APPENDIX G
FEASIBILITY STUDY

Plan for Raising Fishing Vessel Ehime Maru to Allow Recovery of Crewmembers

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Introduction

Tasking

The fishing vessel Ehime Maru sank in 600 meters, following a collision with USS GREENEVILLE (SSN 772). At the time of the sinking, all but nine of the crewmembers were successfully rescued. Following an extensive air/sea search, and a subsea search and visual inspection of the vessel's exterior, it is assumed that some, or all, of the missing crew became trapped inside the vessel. Commander in Chief, U.S. Pacific Fleet requested that Naval Sea Systems Command (NAVSEA), locate the vessel and provide a plan for recovering the missing crewmembers.

Statement of Condition of Vessel on Bottom

The Deep Submergence Unit Remotely Operated Vehicle (ROV) located Ehime Maru on 9 February at 157° 49' West Longitude and 21° 05' North Latitude. The vessel is sitting upright on the bottom but has obvious hull damage. Detailed salvage surveys were conducted by NAVSEA and Deep Submergence Unit ROVs, producing in excess of 20 hours of videotape. A pair of salvage masters from Smit Tak, a salvage contractor from Rotterdam, and a Japanese team of salvage experts viewed Ehime Maru via the video feed from the ROVs. The ship characteristics taken from the shipbuilder's drawings are as follows:

Ship's Characteristics	
IMO Number	**9142281**
Length Overall	**58.18 Meters**
Length Between Perpendiculars	**50 Meters**
Beam	**9.30 Meters**
Draft	**3.50 Meters**
Depth	**3.90 Meters**
Light Ship Weight	**754 Metric Tons**
Gross Tonnage	**499 Metric Tons**

Given the 600-meter depth of the Ehime Maru, its light ship weight and damaged condition, this will be a precedent setting operation, as characterized in Figure 1.

Damage that is evident from the video survey is highlighted in Figures 2, 3, and 4. The most obvious damage (shown in the pictures in Figures 3 and 4) is seen in the forward port and starboard shell plating in way of frame 68. Here the plating has visible buckling presumably from the impact of the vessel when it hit bottom. Other obvious damage includes bending of the forward mast to port and minor shell plate buckling at the stern and bow. She sits with her stern buried up to two meters in the sandy bottom with her rudder and screw not visible.

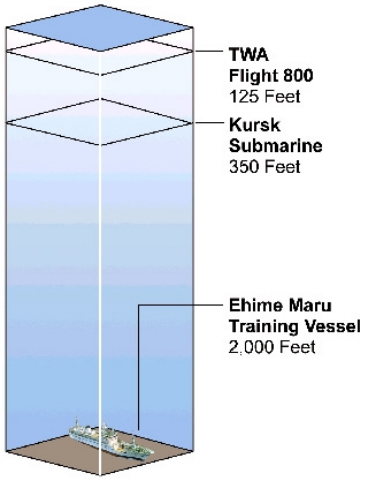

Figure 1. Depth Comparison

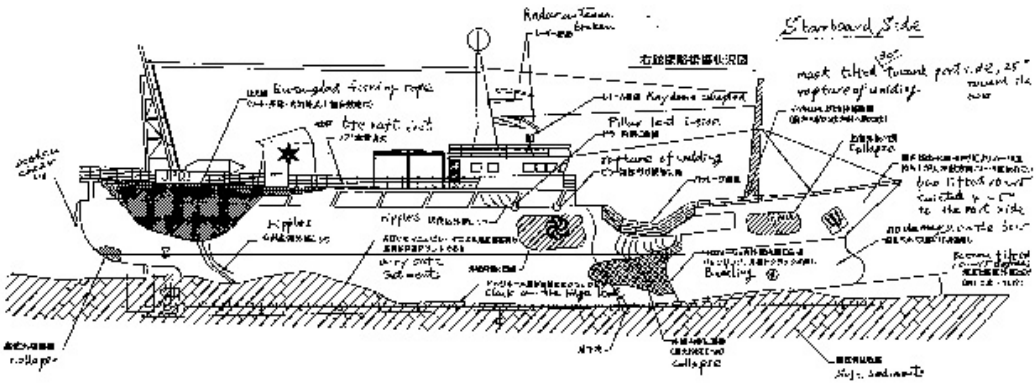

Figure 2 – Starboard Side View

Figure 3 – Starboard Side Forward

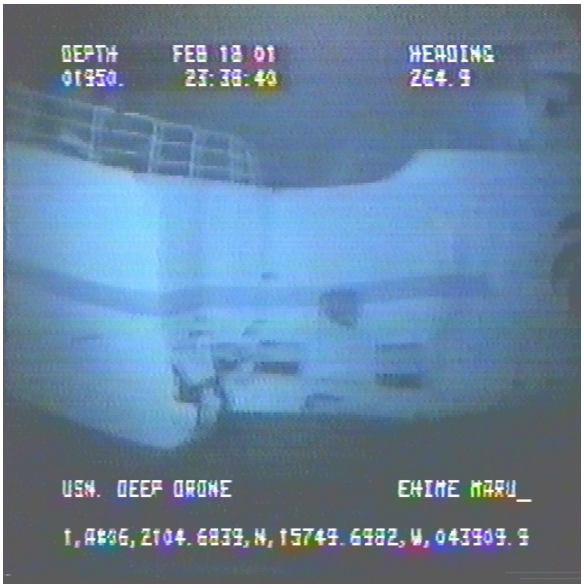

Figure 4 – Port Side Forward

Impact of Damage on Options

Additional hull damage at frame 18 is anticipated due to the rapid nature of the sinking of Ehime Maru and damage sustained by the USS GREENEVILLE's rudder. Rough order of magnitude calculations for flooding that would cause the vessel to sink in 10 minutes or less suggest a hole of approximately 10 m^2. Also, it is assumed that major athwart ship bulkheads were breached by the GREENEVILLE's rudder. Using a hull model based on a beam type finite element of at least 200 nodes and the shipbuilder's light ship weight distribution, multiple bending moment curves were developed for various lifting arrangements. Section moduli were adjusted in the vicinity of frame 18 and frame 68 based on the observed or suspected worst-case damage to these areas. Specific reduction in the section modulus at frame 68 assumed that only the center girder and side girders up to 1500mm off centerline along with the bottom and inner bottom were effective in accepting the loads produced by various lift configurations. Figure 5 provides a graphical depiction of the cross section at frame 68.

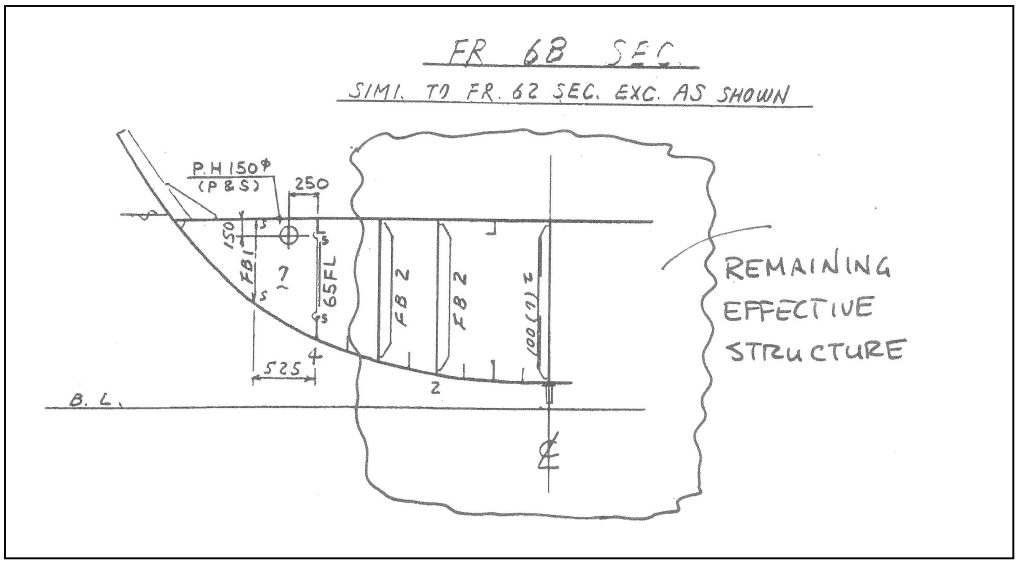

Figure 5 – Cross Section at Frame 68

For the aft damage adjacent to frame 18 the center girder, side girders up to 1500mm from centerline and bottom and inner bottom were assumed to be damaged and unable to carry any load. Figure 6 describes the section. Note that poop deck and navigational decks are excluded as load bearing structure.

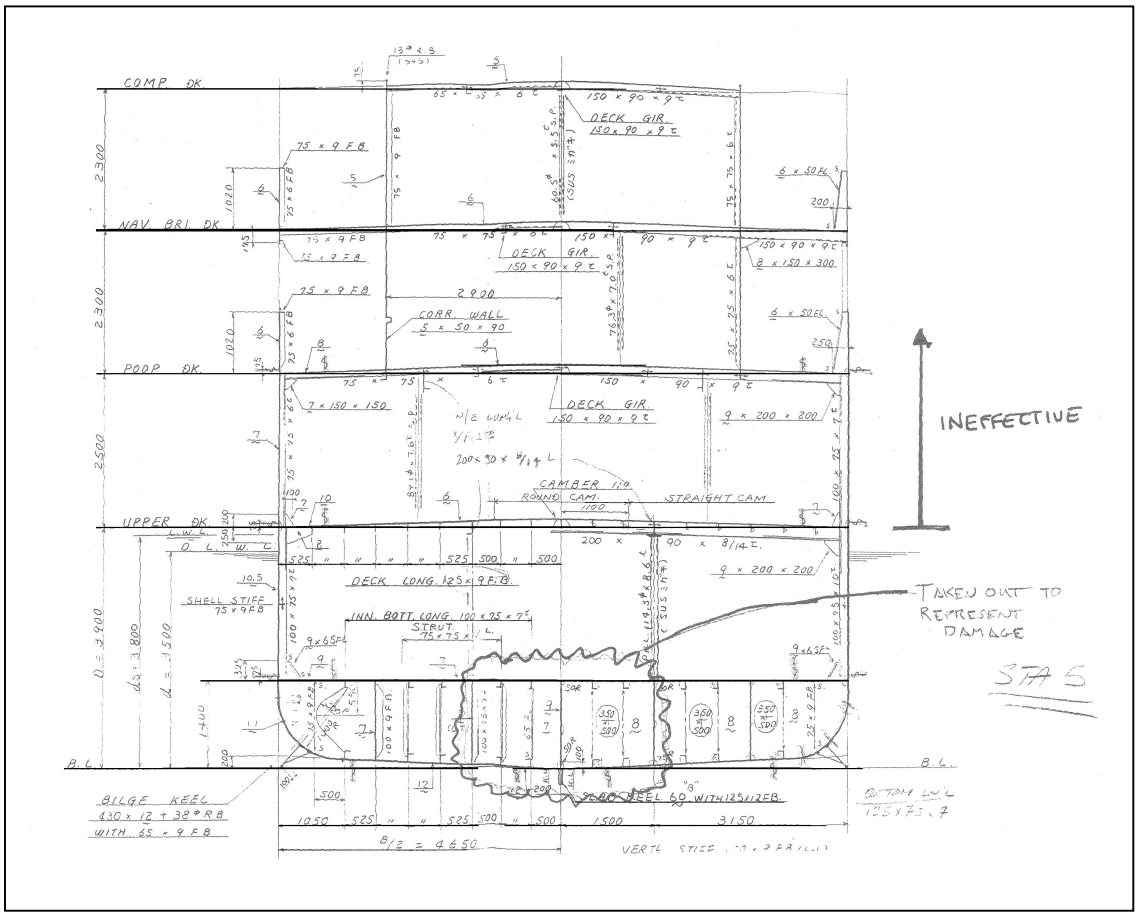

Figure 6 – Cross Section Damage, Frame 18

Using multiple bending moment scenarios, compressive and tensile stresses on the hull were calculated to assess the likelihood of structural failure of the hull during lifting. Localized panel buckling was also considered. At frame 68, where the visible hull damage is most prominent, calculated bending stresses approach yield for the static load imposed in dead lifting the vessel from the bottom. From the static analysis and concurrent dynamic analysis conducted on proposed lift configurations with typical Multi-Purpose Support Vessel sea keeping response profiles, a direct lift to the surface and up onto an ocean-going barge was deemed to be an unacceptable risk.

Options Considered Based on the Damage to the Hull

The first option considered for recovering remains of crewmembers was the use of a mini-ROV to enter the hull and search for and recover crewmembers. Once the vessel was located and found to be intact but with damage to internal bulkheads, this option was deemed not feasible. This type of operation has two problems: first, a precision method of cutting to provide access at that depth does not currently exist and second, fouling of the ROV's umbilical inside Ehime Maru is a major drawback. Without clear definition of where to locate remains, a full search of all compartments would be necessary. Based on the damage visible to the exterior hull and projecting damage to the stern based on the penetration of USS GREENEVILLE's rudder, it is reasonable to assume that bulkheads and piping on the interior also suffered damage. This would increase the likelihood that a mini-ROV would become fouled and unable to accomplish a recovery.

An alternative method for conducting an internal search of the hull would be to use saturation divers. However, at 600m this is not a viable option. Though open ocean dives have been accomplished at this depth, the extensive work of recovering crewmember remains would be not be possible.

Method Selected

To safely recover crewmember remains, the only feasible approach is to rig Ehime Maru on the bottom with lifting straps, lift her off the bottom, and transit to a shallow site. There the vessel can be laid down on the bottom and divers can conduct a thorough survey of all compartments. This method eliminates the adverse affects of lifting the vessel out of the water and maintains Ehime Maru close to the bottom during transit. Rigging for the lift will be accomplished using ROVs, which limits use of typical eductor type tunneling equipment. From multiple bending moment calculations, use of a pair of straps lifting at frames 15 and 61 provides the necessary support and allows effective balancing of the load. Placement of the straps presents a challenge as up to two meters of the hull is buried in the sandy bottom.

Two alternatives are being investigated to position the straps. First would be using a directional drilling technique to tunnel under the vessel passing steel plate straps. This would eliminate the need to stress the hull by lifting to place the straps underneath. Should directional drilling not prove effective, a second method is passing a wire under the stern aft of the rudderpost as the vessel currently sets. Lifting from this aft position enough to pass the straps would set up a bending moment, placing compressive stresses on the poop and navigational decks that may buckle these non-strength members. However, the upper deck and side shell will be able to accept the load.

Discussion of Plan

Phase II - Mobilize Salvage Forces

Mobilization of salvage forces includes the acquisition, charter, rent, and manufacture of all equipment necessary to support the operation. This mobilization is driven by the requirement to complete the lift and

relocate Ehime Maru to the near-shore site at a 30m depth by the end of August to optimize weather conditions. The major equipment required to perform the salvage operation includes:

- Coiled tube drilling system
- Remotely Operated Vehicles (2)
- WASP One Atmosphere Suit
- Special equipment design and fabrication including sheaves, clumps, spreader assembly, lifting frame, and general salvage support hardware
- Anchor handling tug
- Linear winches
- Lifting wire
- Multi-purpose support vessel
- Ocean going barge with tug for supporting diver operations and disposal.

The overall timeline for mobilization is shown in Figure 7, leading to the relocation of Ehime Maru by 15 September. Commitment for the floating assets is critical; specifically the ROCKWATER 2 (RW2), which is a Halliburton owned ship. As shown, the long lead systems include the coiled tube drilling system and the engineering, fabrication, and procurement of salvage systems. Both of these systems have been started via contract with Smit-Tak and will be completed in 70 days in Houston in order to meet the required shipment date for transport to Hawaii. Equipment will be ready for shipment in mid-June. The shipment to Hawaii will take 22 days so that all equipment will be staged in Hawaii in mid-July to commence outfitting of the RW2. Specific discussions of the equipment is included in the Phase III and IV sections of this report.

Mobilization of the linear winches and two lengths of 115mm wire rope will commence in Rotterdam in late May and will take 40 days for shipment to Hawaii. The winches and wire will be available for installation on RW2 in mid-July.

The ROVs and WASP are currently located in Houston and will be mobilized for shipment to Hawaii onboard the anchor handling tug in mid-June for arrival in Hawaii in mid-July.

Mobilization of an anchor handling tug will start in mid-June in Houston. The tug will be loaded with the coiled tube drilling system, salvage support equipment, ROVs, and WASP. She will depart Houston in mid-June for arrival in Hawaii in mid-July.

Mobilization of the RW2 will commence on 20 June in the Philippines. Transit time to Hawaii will take 20 days so that she will be available in Hawaii for outfitting in mid-July. The outfitting of RW2 with all salvage support equipment is scheduled for 14 days. The ship will be fully outfitted and ready to commence the salvage operation by 01 August.

Additional assets and equipment are required for supporting the divers during the crewmember recovery phase, the fuel offloading phase, and the disposal phase. NAVSEA has contracted Crowley Marine to provide support for these phases. This support will consist of an ocean going barge with ballast lift capability, tug, and support equipment. Crowley will mobilize the barge and tug from the West Coast of the U.S. in mid-August and commence outfitting of diving support and lift support equipment in late August. Crowley will provide support equipment including mooring systems, crane, power, accommodations, and hotel services. The diving equipment will be provided by Mobile Diving and Salvage Unit One (MDSU ONE). The barge and tug will support the crewmember recovery operations until completion, currently scheduled for mid-October.

At the completion of the crewmember recovery, Crowley will support the MDSU divers in the fuel offloading using hot tap systems and other means. This phase is estimated to be complete in seven days.

The final phase will be deep sea disposal of Ehime Maru. Crowley's barge and tug will be configured to perform a ballast lift of Ehime Maru two meters off the bottom and transport to a selected deep water site. Ehime Maru will be sunk at that final site. Estimated time for this phase is seven days.

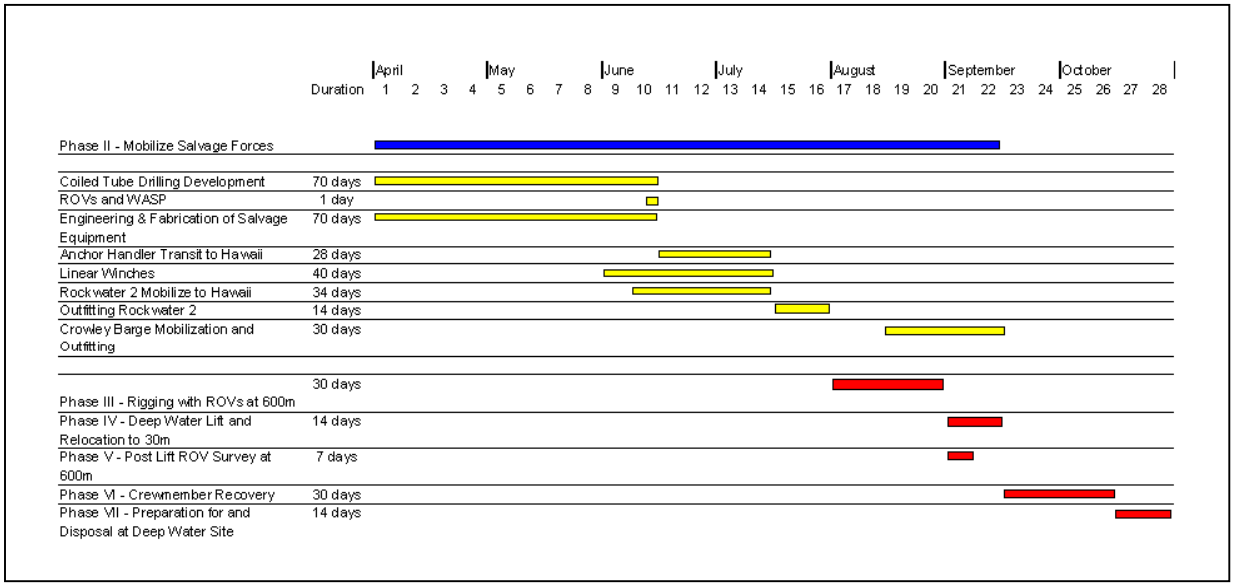

Figure 7 – Mobilization Timeline

Phase III - Rigging w/ ROV

This phase of the operation will include preparation of Ehime Maru for lifting from 600m depth. The operation will utilize two floating assets for accomplishment; the RW2 and an anchor handling tug. The RW2 is a multi-purpose support vessel with dynamic positioning capability, heave compensated crane, and other assets necessary for performance of the operation. She will be outfitted with special drilling equipment, linear traction winches, lifting wire, two Remotely Operated Vehicles, a WASP One Atmosphere Diving Suit, and all fabricated hardware for the operation. The rigging will be performed in several sequential steps as follows:

a. Inspection of Ehime Maru by ROV – A thorough inspection of Ehime Maru will be performed by one of the ROVs to finalize details for the rigging. During this inspection, a number of tests and trials will be performed including scouring out the area beneath the bow of Ehime Maru.

b. Removal of Debris – The ROVs will be used to remove and recover any debris attached to or around Ehime Maru including fishing nets, lines, rafts, and rigging on the masts.

c. Placement of Lifting Plates and Aligning Clumps – The RW2 salvage crew will place various equipment on the seafloor adjacent to Ehime Maru in preparation for installation of the lifting plates

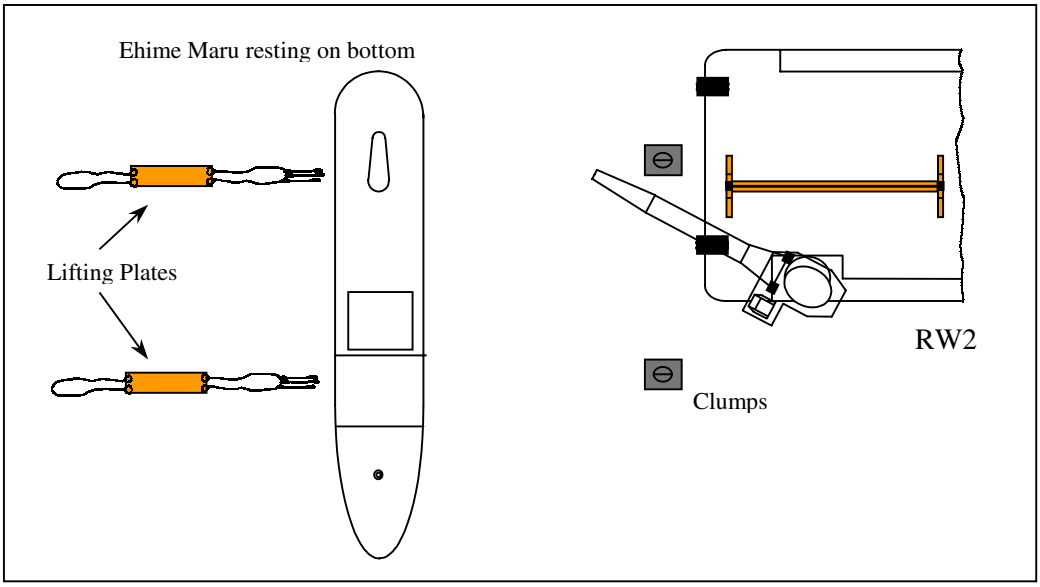

Figure 8 – Positioning the Lifting Plates and Clump Weights on the Seabed

(Figure 8). The lifting plates are 14m x 1.25m x 11mm with bridle terminations on each end. This will be accomplished using the heave compensated crane and a long baseline precision navigation system.

d. Coiled Tube Drilling – The coiled tube drilling system will be utilized to drill beneath the hull of Ehime Maru. The system developed in Houston is shown schematically in Figure 9. The figure shows the system supported from the surface with the actual drilling system on deck. An alternate system with the drilling head positioned on the bottom is also being considered. Final system selection will be made within the first month of the development process. As shown on the figure, a hole (approximately 350mm) will be drilled beneath Ehime Maru using the directional capability of the system. Additional holes may be drilled parallel to the original hole depending on the testing that will be performed in Houston prior to mobilization. The process will be repeated for both forward and aft lifting plate locations.

e. Lifting Plate Installation – After the holes are drilled beneath Ehime Maru, messenger lines will be utilized to attach to the ends of the lifting plates. High strength wire ropes will be attached to the lifting plates through the drilled holes and reaved around sheaves on the clumps. A water jetting assembly will be attached to the end of the lifting plate to assist in the extrusion of the plate through the sediment beneath Ehime Maru. The plates will be pulled through the drilled holes using either the ship's heave compensated crane or the anchor handling tug. A contingency plan has been developed in case the drilling operation is not successful. That alternate plan includes lifting the stern of Ehime Maru by the RW2 to gain access to pull the lifting plates under the hull. Access to the stern area is available to pass a sling. This method requires lifting the stern about four degrees allowing access for installation of the two lifting plates.

f. Installation of Spreader Assembly – The final step in the rigging process is to install the spreader assembly, see Figure 10. The spreader assembly is positively buoyant by 20 tons and held down by clumps configured below the assembly and outboard of Ehime Maru suspended from brackets. The assembly will be lowered with the heave compensated crane and positioned over Ehime Maru at a pre-determined location. When properly positioned, the two lifting plates will be attached to the spreader assembly using messenger lines from the RW2. ROVs will be used extensively during all activities in

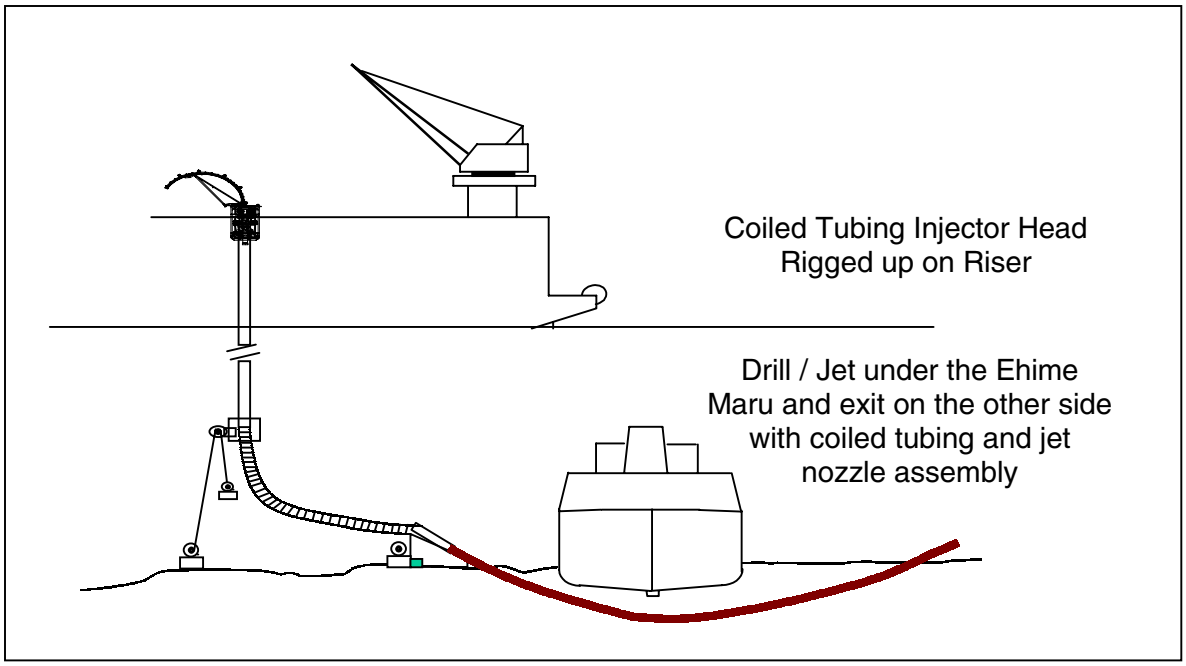

Figure 9 – Coil Tube Drilling System

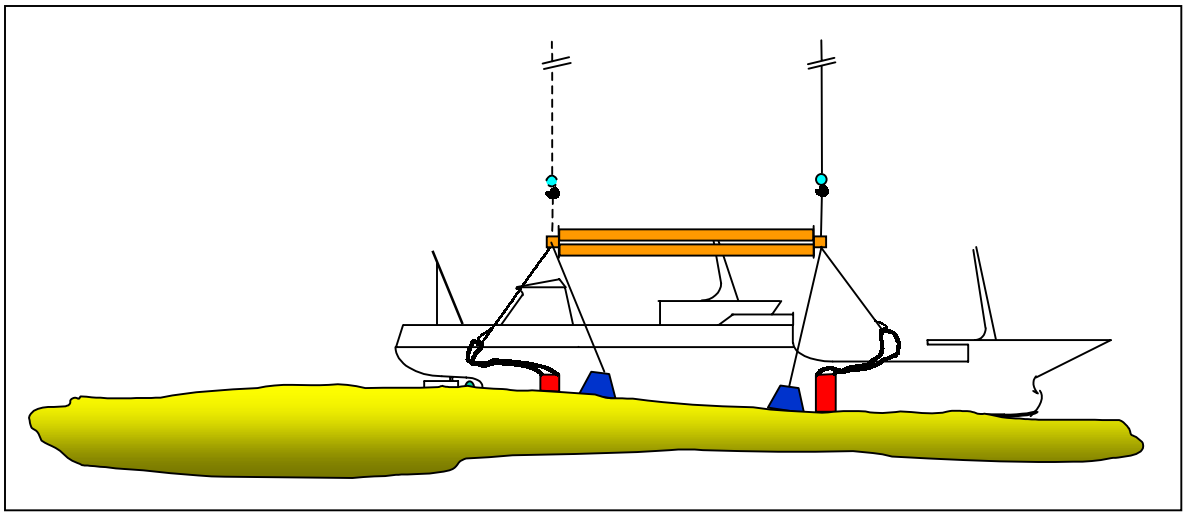

Figure 10 – Pulling the Slings into the Spreader Beam

this phase. Figure 10 shows the spreader assembly positioned above Ehime Maru and the ends of the lifting plates in the process of being attached to the spreader. Once the lifting plates are attached, Ehime Maru is fully rigged and ready to be lifted. The RW2 will then recover any rigging material left on the bottom.

Phase IV - Deep Water Lift and Transit to 30m Dive Site

This phase of the operation will include development of a bathymetric map of the seafloor along the route to be taken; making the initial lift of Ehime Maru from the seafloor; inspecting the vessel while suspended approximately 20m to 30m above the seafloor; transit to the 30m dive site and placing the hull on the bottom for the diver survey. Throughout each of the following steps of this phase, one of the ROVs will be deployed to monitor the condition of the hull and lifting rig (see Figure 11):

a. Bathymetric Survey. Prior to conducting the lift the routes between the salvage site, the diver inspection site and the final disposal site will be surveyed utilizing a precision fathometer coupled to a

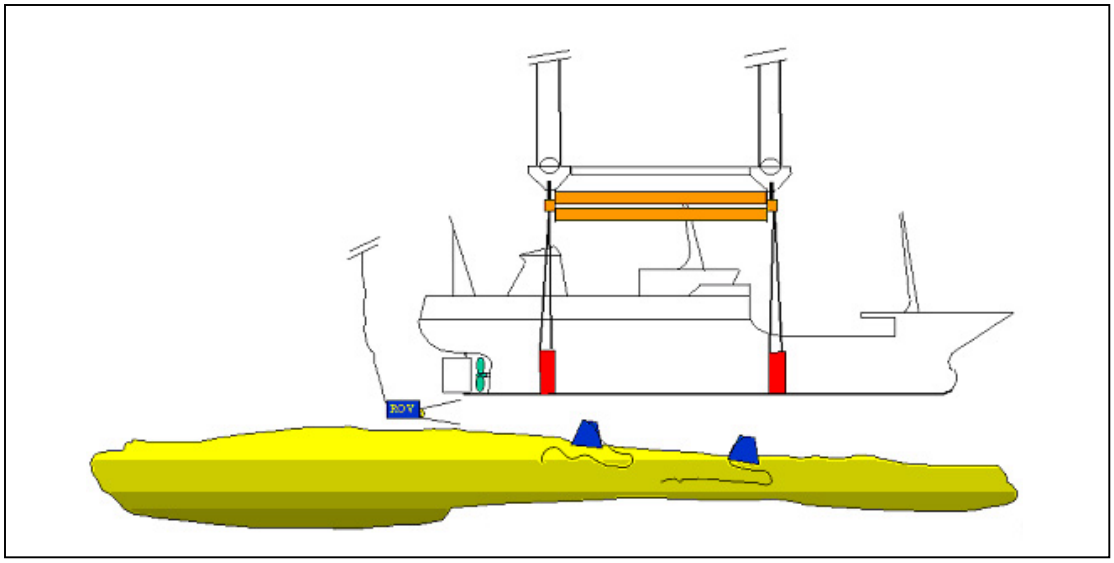

Figure 11 – Transit to 30m Dive Site

differential global positioning system or military GPS navigation system. This information will enable the RW2 to safely transit along the route with Ehime Maru suspended between five and fifteen meters above the seafloor.

b. Diver Survey of the 30m Site. At the 30m dive site, USN divers will conduct a thorough survey of the site and ensure that the bottom conditions will facilitate setting the hull down in a stable, upright position. They will also survey the anchor drop points for the moor that will be deployed to support the dive platform. Video documentation of the bottom will be made during each of the dives.

c. Sea Restrictions During the Lift and Transit. To ensure that the lift and transit is accomplished safely, a computer simulation with the RW2 and the proposed rigging material was done with wave heights up to four meters. To preclude any damage to Ehime Maru, transit will only be conducted if the forecast wave height is two meters or less.

d. Lift Timing. The lift will not commence until a 72-hour window of favorable weather is predicted. The salvage team will utilize USN weather services throughout the operation.

e. Transit to 30m Site. During transit to the 30m dive site one of the ROVs will be deployed to monitor the condition of Ehime Maru and the rigging gear. The ROV will utilize its sonar to ensure that Ehime Maru is maintained between 20m and 30m off the seafloor, and does not impact any outcrops, rocks or cliffs. The transit speed will not exceed one knot.

f. Remediation during Lift, Transit and Placement at 30m Site. Because oil might be released from the vessel during the lift or transit, a helicopter or fixed wing aircraft will be utilized to monitor for evidence of a release. A surface skimming system will be deployed with RW2 and an additional system will be on standby in Pearl Harbor. Subject to approval, two oil dispersant systems will be provided that can be deployed by helicopter. As RW2 approaches the 30m dive site, the second surface skimmer system will deploy to augment the initial system. Both skimmer systems will standby while Ehime Maru is placed on the bottom at the 30m site. Periodic over flights will continue to monitor for evidence of oil or fuel coming to the surface.

g. Bottom Stability of Ehime Maru at 30m Site. When Ehime Maru is placed on the bottom at the 30m site, an ROV will conduct a thorough survey of Ehime Maru to ensure that her hull rests solidly on the seafloor. To ensure diver safety, no dives will be attempted until the vessel has remained in a stable position for 24 hours. At that time, an external diver survey will be completed and the divers will assist

RW2 in detaching from the spreader assembly. The lifting bar will be recovered, leaving the spreader assembly suspended over Ehime Maru. RW2 will then commence demobilization. After the vessel has remained stable for 48 hours, the internal diving will commence. At any time that the vessel shifts, or otherwise exhibits any indication of instability, diving operations will cease until stability is re-established.

Phase V – Post-lift ROV Survey

As soon as practically possible following the lift of Ehime Maru, a visual survey of the sea floor where the vessel originally laid will be conducted. The purpose of the survey will be to ensure that all items of interest have been collected from the site. The survey will be accomplished with SUPSALV's ROV, DEEP DRONE.

The survey will cover a search grid of approximately 1000 meters by 1000 meters and will be centered on the area where Ehime Maru originally sat. The survey will consist of parallel and overlapping search runs with the entire grid being visually inspected. The visual survey will be limited to the 1000-meter square box unless the inspection warrants expanding the grid. This is deemed reasonable since a thorough visual and side scan sonar search outside of this box was conducted during the initial search and recovery effort. A video tape will be made of the entire search for documentation purposes.

The recovery of any remaining personal effects will be accomplished with the ROV manipulators and a collection basket. Recovered items will be placed in the basket and subsequently brought to the surface utilizing the ROV's drop hook. All personal effects will then be inventoried, washed with fresh water, bagged, and immediately turned over to the Japanese Consulate. In addition to the recovery of personal effects, any remaining items that pose a future danger (i.e., fishing nets, hooks, etc.) will also be recovered.

The Government of Japan (GOJ) has expressed an interest in possibly providing a Japanese owned and operated ROV for the post-lift inspection. If the GOJ does pursue this option and depending on the capabilities of the ROV utilized, then use of a USN asset may not be necessary.

Phase VI - Crewmember Recovery

U.S. Navy diving personnel will be augmented by SRF Yokosuka Japanese Divers. The SRF Yokosuka Japanese divers are already under OPNAV waiver to use U.S. Military diving equipment on a U.S. Navy dive station. Four SRF Yokosuka Japanese divers will be requested to support the mission, allowing two per shift. While one Japanese diver is in the water, the other will be at the communications console. Other than diving, they will be able to identify spaces through the diver's camera topside monitor. These divers will be a major part of the salvage through diving and topside support. They will not count as part of the minimum dive team requirements since they will be performing other duties when not diving.

Per the U.S. Navy Diving Manual, a minimum of eight divers is required to operate a surface-supplied diving side using more than one diver. This operation will require two diving systems in use for a minimum of 16 divers per shift. This does not include the personnel required for decontamination, chamber surface-decompression, stage handling, topside camera systems, winch operators, medical personnel, etc.

The estimated 30 meters of water will put divers on a Surface Decompression Table using Oxygen between 30m to 35m depending on actual depth at final rest. Some dives will be less than 30 meters when divers are working in upper decks. Based on this, divers will have between 60 and 90 minutes of bottom time with less than 15 minutes of in-water decompression. With quick turn around times, the maximum amount of dives possible in a 12-hour shift is six. Using three divers per dive, this would require 18 divers per shift. The intention is to use two shifts to support 24-hour diving operations.

Discussion of Methodology of Entering, Inspecting and Documenting all Compartments.

Entering. The third deck is the deepest deck on the Ehime Maru. This deck has the engine room, student mess room, refrigerator store room, etc. Three divers will be used when entering this third deck. Red diver will enter the second deck through passageways accessible on the first deck and will be tended until he is at the ladder or opening to the third deck. Green diver will proceed into the second deck to meet up with Red diver while being tended by Yellow diver. Red diver will then proceed to the third deck while being tended by Green diver. Yellow diver will tend Green diver.

Inspecting, Recovering, and Documenting. The initial inspection will be conducted on last known location of the sailors. Remains and personnel affects encountered will be collected and removed to the surface. If all remains are not recovered during this search, an extensive search of every space will be conducted and documented on video tape. The entry to each space will be clearly marked and numbered. The diver will enter the space and perform a thorough search of the entire space. The helmet mounted camera and light system will be connected to a topside video recorder and monitor. The Diving Supervisor, the SRF Japanese diver, as well as Japanese VIPs can observe the entire search topside through this monitor. The ship's drawing topside will be marked as the divers complete each inspection. A space is completely searched when topside personnel are satisfied that there are no remains in that space. Operations will continue until all victims have been found or all spaces have been thoroughly searched with video documentation.

Details of Support Platform to be Used. NAVSEA will contract with Crowley Marine for the diving support barge CMC 450-10. This barge will be used as a dive platform during the recovery phase and then used as the lift platform for at-sea disposal. The 120 meter long by 30 meter wide barge has power, water, galley, mooring gear, cranes, and berthing for 80 personnel. The barge will be outfitted with mortuary facilities and appropriate personnel to handle crewmember remains. The barge will be moored and supported with the assistance of a commercial tug contracted by NAVSEA.

Type of Diving Used With Number of Chambers Required. Surface Decompression using Oxygen will be used for decompressing the divers. This will allow for minimum time spent in the water with the majority of decompression conducted topside in a recompression chamber under a controlled atmosphere. Two chambers will be used for the operation. A Transportable Recompression Chamber System (TRCS) will be used for the Surface Decompression and a Fly Away Diving System (FADS) Dixie Double Lock chamber will be used for treatment of Arterial Gas Embolism (AGE) or Decompression Sickness (DCS).

Remediation Effort During Crewmember Recovery Phase. During the crewmember recovery phase, NAVSEA will provide personnel and equipment to ensure that the environment is protected by performing periodic surveillance over flights. Additionally, we will maintain one vessel-mounted dispersant spray system on site. One skimmer system will be located on site for the initial survey period and retained as required. A second skimmer system will be in ready standby at Pearl Harbor. Two helicopter dispersant bucket systems will be retained in ready standby in Honolulu.

Timeline. The planned duration for the recovery phase is 30 days. This phase includes load out, mooring, bad weather days, and a full stem-to-stern inspection and video documentation. The length of this phase can be reduced if all crewmembers are found early. As mentioned in Phase IV, diving operations will not start inside the hull until 48 hours after returning Ehime Maru to the ocean floor. This initial time will be utilized to perform external inspections of the condition of the vessel.

Phase VII – Preparation and Disposal of Ehime Maru at Deep Water Site.

Once the dive team completes operations, Ehime Maru will be lifted back off the seafloor and taken to a deep water disposal site. The barge that supported the diving operations will be utilized to make the lift and take Ehime Maru to her final resting place. Steps required in this phase include:

a. Preparation for Disposal. The initial task in this phase is to remove the fuel and lube oil from Ehime Maru to prepare for ocean disposal. Depending on the condition and integrity of the tanks and tank vents, it is likely that tank access from inside the hull would be required, particularly for the lube oil tanks, in order to remove as much remaining oil as possible. Oil released from damaged tanks and trapped in other vessel spaces would be difficult to detect and recover. Even proper access to tanks containing oil would not ensure complete oil removal, as oil trapped by buoyant forces against the tanks internal strength members would not flow to the tank access point. Offloading oil from the submerged vessel following appropriate rigging by divers is feasible, however, it is unlikely that all remaining oil would be removed. A method for offloading oil would utilize divers to access tanks through vents and pumping to the support barge. Alternately, a hot tap system can be used to access tanks through tank tops and sides to increase accessibility. A detailed plan will be developed for oil removal during the planning and engineering phases of the operation. However, based on the condition of the tanks and piping on Ehime Maru, it may be prudent not to attempt fuel removal as it may increase the risk of environmental damage at the near shore site.

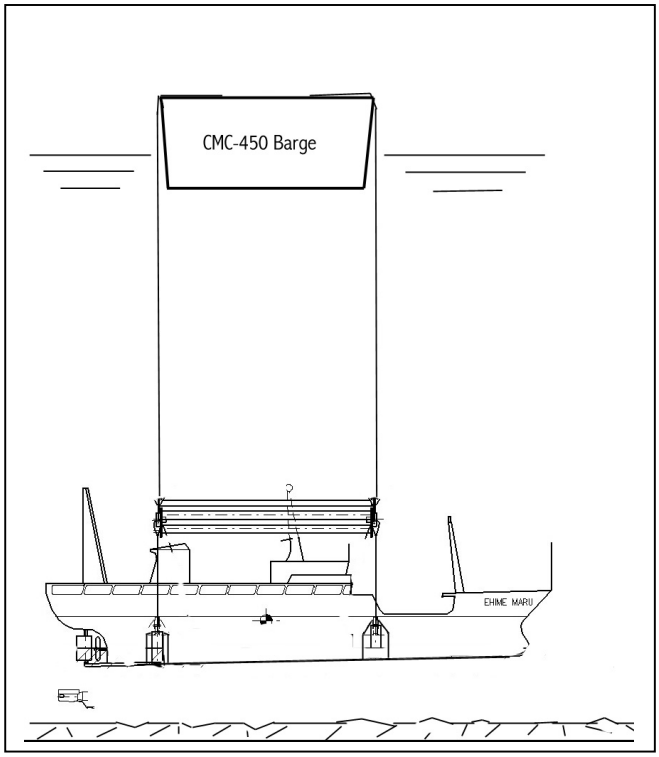

Figure 12 – Barge Lift and Transit to Disposal Site

b. Method for Reattachment. The barge will ballast down approximately 4.5 meters while moored directly over EM. The lifting beam will be lowered back to the spreader assembly, this time utilizing 100mm, Grade 3 chain instead of wire rope. Divers will attach the lifting beam to the spreader assembly and do a final inspection to insure that all rigging is still in place. See Figure 12.

c. Lift from Sea Floor. Once divers are clear of the water and conditions are acceptable, the slack will be taken out of the lifting chains using deck winches and wire rope. Once all slack is out of the chains, the barge will be deballasted to return to its original draft. This will lift Ehime Maru clear of the sea floor for transit to deep water.

d. Transit to the Disposal Site. Two tugs will be used to tow the barge/ Ehime Maru to the disposal site, following the surveyed route. One tug will tow, while the other is connected to the stern of the barge to maintain constant drag for control. A maximum speed of one knot will be maintained.

e. Sinking at the Disposal Site. Navy divers will flood the spreader assembly and rig explosive cutters on the slings to release Ehime Maru from the lifting assembly. The barge will then be towed back to Pearl Harbor to demobilize the dive system and personnel, completing the operation. During this phase, NAVSEA will provide periodic surveillance over flights to detect any spill. A skimmer system be retained on site during the entire oil removal process and will accompany the vessel to ten miles offshore. A second skimmer system will be retained in ready standby at Pearl Harbor throughout the process. Two helicopter dispersant bucket systems will be in ready standby in Honolulu and full logistic support will be provided.