Prevention First 2004 Symposium:

"Bow Mariner" Tanker Casualty

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1.0 Introduction:

The Event:

Approximately 50 nautical miles offshore of Chincoteague Island, Virginia the 39,600 deadweight ton chemical tanker, "*Bow Mariner*" experienced a series of explosions and sank at 37-53n and 074-15w in 265 ft of water at approximately 1930 hours on February 28, 2004.

The sinking resulted in search and recovery operations performed by the USCG. Six crewmen were rescued alive, 3 bodies recovered and 15 remain missing.

The casualty triggered a Unified Command Response and use of a spill management team. This phase of the operation concluded without any oil reaching the US mainland or territorial waters. Favorable wind and currents prevailed during this period. The OSRV "*Virginia Responder*" was utilized under direction of the spill management team.

Upon completion of the oil spill response phase the spill management team was dissolved and Special Casualty Representative Bob Umbdenstock represented salvage in the Unified Command on behalf of the responsible party.

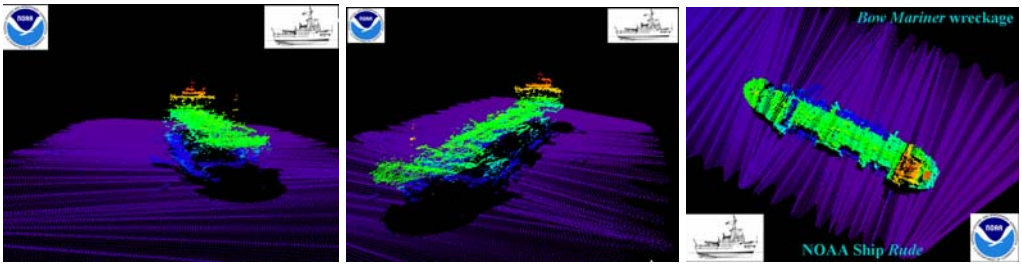
Bow Mariner Information:

LOA 570 ft
Beam 105 ft
Depth 49 ft

Cargo:	Ethanol	3,188,177	gallons /	12,067 cubic meters
Fuel:	IFO 380	192,904	gallons /	730 cubic meters
Diesel:	MDO	48,226	gallons/	183 cubic meters

Side Scan and Multi Beam Sonar Images:

The NOAA vessel "RUDY" 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.



Search and recovery/ oil recovery survey:

Due to the loss of life, risk to the environment and the need for additional information as soon as possible Smit Salvage was contracted for all salvage activities. The Donjon anchor-handling tug *Powhatan* was chartered and outfitted with an inspection class remotely operated vehicle (ROV) called "*Max Rover*". The intention was to search for the missing bodies, assess the feasibility of recovering fuel oil, and evaluation of other risks to the environment. The *Powhatan* arrived on site on March 9th, 2004 with this task. Upon arriving on site oiled moorings lines were observed floating on the surface streaming from the wreck of the casualty. These lines were towed from the wreck site and anchored to the seabed a short distance from the wreck. The imminent passage of a strong cold front with forecasted storm force wind and seas forced the *Powhatan* back to port to avoid damage to the ROV specifically installed for this operation on her aft working deck. The working deck of an anchor-handling tug ships heavy water during these conditions and would risk damage to the ROV.

The *Powhatan* returned to the site after passage of the storm and recovered 7 oiled mooring lines of approximately 12" circumference and 650 feet long each into a lined containment bin on March 14th.

The Cal Dive dynamically positioned dive support vessel "*Mystic Viking*" was chartered and arrived in Norfolk from the US Gulf of Mexico on March 14th . The "*Mystic Viking*" was outfitted with two ROV systems. Search for personal remains, personal effects and preliminary investigation were commenced. Explosion damage of the cargo tanks was massive. Cargo tanks previously containing the Ethanol cargo suffered massive damage. Considering the water-soluble nature of ethanol it would be virtually impossible to have cargo onboard this wreck. The accommodation block of the vessel remained mostly intact with explosion damage forward of the accommodation. Due to another approaching storm the decision was taken to interrupt the casualty inspection and return to Aepco Dock in Little Creek, Virginia (Port of Norfolk) for outfitting the Remote Offloading System (ROLS) and the complete spread for retracting oil from the sunken wreck.

2.0 Oil recovery operation:

The *Mystic Viking* was outfitted at Aepco Dock in Little Creek, VA with a remote offloading system (FRAMO ROLS) designed for recovering oil from sunken wrecks and a salvage team for 24 hour per day operations. The ROLS unit in conjunction with ROV's performed all sub-sea operations. A general description of the ROLS unit is included with this paper.

Due to the viscosity of the fuel oil carried aboard the *Bow Mariner* a steam heating system was required. Steam plants were installed with heat exchangers on both the *Mystic Viking* and *Powhatan.*

6,000-gallon (24,000 liter) intermodal tank containers with steam heating coils were fitted aboard the *Mystic Viking* and *Powhatan.* The *Mystic Viking* was outfitted with four units and the *Powhatan* with six units.

The total target was approximately 540 tons of heavy fuel oil that had been reported as the quantity on board at the time of sinking in the port and starboard heavy fuel oil tanks.

The portable storage tanks aboard the *Mystic Viking* would have become full had the anticipated quantity of oil been realized. A ship-to-ship transfer operation was planned from the *Mystic Viking* to the *Powhatan* in anticipation of this.

Fluids transferred to the *Powhatan* would be heated and allowed to settle. Then the water decanted overboard. Permission was applied for and received through USCG and State authorities for the decanting operation. Oil consolidated aboard the *Powhatan* would be transported to the Aepco dock in Little Creek, Virginia. At the Aepco dock the oil would be pumped ashore to insulated tank trucks for disposal at a waste oil receiving station.

This cycle was planned to repeat itself until completion.

3.0 Oil Spill Contingency:

In the event that oil cleanup would have been required the *Powhatan* and the *Mystic Viking* were supplied with oil absorbent material in the form of rolls, pads, and boom. An inflatable rigid zodiac was on hand that could be deployed for spill containment and recovery.

ROV friendly plugs were on hand aboard the *Mystic Viking*. These can be inserted by ROV into the holes milled into the fuel tanks by the ROLS tool. The use of plugs would only be necessary in the event of a malfunction of the normal emergency valve closing systems built into the ROLS unit.

In the event of a significant release of oil a normal spill responder call out was planned.

4.0 Salvage Spread:

The following craft personnel and equipment were utilized:

Vessels:

.1 AHT *Powhatan* + marine crew
.2 DSV *Mystic Viking* + marine crew

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Salvage Team Personnel:

.1	Salvage Master(s)	2 ea	Capt. D. Martin/ Capt. W. Huismans
.2	Salvage Supervisor	2 ea	C. Bos/ A. van der Hoek
.3	Shore Coordinator/ H&S	1 ea	Richard Mayfield
.4	Salvage engineers/ techs	10 ea	
.5	Salvage divers/ riggers	4 ea	
.6	ROV Team	11 ea	

Remotely Operated Vehicles:

.1 Triton XLS – work class
.2 Max Rover – inspection class

Salvage Equipment:

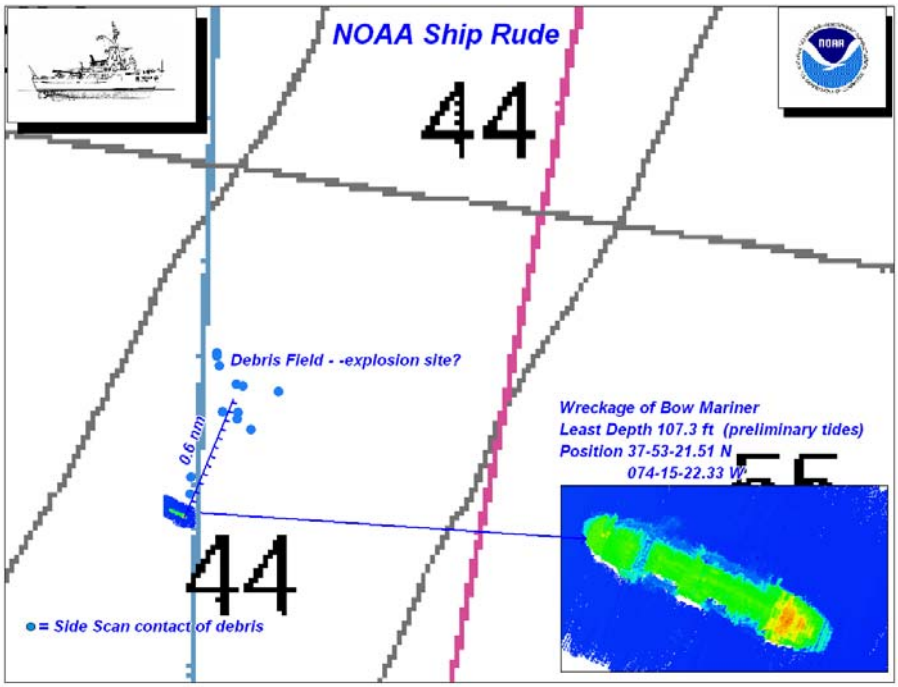
.1 Remote offloading system – ROLS
.2 Ship to ship transfer pumps, floats and hoses.
.3 Ship to shore offloading pumps and hoses.

Additional:

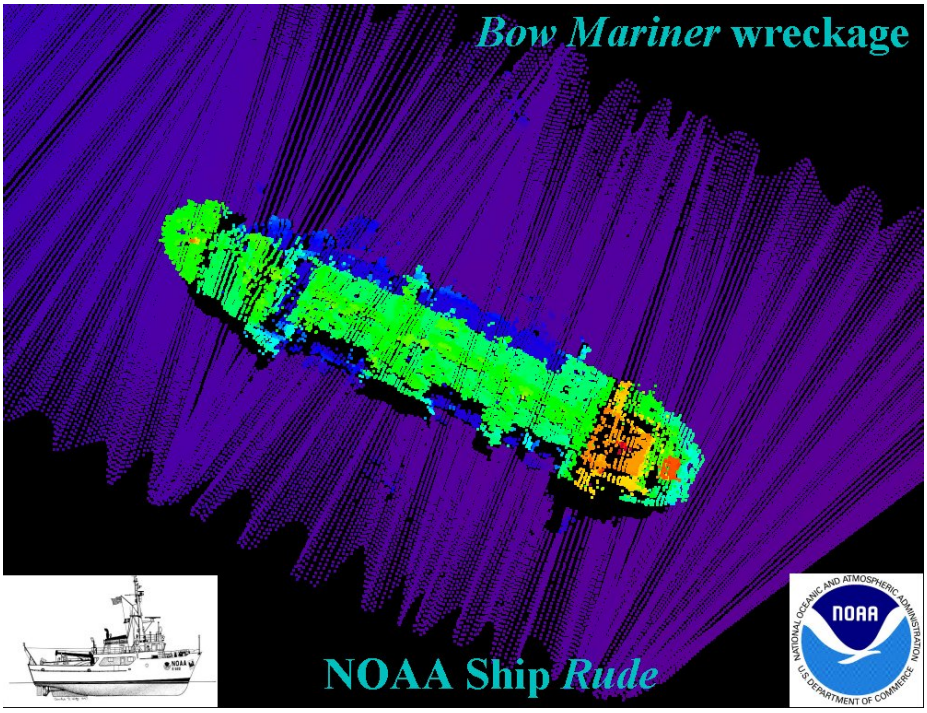
.1 - Intermodal tank containers – fluid storage
.2 – Portable steam generator/ boilers / 50 and 70 Horsepower.
.3 – Heat exchangers

5.0 Oil recovery operational planning illustrated:

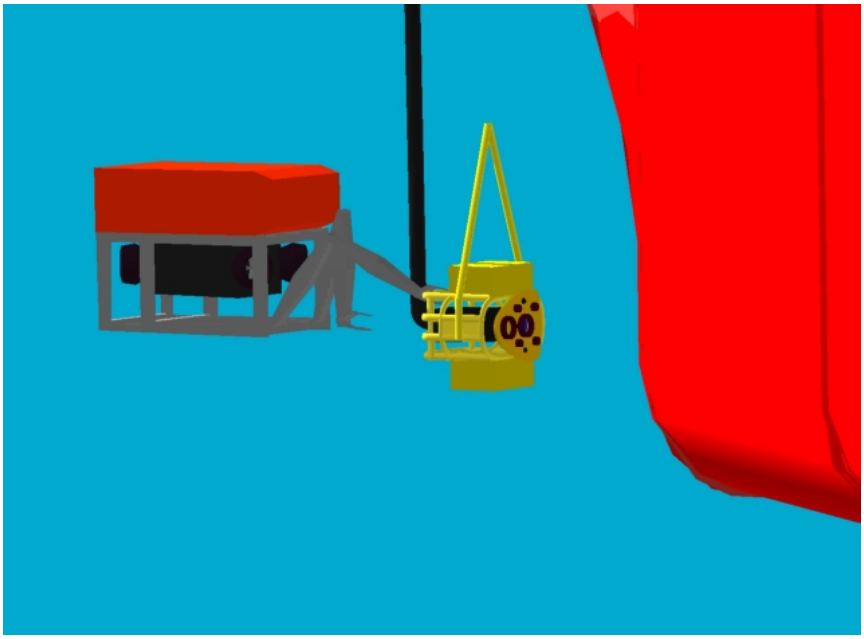
.1 – The Location



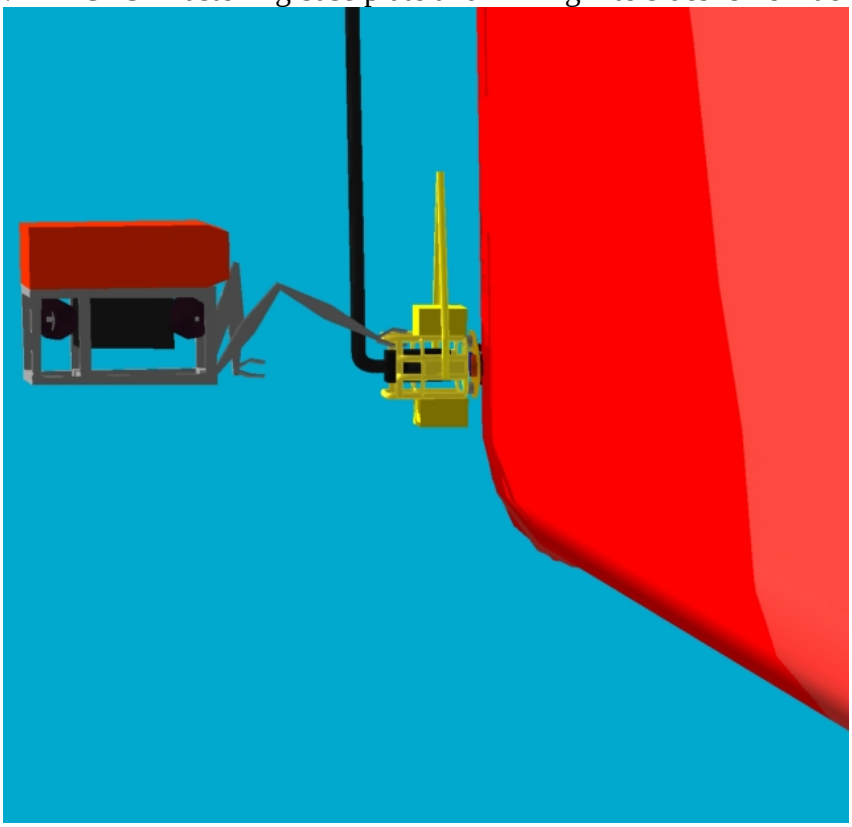
.2- Multi Beam image showing cargo area explosion damage:



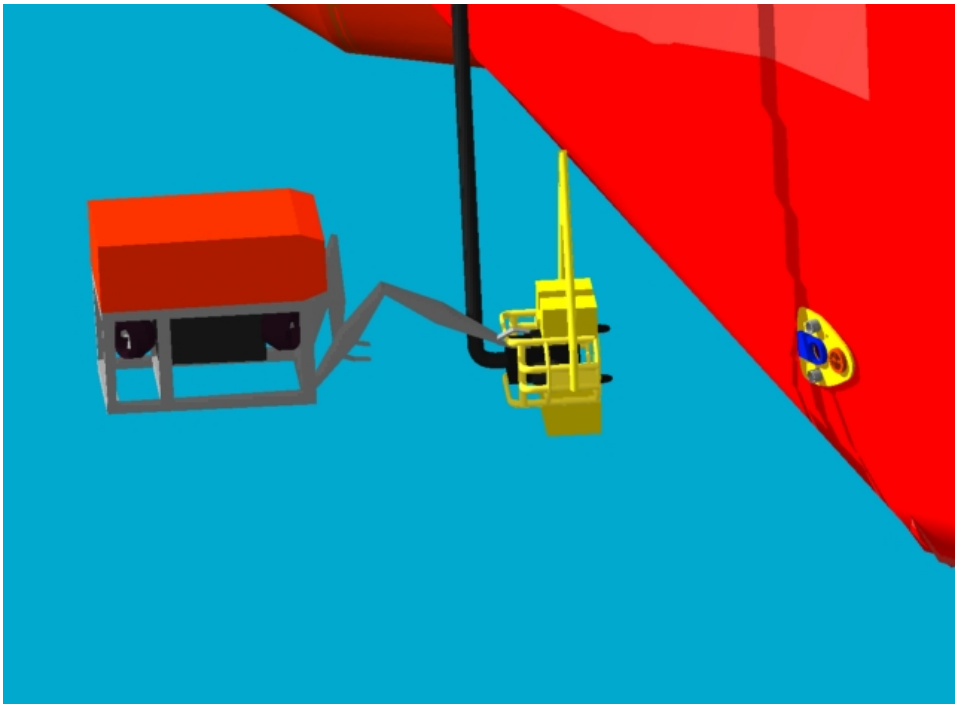
.3- ROLS – ROV approaching with base plate assembly



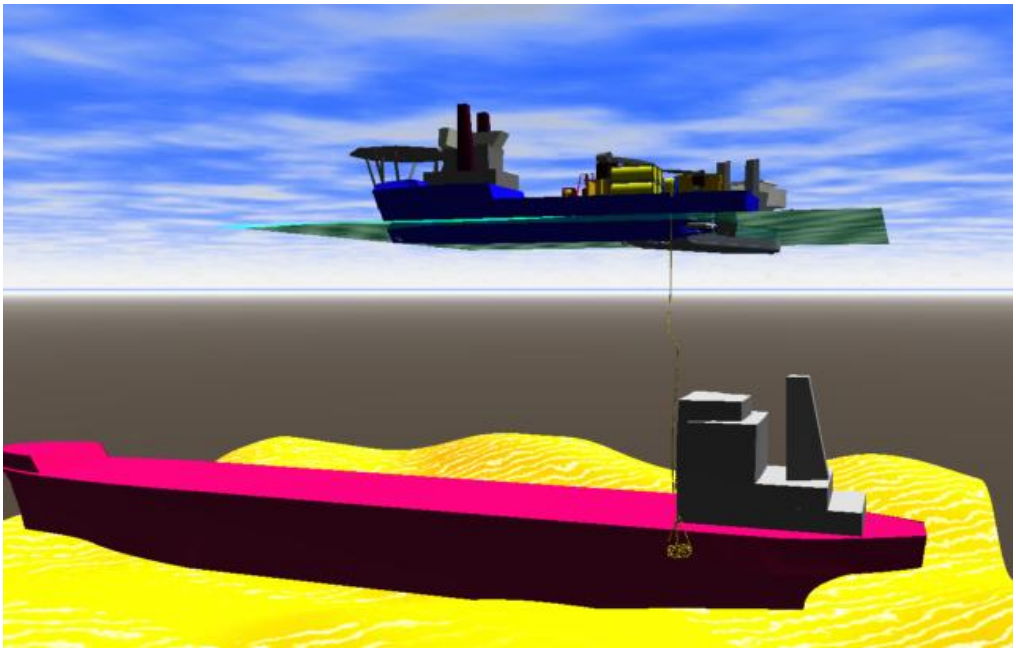
.4 – ROLS – fastening base plate and milling into sideshell of fuel tank:



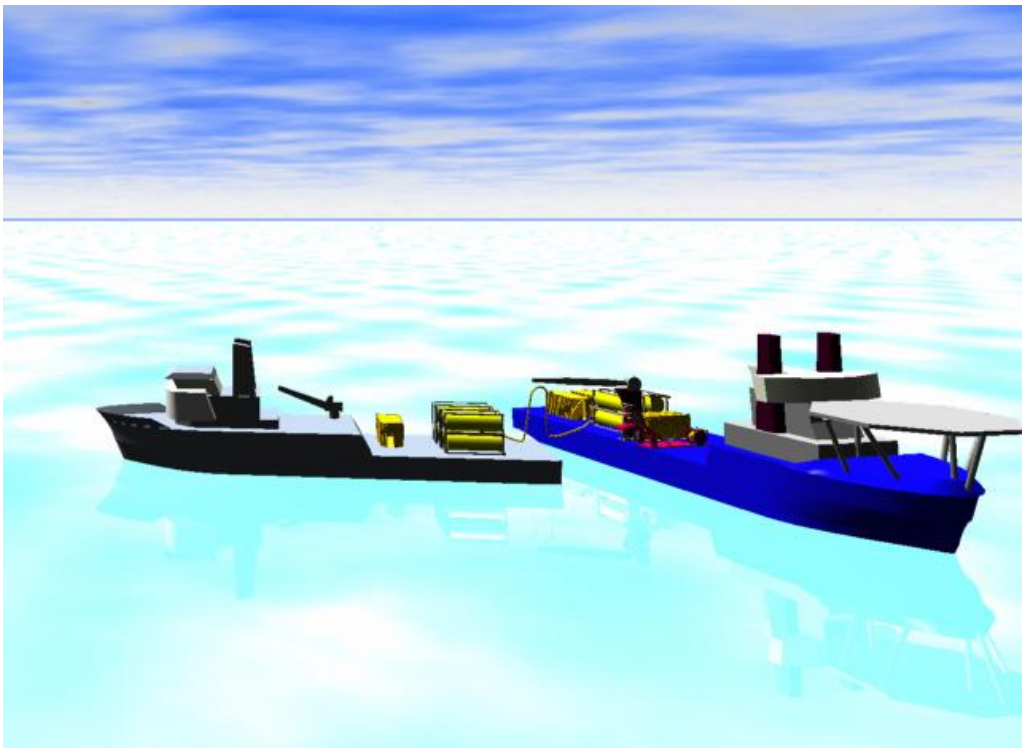
.5- ROLS – ROV and ROLS unit with water inlet base plate installed.



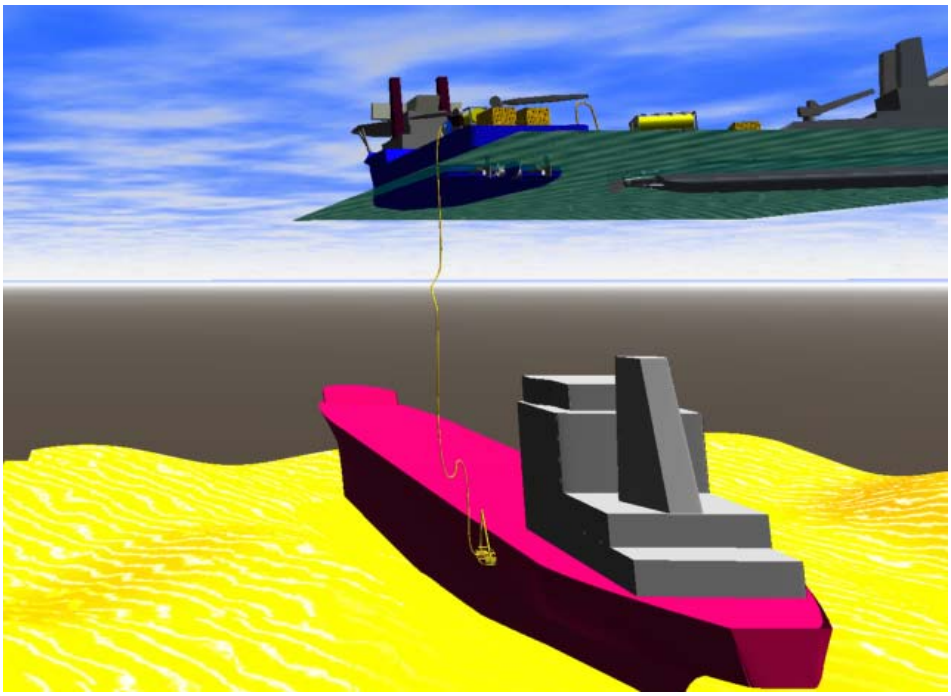
.6- ROLS – Oil Recovery / ROLS unit pumping to *Mystic Viking*



.7- Ship to Ship transfer / *Mystic Viking* to *Powhatan*



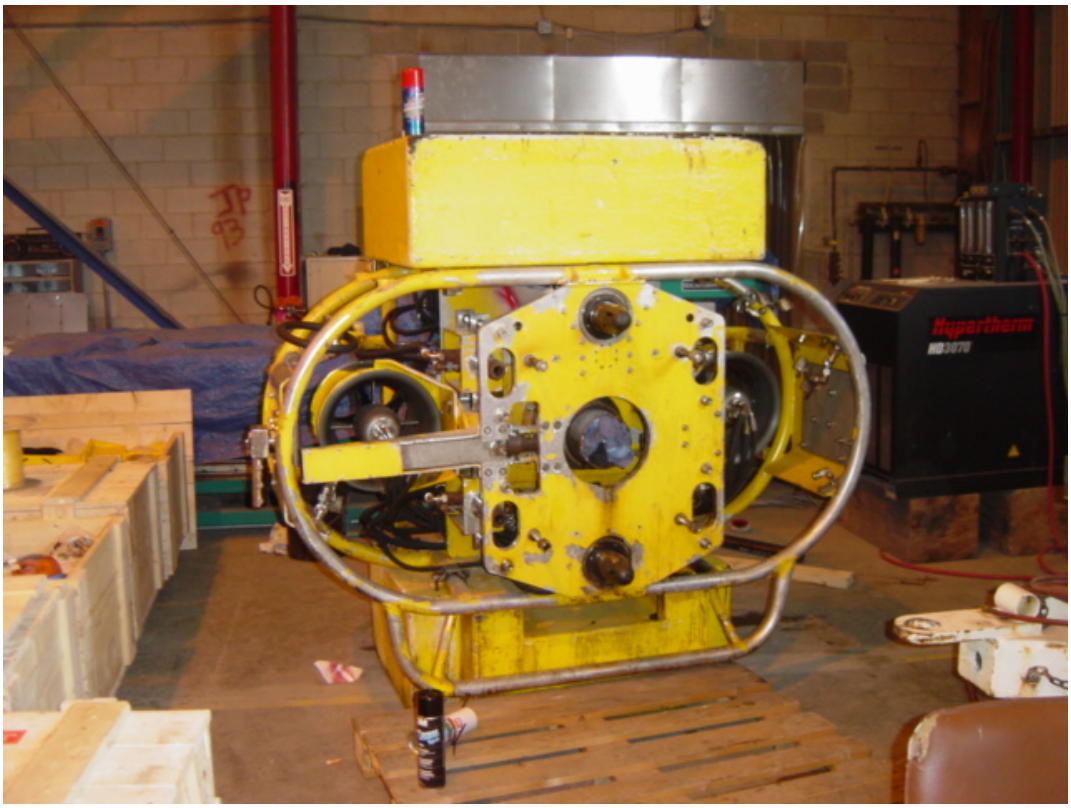
.8- Oil recovery operation – Overview/ ROLS and STS Operations



.9- *Mystic Viking*:

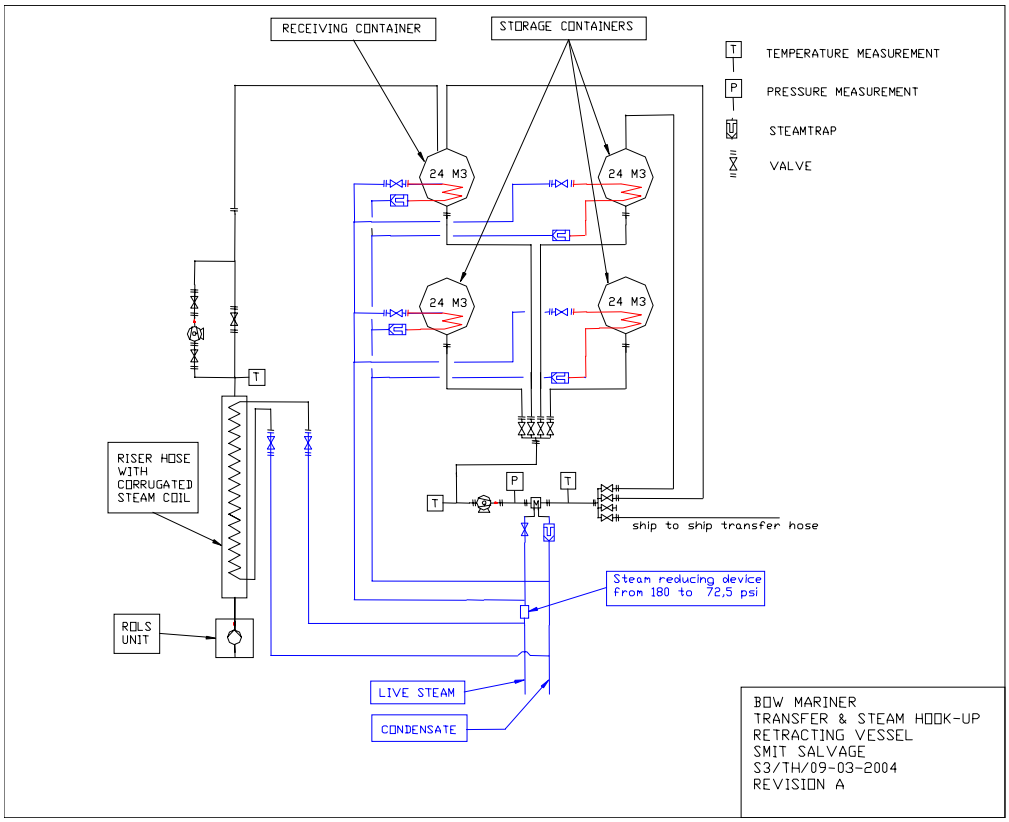
.10- *Powhatan*

.11- ROLS:



.12- Tank Containers:

.13- Heating schematic:

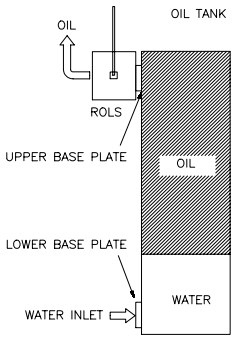


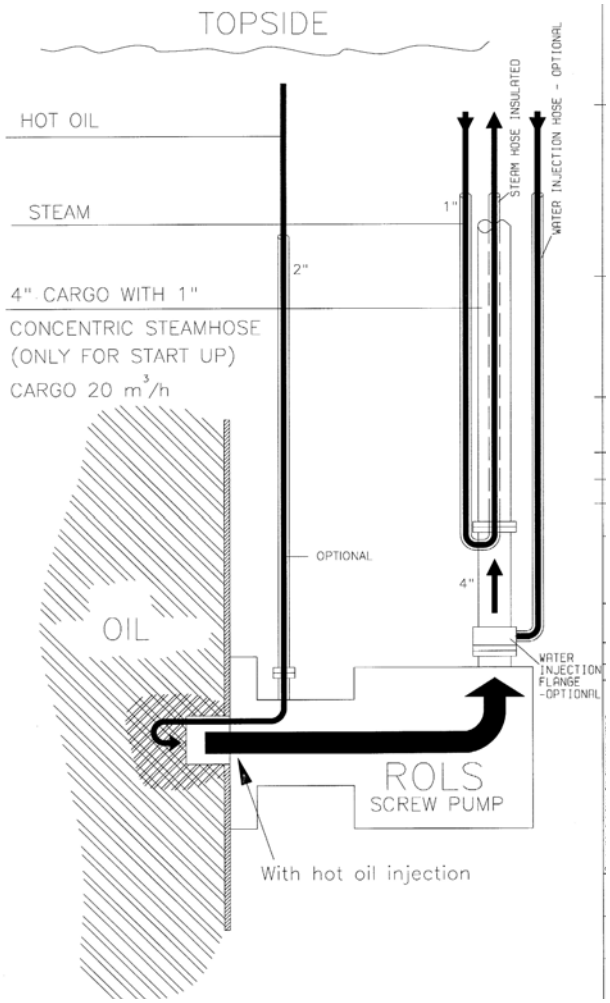
.14 ROV – Triton XLS

6.0 Remote Operated Offloading System (ROLS) standard description

BACKGROUND

The ROLS project was launched as part of the Norwegian State Pollution Control Authority's program for oil removal from sunken ships.





A lot of vessels along the coast of Norway represent a treat to the environment. Most of these ships were sunken during World War II. The ships are all classified as war graves and during offloading this has to be taken into consideration.
The project early identified the need to develop a driverless tool that could penetrate the tanks of the vessels and recover the fuel oil or cargo located in the tanks. The use of divers is costly and involves an added element of risk, especially in deep waters (100 feet and deeper).

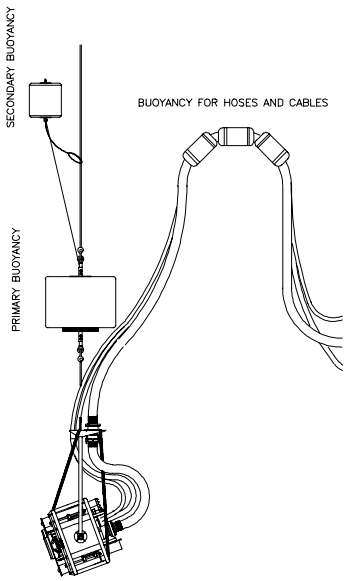
The ROLS system represents a safe and cost effective method for oil recovery of sunken ships/tanks, and the system can be operated from a barge or a vessel. In addition to be a cost effective method, the system is safe and time saving as no divers are used.

PATENT

The ROLS unit is a diverless "Hot Tap" system, patented world wide.

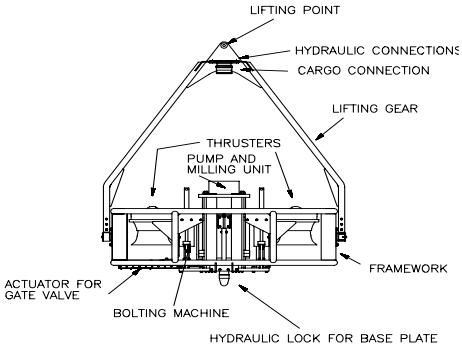
GENERAL DESCRIPTION

The ROLS operation is carried out from a surface vessel keeping its position by means of DP or four point mooring.

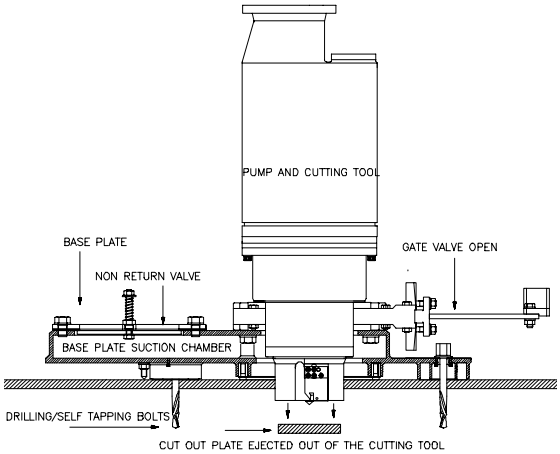


The ROLS system is a diverless hot tap and pump system capable of remote recovery of oils and other hazardous liquids from sunken vessels.
It will normally be launched at sea by means of an onboard crane; the ROLS unit is equipped with two thrusters for horizontal positioning of the unit. In addition the ROLS is assisted by a ROV (Remote Operated Vehicle). The ROLS system is powered from a surface hydraulic system via one hydraulic pressure hose and one hydraulic return hose.
The liquid from the wreck is pumped through a cargo hose up to a surface manifold system and into a tank-vessel.
All controls of the ROLS functionality will be performed from a surface control system via a sub sea control cable.
The ROLS unit consists of the following main equipment:

One pump with milling unit
Four drilling machines
One actuator for the gate valve (The gate valve is located in the base plate)
One hydraulic lock-in device for the base plate
Two hydraulic thrusters
One hydraulic control valve unit.
Four cameras
Four lights
Framework, lifting gear, hydraulic connections and protecting screens.



Materials:
Framework, brackets and other supporting structures are made from sea-water resistant aluminium.
Pump and other moving parts are made from stainless steel (AISI 316L).
Hydraulic motors and hydraulic cylinders are made from carbon steel. For further info see material specifications.



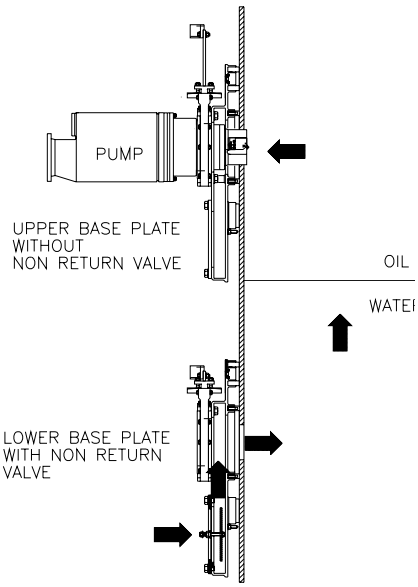
Umbilical with:
Cargo hose
High-pressure hydraulic hose
Low-pressure hydraulic hose
Control cable
Video cable

Umbilical winch
ROLS operating panel

ROLS landing plates (2 for each tank)
Diesel hydraulic powerpack

Prior to penetration of the hull, the oil tanks attachment points are marked by the ROV. Attachment points and co-ordinates are calculated from the as built drawings of the vessel. The co-ordinates are based upon known reference points such as frame nozzles welded to the hull of the ship, welding seams, water inlets etc. Magnetic pods with steel rods, which can be recognized by the ROV navigation system, mark the predetermined attachment points.

Each tank requires two penetration points. One at the lower part of the hull, and one at the upper part of the hull. *The ROLS concept utilizes the difference in physical and chemical properties between seawater and oil.* Since the density of the oil is lower than the density for water, it is important that the upper plate is located as high as possible on the tank, to be able to recover as much as possible. The lower Base Plate is equipped with a non-return valve allowing water to be sucked into the tank when the ROLS is pumping out the oil. This is necessary to maintain the pressure balance between the internal tank and the ambient pressure. Alternatively this balance can be maintained by utilizing the ventilation hoses from the tank to the deck.



After the ROLS is guided gently down to the lower part of the wrecks' oil tank, and there is physical contact between the base plate and the wreck, the two ROLS thrusters are started and increased to maximum power. Due to the friction between the Base Plate and the hull, the ROLS unit will remain steady in this position without any external support either from the ROV or from the crane.
The ROV can then be released from the ROLS and “fly” back to a position where it can observe the ROLS operation.

For viscous oils specific solutions can be developed depending on the circumstances of the situation including viscosity reducing fluids, heating and water-jacketed discharge hoses.

7.0 The operation:

In response to continuous outflow of oil from the wreckage of the *Bow Mariner* a decision was undertaken by authorities and the responsible party to intervene to remove the source of the oil outflow. The responsible party awarded this contract to Smit Salvage. In addition to oil recovery the responsible party required search and recovery of human remains, personal effects and assistance with investigation.

Once contracted salvage personnel were mobilized to Norway and Norfolk, Virginia for planning and execution. The ROLS unit has previously been used for oil recovery operations in a planned project manner. This was the first emergency response deployment of the unit. Smit and FRAMO design engineers met in Norway where the ROLS unit is stored. Technical requirement of the ROLS, cargo heating and pumping requirements were addressed. The equipment was mobilized via charter plan to Norfolk.

As operations were ongoing preparing the ROLS unit the anchor handling tug *Powhatan* was outfitted with an inspection class ROV and a small salvage team for a preliminary investigation. At the wreck site mooring lines blocked access to the wreck. The lines were saturated in oil and not recoverable without an oil containment arrangement. The lines were relocated to an area nearby the wreck and moored. Positions of the lines were provided to the USCG and a Notice to Mariners was issued. Due to an approaching severe storm the Powhatan returned to port. In port the inspection class ROV system was removed from the *Powhatan* for transfer to the *Mystic Viking*. The *Powhatan* was outfitted with an appropriate containment bin for recovering the oiled mooring lines. The *Powhatan* returned to site with a small salvage team and recovered the lines, which were subsequently disposed of by Clean Harbors. As removal of the mooring lines was completed the *Mystic Viking* arrived at the wreck site with a small Smit team. The balance of the team prepared the ROLS, steam plants, storage tanks, pumps and assorted apparatus to be installed onto the *Mystic Viking* and subsequently the *Powhatan.*

Concurrently, at the wreck site two ROV's were deployed from the *Mystic Viking* to search for human remains, personal effects and investigation. Approximately 50 hours of ROV flying time on the wreck was completed before having to cease operations due to weather. Seas had increased to 10 feet and a second approaching storm was forecast. The Mystic Viking returned to Little Creek and was outfitted along with the Powhatan as previously described. During the outfitting the salvage plan was presented to the USCG and State representatives. All inquiries from local, state and federal agencies were answered and permission was granted to proceed. Included in the plan was a separate permission to perform the decanting operation. All permissions and plans were submitted by the salvors with cooperation and support from the responsible party.

The salvage team comprised of 2 salvage masters, 2 salvage supervisors, 10 engineers, 4 salvage diver/ riggers, 11 ROV technicians/ pilots, standard marine crews of craft, and 1 shore coordinator. Additional key personnel included 1 SCR (responsible party representative), and 2 USCG representatives.

Upon completion of outfitting the *Mystic Viking* returned to the wreck site and conducted further investigation into the status of the (2) side bunker tanks that stored the largest quantities and majority of the fuel oil. While flying the ROV inside the port side cargo tanks, accessed through side plate and main deck damage, a route was found from the cargo tanks into the port side bunker tanks. The segregating bulkheads had been destroyed in the explosions. Once inside the bunker tank it could be seen with the ROV that this tank was no longer a risk to the environment. The starboard side bunker tank was investigated and found to have damage at the forward end. The ROLS unit was used to install a base plate with quick closing valve at the after upper section of the tank. Upon completion of installation the quick closing valve was opened and the tank was confirmed free of oil and was no longer a risk to the environment. Other tanks that contained smaller quantities of oil at the time of sinking were deemed to be a relatively low order environmental risk and no further intervention was required nor requested. Upon leaving location no oil was observed escaping from the wreckage.