*Underwater Oil Detection and
Recovery Operations*
Prevention First 2016

Michael Popa
T&T Marine Salvage

Overview

- U.S. Regulatory Requirements
- Updated OSRO Classification Guidelines
- American Petroleum Institute (API)
Submerged Oil Response Guide
- Historical Case Studies
- Advances in Technology



Nonfloating oils provide response challenges significantly different than for floating oils. Technology for tracking and predicting the behavior of submerged oil remains in its infancy. Currently, there does not exist robust and effective ways to remotely detect sunken oils under realistic field conditions nor sufficiently understand its ultimate fate.

National Oceanic and Atmospheric Administration (2008)



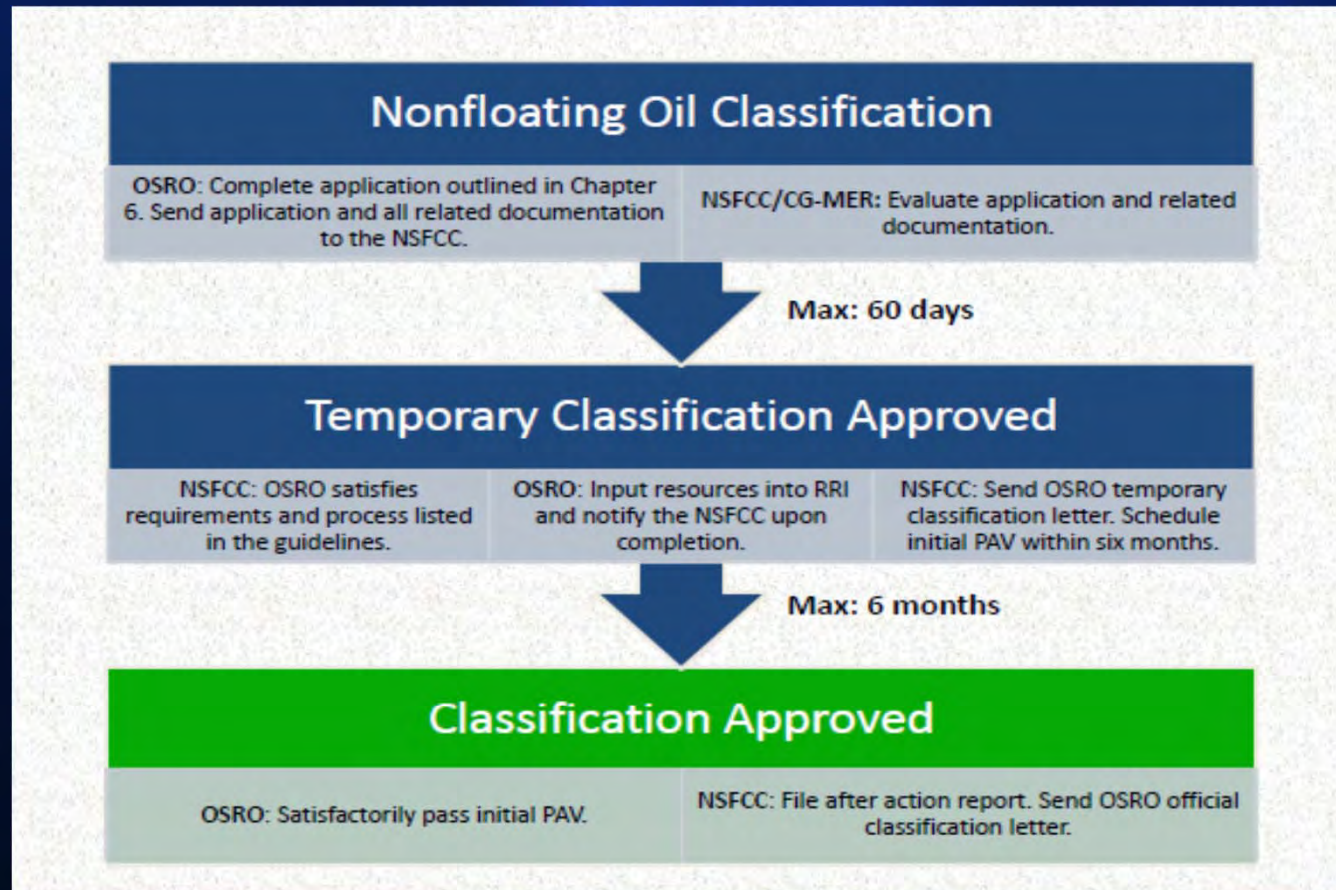


Salvage Planning Timelines

					Inland Waters Great Lakes Rivers & Canals < or = 12 miles	Ocean Environment 50 mile point
Service						
Salvage						
<u>Assessment & Survey</u>						
Remote assessment & consultation					1	1
Begin assessment of structural stability					3	3
On-site salvage assessment					6	12
Assessment of structural stability					12	18
Hull and bottom survey					12	18
<u>Stabilization</u>						
Emergency towing Salvage plan					12	18
External emergency transfer operations					16	22
Emergency lightering					18	24
Other refloating methods					18	24
Making temporary repairs					18	24
Diving services support					18	24
<u>Specialized Salvage Operations</u>						
Special Salvage Operations Plan					18	24
Heavy lift					72	84
Subsurface product removal					72	84

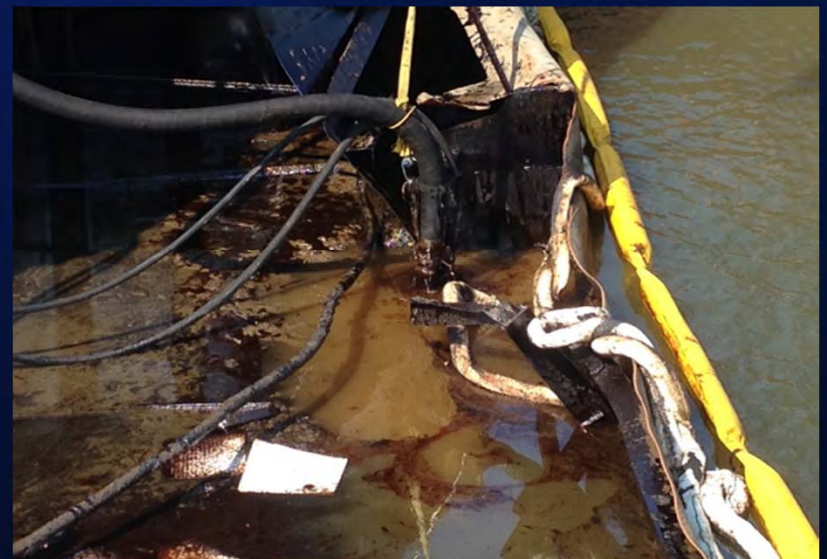
Guidelines for the U.S. Coast Guard Oil Spill Removal Organization Classification Program

PAV – Preparedness Assessment Verification





Upper Mississippi River 2015 #3 Starboard Tank Total Loss



T/B APEX 3508



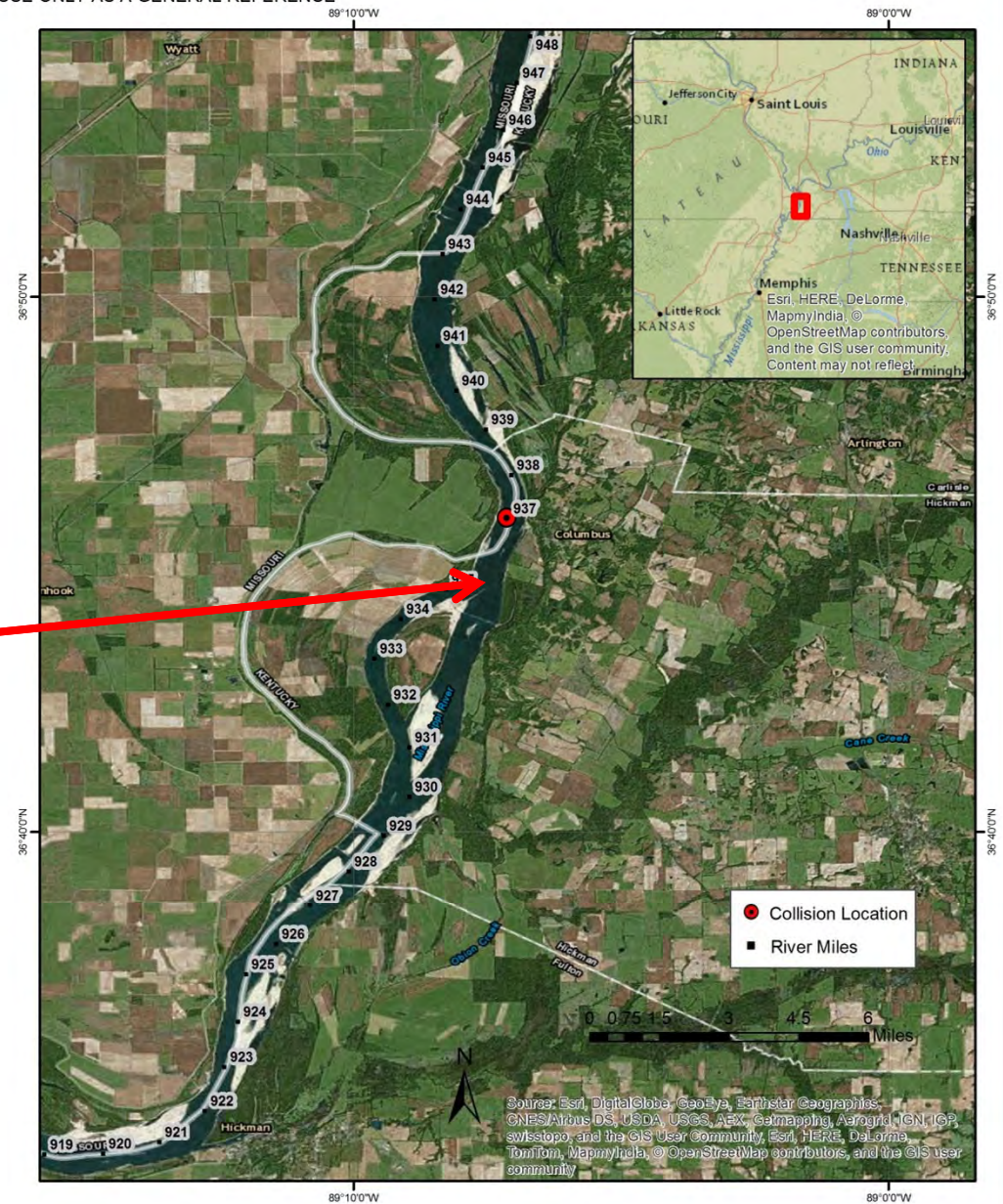
UTV Dewey Collision, Incident Map 3-Sept-2015

Type of Map: Incident Location

Prepared by: NOAA

USE ONLY AS A GENERAL REFERENCE

Date/Time: 09-03-2015 / 0900

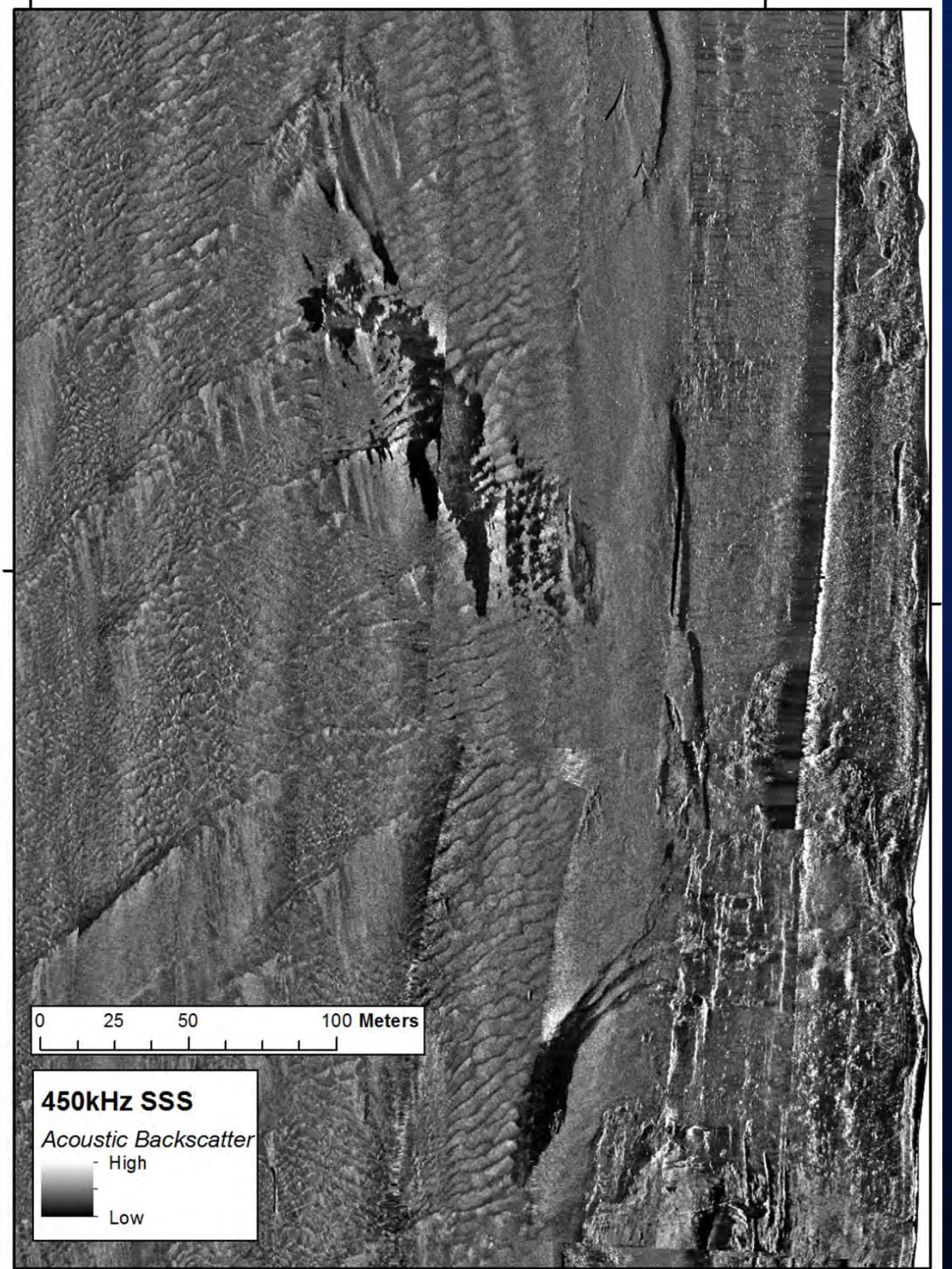
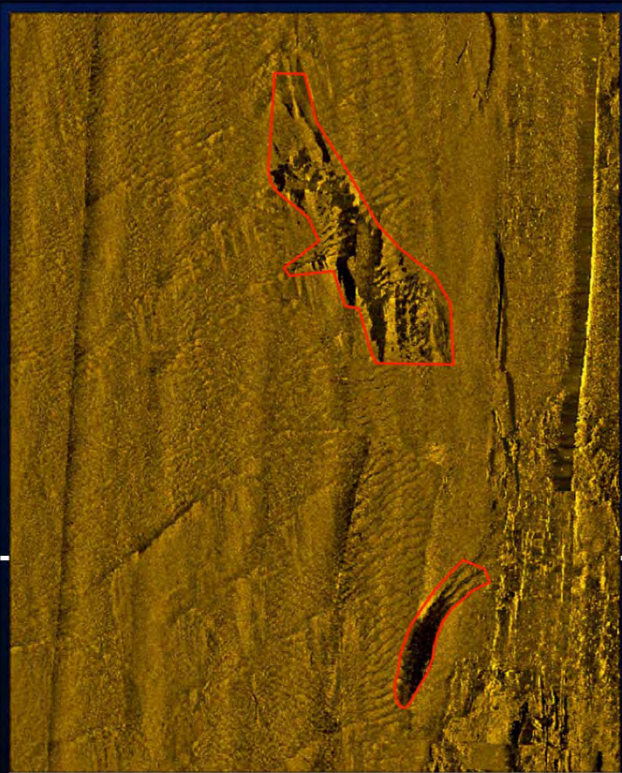




High-resolution side scan sonar; two targets identified

- Collision site
- Current barge site

Processed near real time



Red = not likely effective; **yellow** = may be effective; **green** = most likely effective

	Suction Dredge	Diver Vacuum	Diver Pump	Excavator	Grab Dredge	Environmental Clamshell	Sorbents/V-SORS	Trawls and Nets	Manual Removal Shallow Water	Manual Removal by Divers	Agitation/ Refloat
Water Depth (ft)											
- < 5 ft	Yellow	Red	Red	Green	Green	Green	Yellow	Yellow	Green	Green	Green
- 5-40 ft	Green	Green	Green	Yellow	Green	Green	Green	Yellow	Red	Green	Yellow
- 40-80 ft	Red	Green	Green	Red	Green	Green	Green	Yellow	Red	Yellow	Red
- > 80 ft	Red	Green	Green	Red	Green	Green	Yellow	Yellow	Red	Red	Red
Water Visibility											
- > 5 ft	Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Green
- < 5 ft	Green	Yellow	Yellow	Green	Green	Green	Green	Green	Yellow	Green	Green
Water Current											
< 1 (kt)	Green	Green	Green	Yellow	Green	Green	Green	Green	Green	Green	Green
-1-2 kt	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
- >2 kt	Yellow	Red	Red	Yellow	Yellow	Yellow	Yellow	Yellow	Red	Red	Yellow



ENVIRONMENTAL CLAMSHELL DREDGING

ACHIEVING CUSTOMER SATISFACTION BY REDUCING PROJECT OWNER COSTS AND INCREASING DREDGER PROFIT THROUGH INCREASED SEDIMENT REMOVAL EFFICIENCY.

RESUSPENSION ⇒ RELEASE ⇒ RESIDUAL = RISK

Sloping Profile

Allows for angled, lateral movement along an inclined bottom. Previously, over dredging in "steps" were required. These steps are then often filled in with capping material.

Over-Square Footprint

Width greater than opened length minimizes outward flow of material during bucket closure.

(up to 100 m²)



Material Location

Center of Mass of material is located below the center of the bucket's containment area minimizing material washout during bucket closing and ascension.

150° Cutting Edge

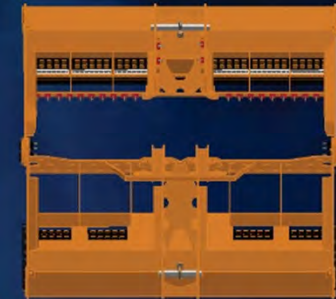
Allows the bucket to "scoop" material which lowers the materials center of mass within the containment area.

Lightweight

Eliminates the processing of hard, uncontaminated sediment.

Venting System with Open Center

Decreases downward pressure during bucket descent and seals in material during bucket ascension.



Overlapping Side Plates

Minimize outward flow (windrowing) of material during bucket closure and seals in material during bucket ascension.

Low Water Content

Squeezes and drains water to minimize transportation/disposal costs.



Level-Cut

Produces a near flat surface opposed to the pothole effect which can create a pool of contamination.

CLAMVISION®
PRECISE XYZ DREDGE
POSITIONING SOFTWARE

Cable Arm
info@cablearm.com





2870 Barrels of Heavy Clarified
Slurry Oil (CSO) spilled and sank
to 90 ft. on Mississippi River



Solids Removed: 2,260 yd³





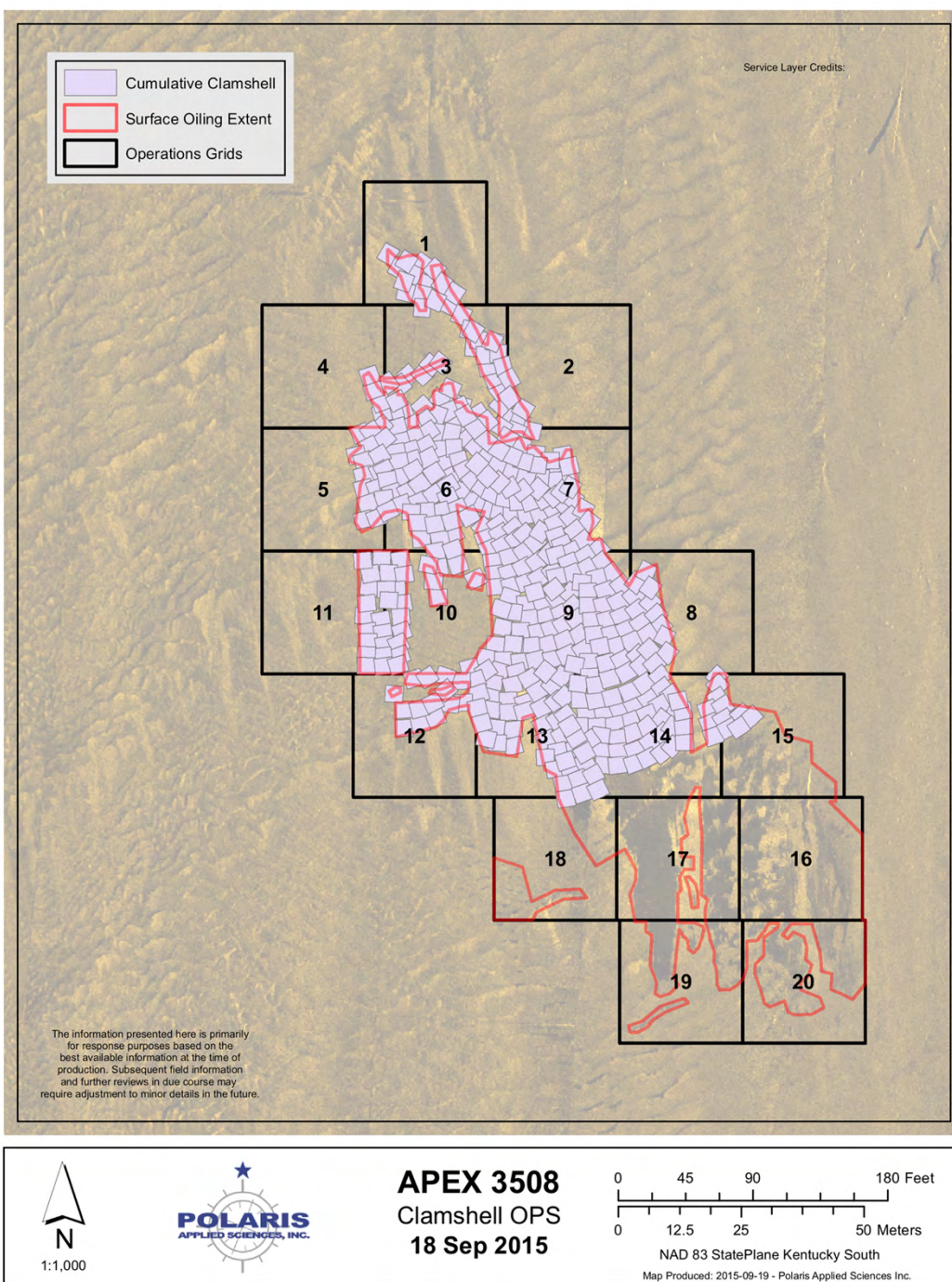
Recovery Of Contaminated Material Observed
By All Involved Stake Holders & Recorded

Stakeholders Provide Timely Operational
Recovery Decisions On Site





Tracking the progress of the oil removal with the Environmental Clamshell



T/B *Apex 3508* Summary

Spill Details

- 2,870 bbl Clarified Slurry
- API = -7.4 (SG = 1.14)
- Viscosity = 160,000 cSt
- Sank straight to the bottom

Detection Techniques

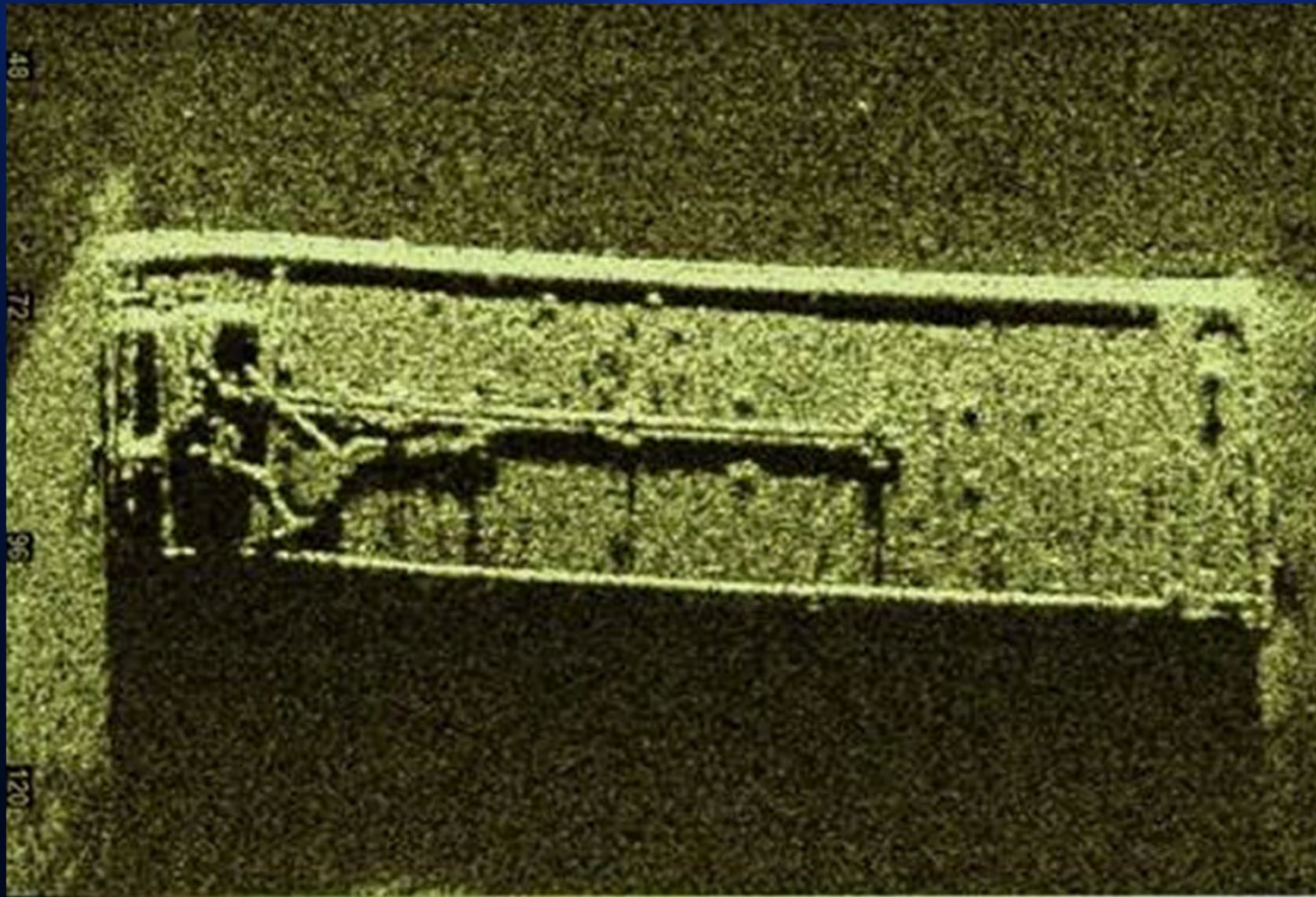
- Side scan sonar, MBES
- V-SORs, stationary sorbents
- Sediment coring
- Diver observations

Recovery Technique

- Environmental Clamshell Dredge
- 2,260 yd³ over 10 days



T/B ARGO Sunken Barge Lake Erie- August 2015
Cleveland Underwater Explorers (CLUE) Divers Discovered Sunken Tank Barge
Reported Findings to United States Coast Guard, Sector Detroit



USCG Requested T&T
Marine Salvage, Inc. Provide
Dive Survey. Confirmed
Barge Dimensions Matched
T/B ARGO.



Port Clinton, OH- Lake Erie



Findings

- Barge approximately 120-ft by 35-ft with 4 to 5-ft visible above the mudline.
- Barge covered in marine growth; 4 to 6-in in some locations.
- Discovered holes on bow rake and four open hatches forward; eight closed cargo hatches
- Due to low visibility and heavy marine growth, hand-over-hand assessment was required



Diver places finger in top deck of rake



- T/B ARGO Sank in Storm October 20, 1937
- Single Steel Skin
- Riveted Hull Design with Eight Cargo Tanks
- Constructed in 1911
- Total Oil Cargo Carried reported 4,762 BBLS.
- Benzoyl Crude Oil
- Cargo included Benzene, Toluene, Xylene
- Listed on NOAA RULET Sunken Ship Program, ARGO is one of 87 wrecks that pose potential threat of pollution in the USA
- RULET – Remediation of Underwater Legacy Environmental Threats







Positive Pressure DESCO Helmet and HAZMAT Viking Dry Suit



Salvage Plan Developed

Plan Included:

- Initial Survey
- Load out Plan/Calculations
- Lightering Plan
- Cargo Offloading Plan
- Dive Plan
- Safety Plan
- Air Monitoring Plan
- Pollution Response Plan

All Plans submitted to Unified Command for Approval









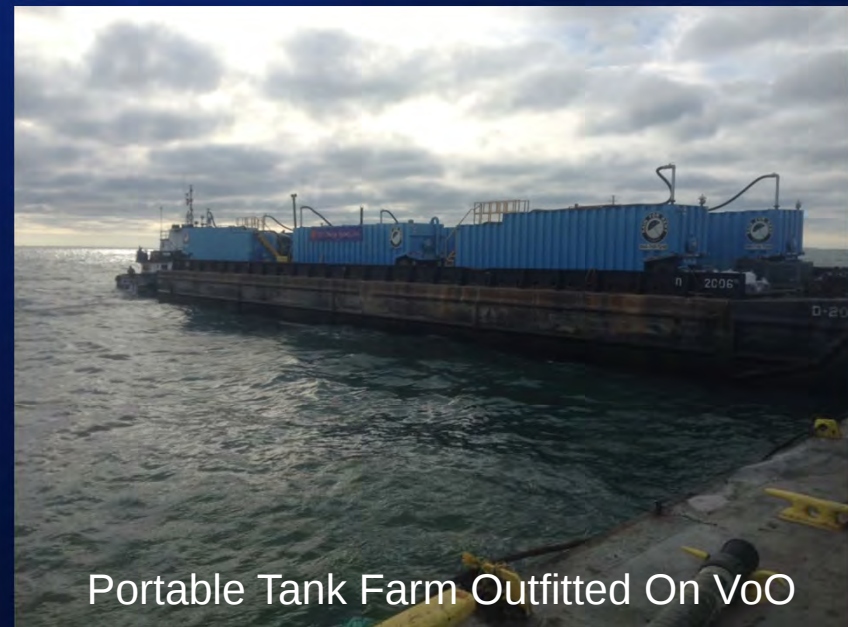
20,000 Gallon Portable Frac Tank



Nitrogen and Carbon Units

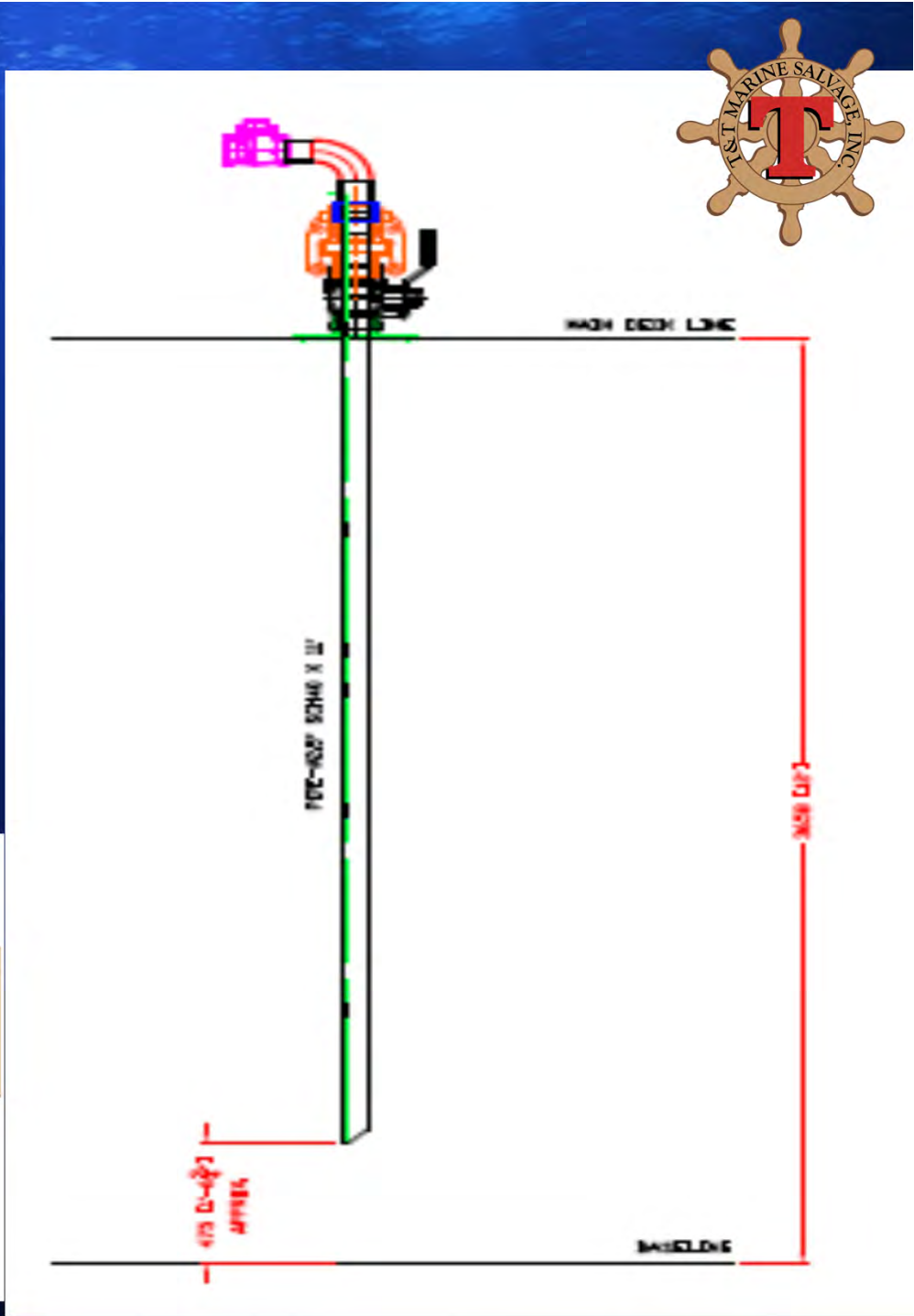
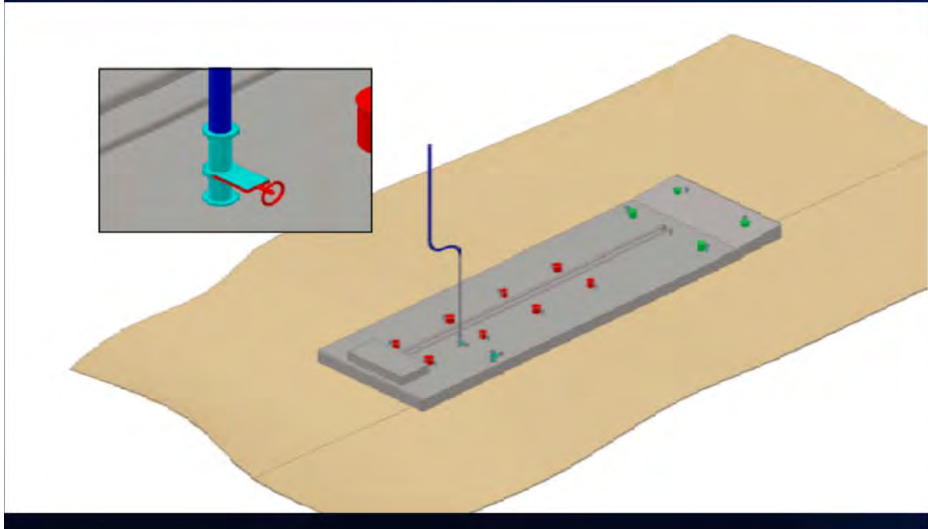
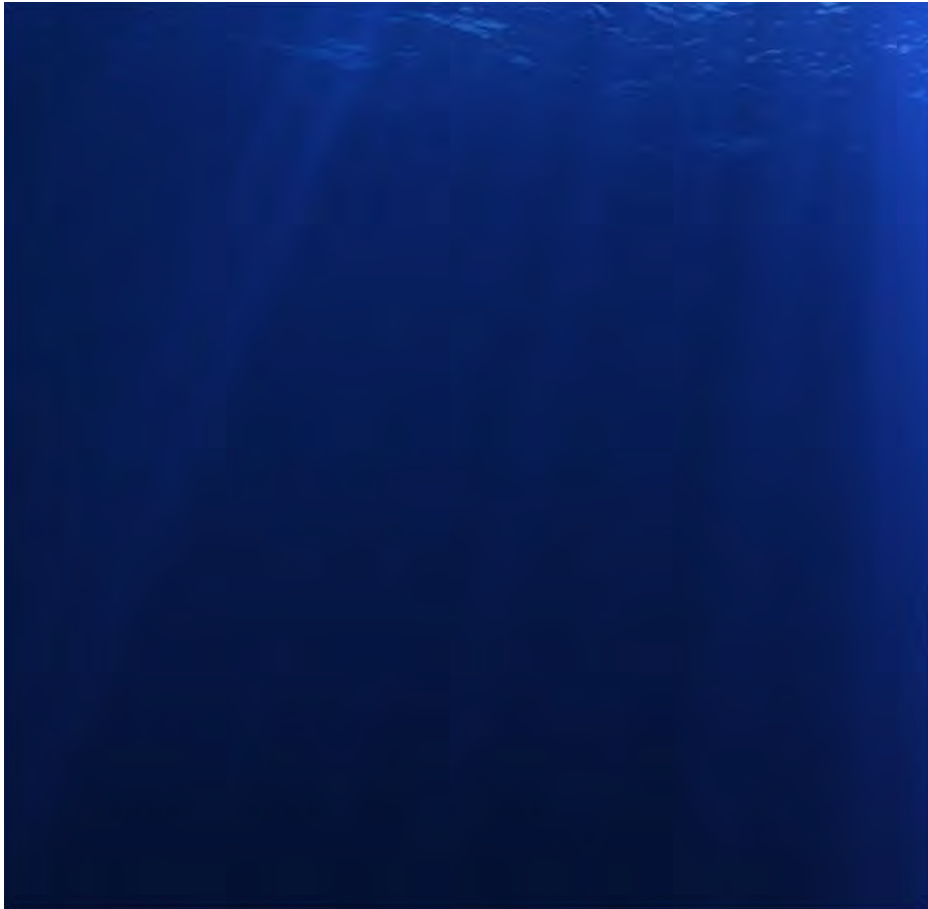


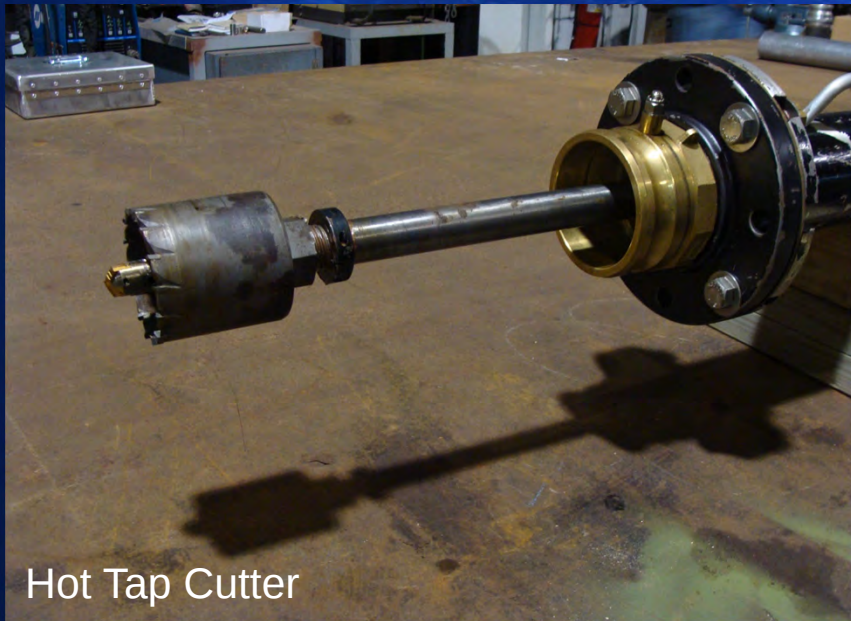
Loading And Offloading Manifold
Included Sample Valve



Portable Tank Farm Outfitted On VoO

Portable Tanks Utilized On Vessel Of Opportunity (VoO)





Hot Tap Cutter



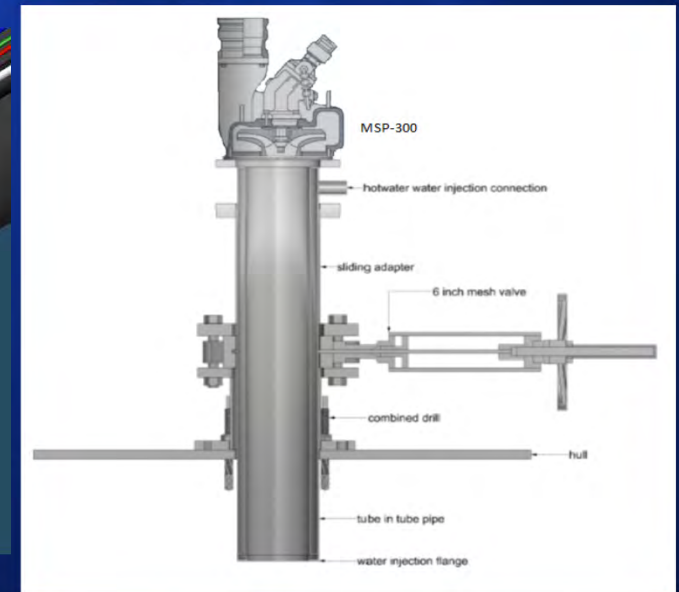
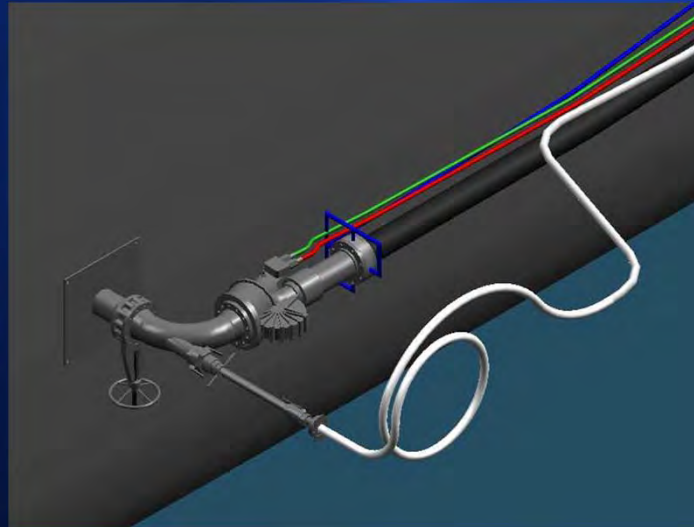
Hot Tap Valves/Flanges



Coupon



Submersible Hydraulic Pump



Rotary Lobe Pump





RECONSTRUCTED GENERAL ARRANGEMENT PLAN - ILLUSTRATION PURPOSE

TANK BARGE 'ARGO'

BARGE PARTICULARS

OFFICIAL NAME: ARGO
 OFFICIAL NUMBER: 164617
 YEAR BUILT: 1911
 FLAG: U.S.
 LENGTH: 120FT
 BEAM: 35FT
 DEPTH: 12FT

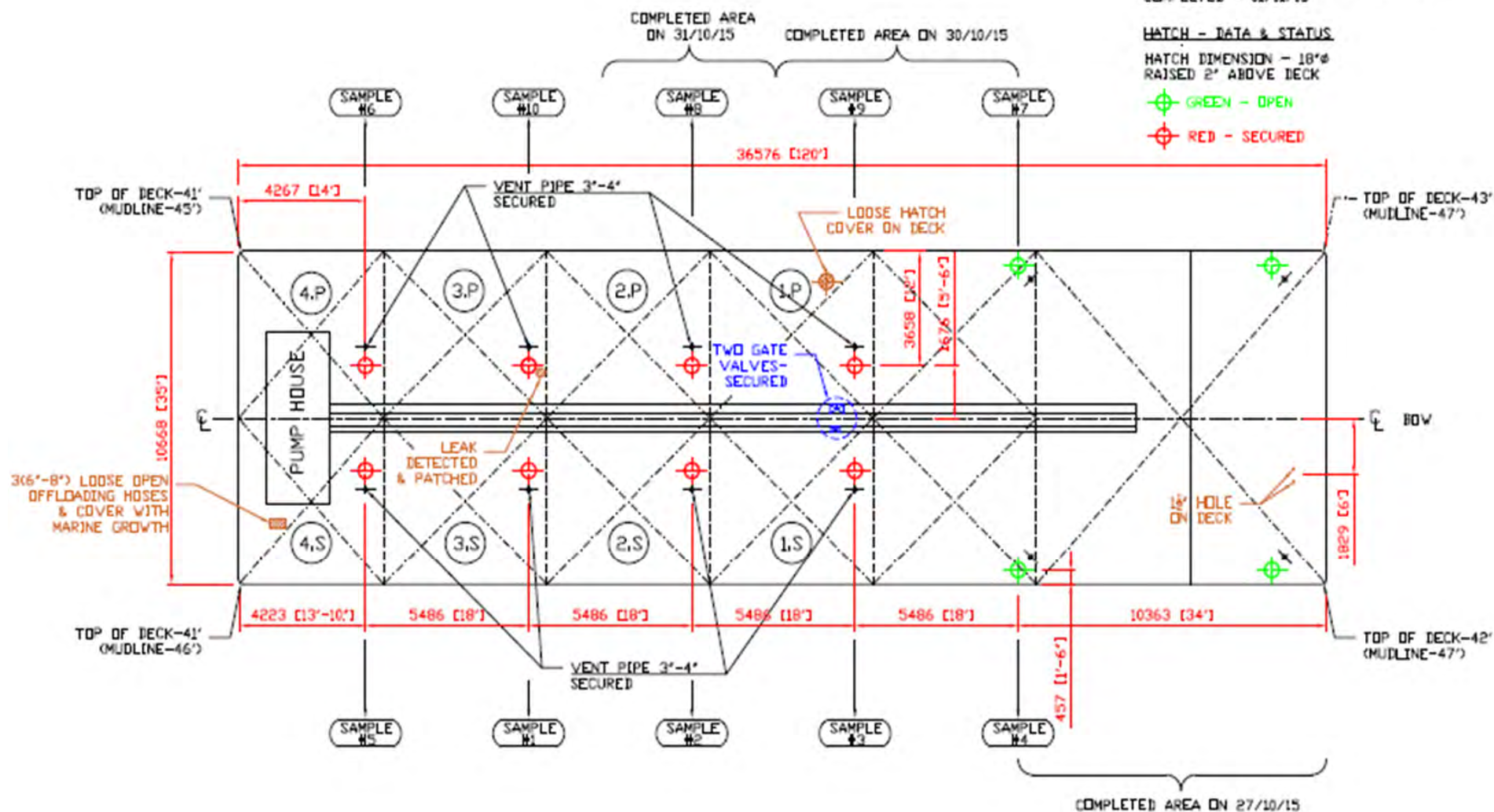
UNDERWATER - SURVEY/WORK STATUS
 AREA WITHOUT BRACE PARENTHESES WAS
 COMPLETED - 01/11/15

HATCH - DATA & STATUS

HATCH DIMENSION - 18'6"
 RAISED 2' ABOVE DECK

GREEN - OPEN

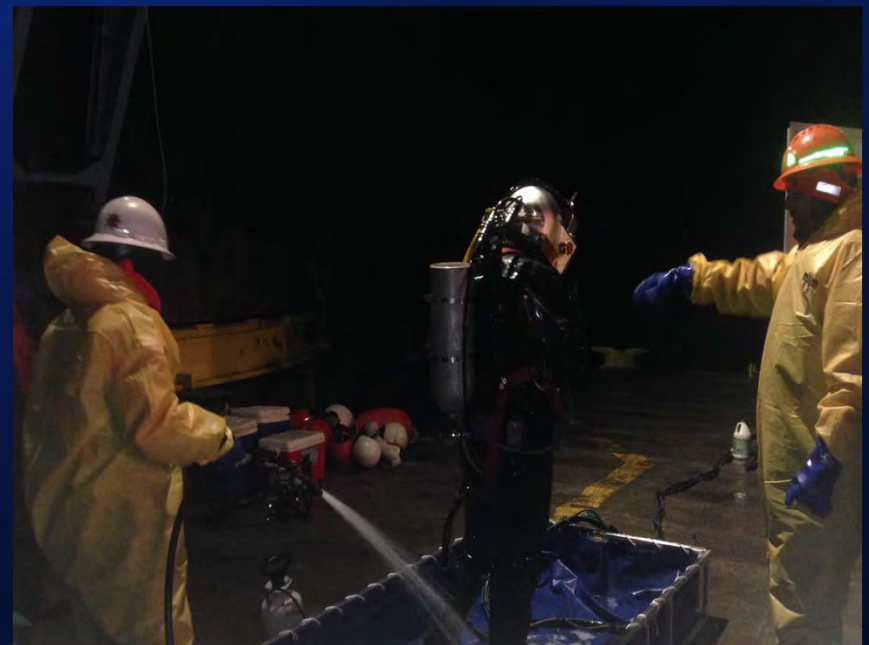
RED - SECURED



Difficult sea conditions made it necessary to adjust operations.

Switch from Spud Barge to Barge with 4 Point Anchoring System

Night Operations included capitalize on Weather Windows



Fire pump staged for fire watch during cargo removal





Spill Response Plan developed including
response equipment staged on location.
Plan developed based on Geographic
Response Plans (GRP)



Summary

- Liquids removed from ARGO Tanks - 48,821 gallons
- Carbon used for Vapor Recovery System - 10,000 lbs. transported in 2 - 20 yard roll off boxes.



Detection Options

- Visual
- Divers
- VSORS
- Net Trawls
- Snare Sentinels
- Sorbent Drops
- Bottom Sampling
- Fluorometer
- Side-Scan Sonar
- Multi-Beam Sonar
- Bottom Classification System
- Real-Time Mass Spectrometry
- Echoscope
- Laser



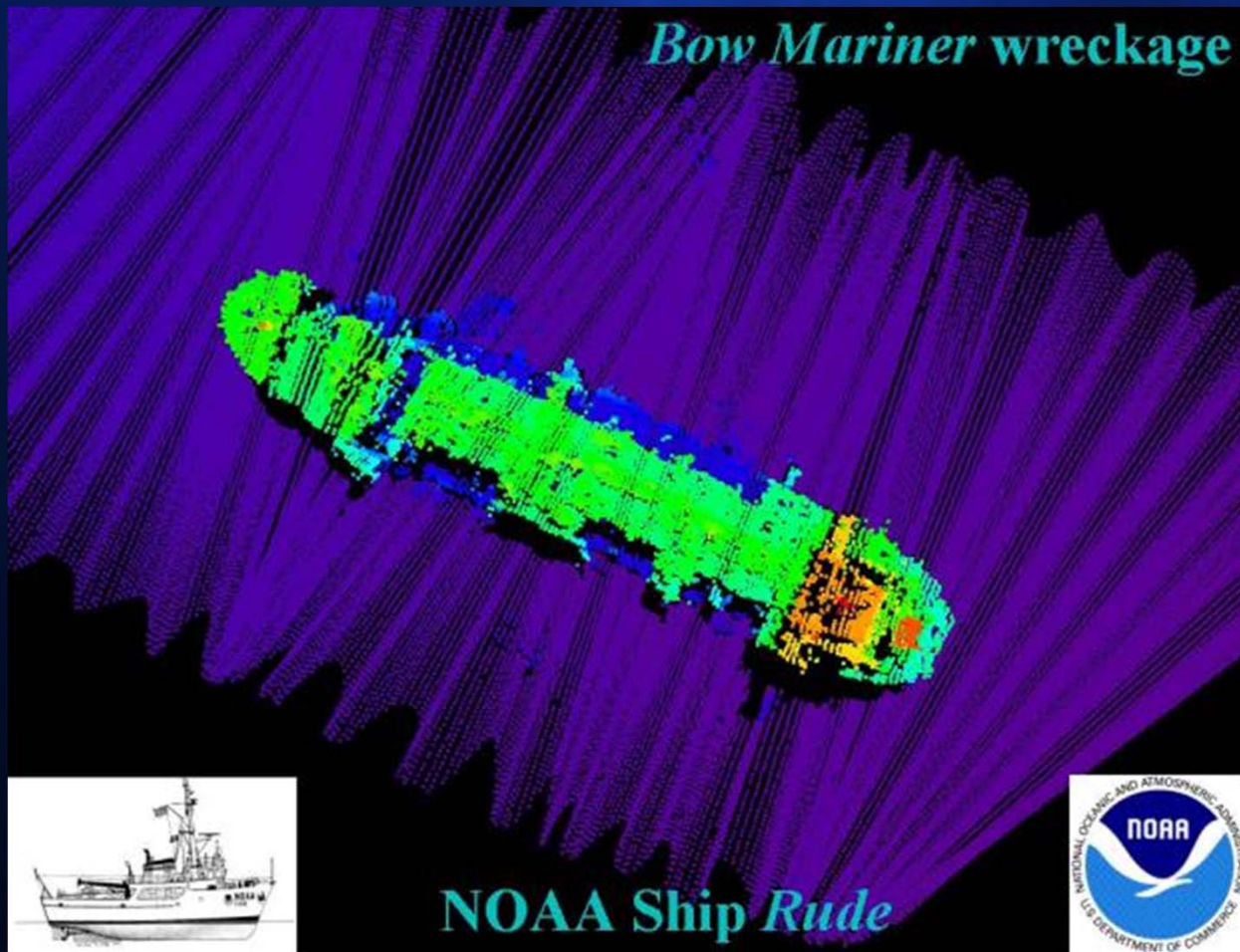


Submerged Oil Assessment

- In-Situ Visual (Divers)
- Remote Visual (VSORS/Sentinels)
- Side-Scan Sonar
- RoxAnn Bottom Classification System
- Remote Video (ROV/Towed Video)



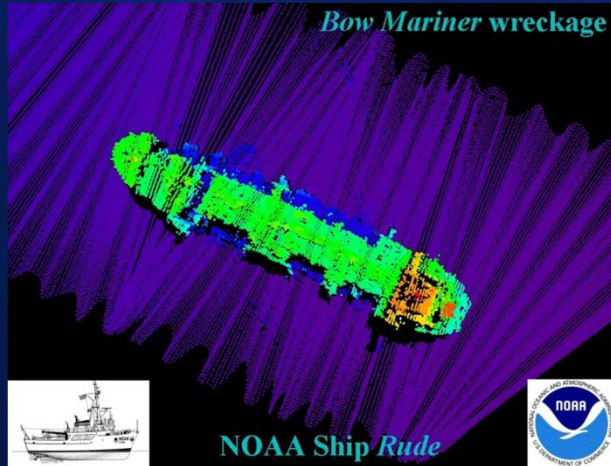
On February 28, 2004, T/V BOW MARINER, a Singapore-flagged chemical tanker, left Linden, New Jersey, for Texas City, Texas, carrying a partial cargo of 3.2 million gallons of ethanol when it exploded and sank 50 miles off the coast of Virginia. Sunk 250 ft. water.



T/V BOW MARINER



BOW MARINER



Side Scan and Multi Beam Sonar Images

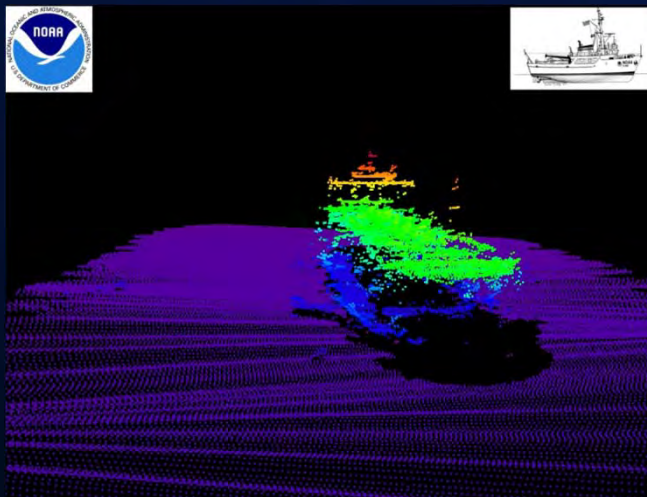
The NOAA vessel "RUDE" was deployed in the first days after the sinking to obtain sonar images of the wreck. These images showed the wreck to be in an upright position and confirmed damage consistent with massive explosions.

Oil Recovery Operations (FRAMO ROLS) designed for recovering oil from sunken wrecks.

The ROLS unit in conjunction with ROV's performed all sub-sea operations.

Due to the viscosity of the fuel oil carried aboard the BOW MARINER a steam heating system was required. Steam plants were installed.

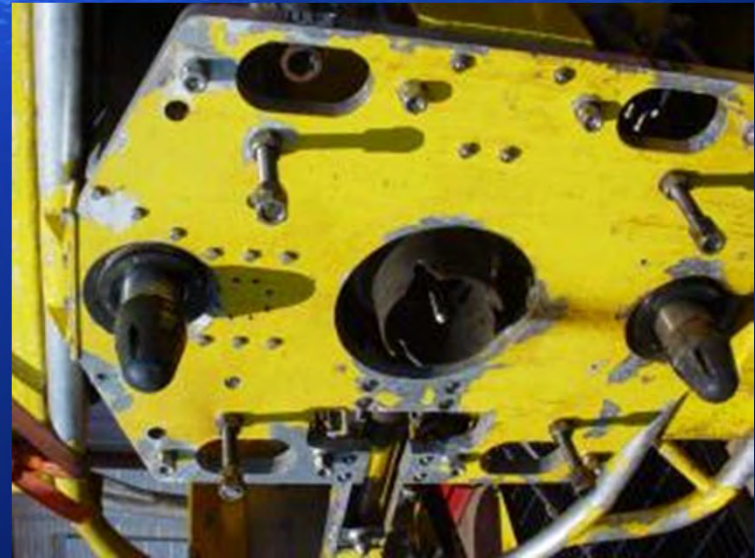
ROV friendly plugs were on hand. These can be inserted by ROV into the holes milled into the fuel tanks



ROLS



Milling Unit



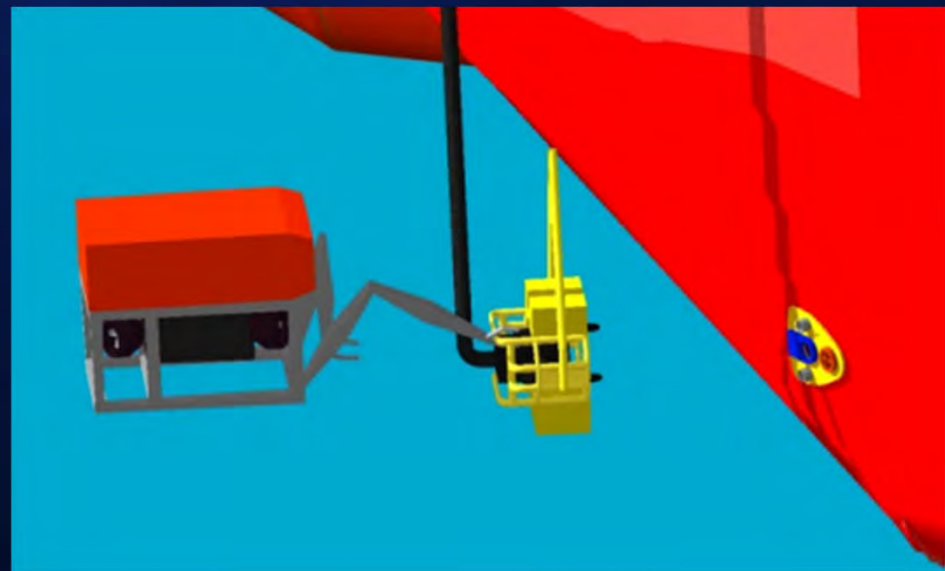
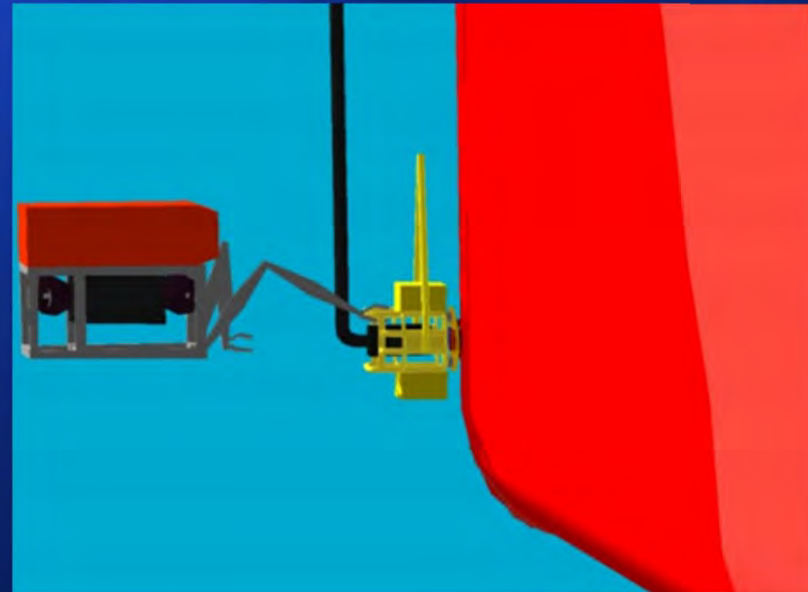
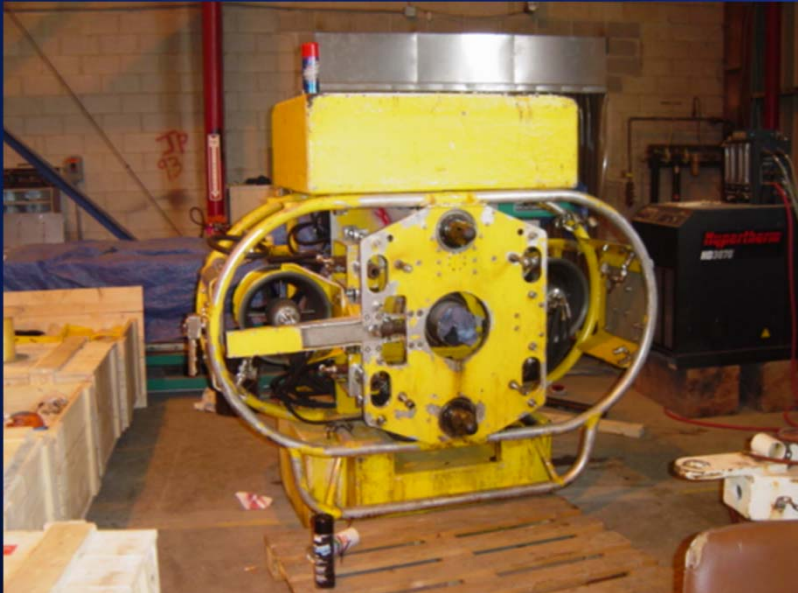
Base Plate Connection



Frank Mohn AS Oil and Gas Remote Offloading System (ROLS)



ROLS



Looking Forward / Issues

Submerged Oil Plume Modeling

In-Situ Monitoring Capabilities

Decision-Making Tools

Submerged/Sunken Oil Response Capabilities

