

**NATIONAL TRANSPORTATION SAFETY BOARD
Office of Research and Engineering
Vehicle Recorder Division
Washington, D.C. 20594**



GROUP CHAIRMAN'S FACTUAL REPORT OF INVESTIGATION

***S.S. El Faro* Wreckage Examination Report**

DCA16MM001

**By
Sean Payne**

NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, D.C. 20594

June 26, 2017

***El Faro* Wreckage Examination**

Group Chairman's Factual Report by Sean Payne

1. EVENT

Location: 36 Miles NE of Crooked Islands, Bahamas
Date: October 01, 2015
Vessel: SS *El Faro*, Registration IMO: 7395351
Operator: TOTE Services
NTSB Number: DCA16MM001

On Thursday, October 1, 2015, about 07:15 a.m. eastern daylight time, the US Coast Guard received distress alerts from the 737-foot-long roll-on/roll-off cargo ship *El Faro*. The US flagged ship, owned by Sea Star Line, LLC, and operated by TOTE Services (TOTE), was 36 nautical miles northeast of Acklins and Crooked Islands, Bahamas, and close to the eye of Hurricane Joaquin. The ship was en route from Jacksonville, Florida, to San Juan, Puerto Rico, with a cargo of containers and vehicles. Just minutes before the distress alerts, the *El Faro* master had called TOTE's designated person ashore and reported that the ship was experiencing some flooding. He said the crew had controlled the ingress of water but the ship was listing 15 degrees and had lost propulsion. The Coast Guard and TOTE were unable to reestablish communication with the ship. Twenty-eight US crewmembers and five Polish workers were on board.

2. GROUP

On January 12 - 13, 2017 a video group was convened at the National Transportation Safety Board (NTSB) Vehicle Recorder Laboratory. In addition to the NTSB's Research and Engineering Group Chairman, the group was comprised of the NTSB's *El Faro* investigation Naval Architecture Group Chairman and Naval Architecture Group party representatives, or their designee.

Chairman: Sean Payne
Mechanical Engineer
National Transportation Safety Board (NTSB)

Member: Eric Stolzenberg
Senior Marine Accident Investigator
National Transportation Safety Board (NTSB)

Member: LT. Evan Reger
Naval Architect/Marine Safety Engineer
United States Coast Guard (USCG)

Member: Thomas Gruber
Chief Engineer
American Bureau of Shipping (ABS)

Member: Lee Peterson
Director of Operations
TOTE Maritime Puerto Rico

Member: Eugene Van Rynbach
Naval Architect/Marine Engineer
Vice President
Herbert Engineering Corp.

Member: Sean Kery
Senior Distinguished Technologist
CSRA

3. DETAILS OF INVESTIGATION

Multiple sources of photographs and video from all three missions associated with the search and underwater recovery of the voyage data recorder (VDR) were examined on January 12 and 13, 2017 at the NTSB's Vehicle Recorder Laboratory in Washington, D.C.

In general, although the entire hull, bridge, stack and mast were examined, only damaged areas of the components are discussed in the report. Undamaged portions of the ship's structure are not covered in this report. Additionally, areas that were not covered by ROV¹ photography or video were not examined or discussed. In general, ROV photography and video was provided for most of the exterior ship structure.

The ROV imagery generated from search missions I, II and III are provided in the public docket as attachment 1 to this report; El Faro ROV Imagery. Attachment 1 contains only imagery of ship structure or large debris; it does not contain imagery of the seafloor in areas that were not pertinent to the investigation. The submersible imagery is sorted in the following hierarchical structure:

- Ship's Structure (Region: Bow, Stern, Wheelhouse etc.)
- Voyage/Mission Number
- Imagery Capture Vehicle

¹ ROV – Remotely Operated Vehicle

The vessel lies on a generally flat region of seafloor consisting of what appears to be soft sand and sediment. The makeup of the seafloor appeared to be sandy, however, the makeup of the seafloor was not extensively examined or quantified by the group. In general, the ship's deck sockets were intact. Cargo inside the ship's hold that were viewed either through access ports or openings in the ship's structure were noted. The condition of the cargo as well as the securing of those cargo was noted where possible. The 160 figures below contain still imagery and screen captures from recordings viewed by the group. The presentation of the ship's structure as examined by the group begins with the main hull from the main deck down, moving from the port side bow in a counter-clockwise direction. Next the deck house sides and top were reviewed. Pieces of *El Faro's* structure located away from the main area of the structure are discussed in the order of their size. Imagery of the ship's wheelhouse and navigation bridge deck (which was located approximately 965 meters from *El Faro's* main hull) is presented, as well as imagery of the ship's mast, the stack, and a lifeboat found on the seafloor.

Figures 1 through 6 were created from sonar data, photographs and video compiled from VDR search mission II aboard the Woods Hole Oceanographic Institution's vessel *Atlantis*. Although all three missions provided video and photographic imagery, only mission II data was used to map and categorize wreckage in the debris field.

Figure 1 is an annotated side scan sonar composite image of the seafloor in the vicinity of the *El Faro* wreck. The hull, mast/VDR, stack, bridge, and one of the lifeboats are annotated on the image. Items on the seafloor associated with cargo and other vessel structure and components are annotated and described by the legend.

Figure 2 depicts an orthogonal view of the main hull wreckage geometry of the *El Faro* wreck processed from multibeam sonar scans conducted during mission II on the R/V *Atlantis*. Both the X-Y scale and the depths scale are given in meters.

Figure 3 is a side view of the main hull processed from multibeam sonar scans conducted during mission II on the R/V *Atlantis*. Both the X-Y scale and the depths scale are given in meters.

Figure 4 is an isometric side view of the port side of the main hull processed from multibeam sonar scans conducted during mission II on the R/V *Atlantis*. Both the X-Y scale and the depth scale are given in meters.

Figure 5 is an isometric side view of the starboard side of the main hull processed from multibeam sonar scans conducted during mission II on the R/V *Atlantis*. Both the X-Y scale and the depth scale are given in meters.

Figure 5 is an isometric view from the port quarter of the *El Faro* wreck. The image was created from processed multibeam sonar data. No scale was applied.

Figure 6 is an isometric view from astern the *El Faro* wreck. The image was created from processed multibeam sonar data. No scale was applied.

Attachment 2 is a simplified inboard profile of the El Faro. The drawing is given in .PDF format.

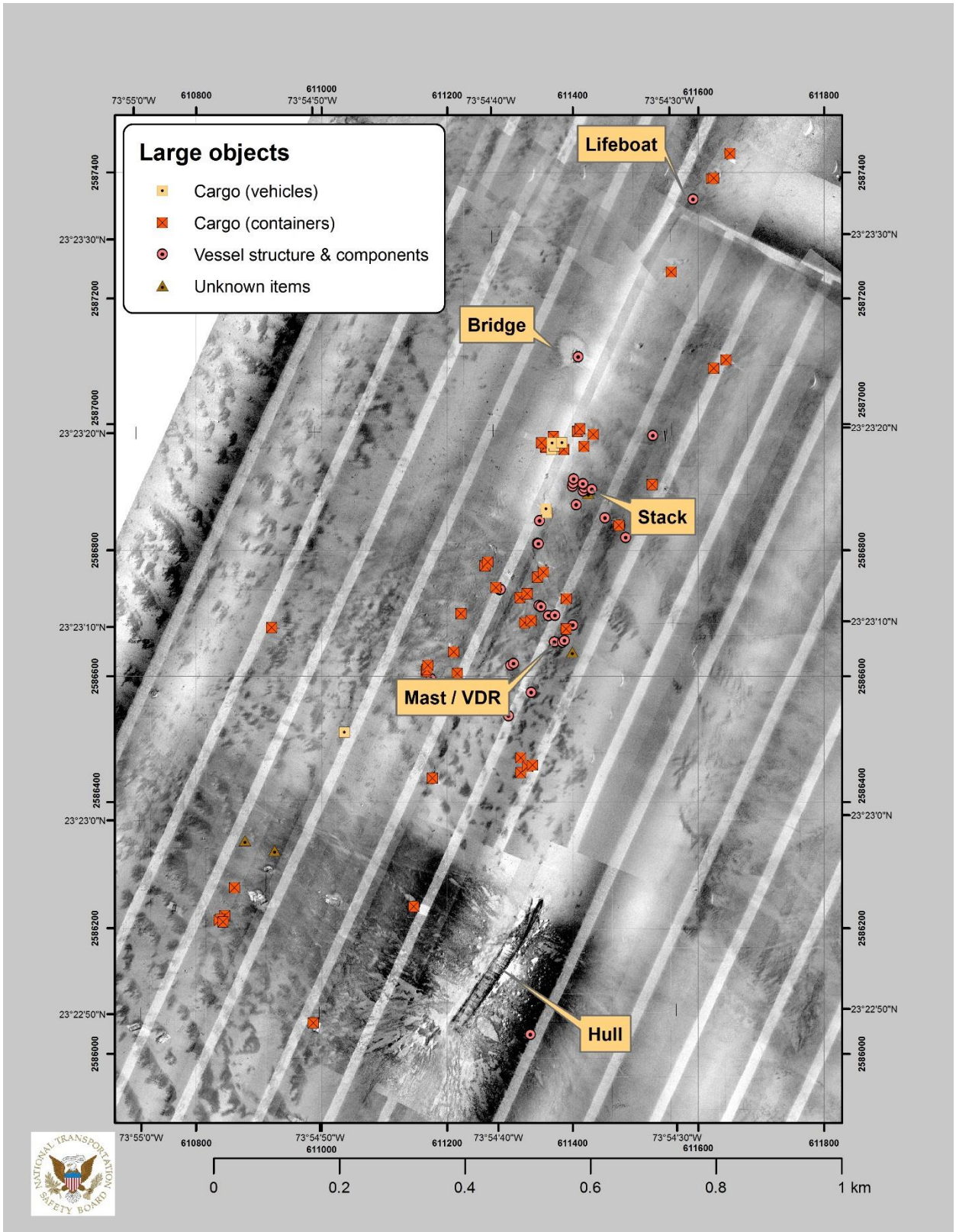


Figure 1. A generalized layout of the *El Faro* shipwreck and associated structure and cargo.

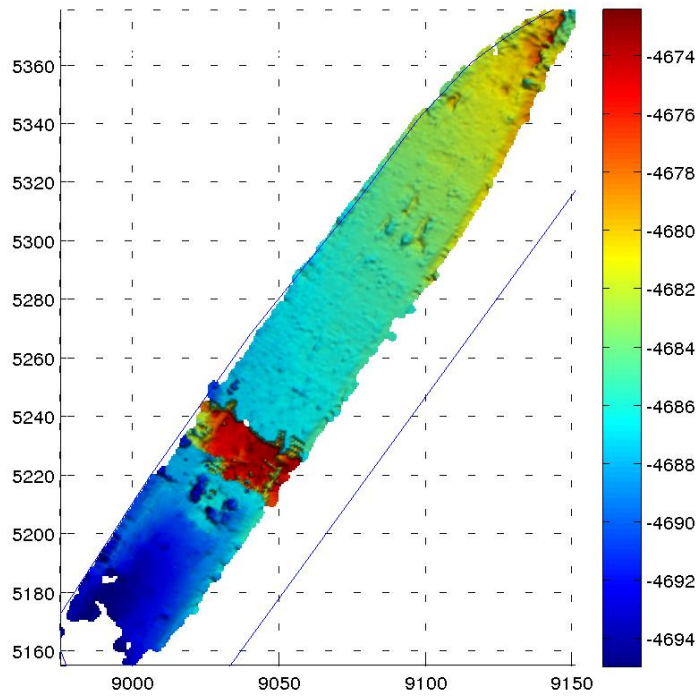


Figure 2. An orthogonal view of the El Faro shipwreck processed from multibeam sonar data.

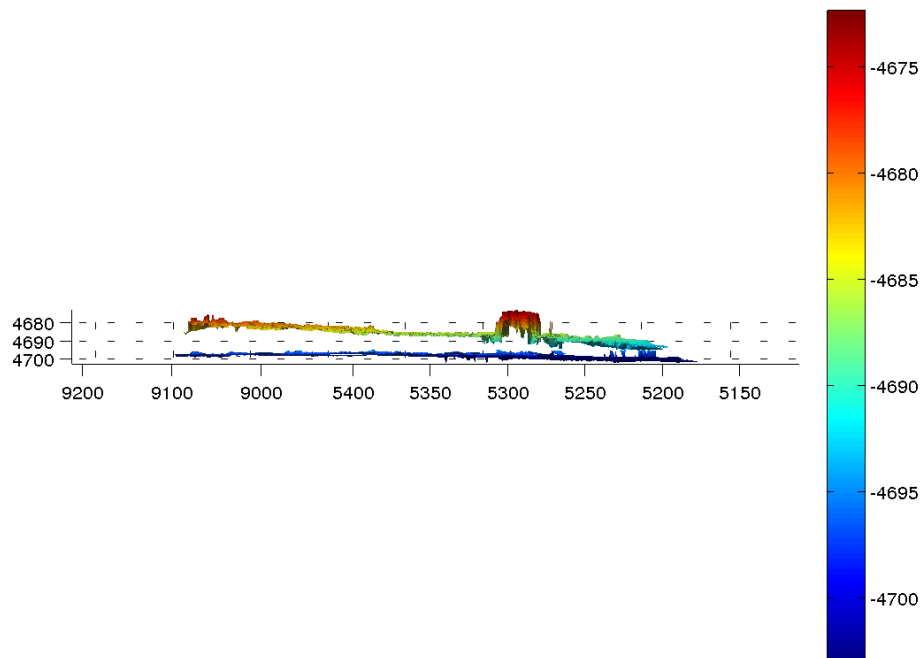


Figure 3. A side view of the El Faro shipwreck processed from multibeam sonar data.

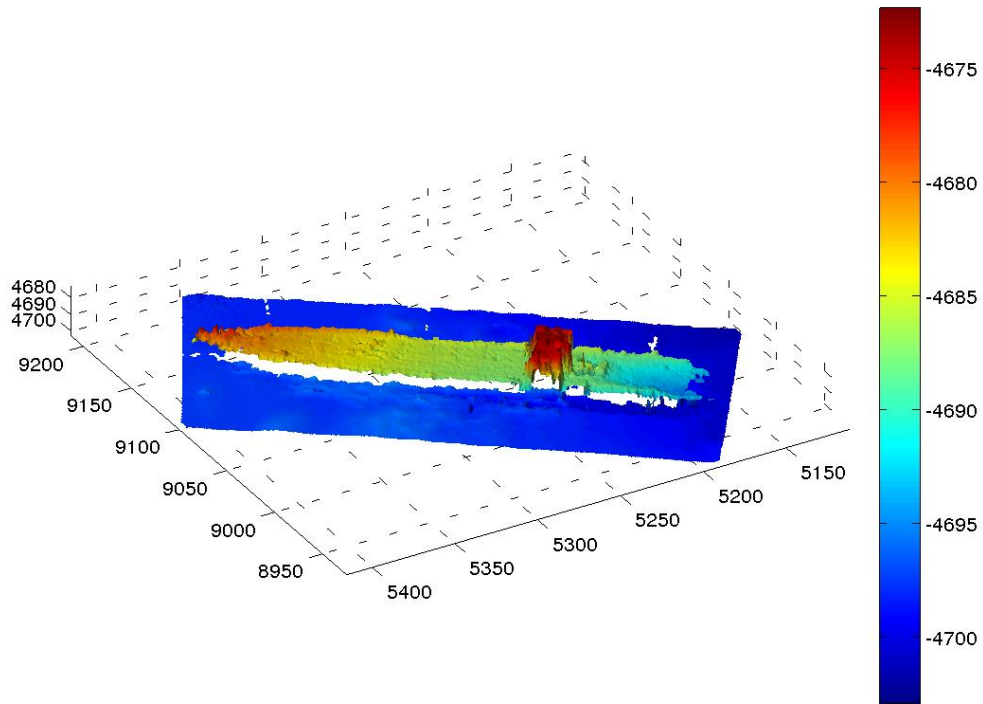


Figure 4. An isometric view of the port side of the *El Faro* wreck processed from multibeam sonar data.

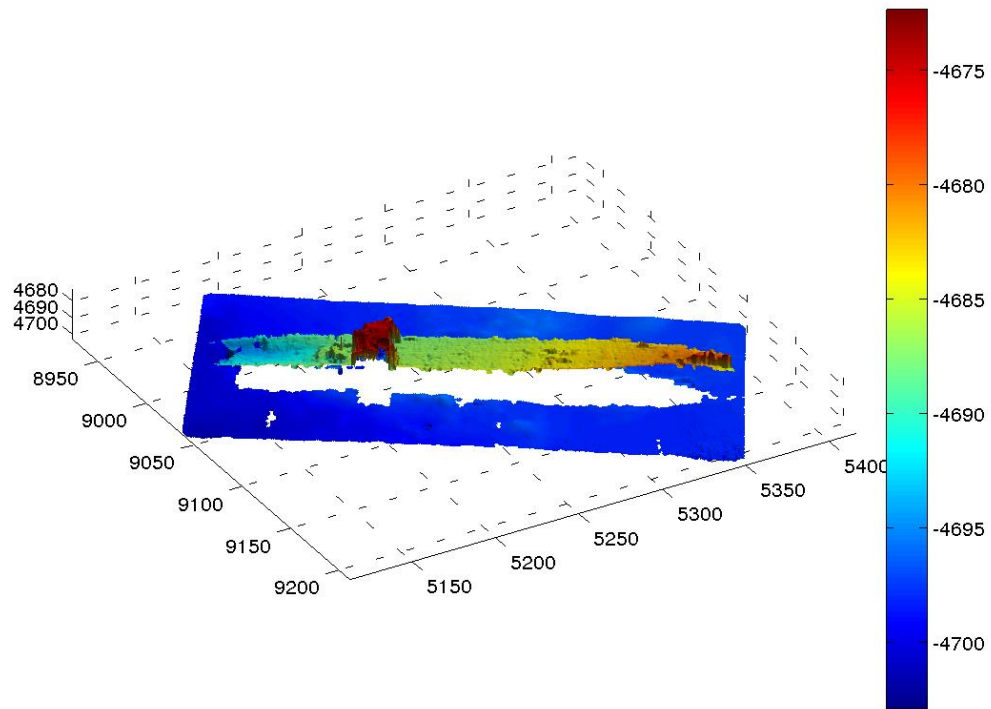


Figure 5. An isometric view of the starboard side of the *El Faro* wreck processed from multibeam sonar data.

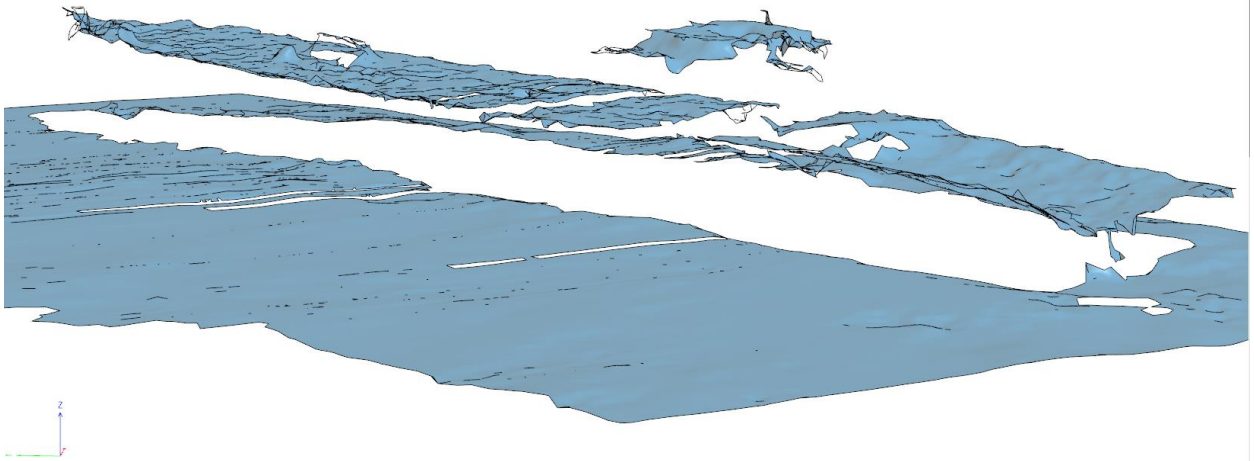


Figure 6. An isometric view from the port quarter of the El Faro wreck processed from multibeam sonar data.

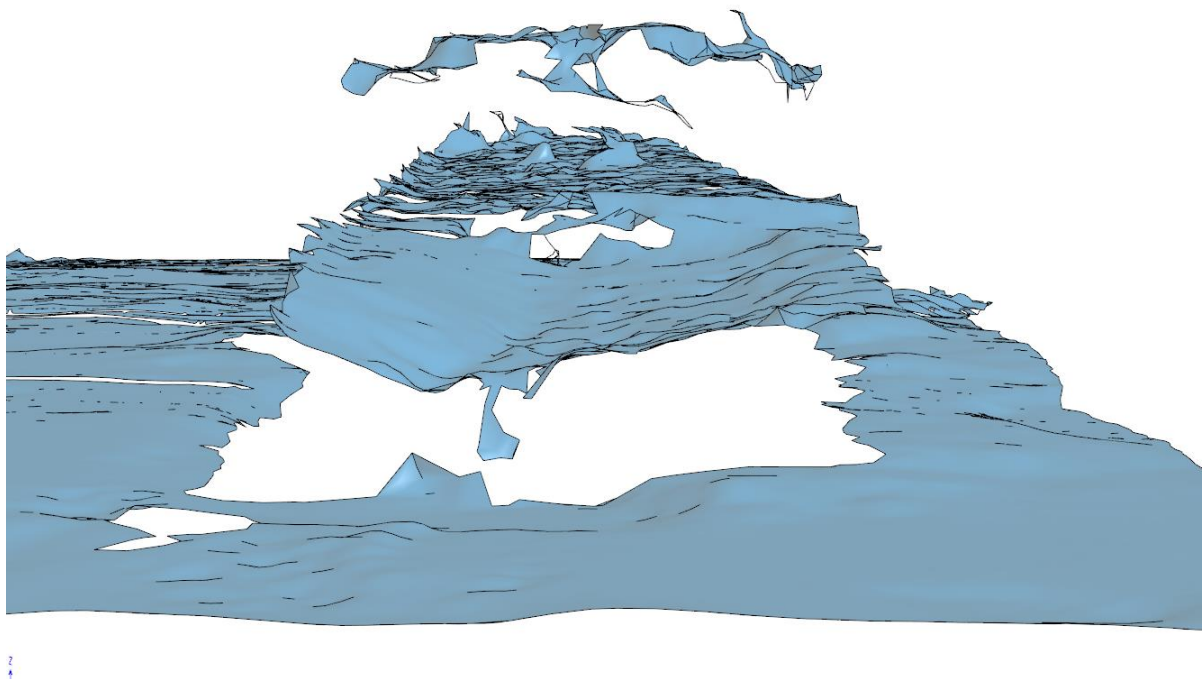


Figure 7. Isometric view from the astern of the El Faro wreck processed from multibeam sonar data.

4. DETAILS OF INVESTIGATION

The following 153 figures are photographs of the wreckage with detailed descriptions. Some photographs are mosaic images created by Woods Hole Oceanographic Institution. The mosaic images consist of a conglomeration of images that are stitched together to form a larger overall image of an area of ship structure. Additionally, one image, figure 144, is a 3-D model created from a series of overlapping images. Software was used to create a 3-D point cloud that represents an area of ship structure. The 3-D point cloud image was created in-house by the NTSB.

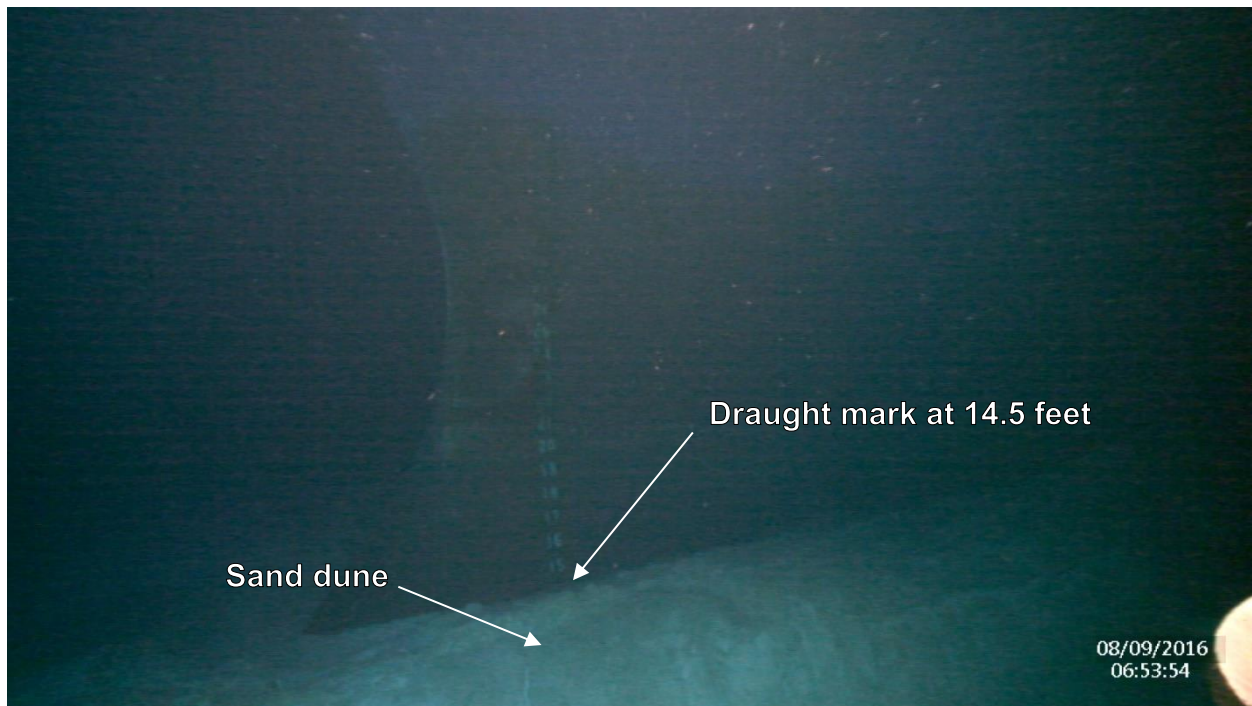


Figure 8. Region: Bow Source: Mission III Vehicle: CURV 21

The port forward draught mark shows that the bow is embedded in the seafloor to a depth of approximately 14.5 feet. There is an appearance of a sand dune on the port side of the bow, but not noticeable on the starboard side from this image. The dune appears to be approximately 1 to 2 meters high.

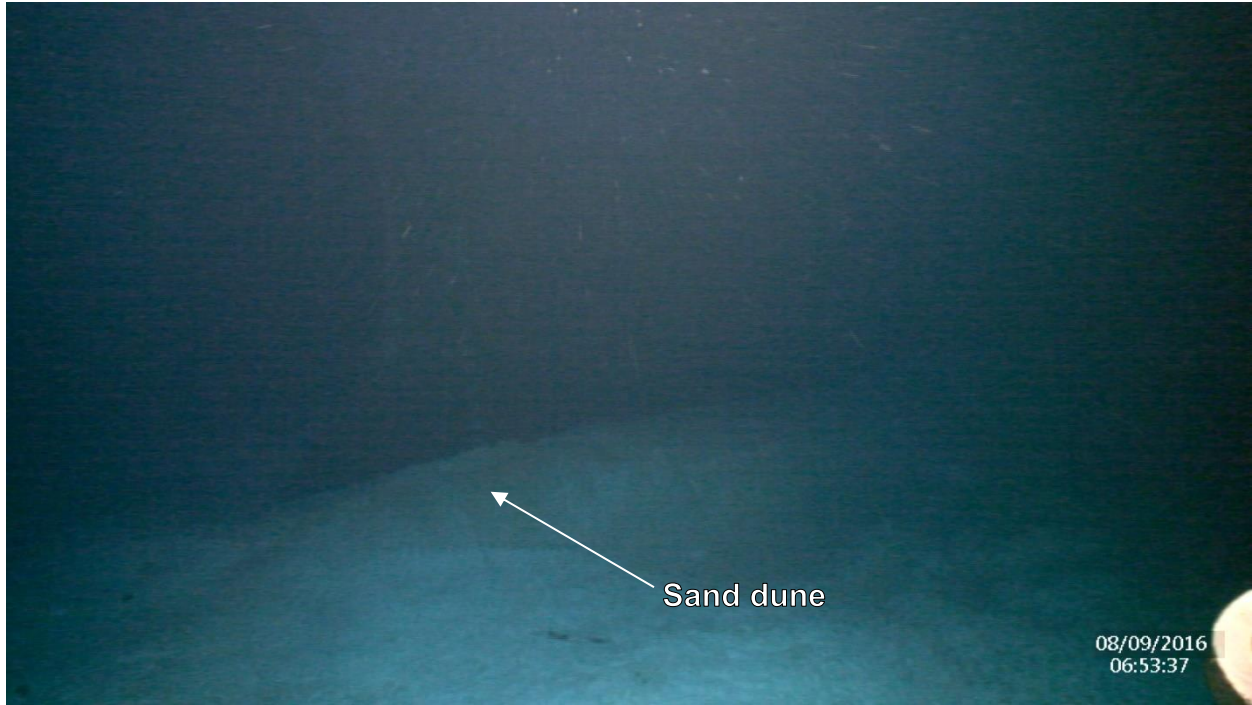


Figure 9. Region: Bow Source: Mission III Vehicle: CURV 21

A more pronounced view of the sand dune located on the port side of the bow.

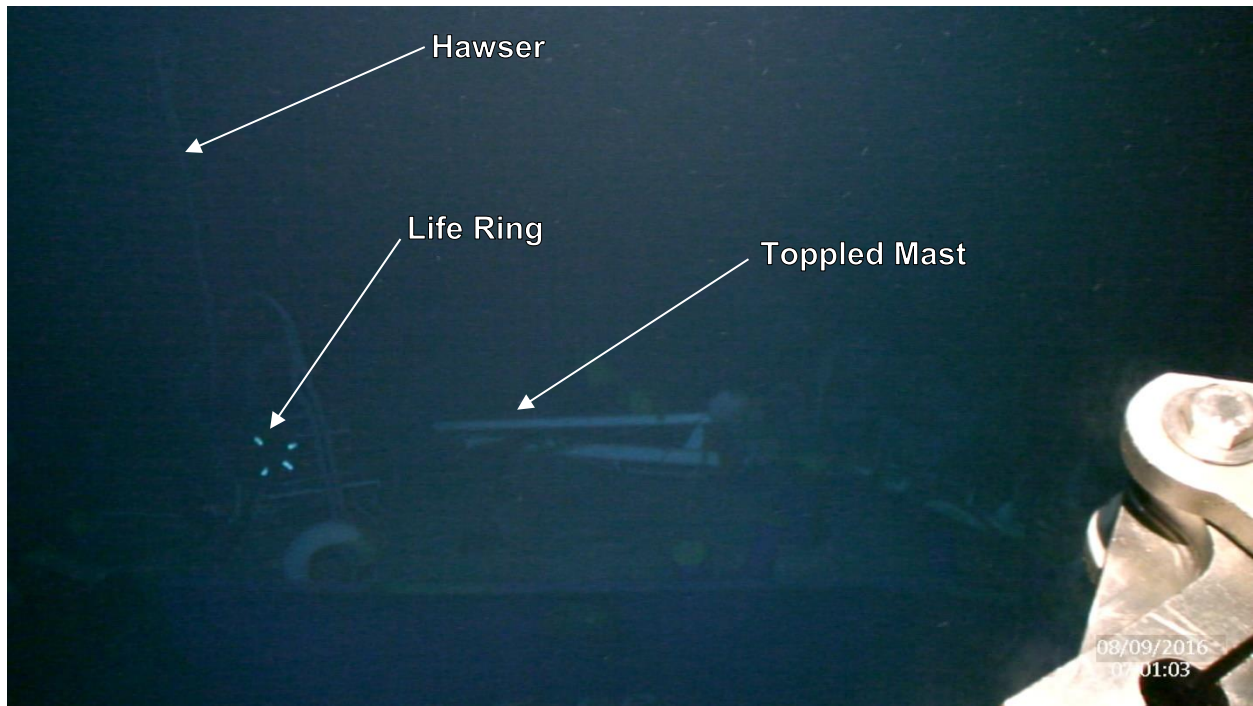


Figure 10. Region: Bow Source: Mission III Vehicle: CURV 21

The port bow is shown from just above the level of the port bulwark. The foremast is shown toppled from its mounting position. An intact life ring, still circular in shape, but the SOLAS tape on the life ring is no longer in the shape of a cross. The life ring is mounted on a railing in close proximity to the hawsepipe. There is a loose hawser² streaming upwards from an area of debris.

² Hawser – a thick rope or cable capable of mooring or towing a ship.



Figure 11. Region: Bow Source: Mission III Vehicle: CURV 21

An additional view of the port side bow, captured from just above the port side bulwark.

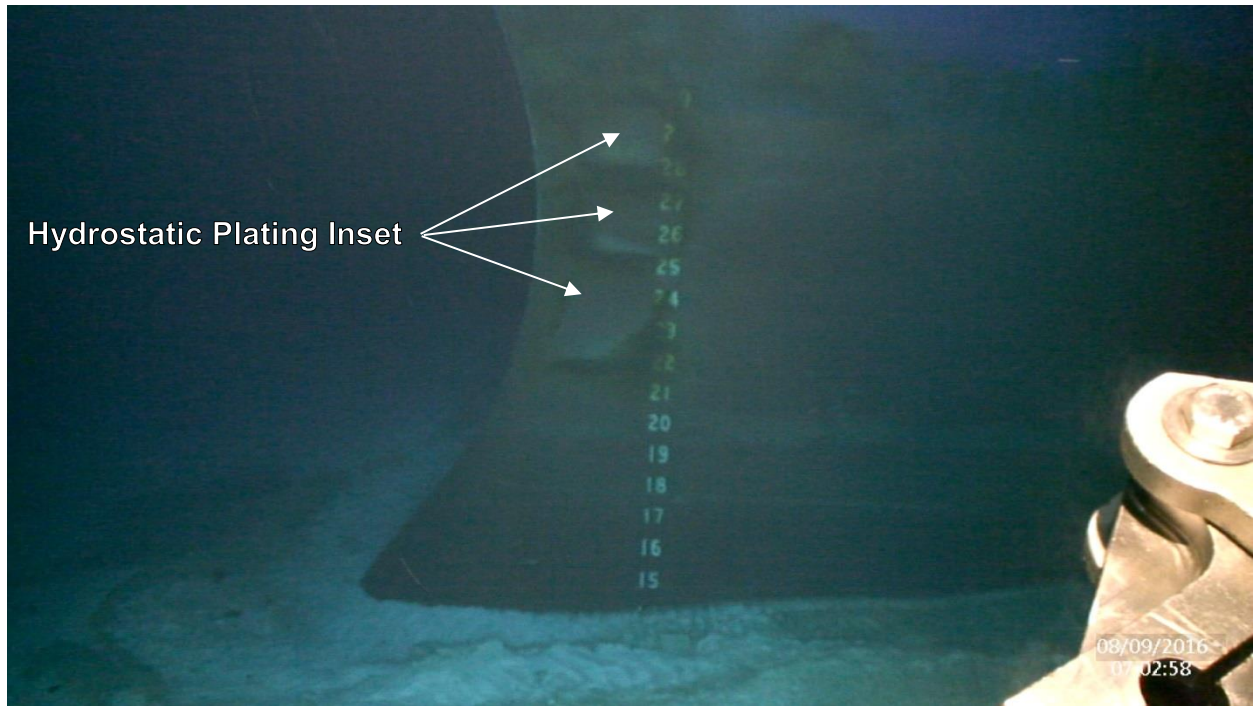


Figure 12. Region: Bow Source: Mission III Vehicle: CURV 21

Hydrostatic plating inset over the cast stem bar is visible between and forward of the 22 and 25 foot draught marks and between and forward of the 28 and 30 foot draught marks.

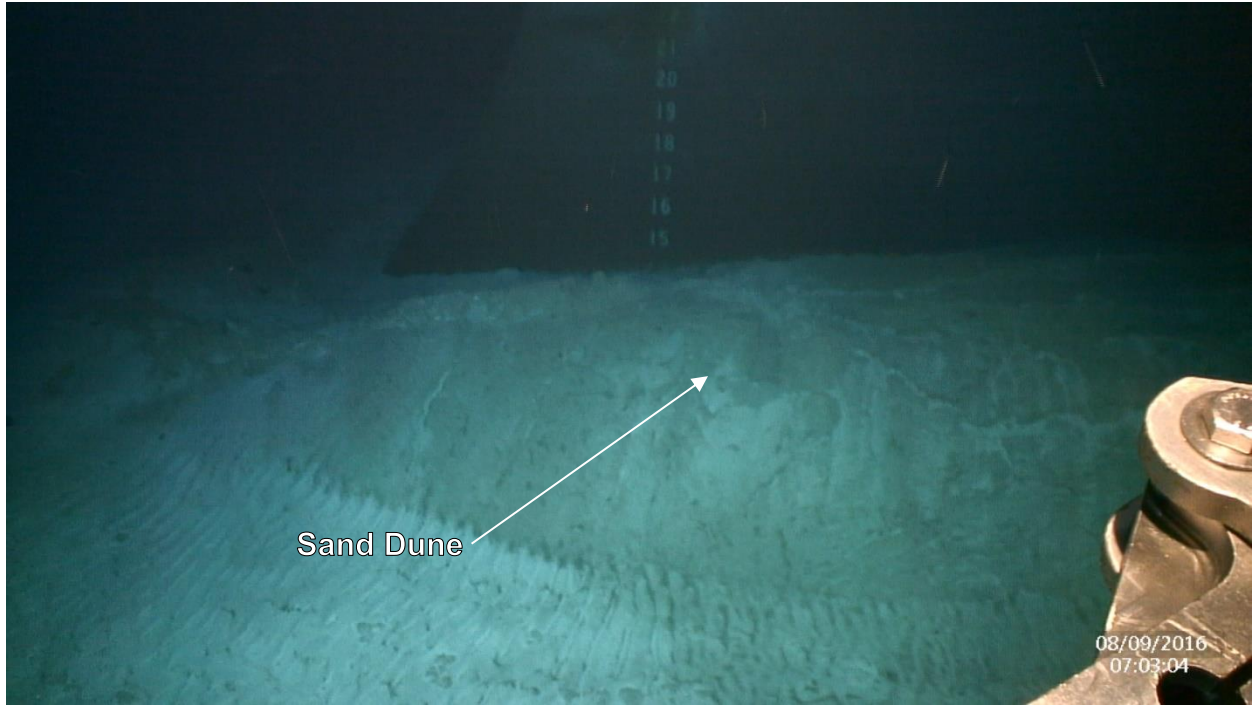


Figure 13. Region: Bow Source: Mission III Vehicle: CURV 21

An additional image of the approximate 1 to 2 meter high dune on the port side of the bow. As the camera moved away and slightly aft from the port bow, the dune was seen as being slightly larger in size.

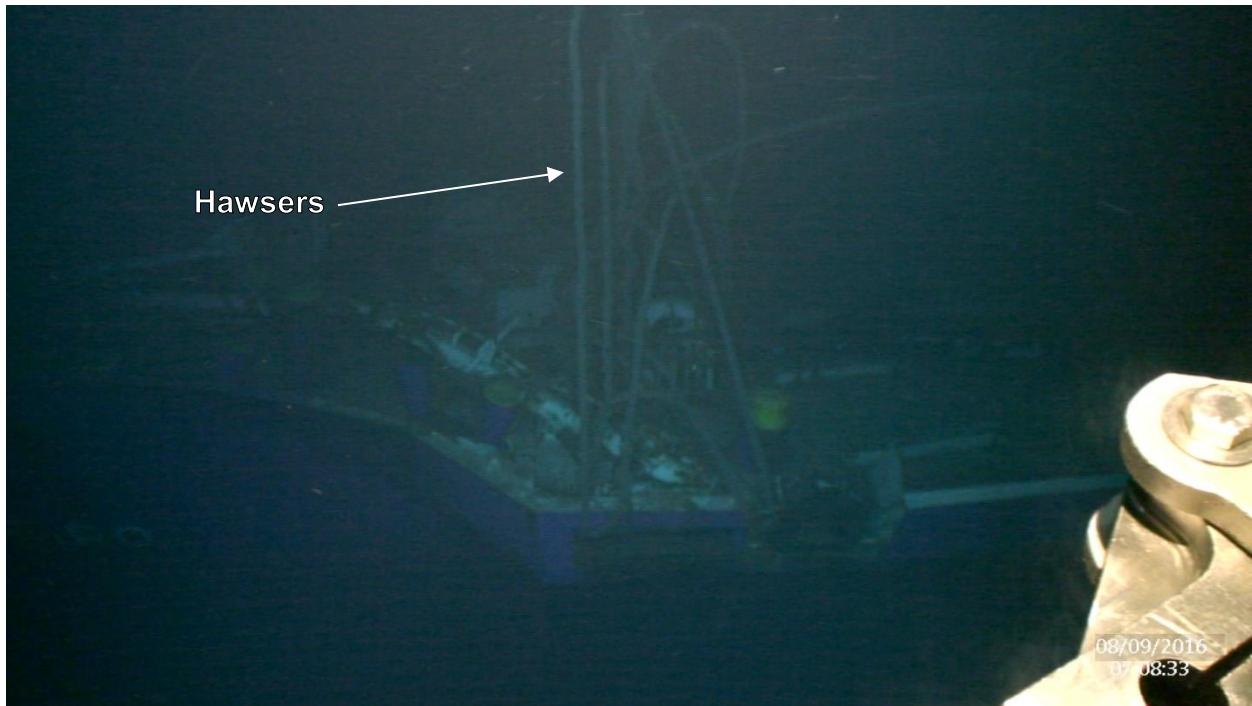


Figure 14. Region: Bow- Frame 15 to Source: Mission III Vehicle: CURV 21

Imagery shows port side of the ship, near the bow in the region of frame 15 to 20. The imagery was taken just above the port bulwark. Hawsers are streaming and the top of the foremast is laid to port toward the roller fairleads. The six man life raft and life raft canister, that should have been located between the mooring chocks and the anchor winch were not present.

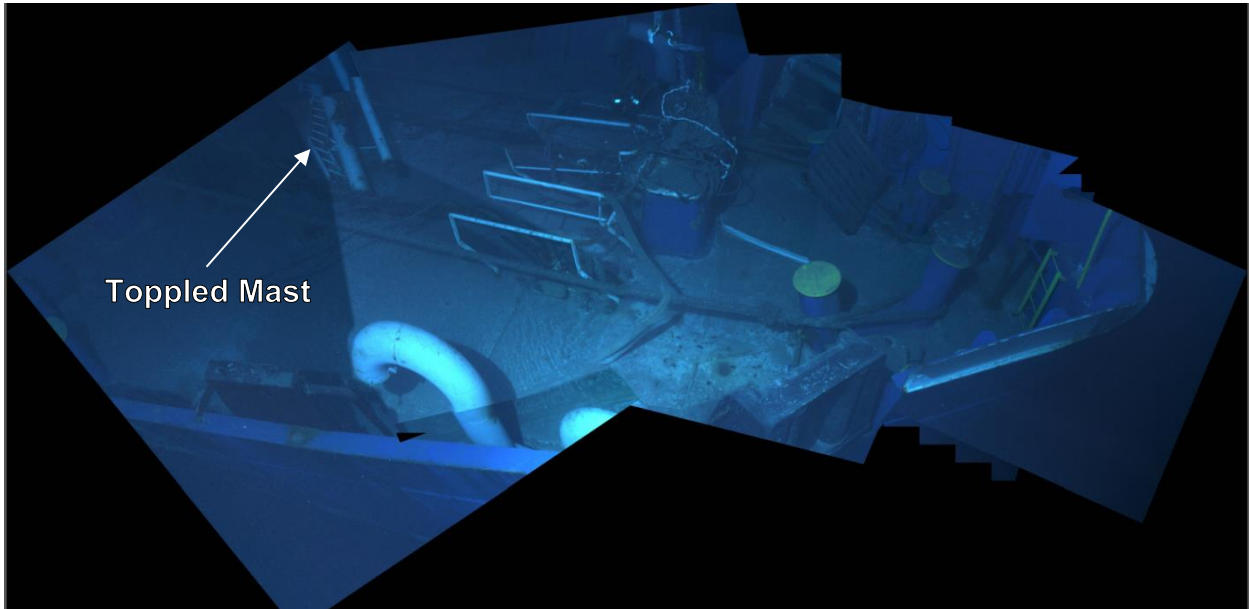


Figure 15. Region: Bow Source: Mission II Vehicle: Alvin Observation Vehicle - Mosaic

A mosaic created from multiple images taken from the starboard side of the ship above the bulwark. The image shows the foremast toppled aft and the general condition of the deck in the region of the bow.

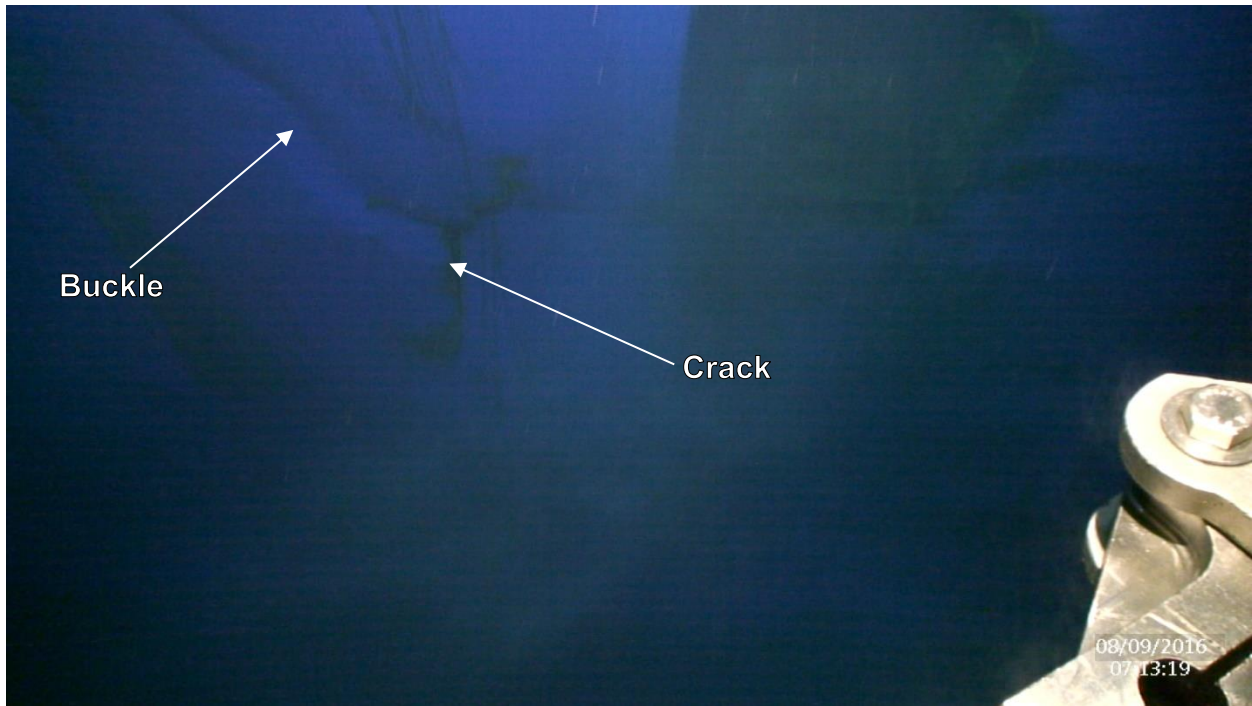


Figure 16. Region: Port – Aft Frame 20 Source: Mission III Vehicle: CURV 21

A buckle and crack in shell plating forward of vent opening, in the vicinity of frame 20.



Figure 17. Region: Port – Aft Frame 20 Source: Mission I Vehicle: CURV 21

An alternate, closer view of the buckle and crack in shell plating forward of vent opening, in the vicinity of frame 20.

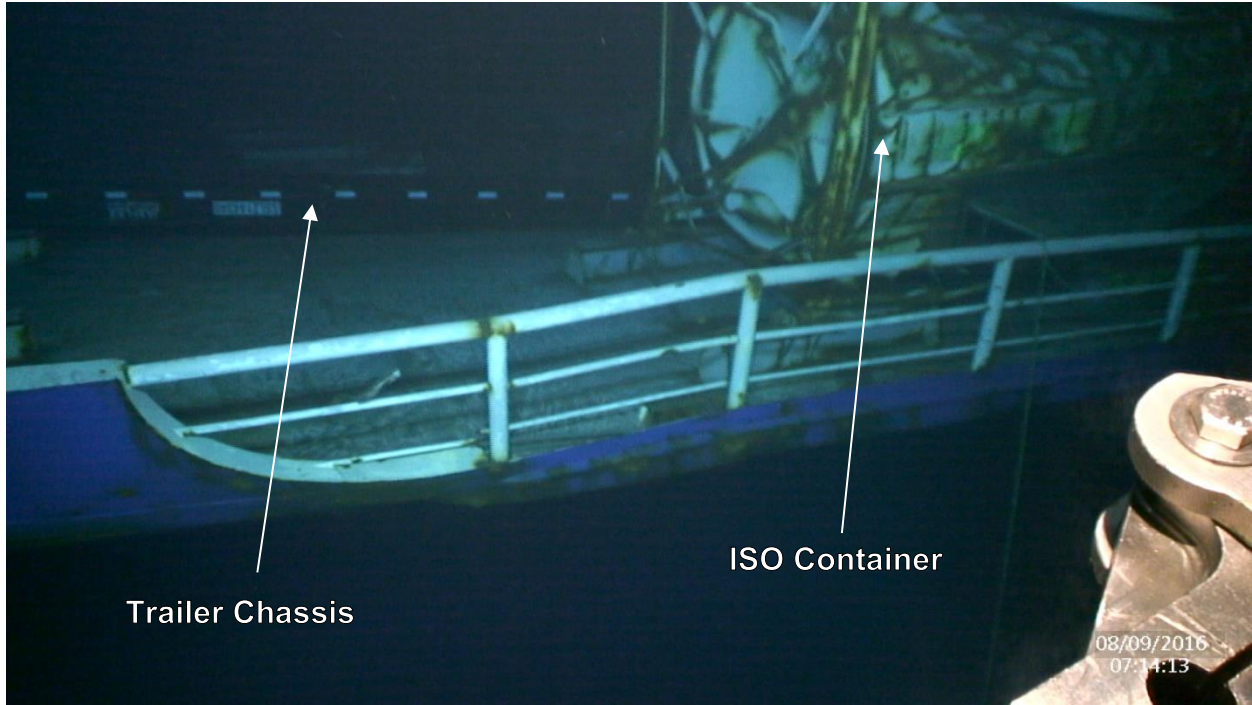


Figure 18. Region: Port – Bay 2 (outboard) Source: Mission III Vehicle: CURV 21

Port side bay 2, outboard most location. A 20 foot ISO tank container crushed between internals but still mounted to stowage location. A trailer chassis is visible behind the ISO container. The trailer chassis is upside down and the ID number reads 55112144340.

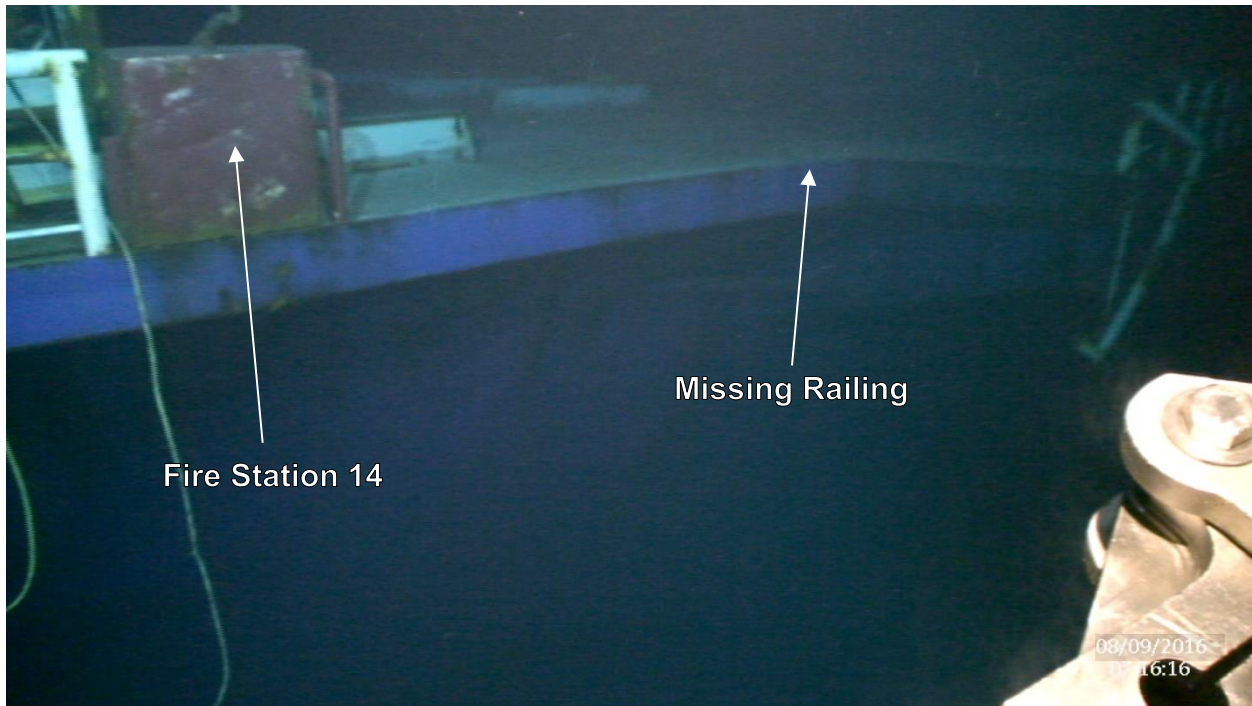


Figure 19. Region: Port – Frame 50 Source: Mission III Vehicle: CURV 21

Fire station 14 is visible and mounted. The ship's port side railing is missing between approximately frames 45 to 50.

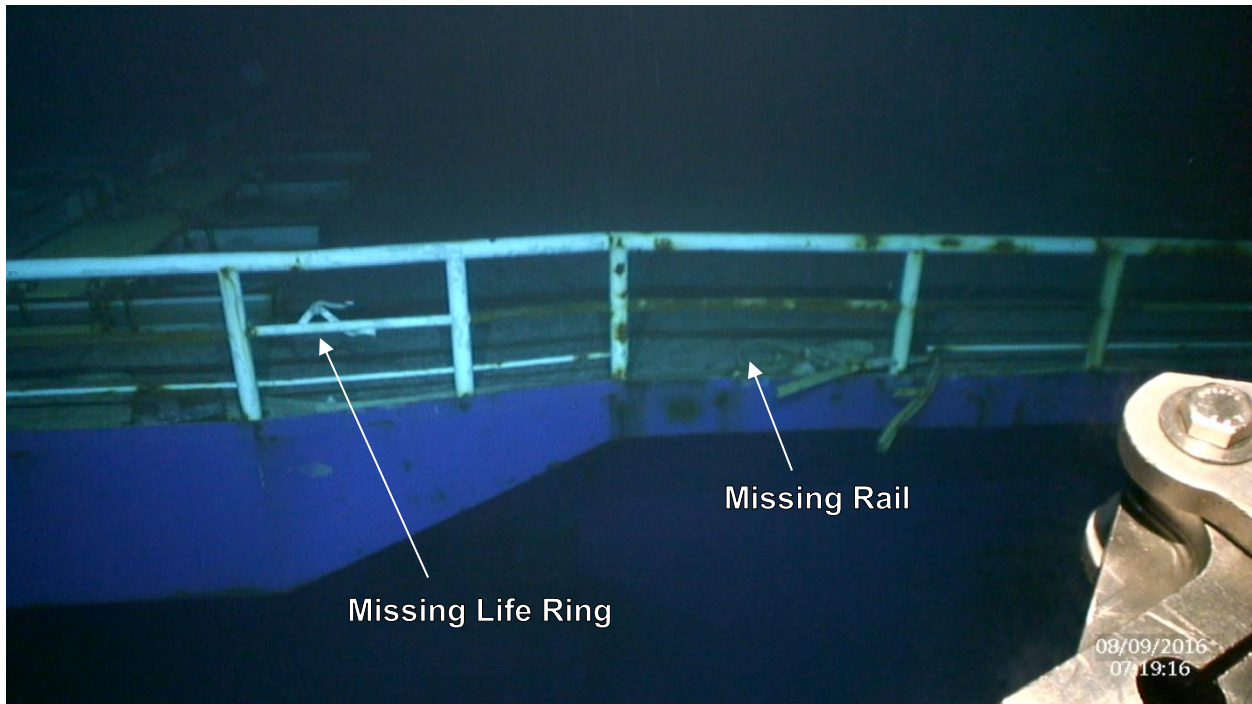


Figure 20. Region: Port – Frame 62 Source: Mission III Vehicle: CURV 21

A life ring is missing from its mounting location near frame 62 on the port side of the vessel. A small portion of railing is missing. Railing is estimated to still be seen in this location and is visible in subsequent figures up to approximately frame 70.

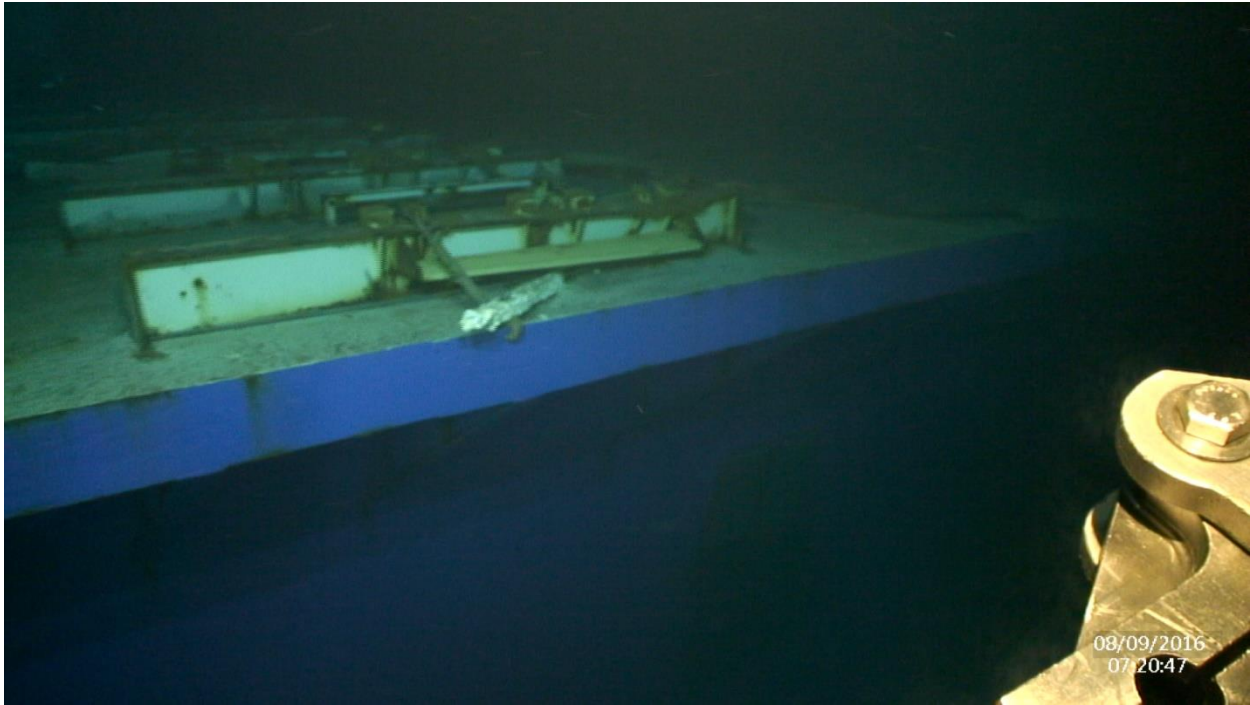


Figure 21. Region: Port – Frames 85-90 Source: Mission III Vehicle: CURV 21

Imagery shows deck rail missing aft of frame 70. Frames 85-90 is shown here with the deck rail missing.

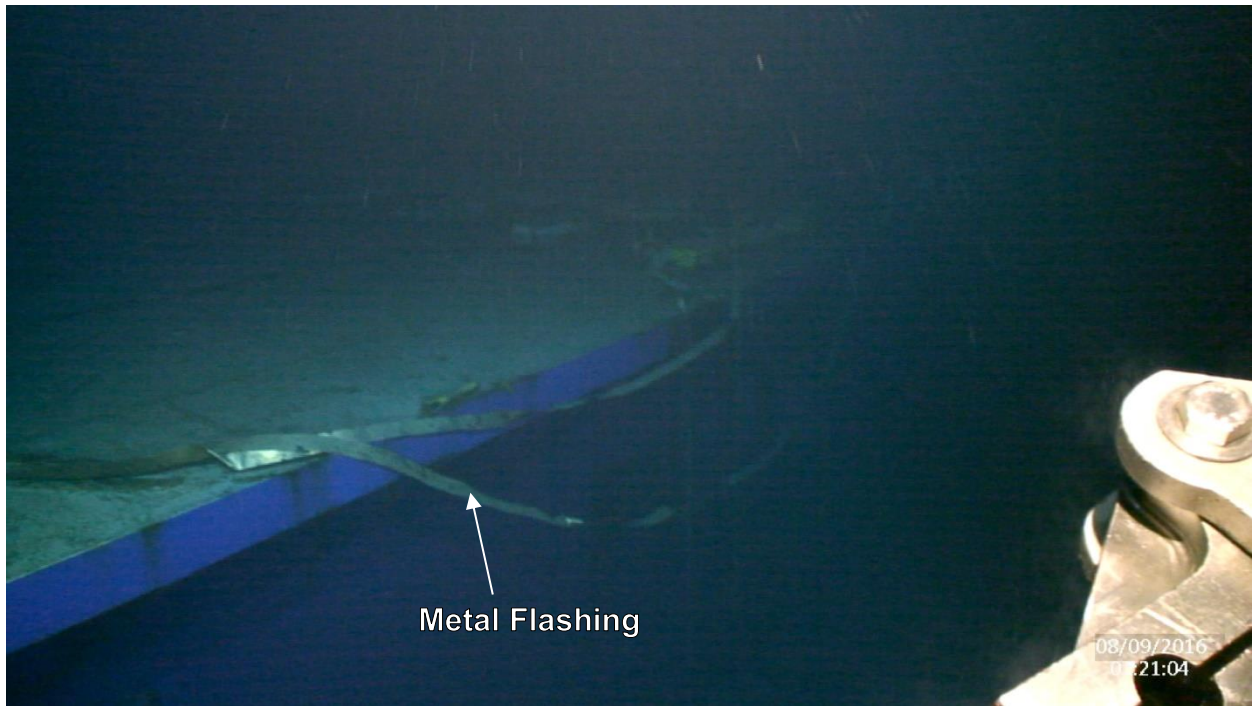


Figure 22. Region: Port – Frames 95-100 Source: Mission III Vehicle: CURV 21

Approximately 4 inch wide metal flashing hanging over the ship's deck between approximately frames 95 and 100 on the port side. The metal flashing was determined to be part of the ship's cargo. The deck rail is missing in this area.

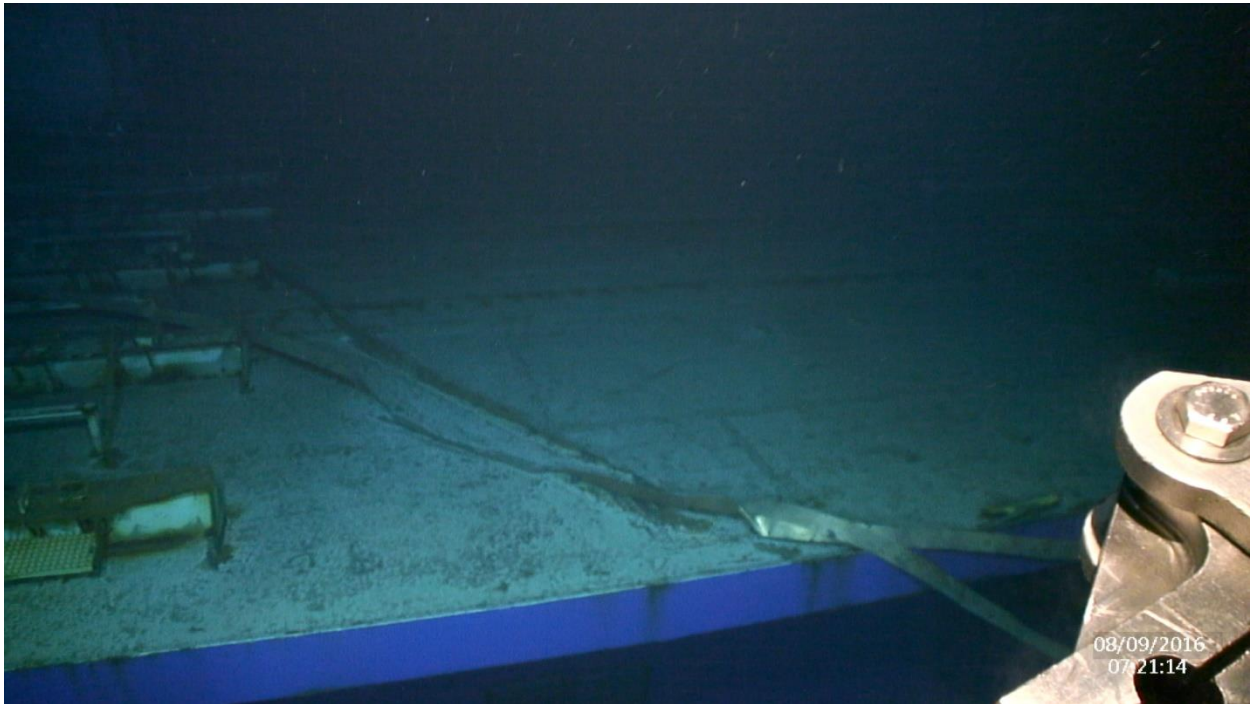


Figure 23. Region: Port – Frames 95-100 (Bay 7) Source: Mission III Vehicle: CURV 21

A container mount on main deck in Bay 7, looking inboard.

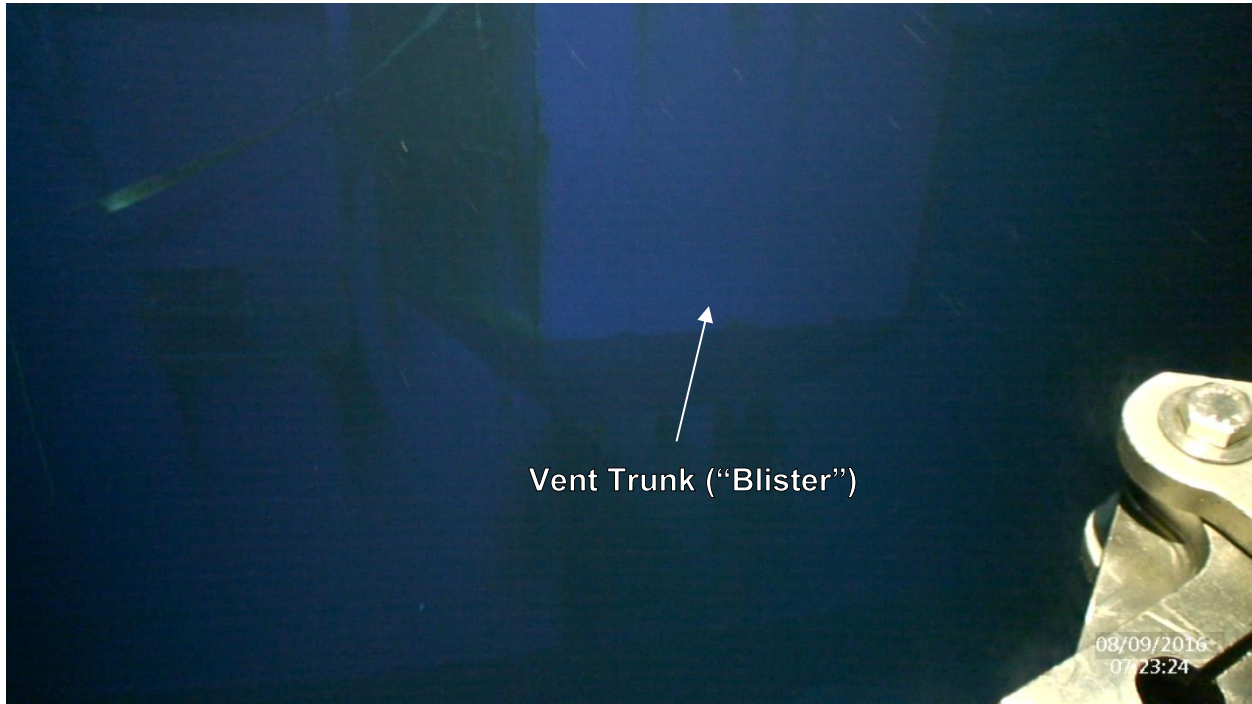


Figure 24. Region: Port – Frame 110. Source: Mission III Vehicle: CURV 21

Cargo hold supply vent trunk (“blister”) at frame 110 on the port side.

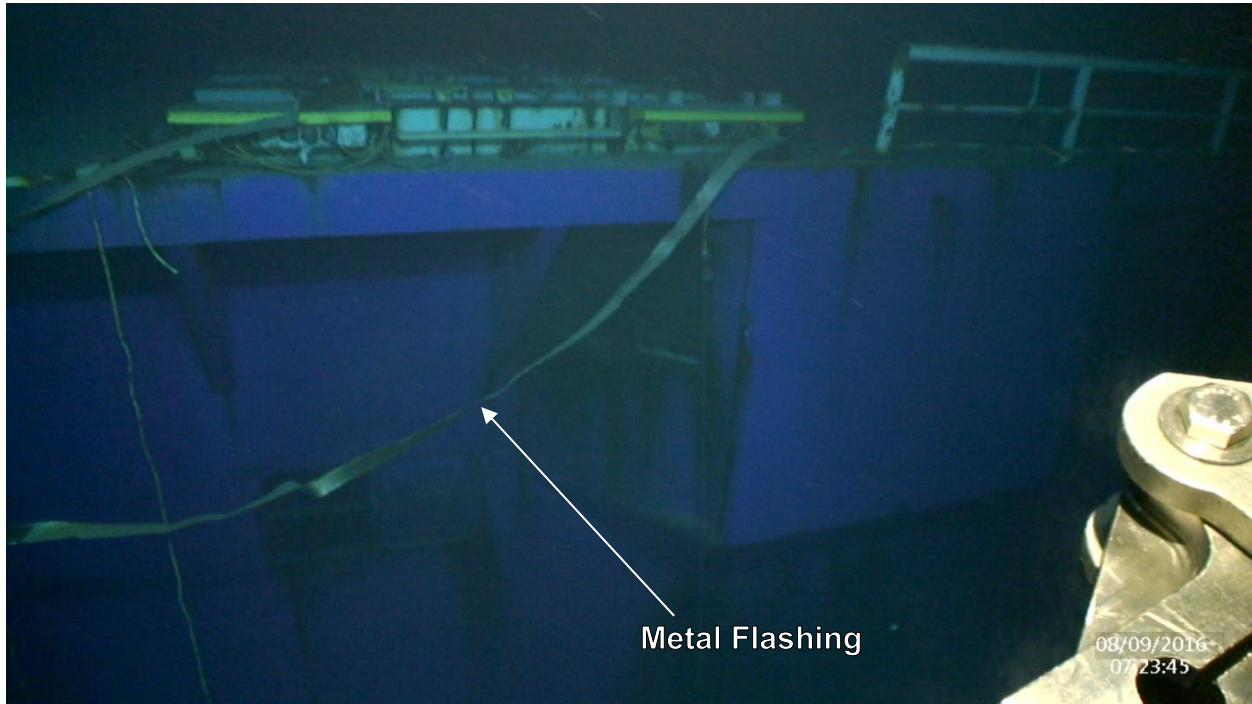


Figure 25. Region: Port – Frame 110. Source: Mission III Vehicle: CURV 2

Deck railing shown to begin at frame 110. Metal flashing (cargo³) visible hanging over the ship's deck.

³ Metal flashing contained in the remainder of the report was associated with ship's cargo.

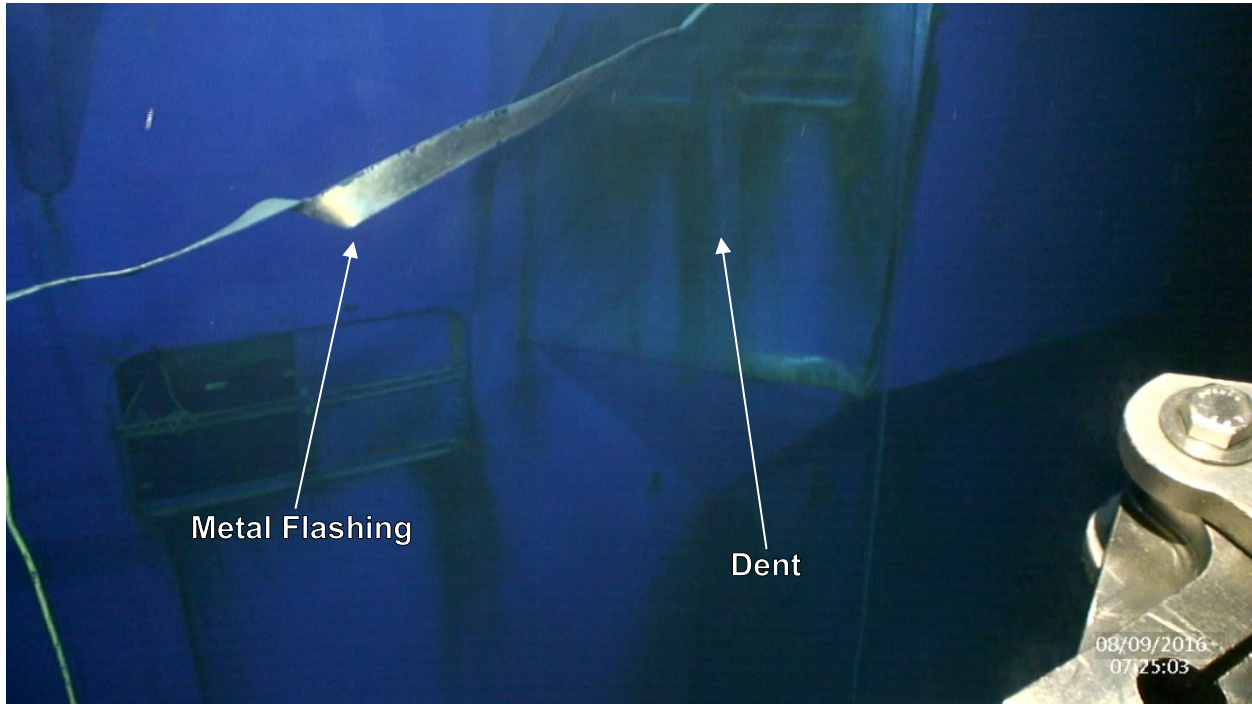


Figure 26. Region: Port – Frame 110. Source: Mission III Vehicle: CURV 21

Dent on forward face of blister/cargo hold supply vent at frame 110, port side. 4 inch metal flashing roll in foreground.



Figure 27. Region: Port – Frame 110. Source: Mission III Vehicle: CURV 21

Intact deck railing from frame 110 aft to frame 123. A missing life ring in the vicinity of life ring holder is noted.

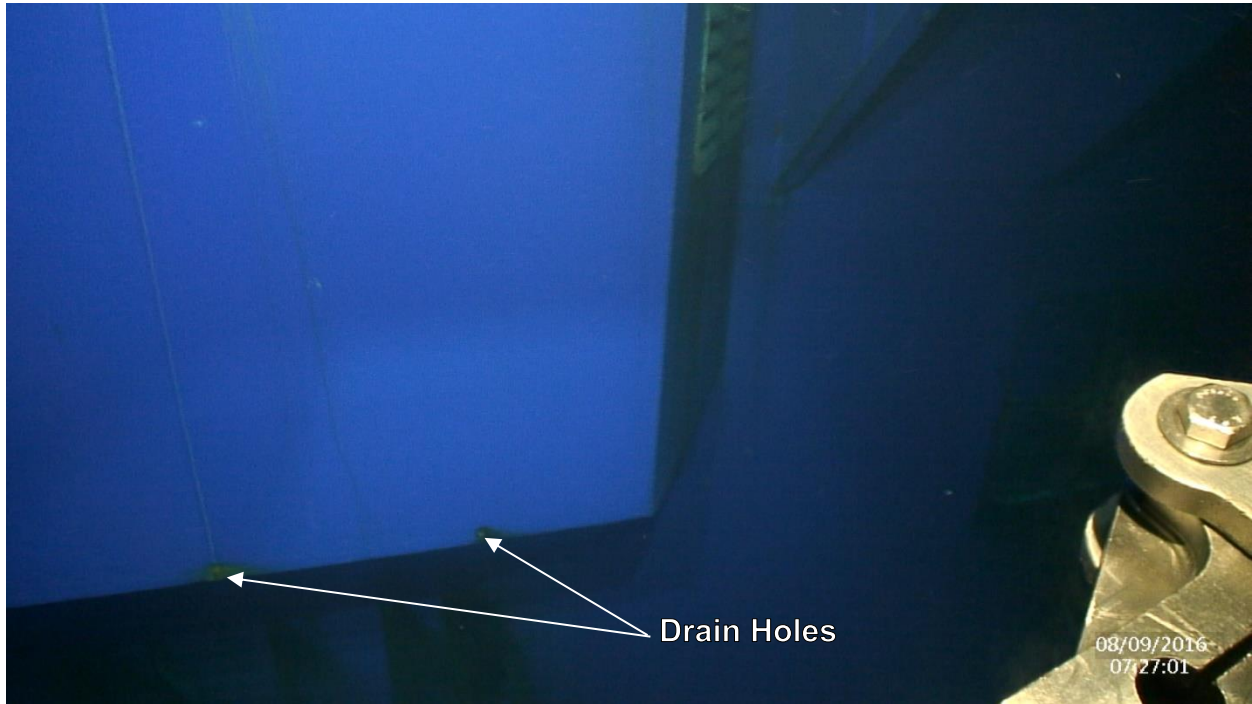


Figure 28. Region: Port – Frame 112. Source: Mission III Vehicle: CURV 21

Drain holes on the bottom seam/corner of blister/cargo hold supply vent trunk.



Figure 29. Region: Port – Frames 123 -130. Source: Mission III Vehicle: CURV 21

Hand rail missing between approximately frames 123 and 130.

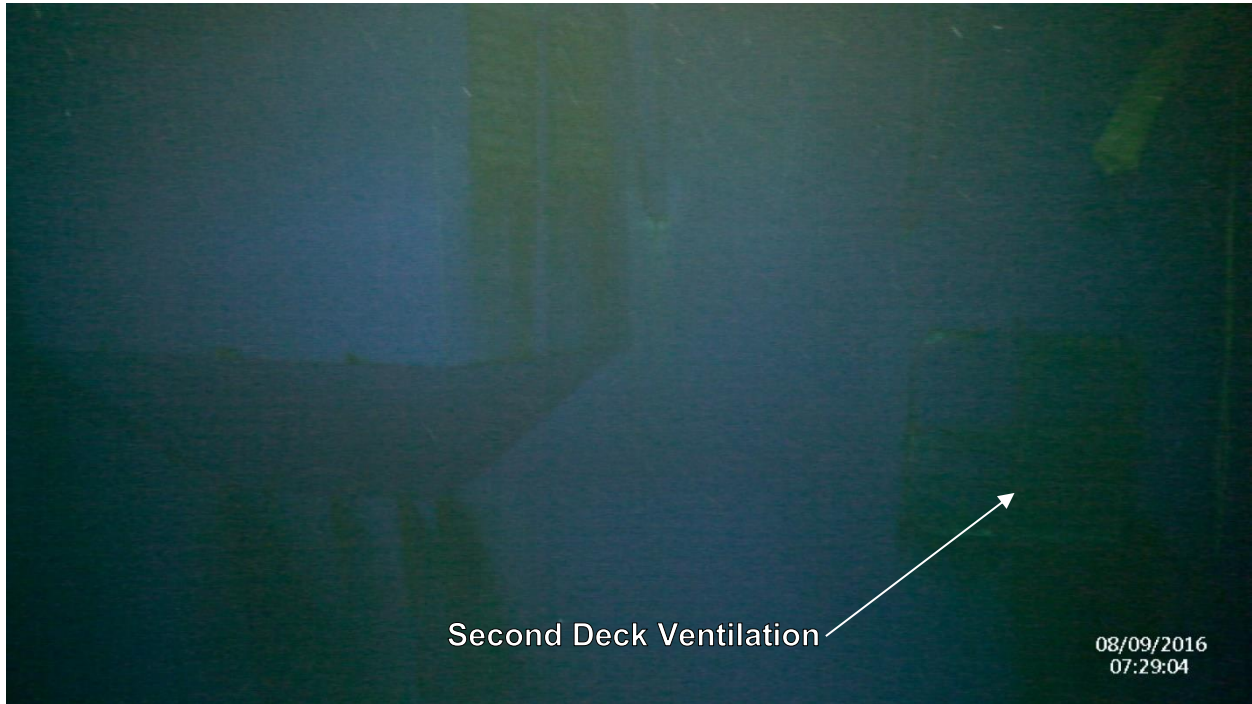


Figure 30. Region: Port – Frames 118 - 120. Source: Mission III Vehicle: CURV 21

Second deck ventilation opening with closed door between frames 118 and 120.

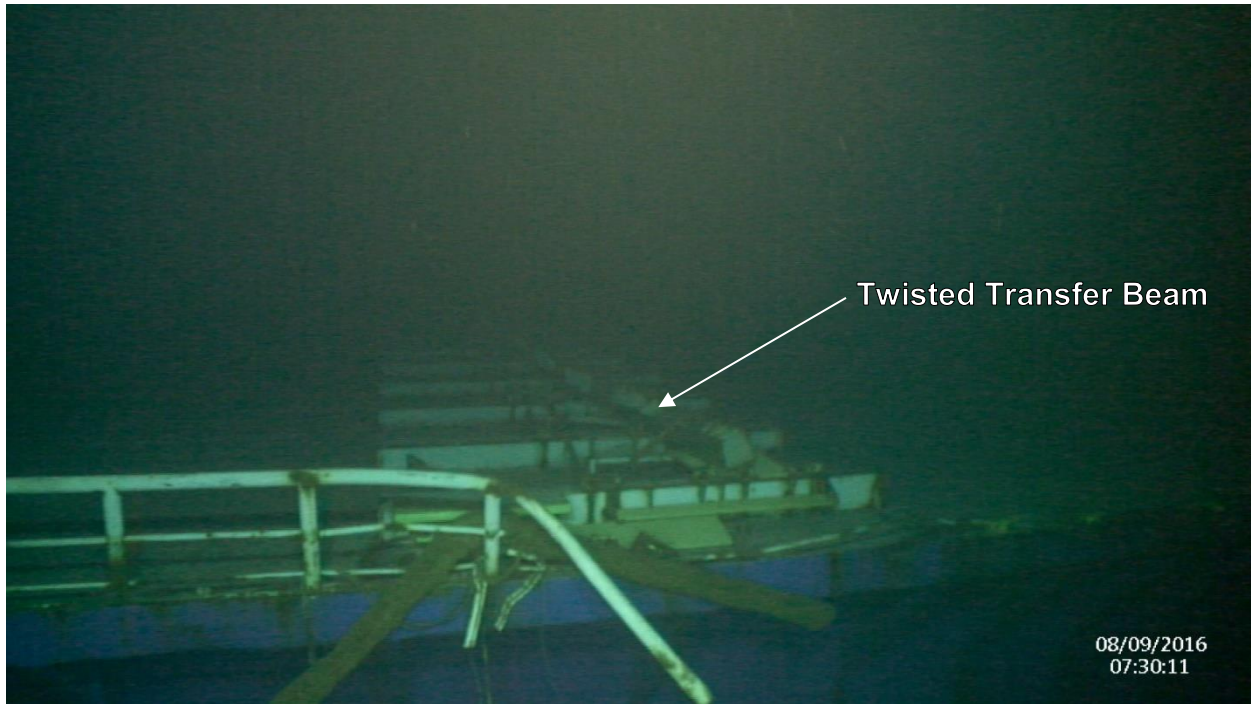


Figure 31. Region: Port – Bay 10 -11. Source: Mission III Vehicle: CURV 21

Twisted transfer beam between bays 10 and 11.

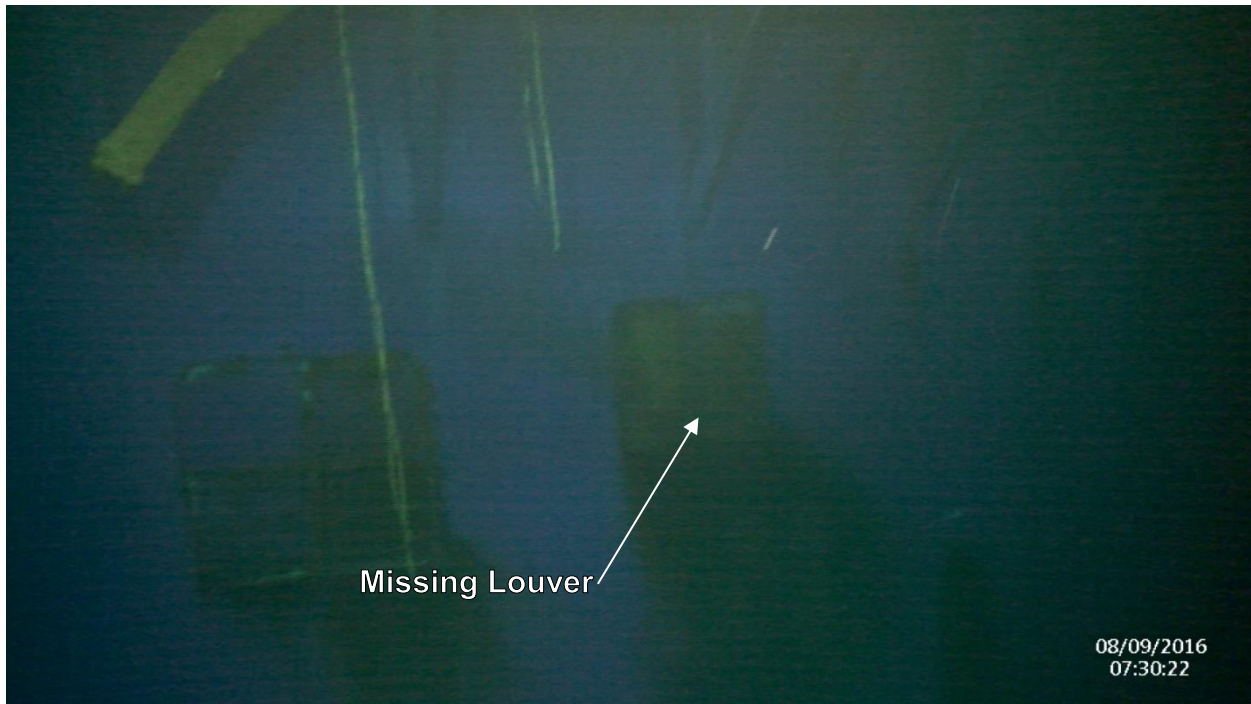


Figure 32. Region: Port – Frames 123 - 125. Source: Mission III Vehicle: CURV 21

Forward louver between approximately frames 123 and 125 is blown outward. Upper two thirds of louver are missing.

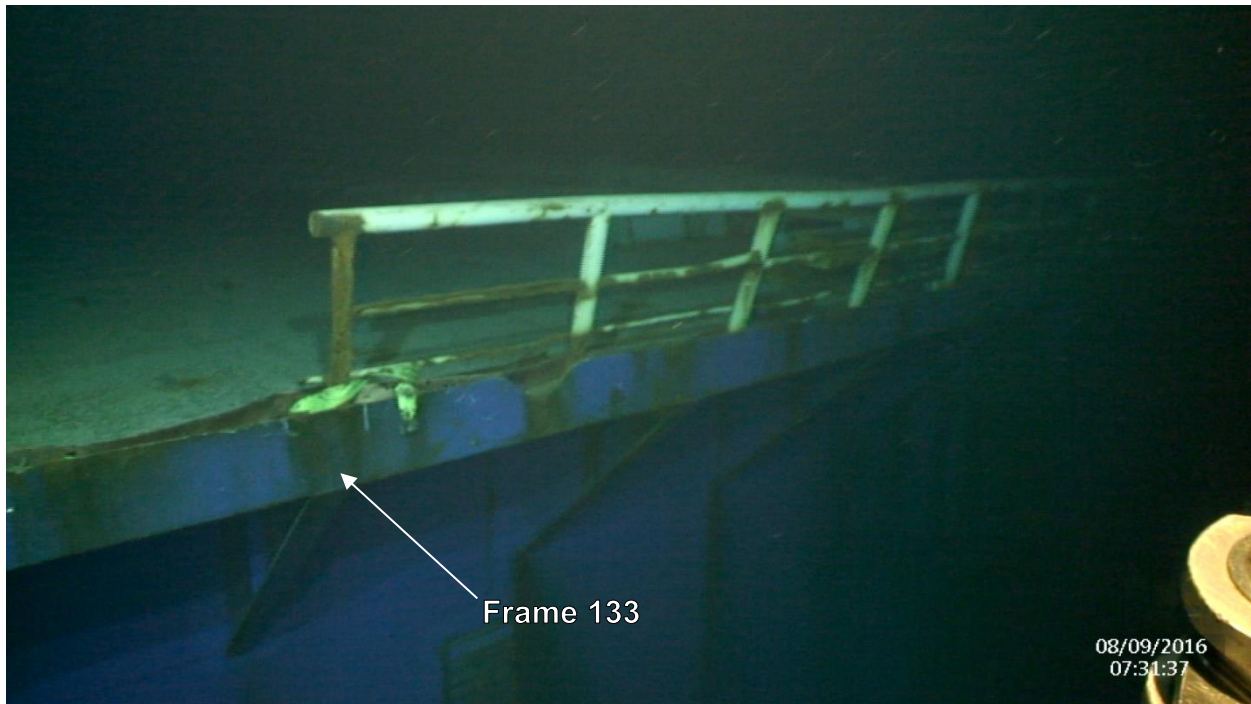


Figure 33. Region: Port – Frame 133. Source: Mission III Vehicle: CURV 21

Missing fire station number 20. Deck rail begins again at approximately frame 133.

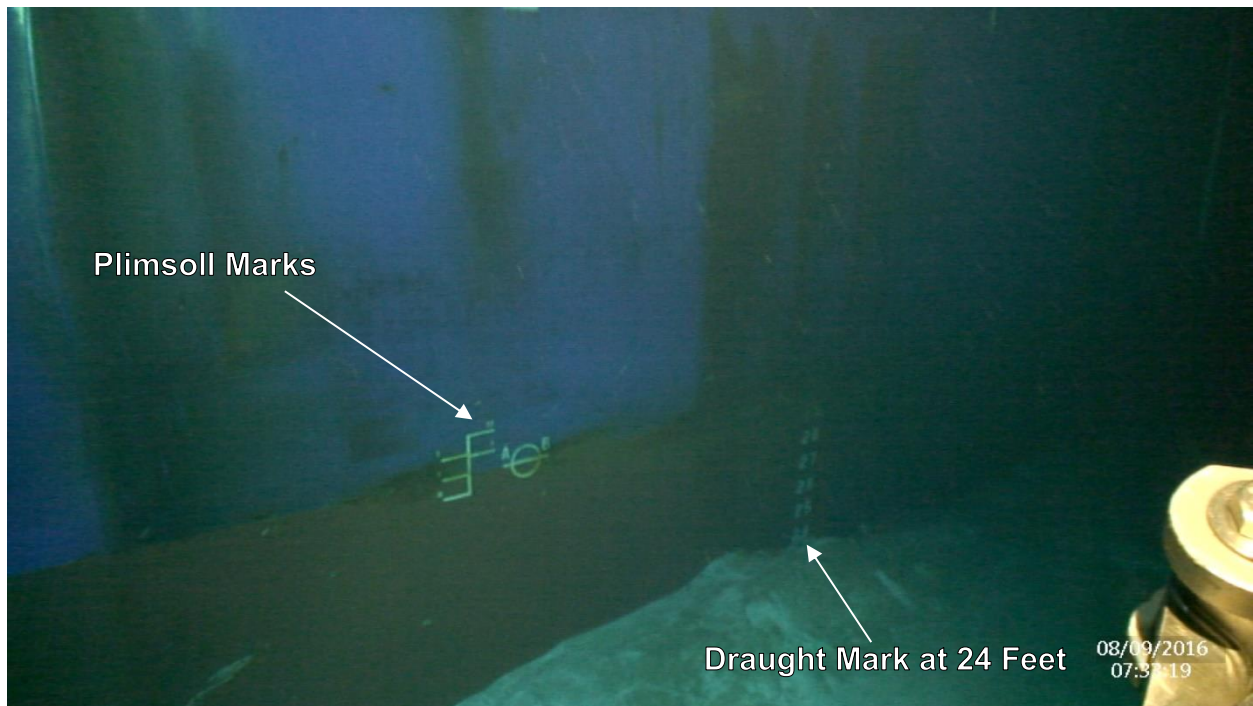


Figure 34. Region: Port – MidShip. Source: Mission III Vehicle: CURV 21

Plimsoll marks visible. Draught marks visible showing port midship mudline (draught) at approximately 24 feet.

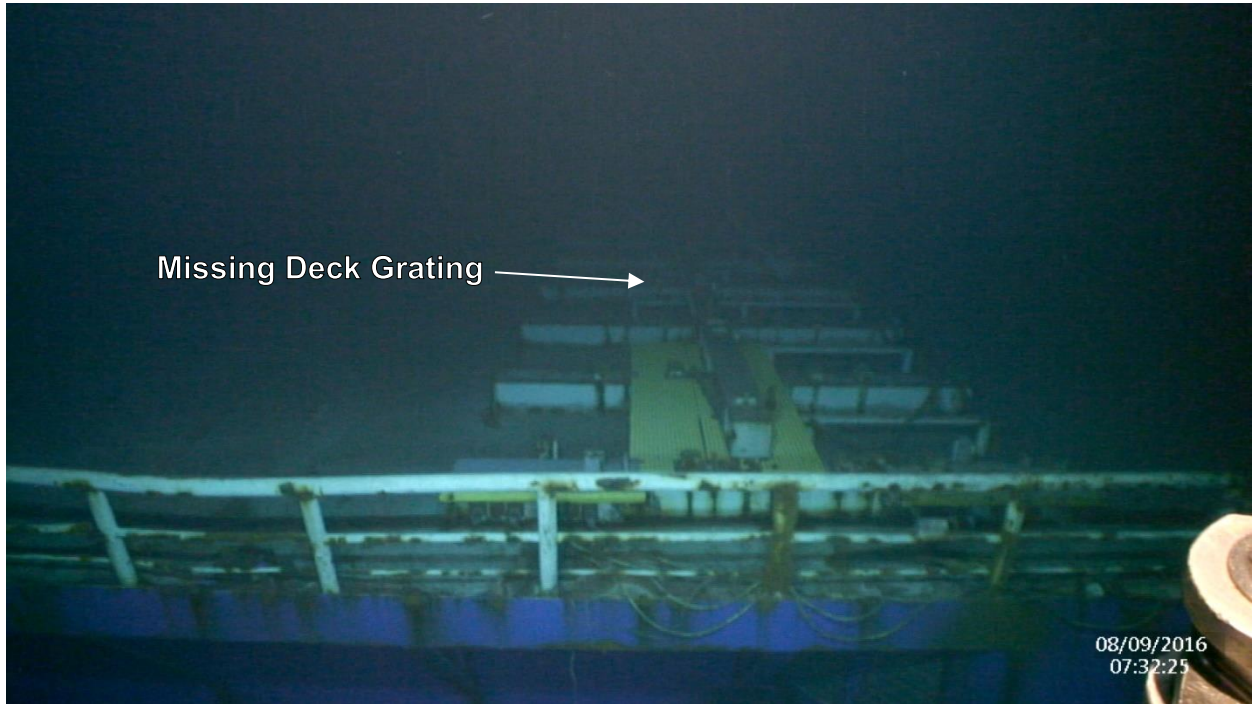


Figure 35. Region: Port – Frame 134/10. Source: Mission III Vehicle: CURV 21

Fiberglass deck grating missing from container support beams. Condition of missing grating is typical of the El Faro wreck and across most of the ship's deck. Transfer beam is intact in this area and does not appear twisted.

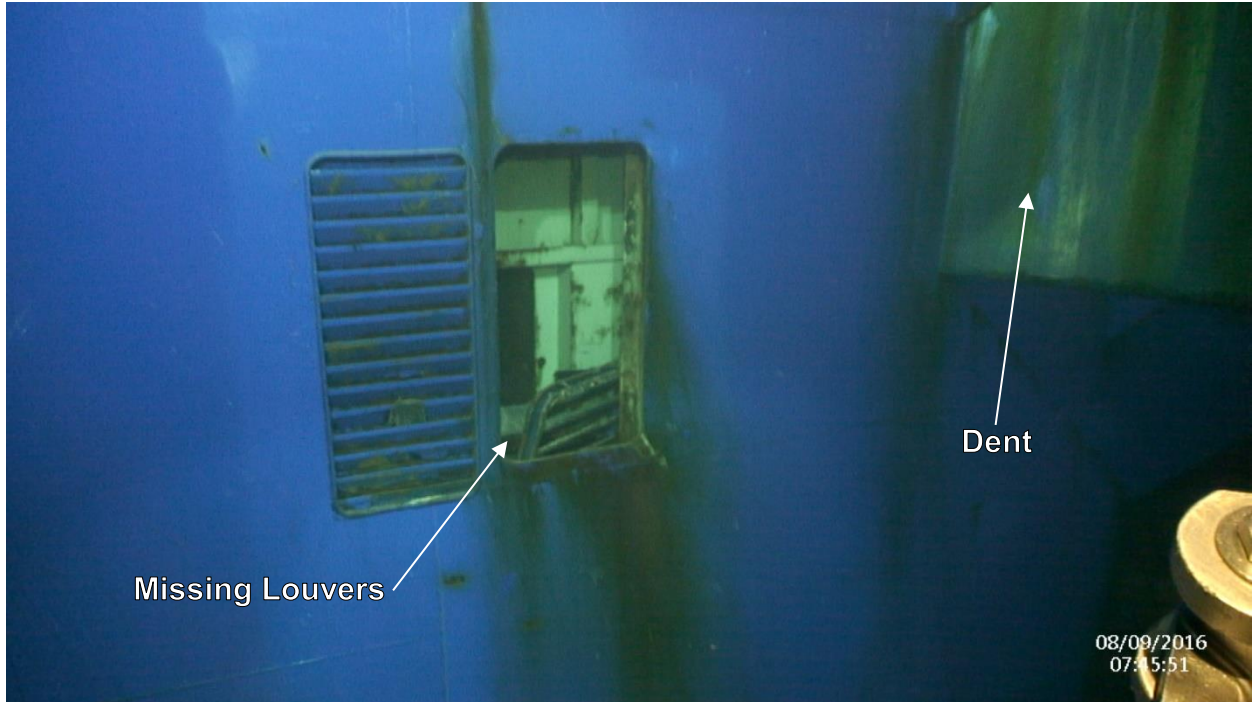


Figure 36. Region: Port – Frame 143. Source: Mission III Vehicle: CURV 21

Cargo hold exhaust vent with louvers missing in the approximate area just forward of frame 143. A dent is seen on forward face of blister for cargo hold supply vent at frame 143.

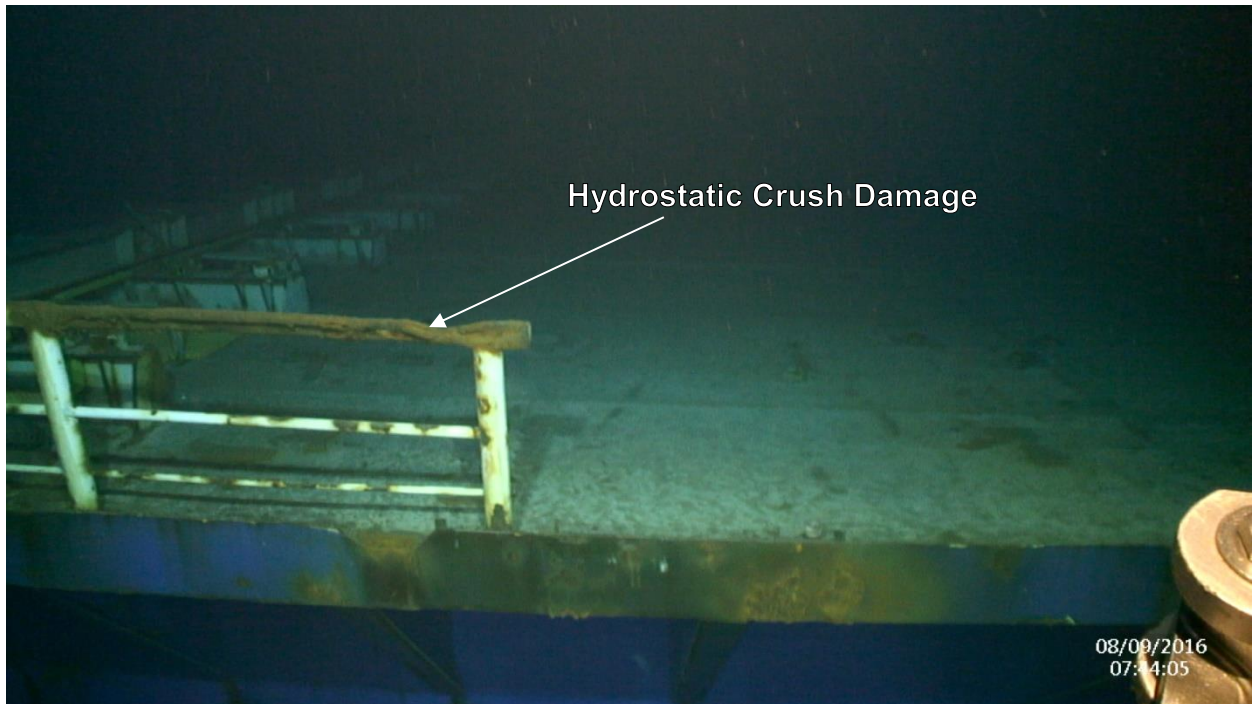


Figure 37. Region: Port – Frame 134/28. Source: Mission III Vehicle: CURV 21

Handrail missing from frame 134/28 aft. Handrail exhibits a hydrostatic crush. Fire station no. 40 is missing at frame 134/30.

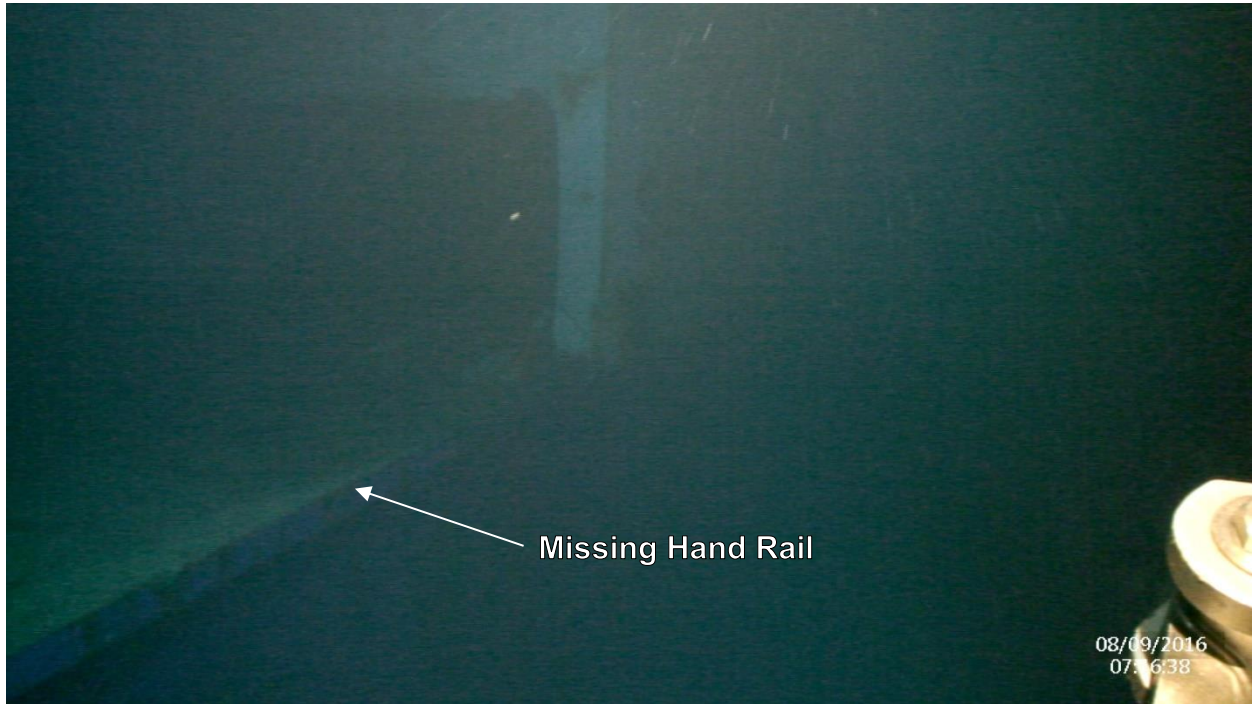


Figure 38. Region: Port – forward of house Source: Mission III Vehicle: CURV 21

Handrail missing between frame 134/30 forward face of house.



Figure 39. Region: Port – forward of house Source: Mission III Vehicle: CURV 21

An undamaged section of container supports and transfer beams. This is not typical of the other bays that were visible in other areas of the ship.

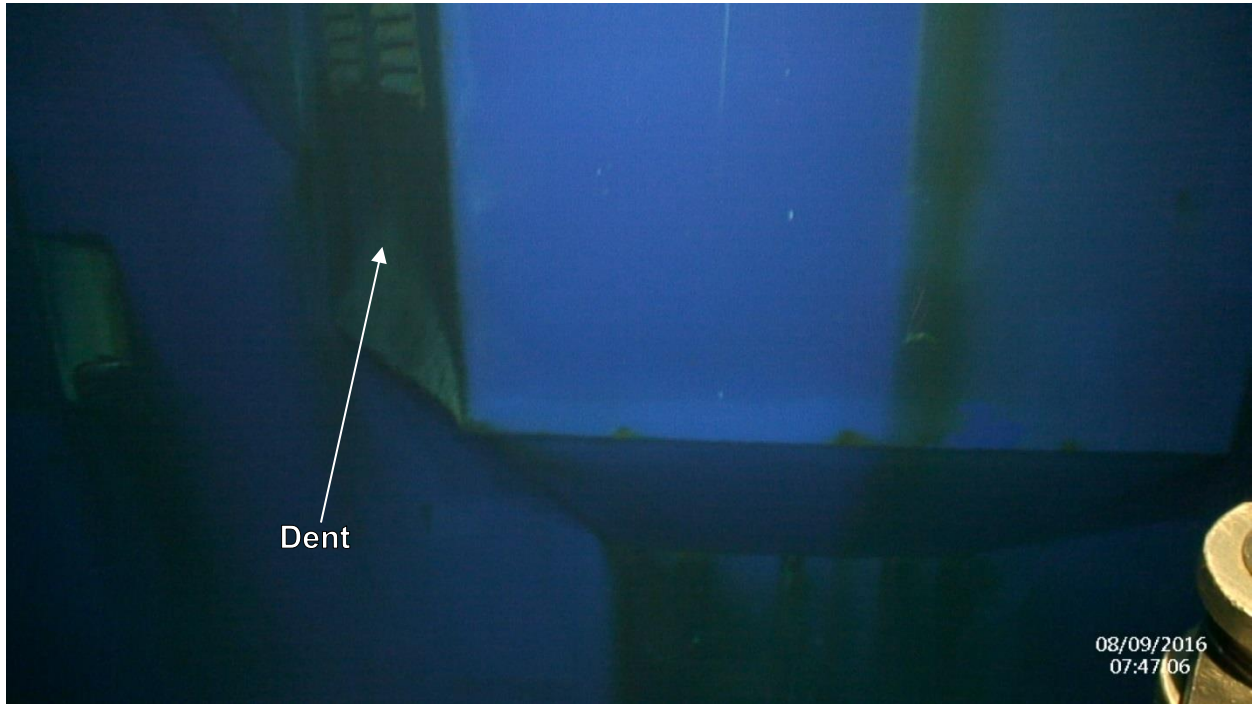


Figure 40. Region: Port – frame 143 Source: Mission III Vehicle: CURV 21

A dent is seen on forward face of blister/cargo hold supply vent at frame 143.

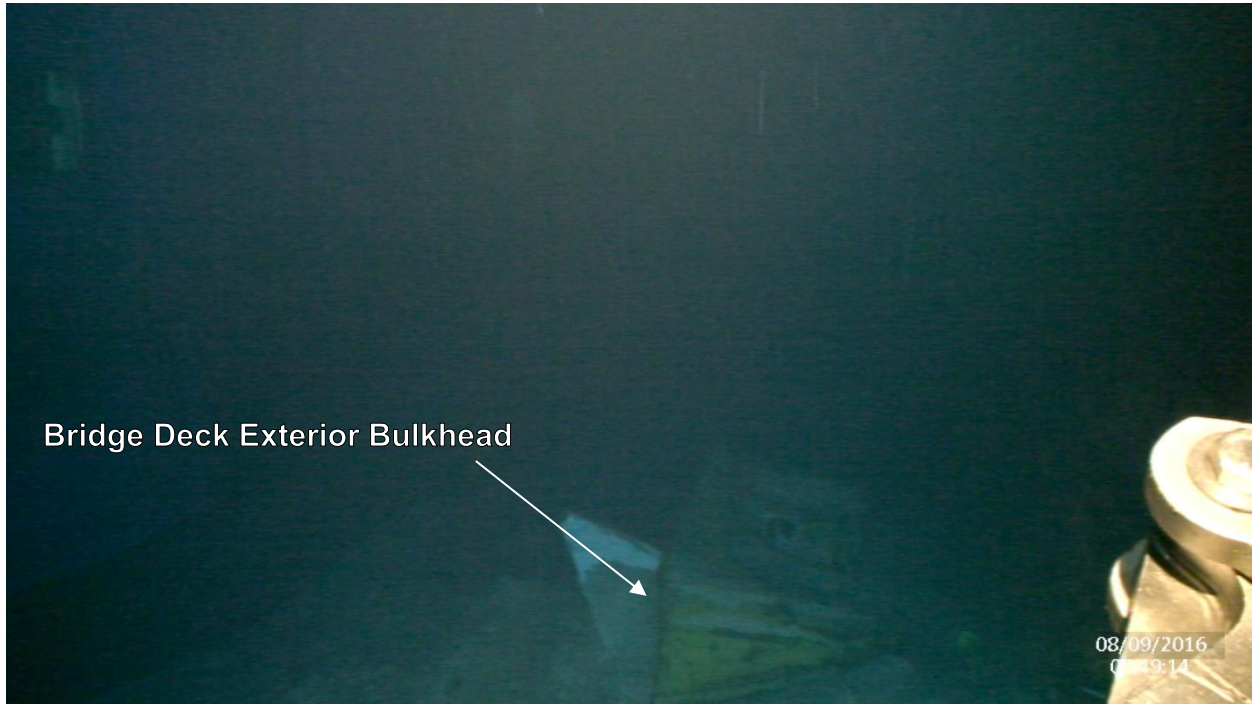


Figure 41. Region: Port – Abeam House Source: Mission III Vehicle: CURV 21

Section of lower navigation bridge deck exterior bulkhead with window on the seafloor, located abeam port side of the house, adjacent to the fueling station near frame 170.



Figure 42. Region: Port – Frame 173 Source: Mission III Vehicle: CURV 21

Hydrostatic crush damage to life boat launch skid piping. The port side of the ship between the superstructure and the transom was not covered with high definition imagery during mission III. Only low definition video and a few photographs show this region of the ship. Video from mission I was referenced for this area, but the area was unable to be imaged in a continuous stream due to entanglement hazards.

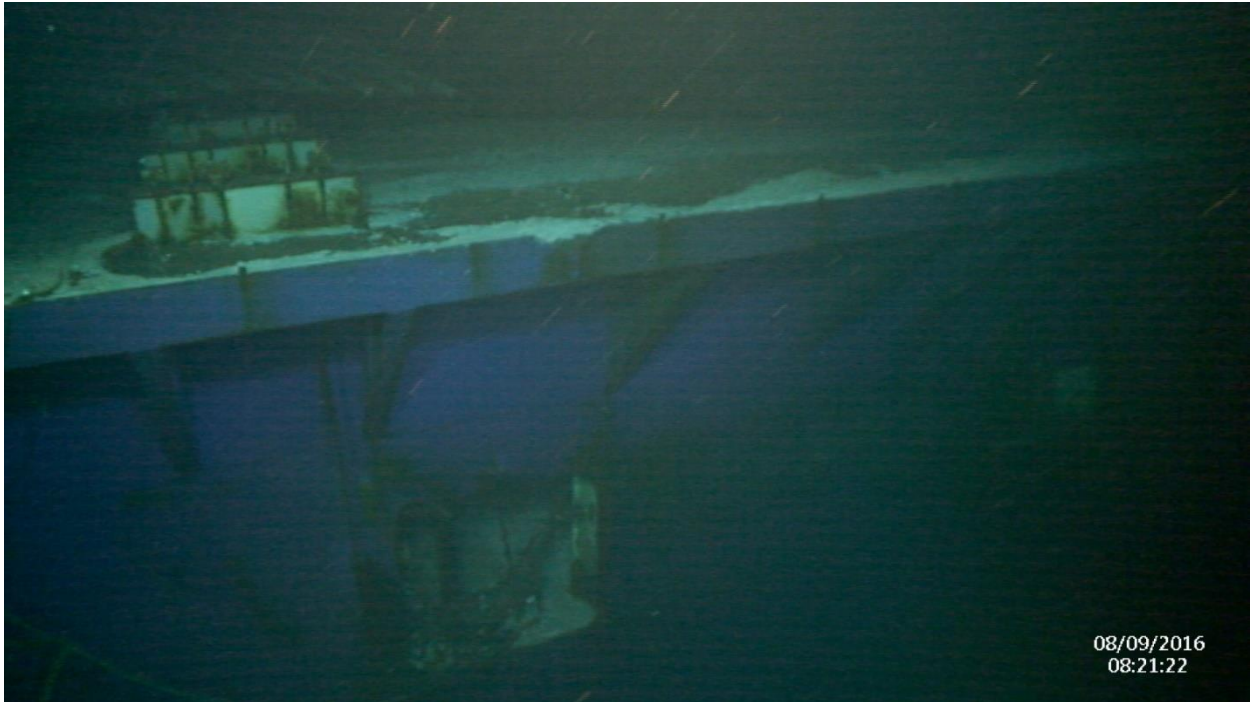


Figure 43. Region: Port – Frame 186 Source: Mission III Vehicle: CURV 21

Port main deck edge. Deck rail is absent.

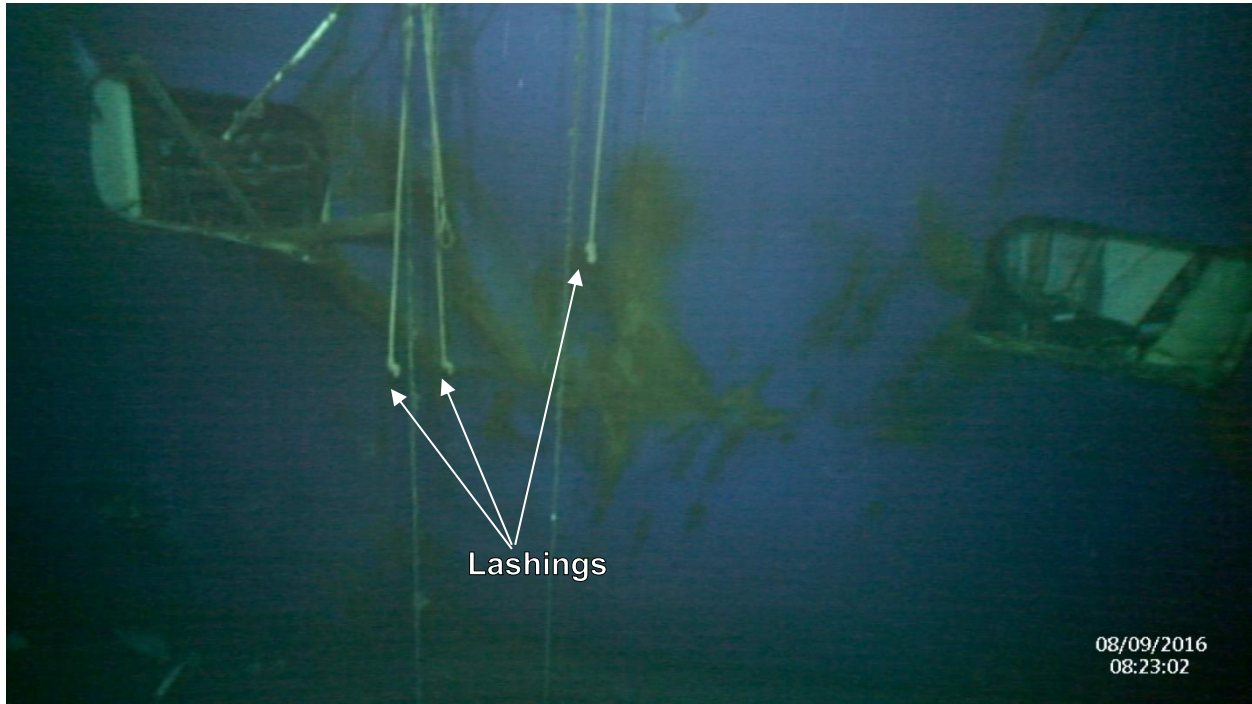


Figure 44. Region: Port – Frame 193 Source: Mission III Vehicle: CURV 21

Container lashings and other cordage hanging from main deck edge between 2nd deck openings at frame 198 and 193.

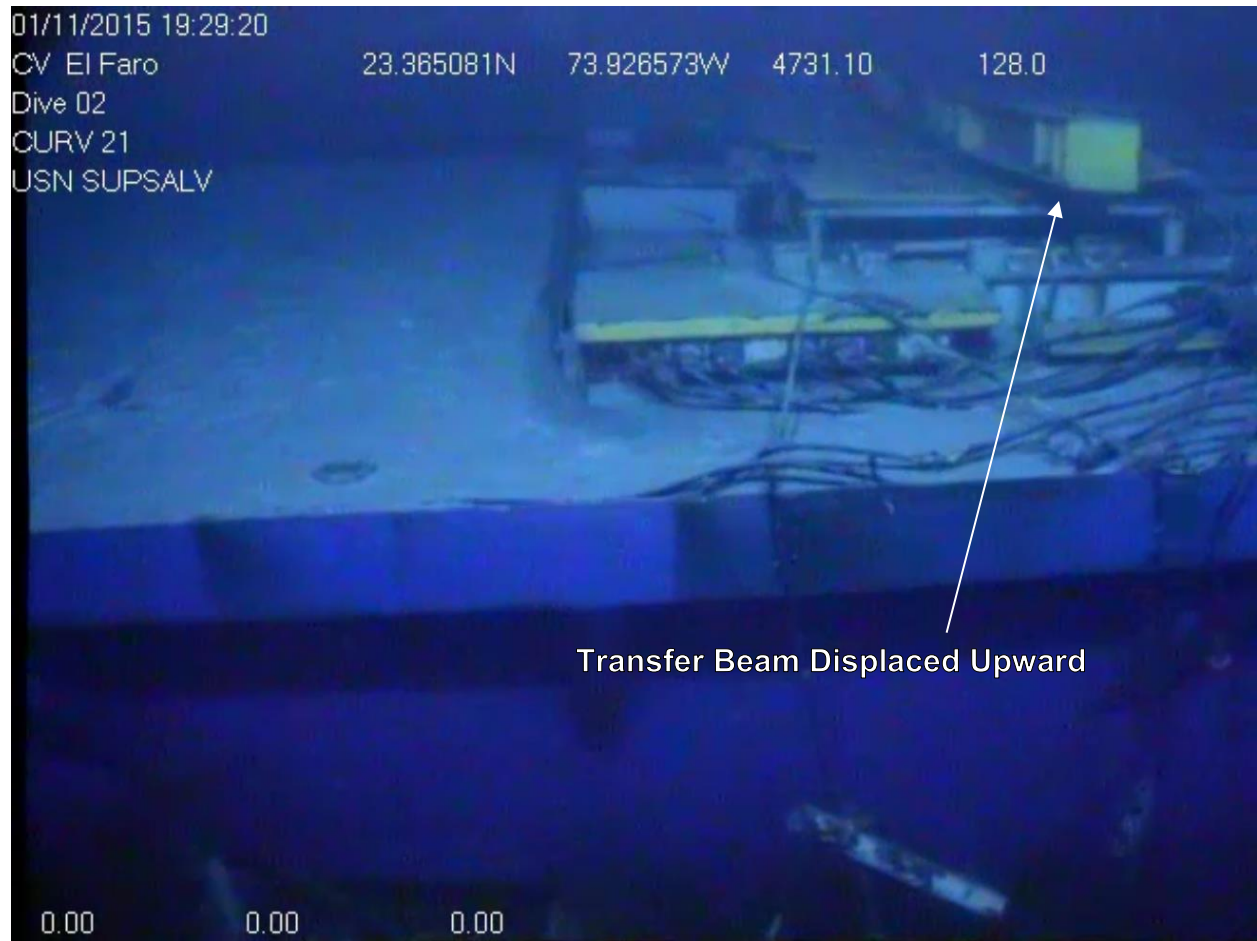


Figure 45. Region: Port – Bay 16 Frame 200 Source: Mission I Vehicle: CURV 21

Video was captured starting on the port side near bay 16 around frame 200. The transfer beam at frame 203 is visible and bent upward. The outboard portion of the transfer beam is displaced upward at least 12 inches.

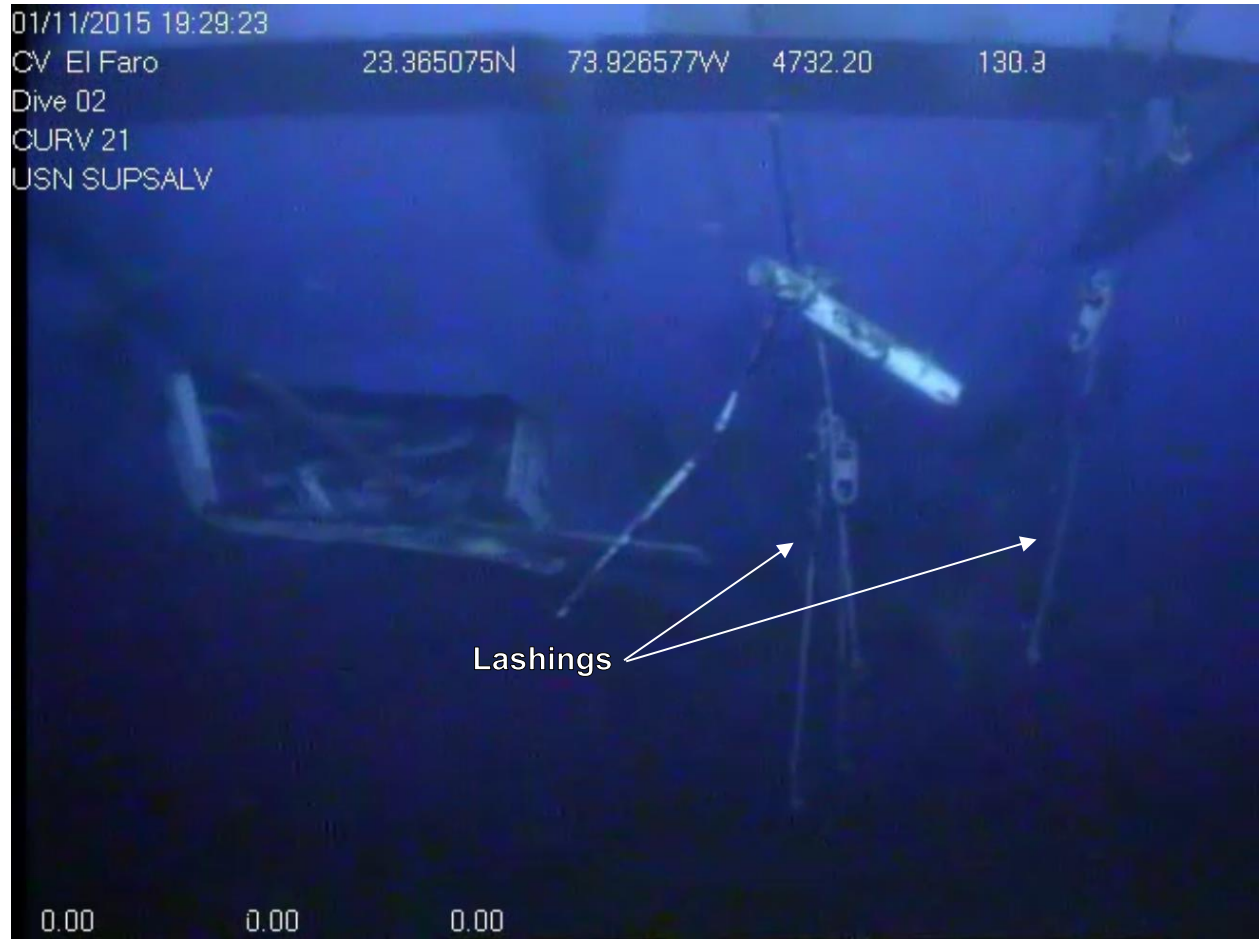


Figure 46. Region: Port – Frame 200 Source: Mission I Vehicle: CURV 21

Lashes hanging in the region of frame 200. A handrail station is entangled in the hanging lashings.



Figure 47. Region: Port – Frame 217-220 Source: Mission I Vehicle: CURV 21

Handrail is missing from the superstructure aft to the port stern quarter.

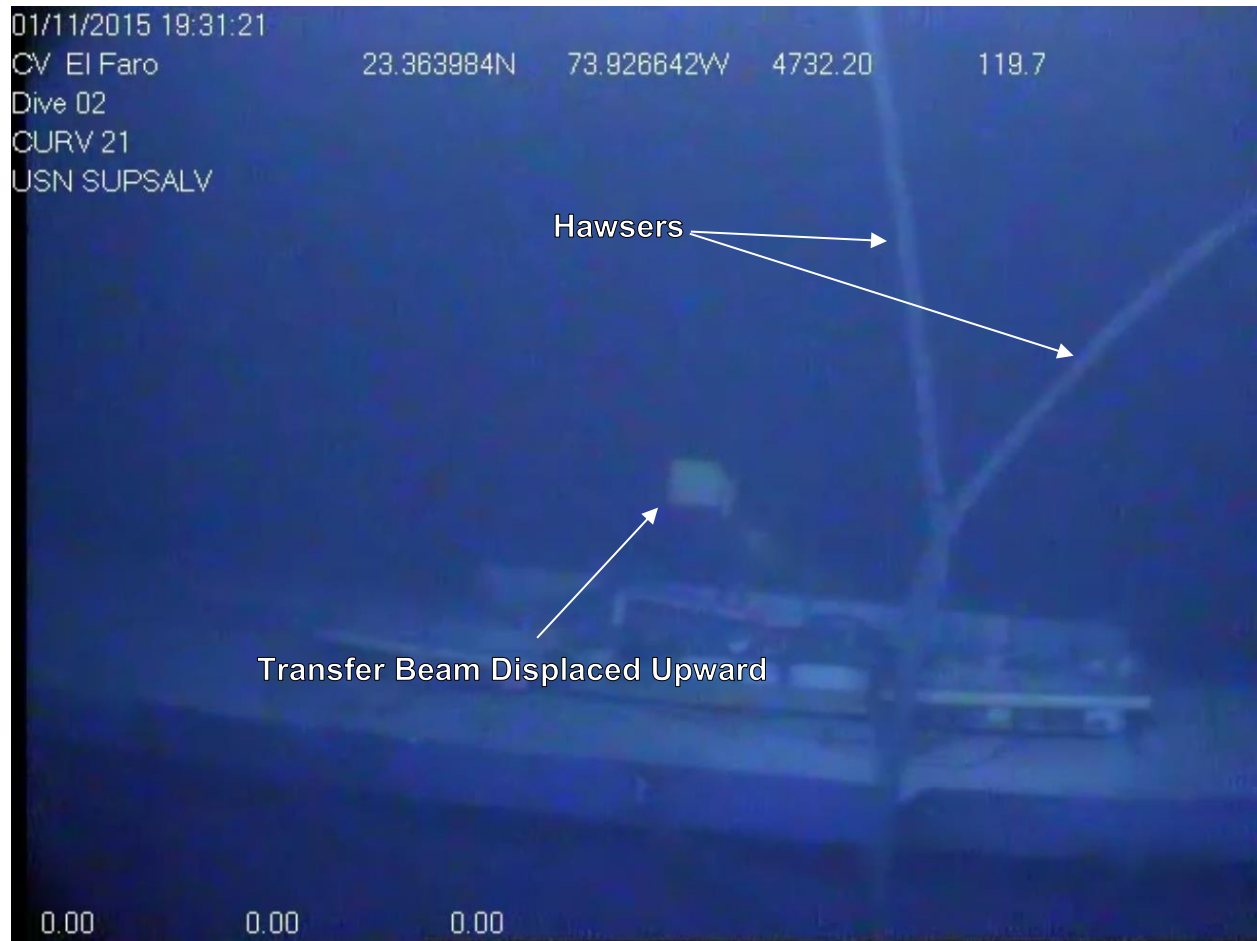


Figure 48. Region: Port – Bay 18 and 19 Source: Mission I Vehicle: CURV 21

A transfer beam is bent upward approximately four feet. A hawser is seen floating upward in the same area. The end of the mooring line was not seen.

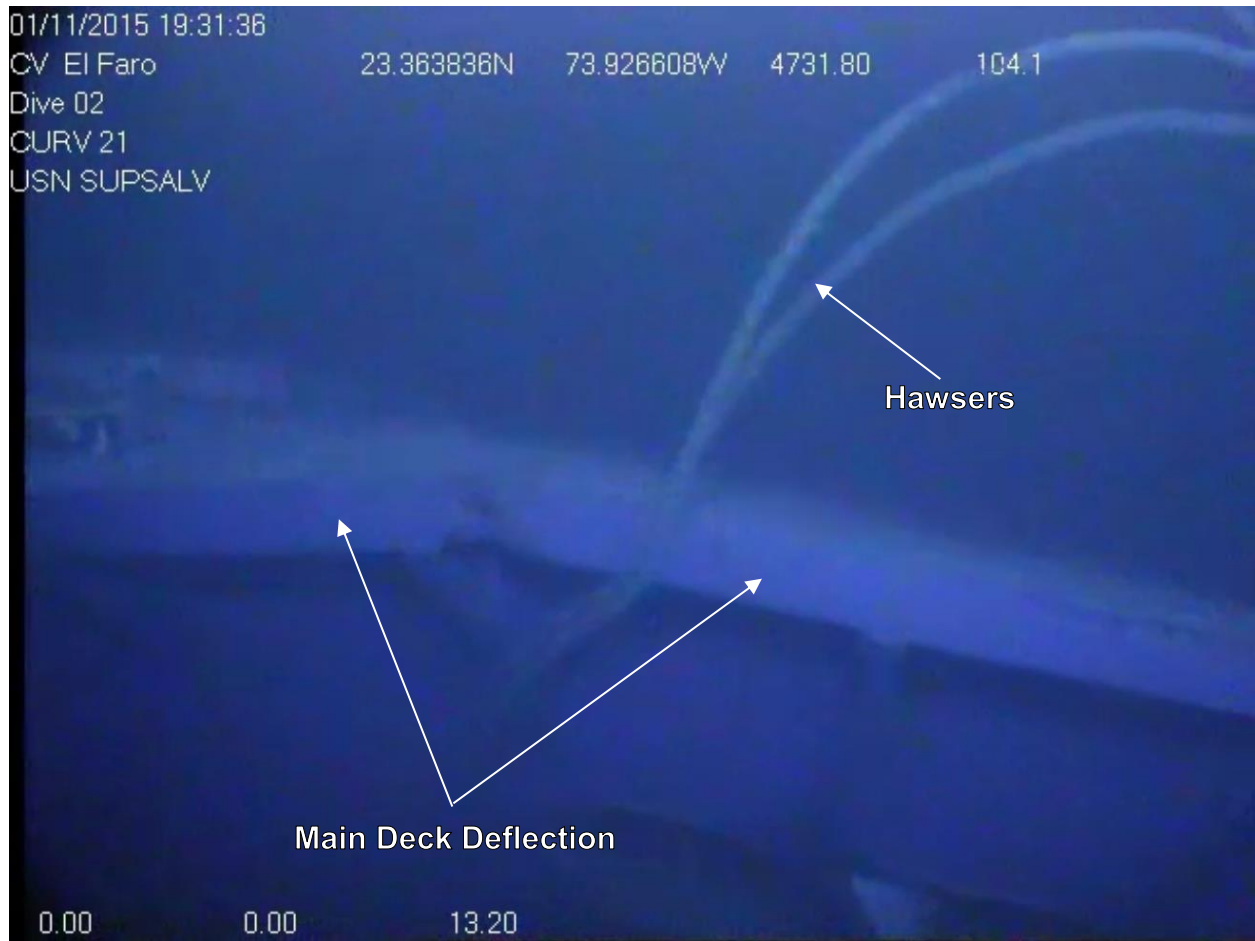


Figure 49. Region: Port – Frame 247 Source: Mission I Vehicle: CURV 21

Main deck is significantly displaced in the region of frame 247 on the port side. The angle of longitudinal deflection is estimated between 12 and 15 degrees.



Figure 50. Region: Port – Stern Quarter Source: Mission I Vehicle: CURV 21

Stern quarter on the port side. The hand rail is absent in this region and is missing along the transom.

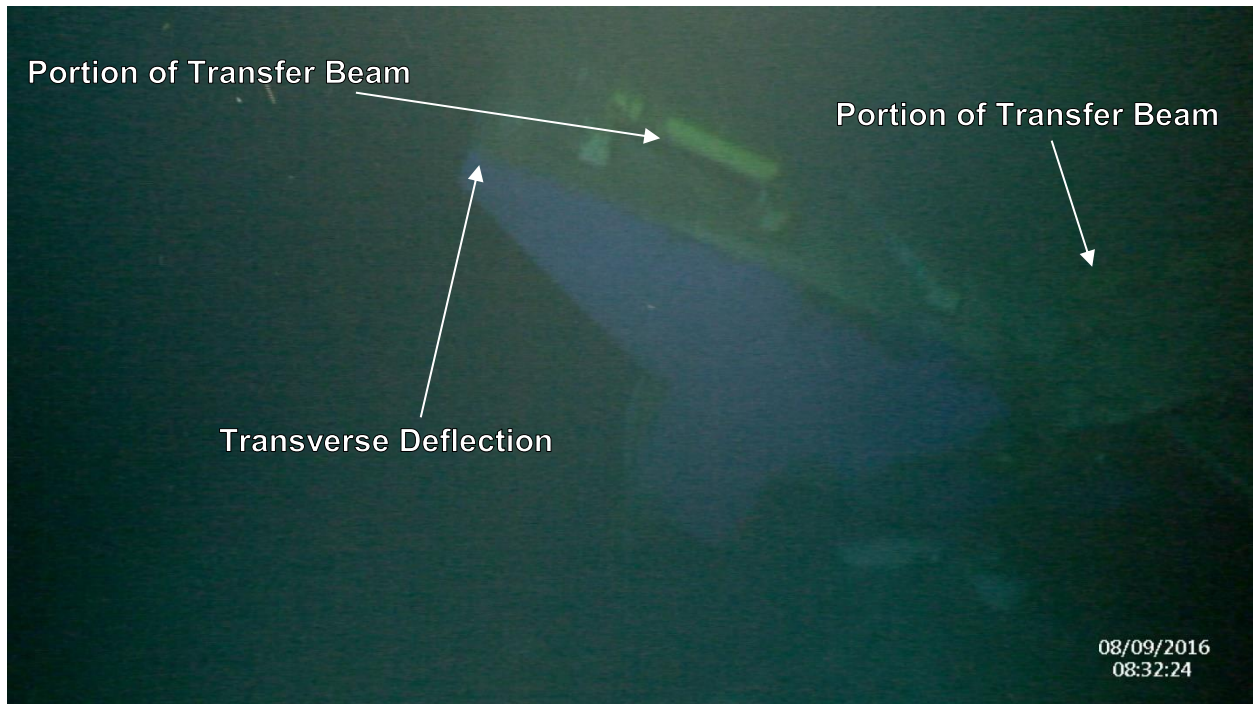


Figure 51. Region: Port – Stern Quarter Source: Mission III Vehicle: CURV 21

The port stern quarter showing substantial transverse deflection upward at the deck edge, twisting and possible shear. The outboard section of a transfer beam is present. The centerline section of the transfer beam is missing. A separate piece of a transfer beam is also seen to the right of image.

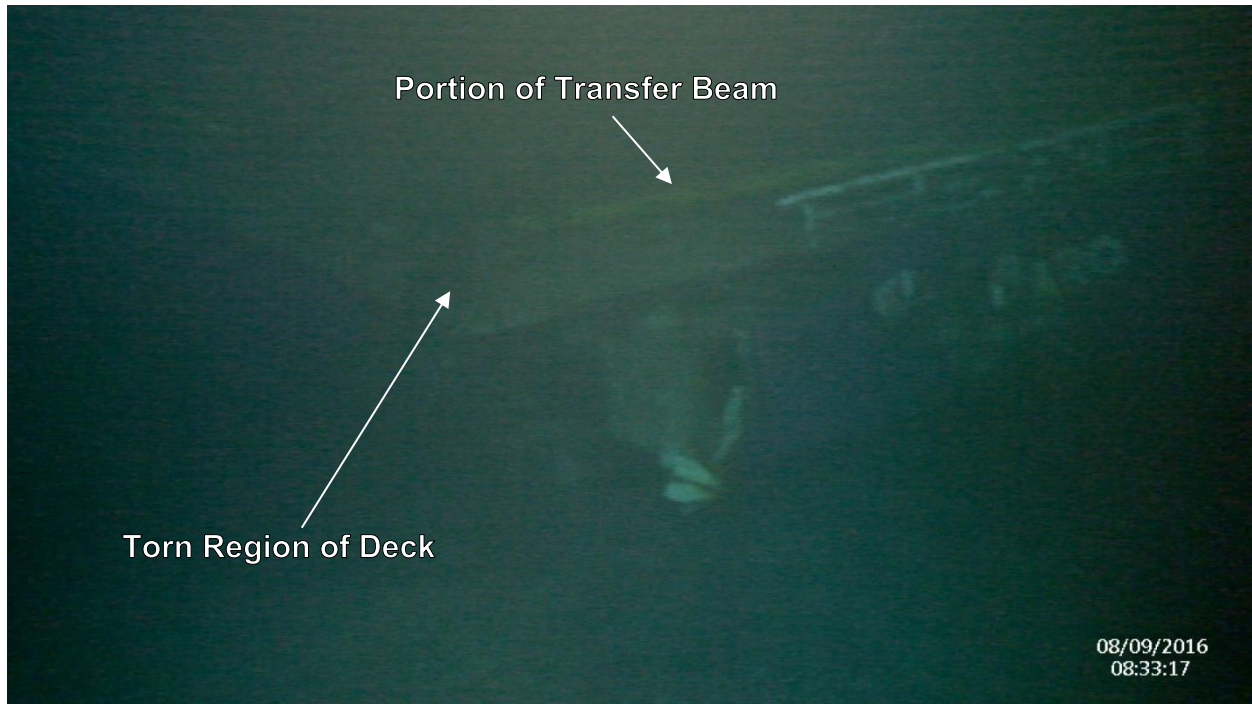


Figure 52. Region: Port – Stern Source: Mission III Vehicle: CURV 21

A wide shot of the ship's transom. Approximately 20 feet of handrail is visible on the transom above the ship's name. A portion of the transfer beam is visible. The aft port corner of the main deck is deflected upward approximately 16 feet relative to the main deck at the transom where the deck is fractured inboard. The deck is torn and bent upwards.

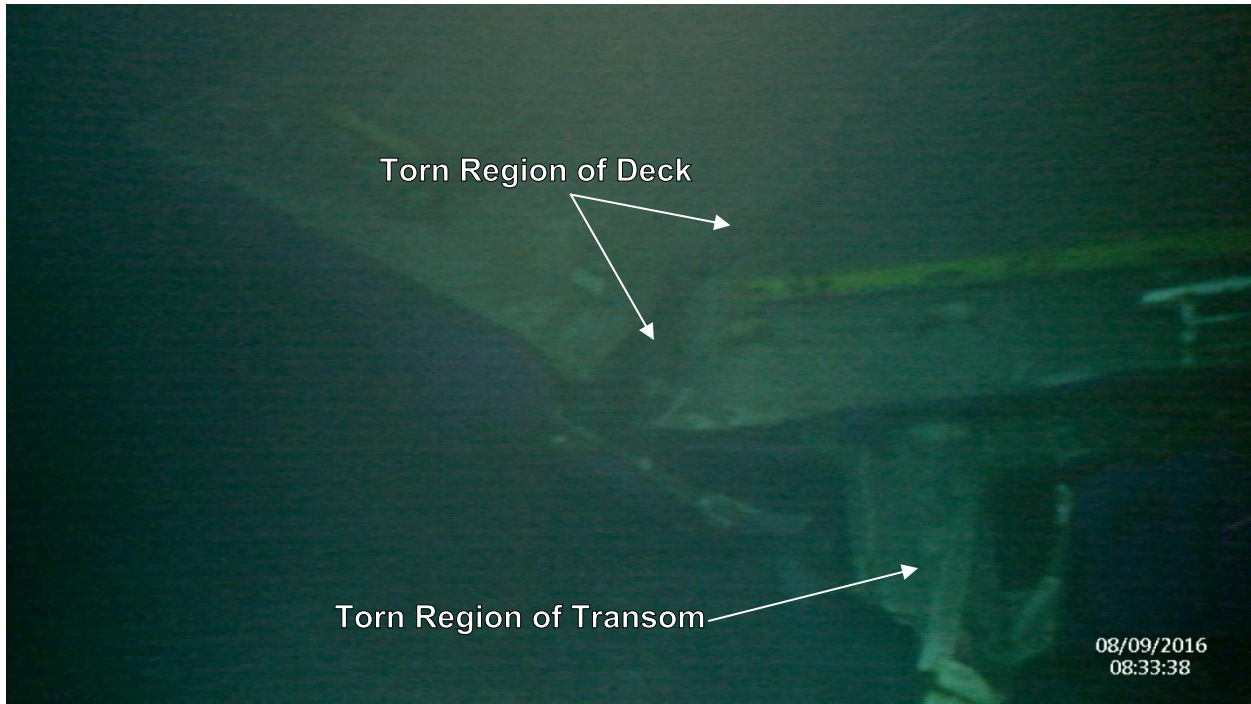


Figure 53. Region: Port – Stern Source: Mission III Vehicle: CURV 21

The tear that began approximately 16 feet inboard from the port deck edge extends an estimated 20 feet in length forward (longitudinally) from the ship's transom. The fracture in the ship's stern is seen in greater detail. The ship's transom is torn open below this area down to the ship's second deck.



Figure 54. Region: Port – Stern Source: Mission III Vehicle: CURV 21

Greater detail of the tear in the ship's transom between centerline and 30 feet to port of centerline. The transom shell plating is separated from the main deck seam from the port corner to approximately 6 feet to port from the ship's centerline.



Figure 55. Region: Port – Stern Source: Mission III Vehicle: CURV 21

The transom starboard side bent aft (outwards) above second deck. Mooring chock on second deck visible approximately 8 feet forward of transom.

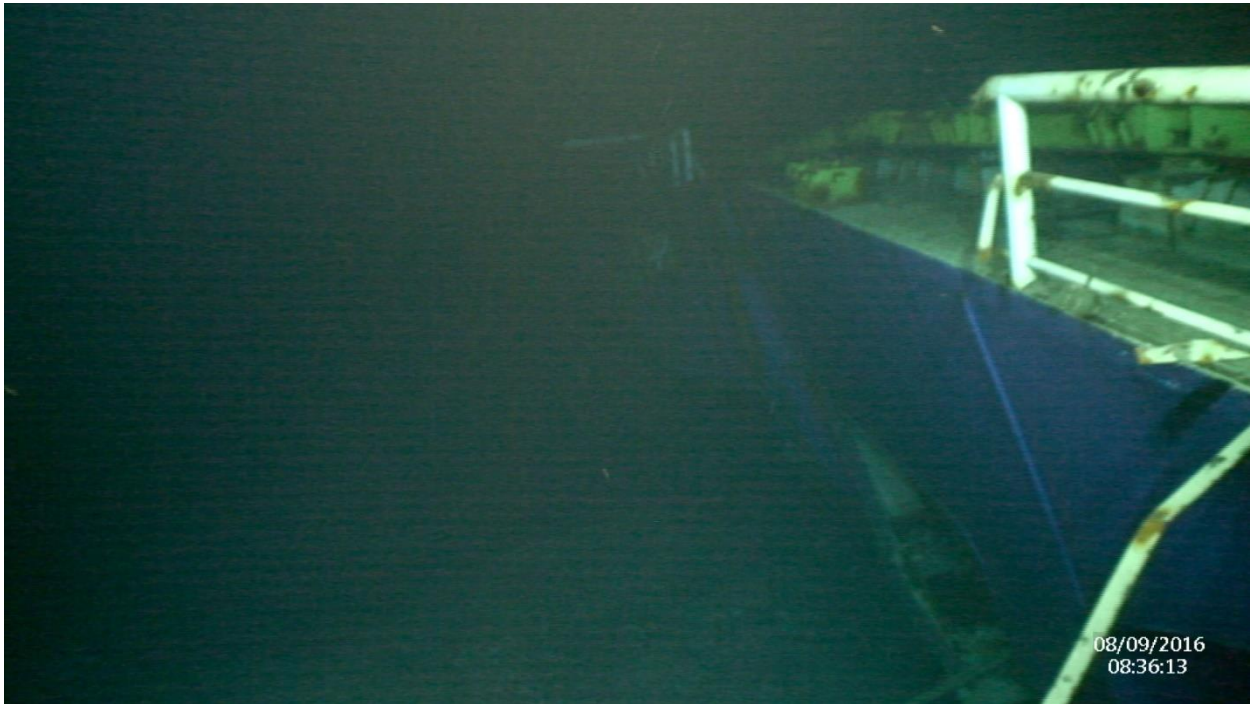


Figure 56. Region: Starboard – Stern Source: Mission III Vehicle: CURV 21

The image shows the stern of the ship as well as the ship's transom captured from the starboard stern quarter at main deck.

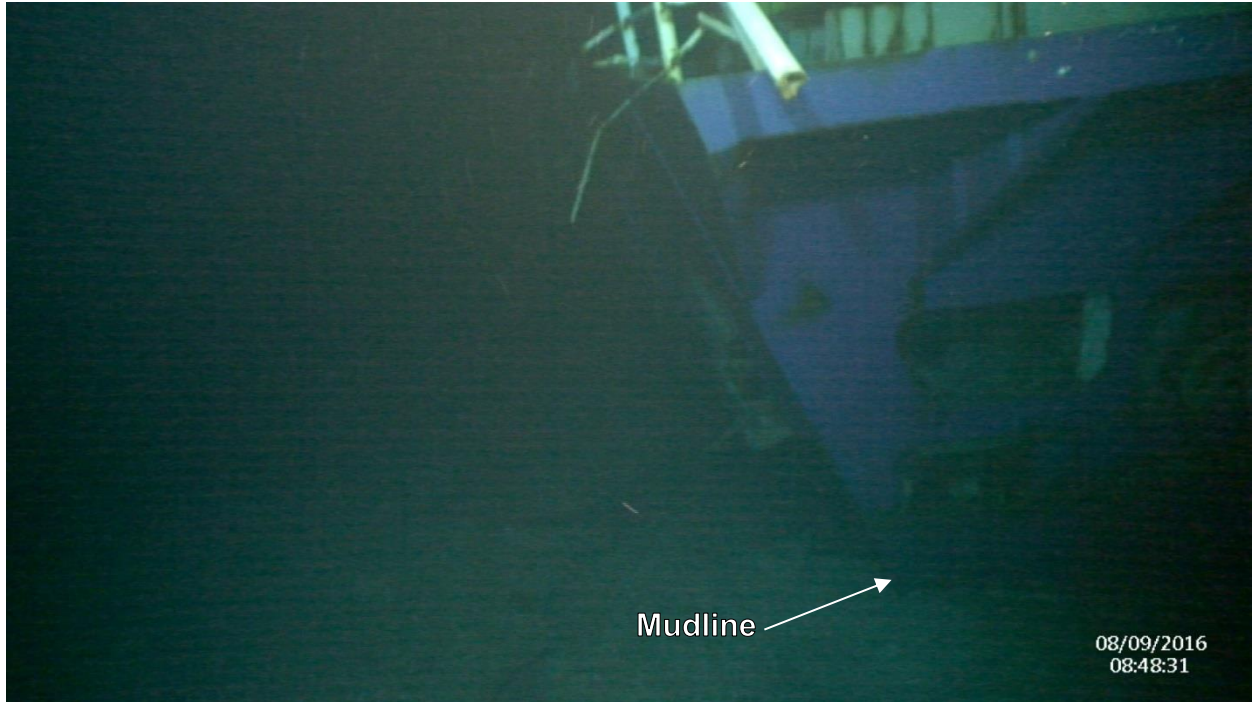


Figure 57. Region: Starboard – Stern Source: Mission III Vehicle: CURV 21

The mudline about three feet below the second deck at the starboard stern quarter.



Figure 58. Region: Starboard – Frame 248 Source: Mission III Vehicle: CURV 21

The handrail is missing from frame 248 to the transom on the starboard side.



Figure 59. Region: Starboard – Frame 248 Source: Mission III Vehicle: CURV 21

View of the second deck mooring area on the starboard side of the ship.

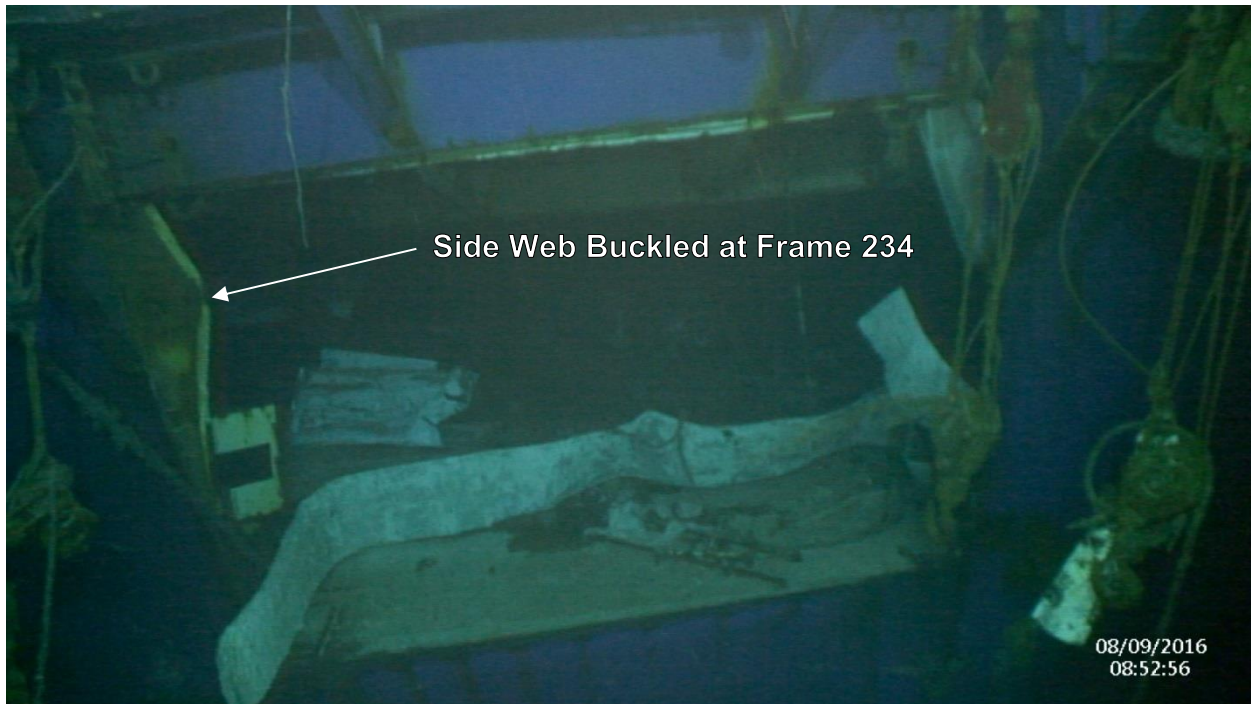


Figure 60. Region: Starboard – Frame 234 Source: Mission III Vehicle: CURV 21

Visible on the left (aft) side of the aft ramp opening, the side web at frame 234 is heavily buckled. Additionally, not clearly captured by the ROV, the handrail was present between bays 18 and 19.

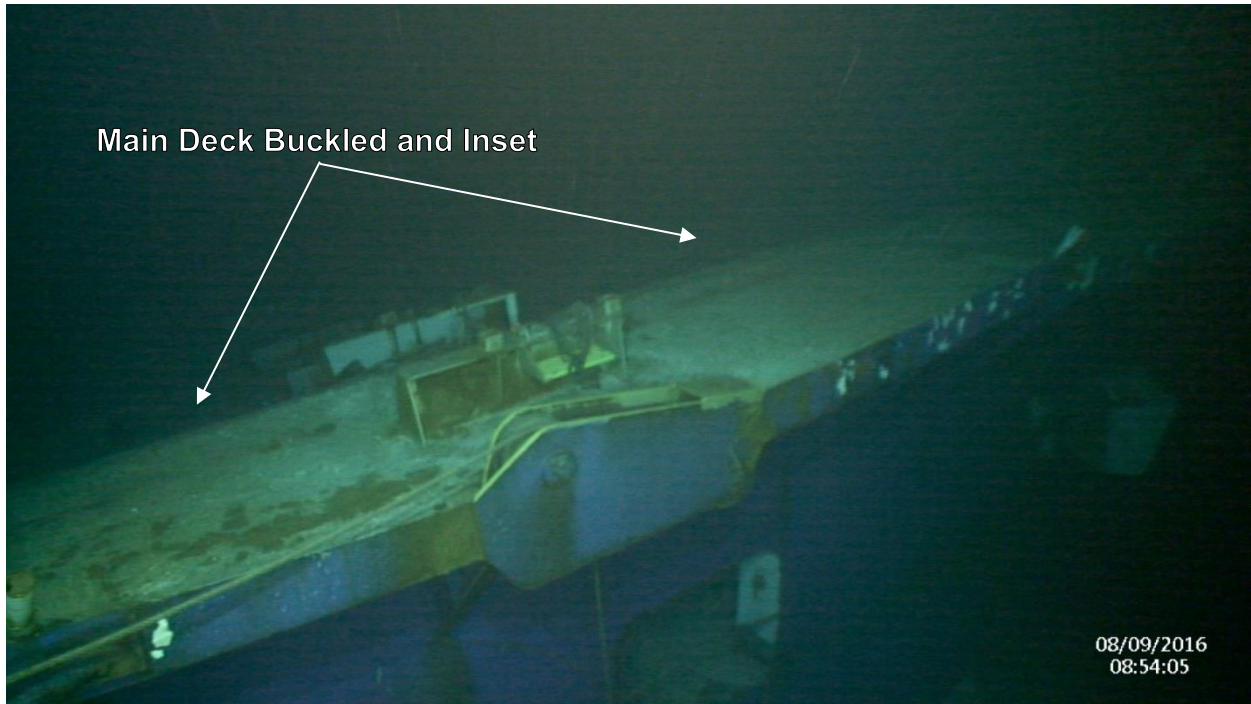


Figure 61. Region: Starboard – Frame 234 Source: Mission III Vehicle: CURV 21

Handrail is missing from bay 18 forward. Main deck is severely buckled and inset inboard about 8 feet from the starboard deck edge. The deformation begins at the junction between the main deck and the side shell plating, where the plating meets the underside of the deck overhang.

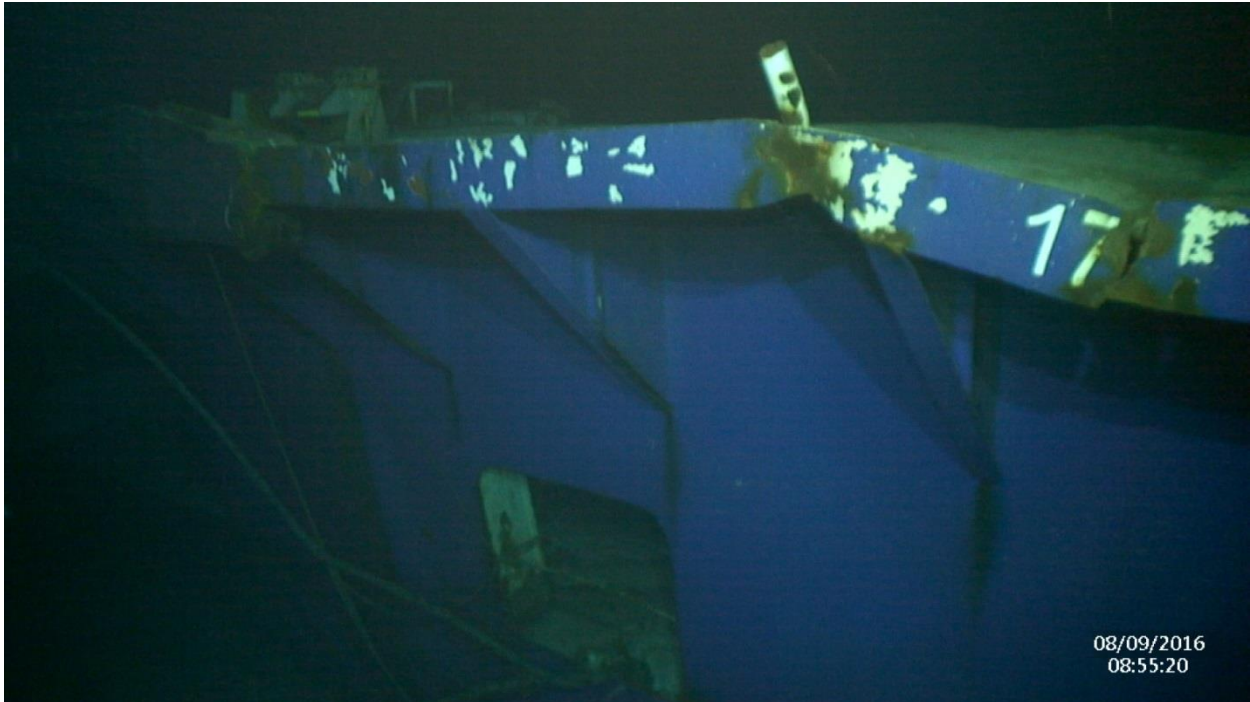


Figure 62. Region: Starboard – Frame 212 Source: Mission III Vehicle: CURV 21

Deformation in the region of bay 17 near frame 212 on main deck wing gunwale plate.

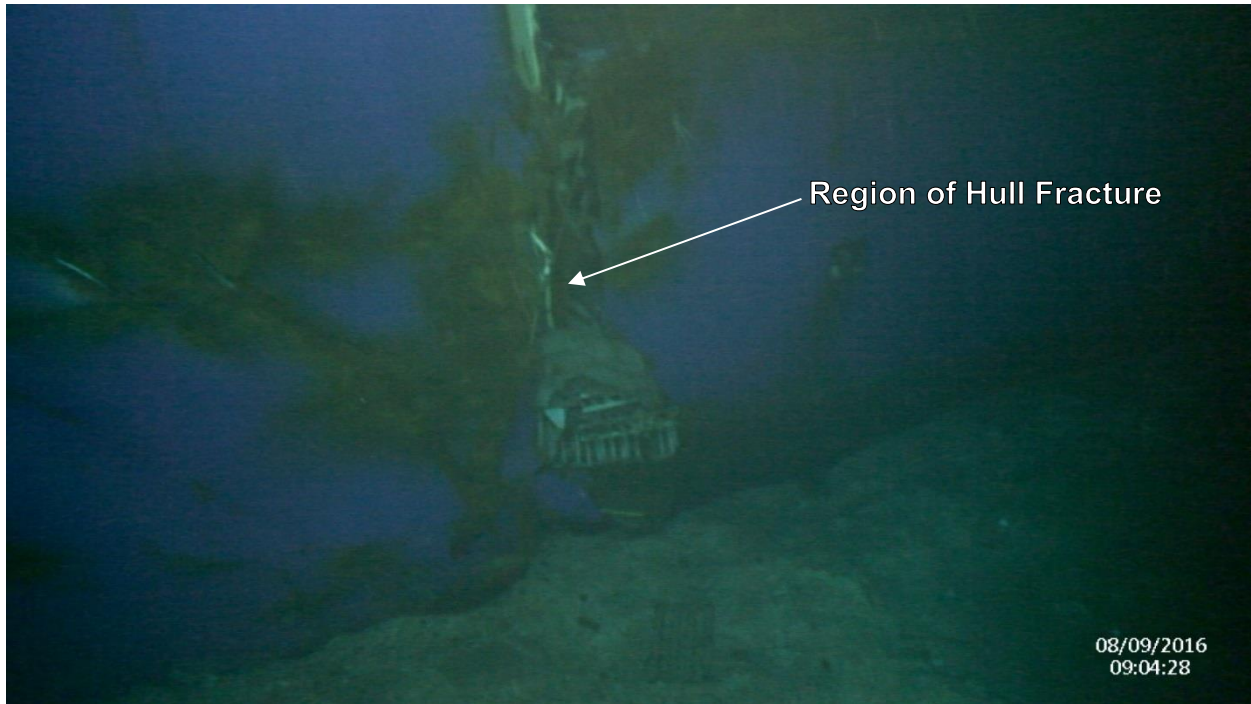


Figure 63. Region: Starboard – Frame 200 Source: Mission III Vehicle: CURV 21

Large hull fracture extending vertically from the mudline just forward of frame 200 in the vicinity of bay 16.

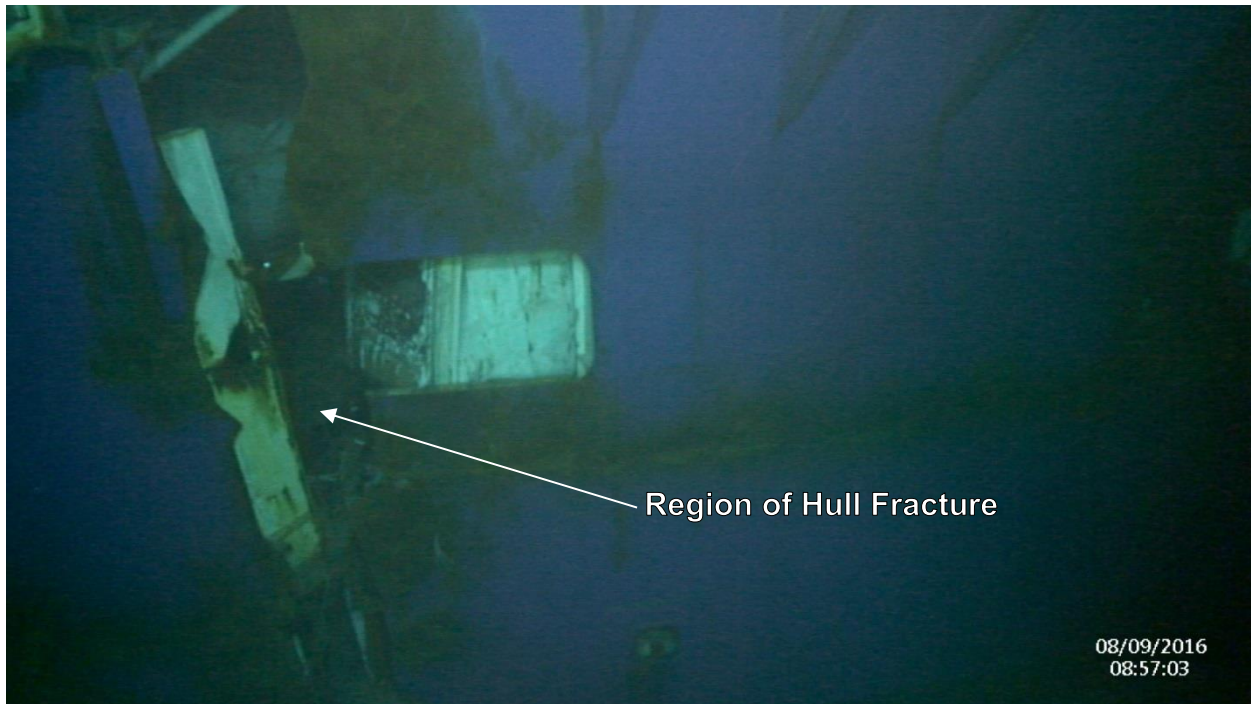


Figure 64. Region: Starboard – Frame 200 Source: Mission III Vehicle: CURV 21

Crack in the region of bay 16, just forward of frame 200. The full height side shell crack extends from the mudline up to the main deck. The estimated width of the crack at the main deck is approximately three feet.



Figure 65. Region: Starboard – Frame 200 Source: Mission III Vehicle: CURV 21

A view of the crack just forward of frame 200. The view shows the crack extending transversely across the main deck toward the port side.

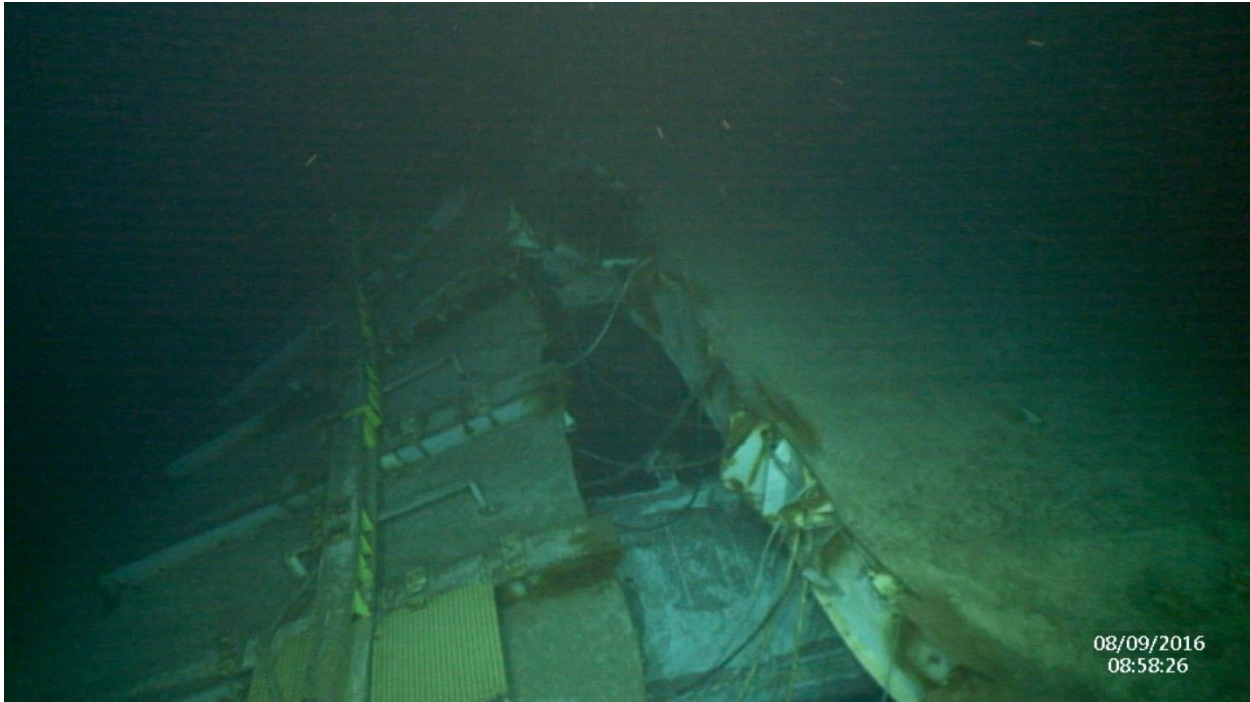


Figure 66. Region: Starboard – Frame 200 Source: Mission III Vehicle: CURV 21

Fly over of crack on the main deck looking transversely, starboard to port.



Figure 67. Region: Starboard – Frame 200 Source: Mission III Vehicle: CURV 21

View of crack along main deck approaching the port side of the ship viewed from starboard.



Figure 68. Region: Starboard - Main deck (aft) – Frame 200 Source: Mission III Vehicle: CURV 21

Substantial hull fracture (crack) at frame 200 shown along main deck nearing the port side of the ship as viewed from starboard.

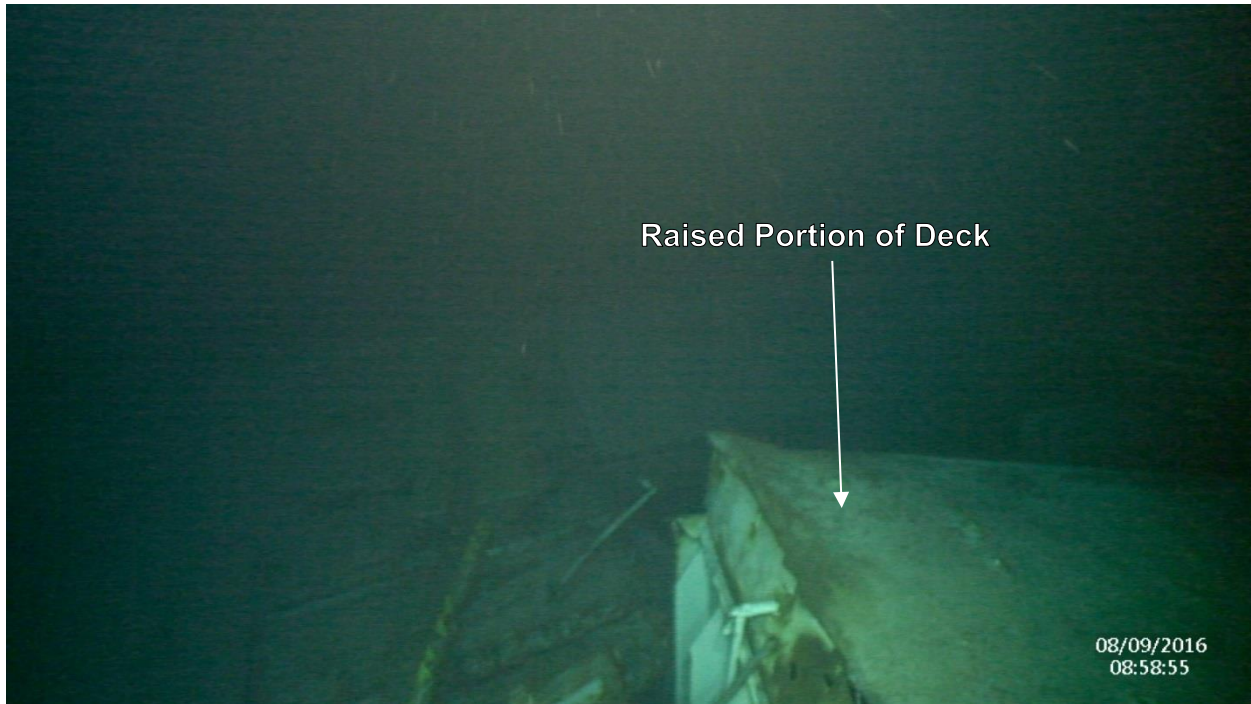


Figure 69. Region: Starboard - Main deck (aft) – Frame 200 Source: Mission III Vehicle: CURV 21

The main deck to port and aft of frame 200 is deflected downward relative to the main deck forward of frame 200 to starboard. The port side of the ship appears to have remained intact. The main deck is set down inboard of the side shell. The raised platform at lower right is the portion of the main deck above the port stanchion where the transverse bulkhead meets the main deck adjacent to the longitudinal ramp cut out.

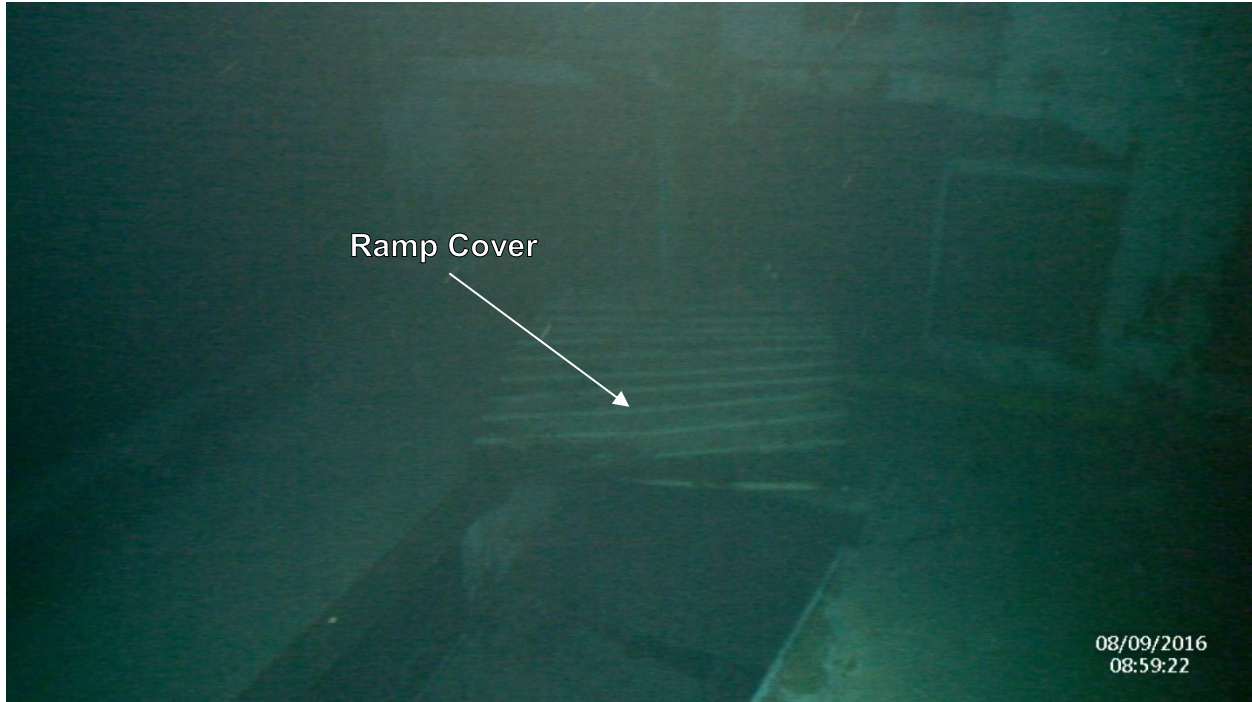


Figure 70. Region: Main deck (aft of house) – Frame 200 Source: Mission III Vehicle: CURV 21

Ramp cover (for obsolete ramp opening) is peeled back (toward the deck house) and slightly to port. The ramp cover is peeled up and forward. The ramp is inverted showing transverse stringers on top that were normally on the inside and underside of the plate.



Figure 71. Region: Main deck (aft) – Frame 200 Source: Mission III Vehicle: CURV 21

Substantial crack on the main deck looking from port to starboard.



Figure 72. Region: Main deck (aft) – Frame 200 Source: Mission III Vehicle: CURV 21

Main deck looking from port to starboard into the obsolete ramp opening. The railing that surrounds the ramp opening on second deck is missing.

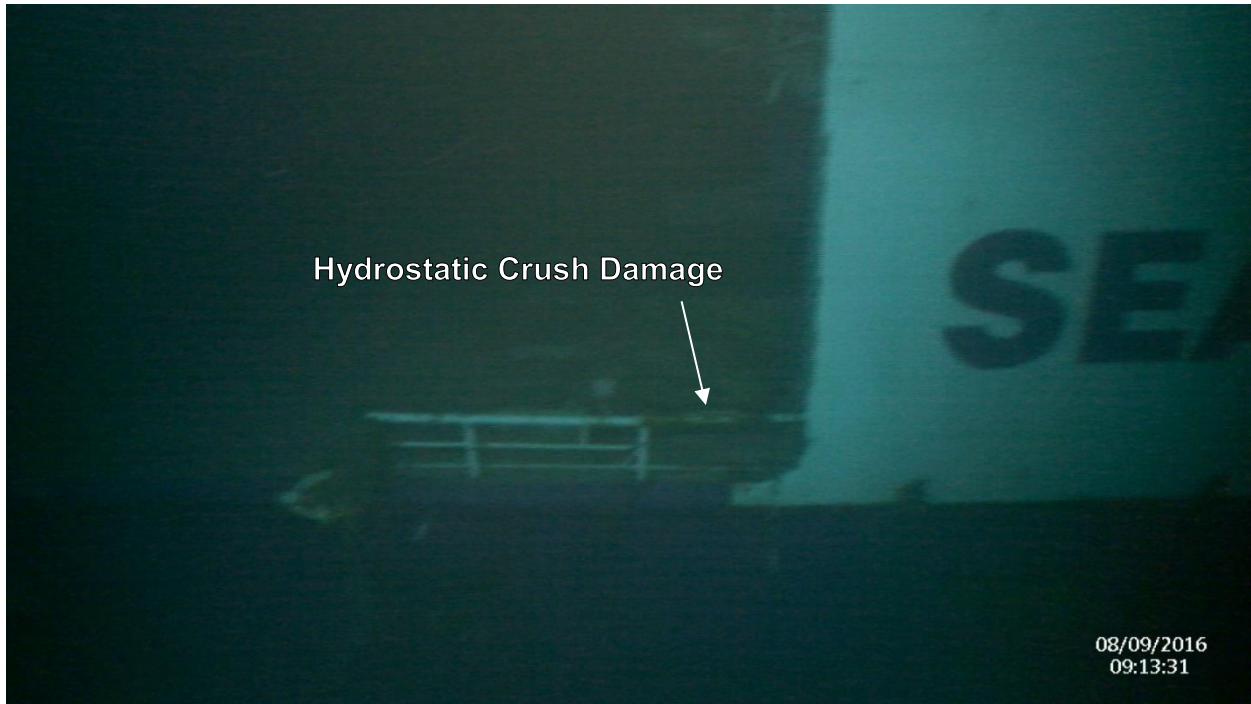


Figure 73. Region: Starboard – Frame 190 Source: Mission III Vehicle: CURV 21

Deck rail present forward to frame 190. Forward portion of the top rail exhibits hydrostatic implosion damage on the pipe section.



Figure 74. Region: Starboard – Life Boat Skid Source: Mission III Vehicle: CURV 21

View of starboard side life boat skid, undamaged.



Figure 75. Region: Starboard –Bay 15 Frame 156 Source: Mission III Vehicle: CURV 21

Vehicle opening in the area of bay 15 near frame 156. A reefer container on chassis is sticking out through the starboard side vehicle opening. The container on chassis exhibits hydrostatic crush damage. Two breakwater panels that were mounted at the side shell in the opening are missing. Deck rail is missing from the house forward.

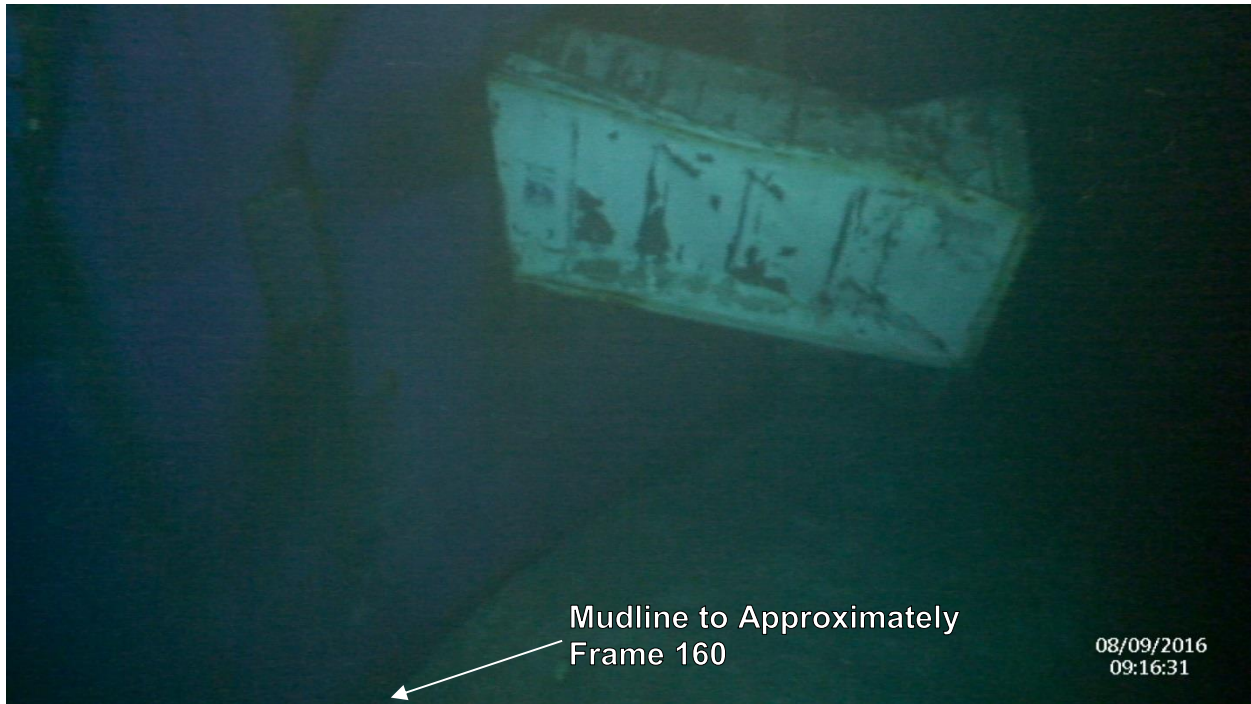


Figure 76. Region: Starboard –Bay 15 Frame 156 Source: Mission III Vehicle: CURV 21

Alternate view of reefer container on chassis sticking out of starboard side vehicle opening. The reefer container number is labeled “GESU 910338-6 45R1” in a later image. Also visible is the mudline to about frame 160. The mudline is above the loaded waterline in this area. The starboard side Emergency Fire Pump side shell penetration in Hold 3 above the Tank Top is located below the mudline.



Figure 77. Region: Starboard –Bay 15 Frame 151 Source: Mission II Vehicle: AOV

The reefer container number is labeled “GESU 910338-6 45R1”.



Figure 78. Region: Starboard –Bay 15 Frame 151 Source: Mission II Vehicle: AOV

A 40 plus foot white container on a chassis is seen inside the ship's hull in what appears to be an upright and a longitudinally stowed position.

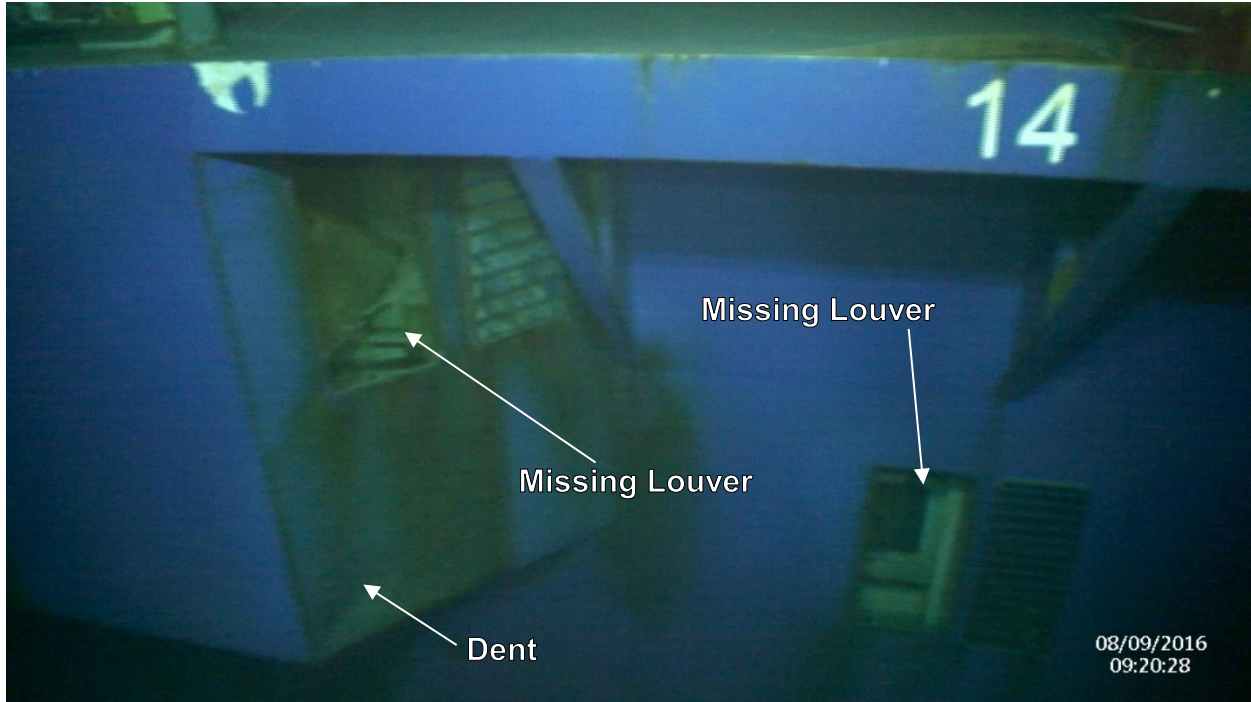


Figure 79. Region: Starboard – Bay 14 Source: Mission III Vehicle: CURV 21

A outboard louver for the cargo hold supply air intake at frame 142 is missing. A dent is on the forward face of the intake blister. A smaller louver associated with the cargo hold air exhaust vent located at frame 136 is also missing.

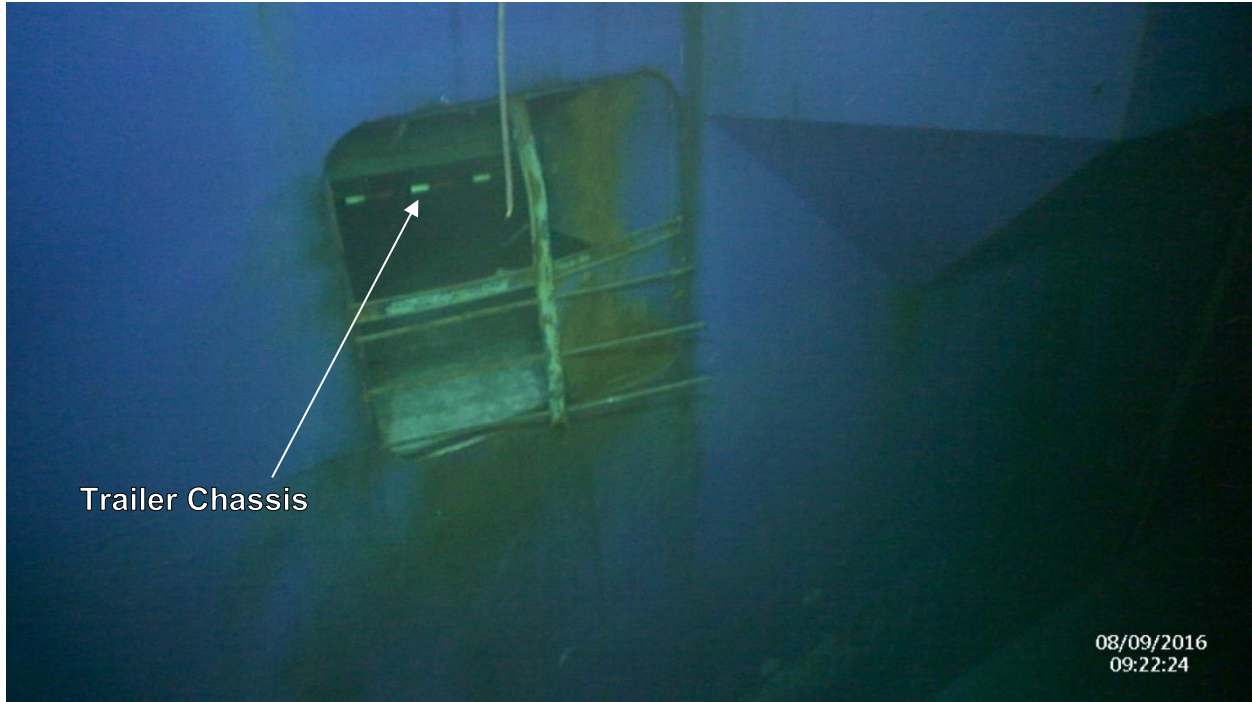


Figure 80. Region: Starboard – Frame 134/16 Source: Mission III Vehicle: CURV 21

Reflective tape associated with a trailer chassis is behind an open second deck access door in the vicinity of frame 134/16. The stanchions surrounding the second deck access door are pushed outward.

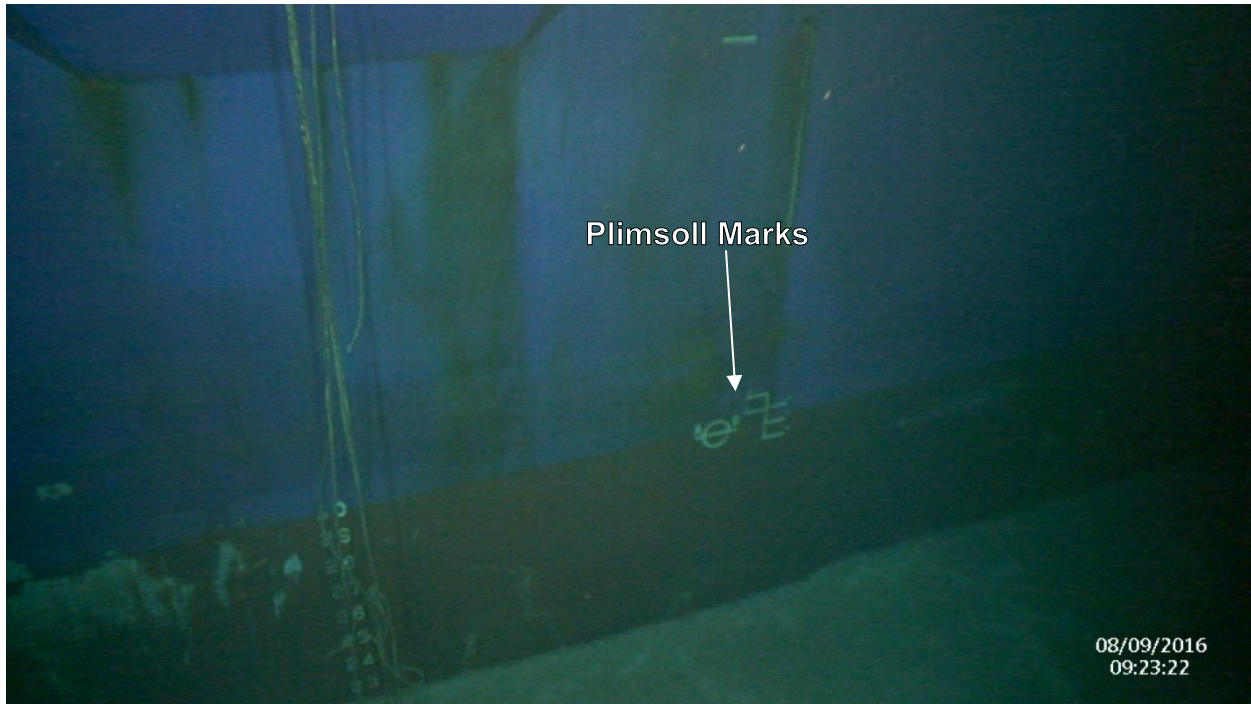


Figure 81. Region: Starboard – Midship Source: Mission III Vehicle: CURV 21

The plimsoll marks are visible. The draught marks are visible, showing a starboard midships mudline (draught) of 22.5 feet.

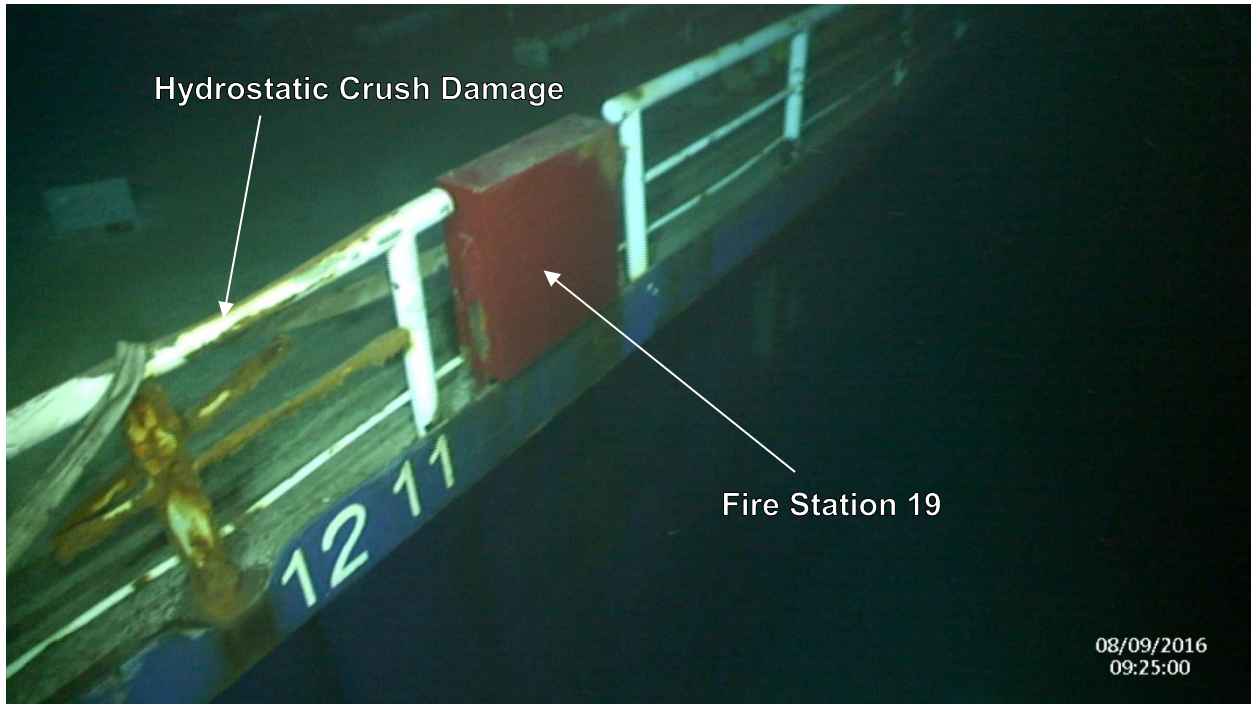


Figure 82. Region: Starboard – Frame 133 Source: Mission III Vehicle: CURV 21

Fire station no. 19 and railing intact at frame 133. Note hydrostatic crush damage to railing pipe just above the number "12."

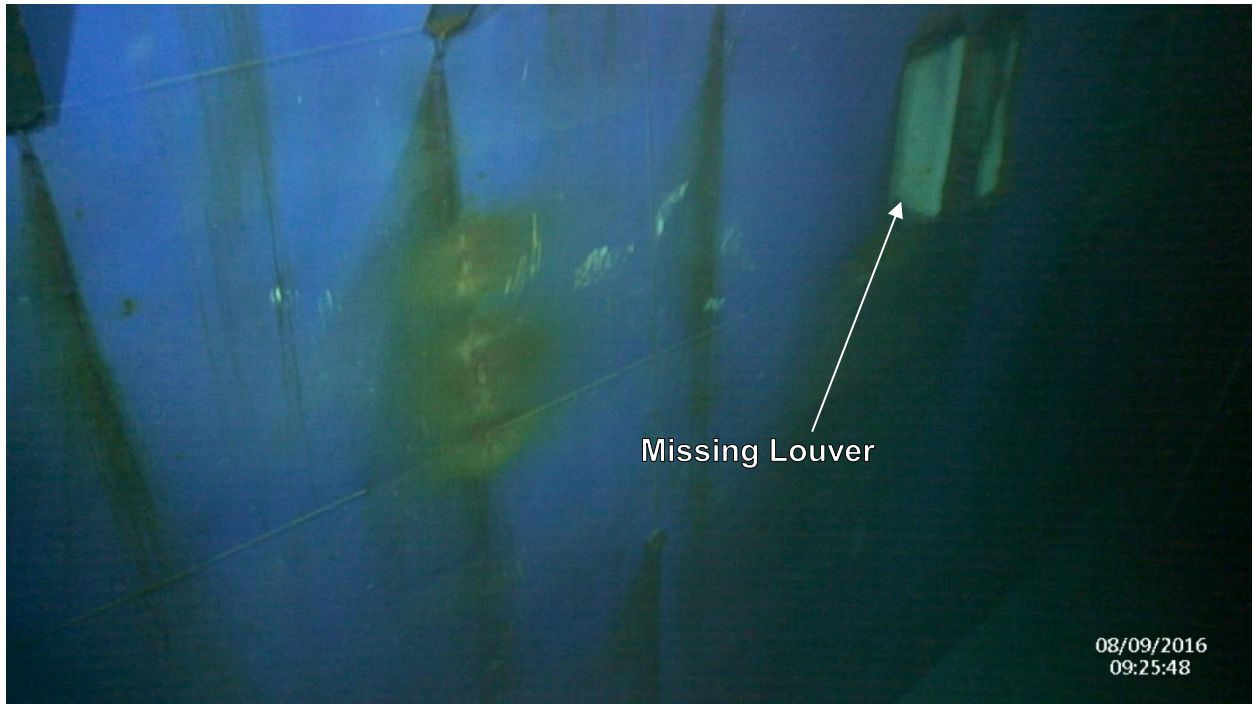


Figure 83. Region: Starboard – Frame 123 Source: Mission III Vehicle: CURV 21

Missing cargo hold exhaust ventilation louvers at frame 123.

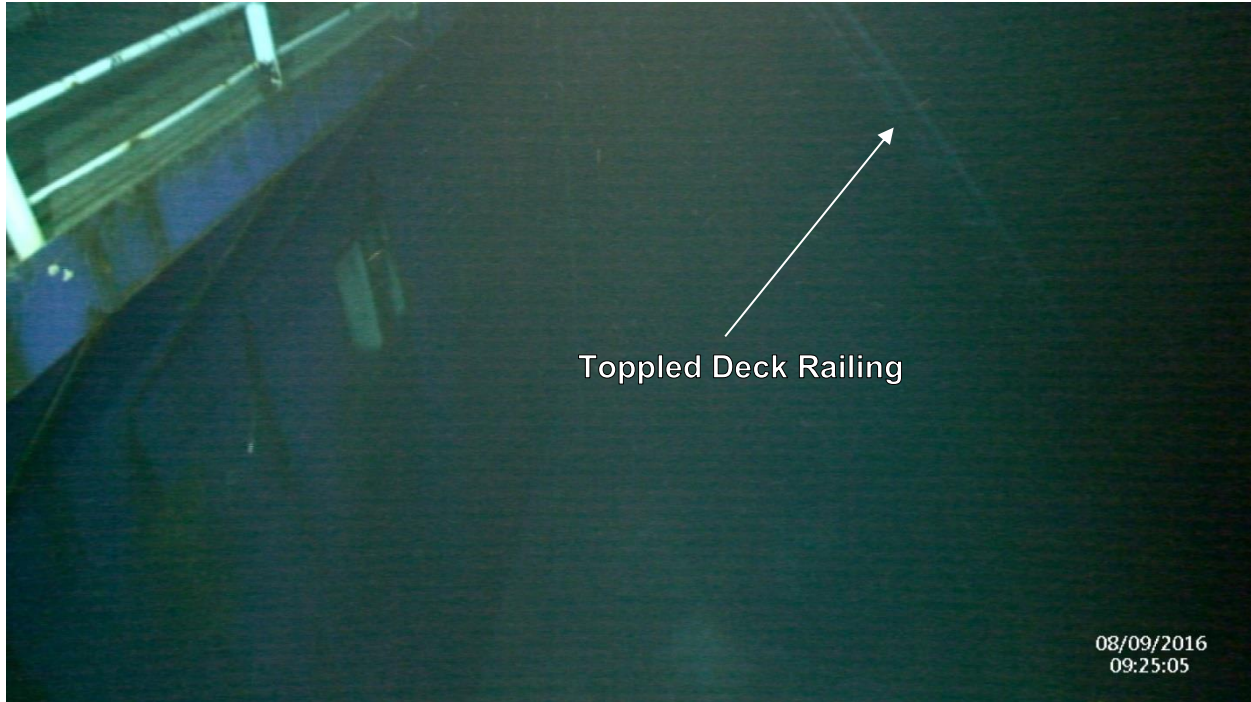


Figure 84. Region: Starboard – Frame 133 Source: Mission III Vehicle: CURV 21

Deck railing detached from deck and toppled onto seafloor. The deck rail is estimated to depart the deck around frame 115.

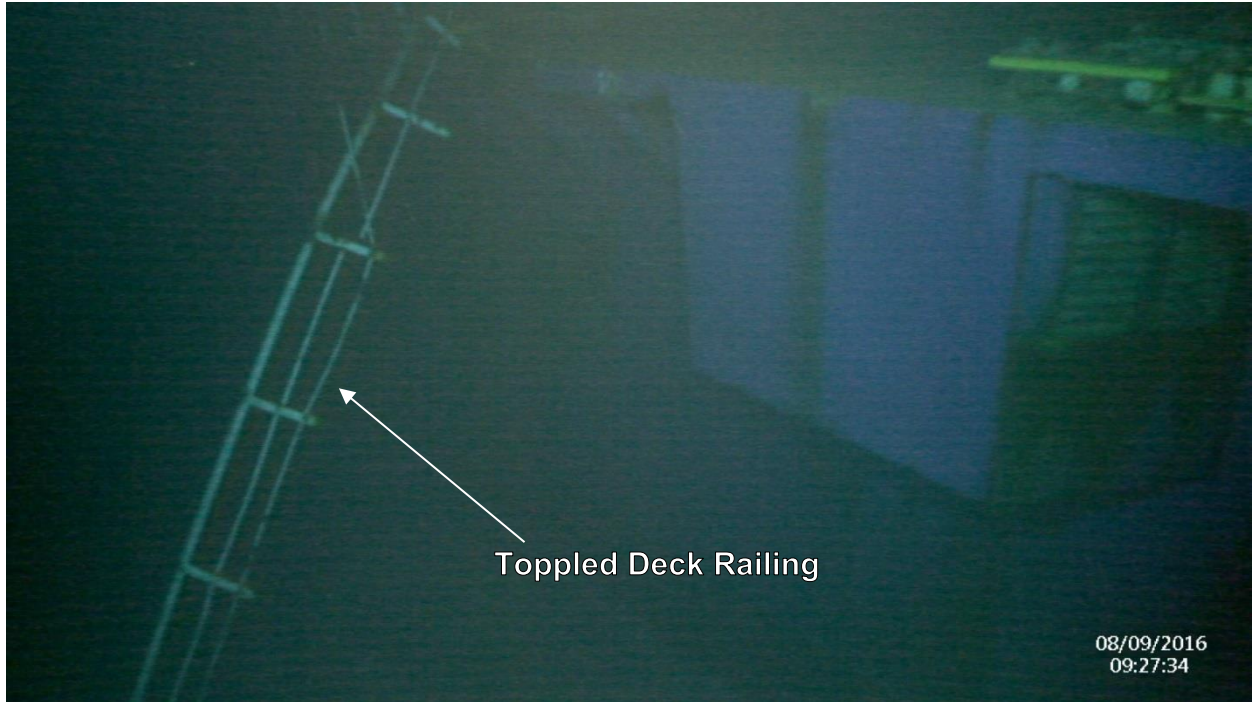


Figure 85. Region: Starboard – Frame 100 Source: Mission III Vehicle: CURV 21

Alternate view of deck rail detached from deck edge around frame 115.

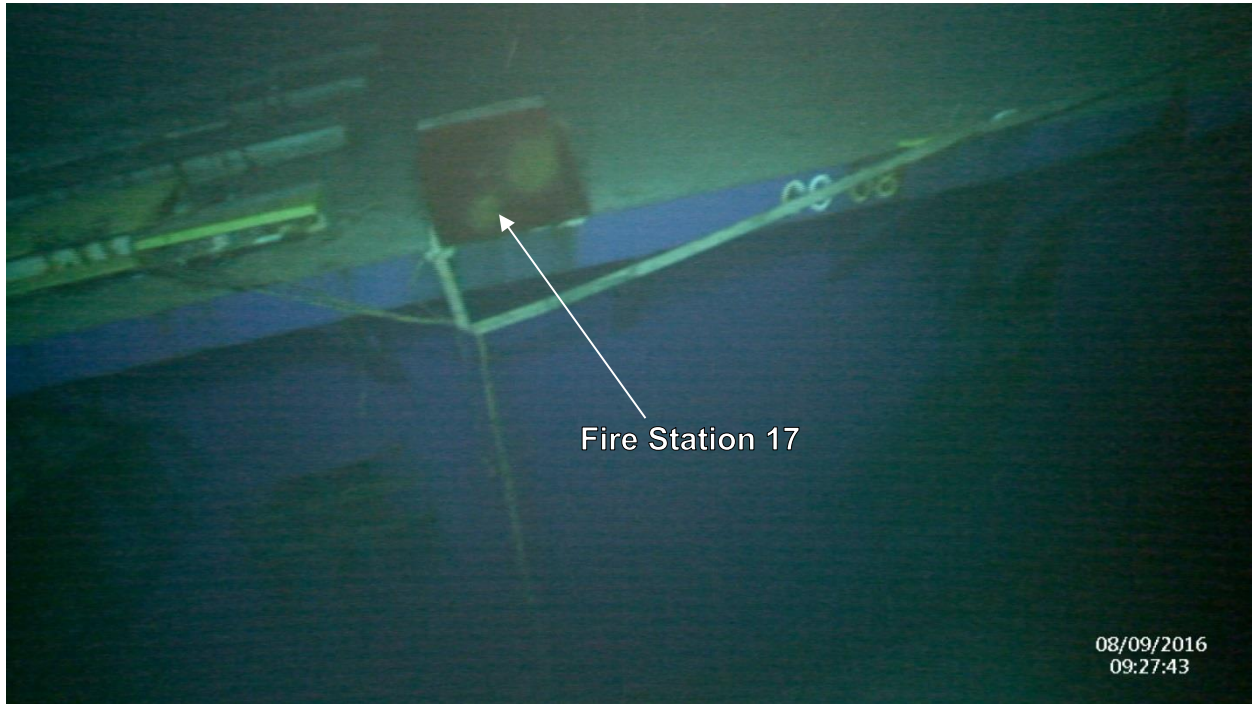


Figure 86. Region: Starboard – Frame 100 Source: Mission III Vehicle: CURV 21

Fire station no. 17 intact at frame 100. Deck railing to each side is missing.

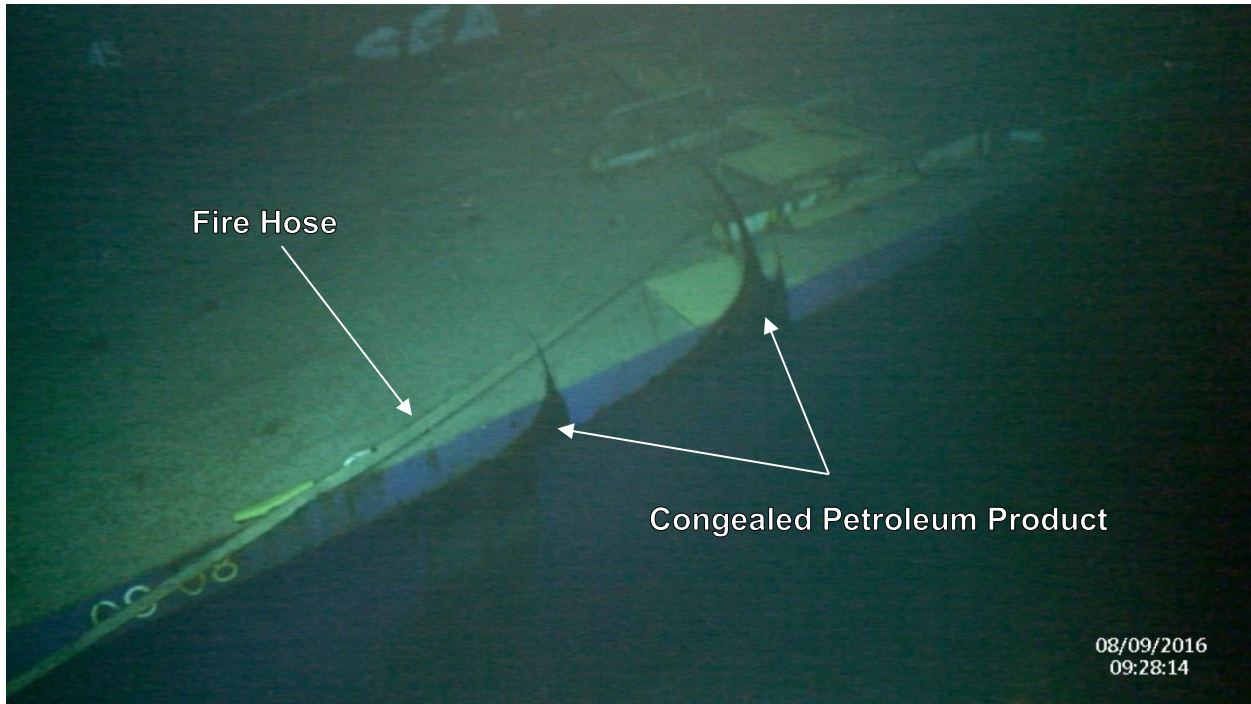


Figure 87. Region: Starboard – Frame 100 Source: Mission III Vehicle: CURV 21

2.5 inch firehose from fire station no. 17 streamed forward above bays 09 and 08. Visible congealed petroleum product plumes from second deck out through side vent alongside main deck. 45-foot container exhibiting hydrostatic crush damage resting on deck above bay 08.

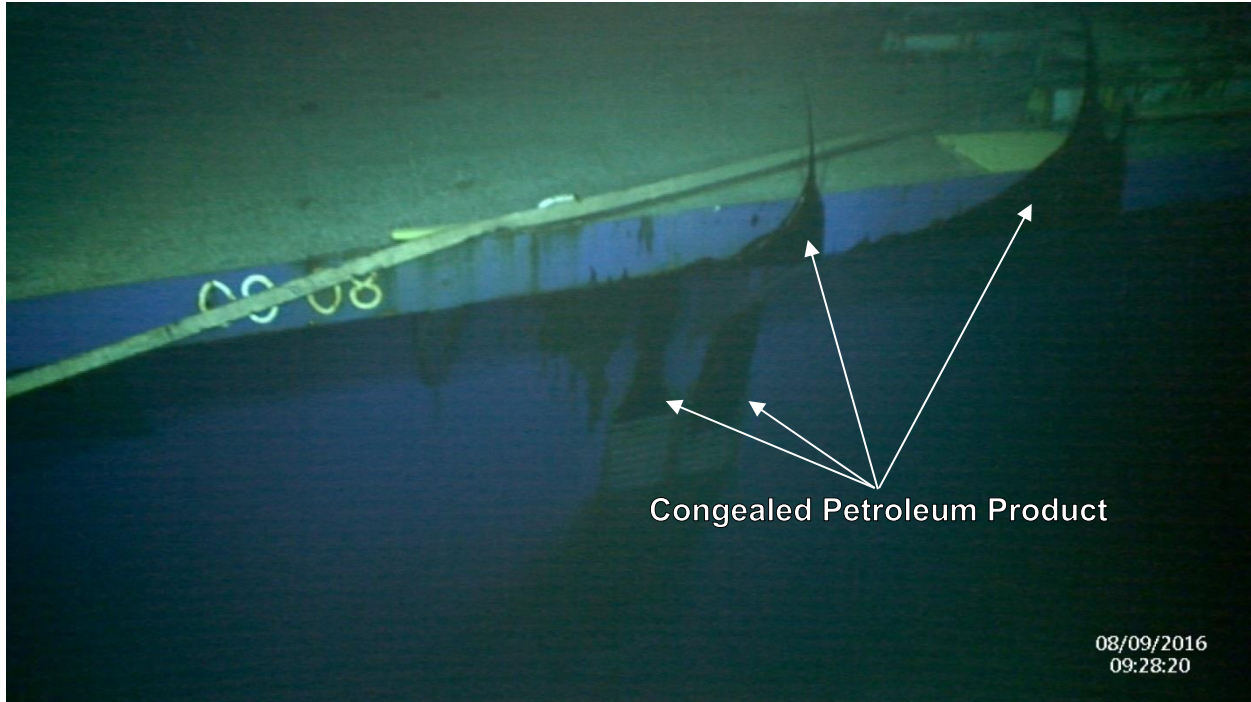


Figure 88. Region: Starboard – Frame 93 Source: Mission III Vehicle: CURV 21

Exhaust vent louvers from cargo hold no. 2 at frame 93 shows a congealed petroleum product streaming upward.

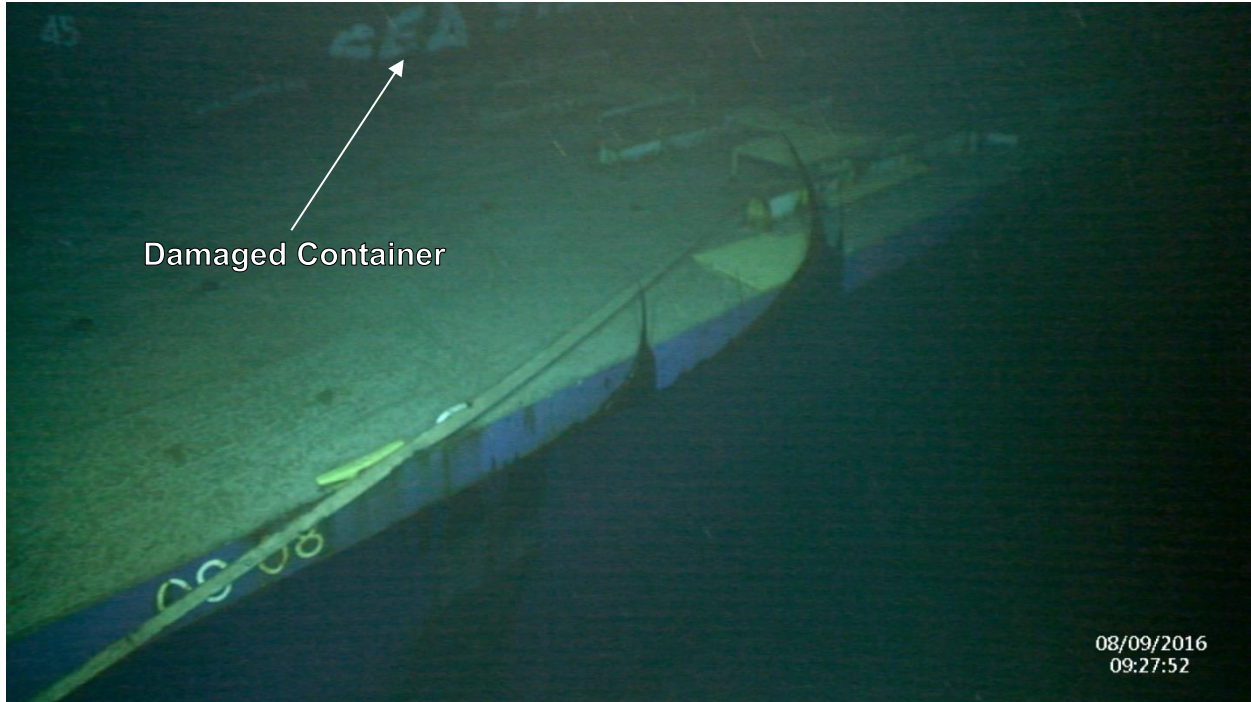


Figure 89. Region: Starboard – Frame 93 Source: Mission III Vehicle: CURV 21

A 45-foot dark red colored Sea Star container exhibiting crush or collision damage resting on main deck. The container is not in a secured position, as it is not resting on the deck sockets.

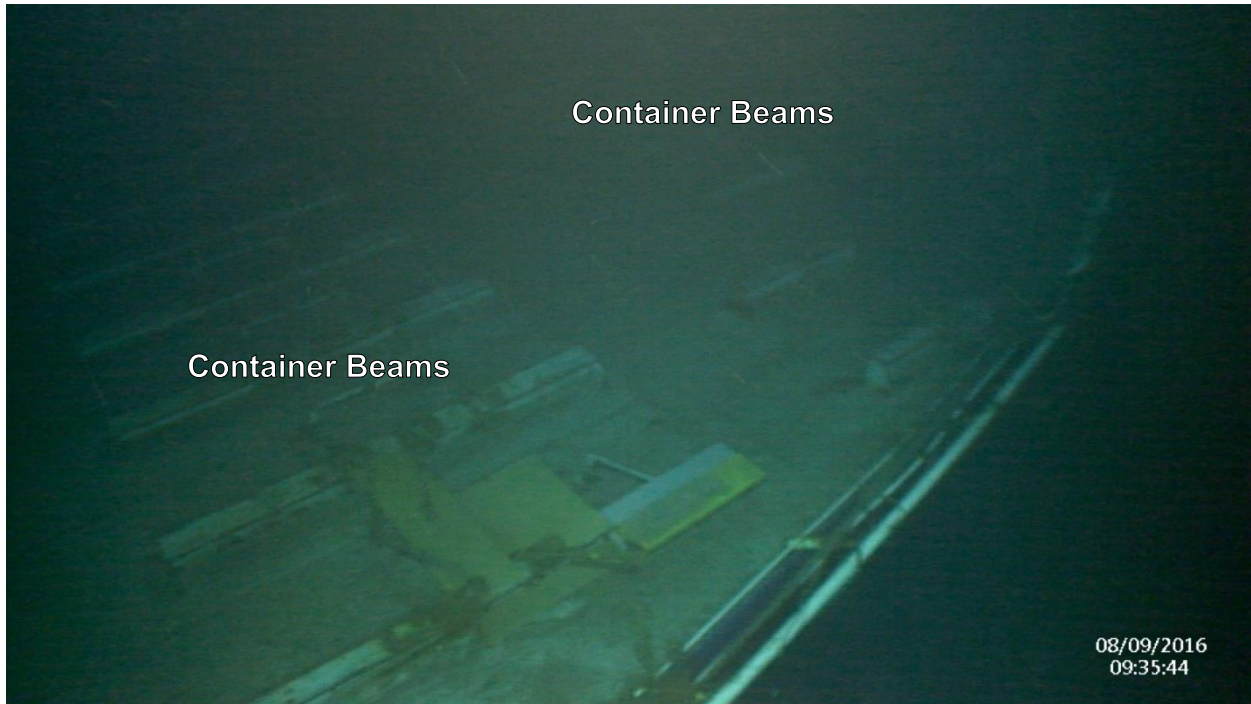


Figure 90. Region: Starboard – Frames 40 - 45 Source: Mission III Vehicle: CURV 21

The container beams in the vicinity of bay 02 and 03 appear to be undisturbed. The starboard side deck railing appears to be bent outward. The deck rail appears to begin around frame 45 where fire station no. 15 is missing.

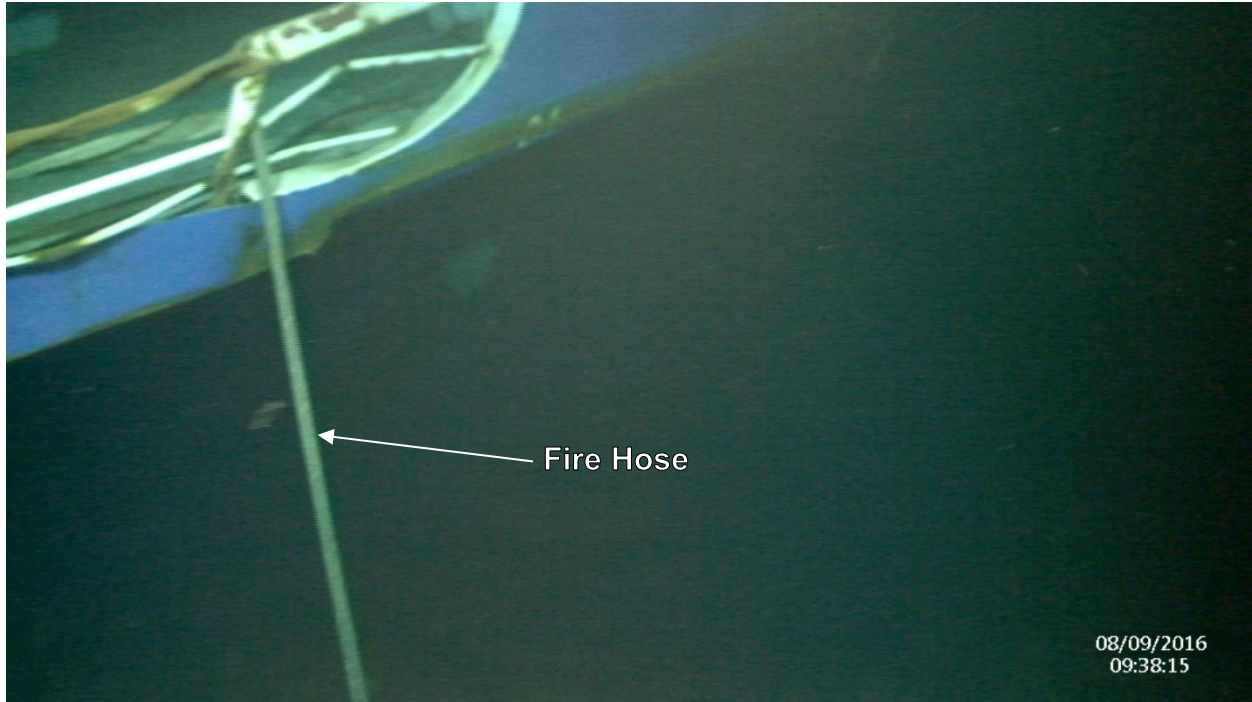


Figure 91. Region: Starboard – Frame 35 Source: Mission III Vehicle: CURV 21

Termination of firehose shown previously in figure 75, likely streaming from fire station no. 15. Deck rail twisted and showing signs of hydrostatic implosion damage.

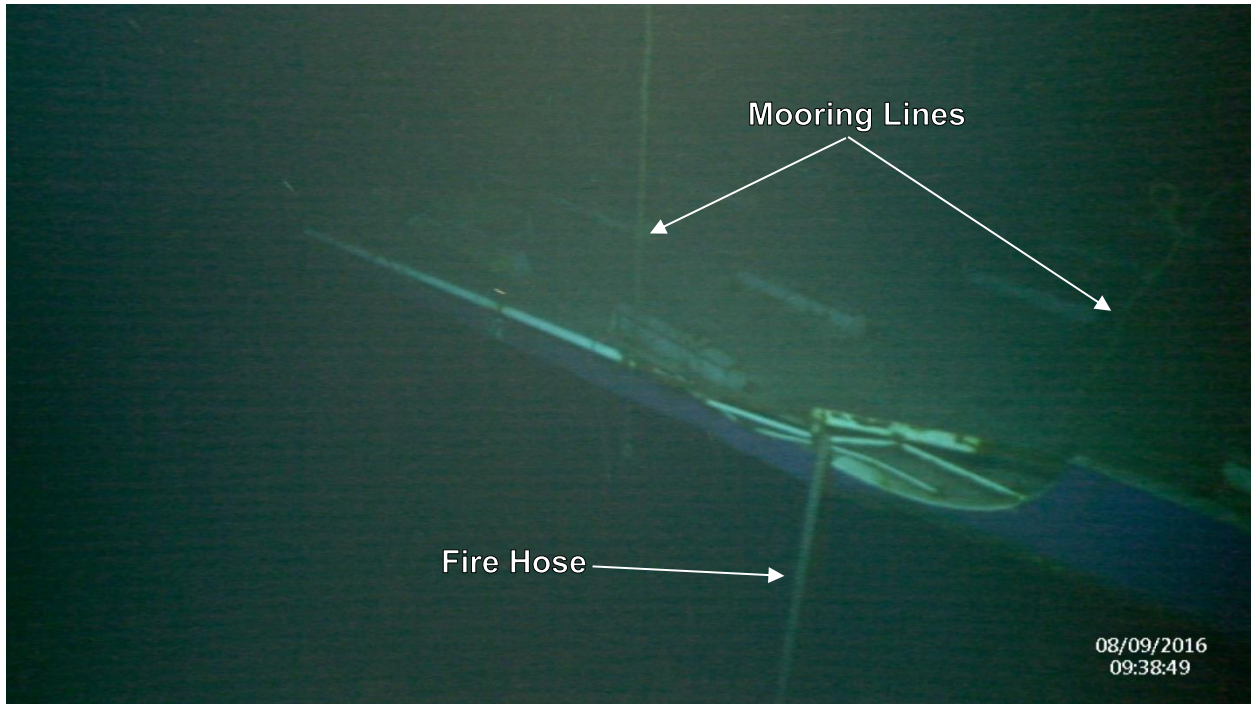


Figure 92. Region: Starboard – Frame 35 Source: Mission III Vehicle: CURV 21

View of two upward streaming mooring lines, one at approximately frame 38 and the other line at approximately frame 32. An alternate view of the termination of the streaming fire hose, likely streaming from fire station no. 15, is hanging downward near frame 35.

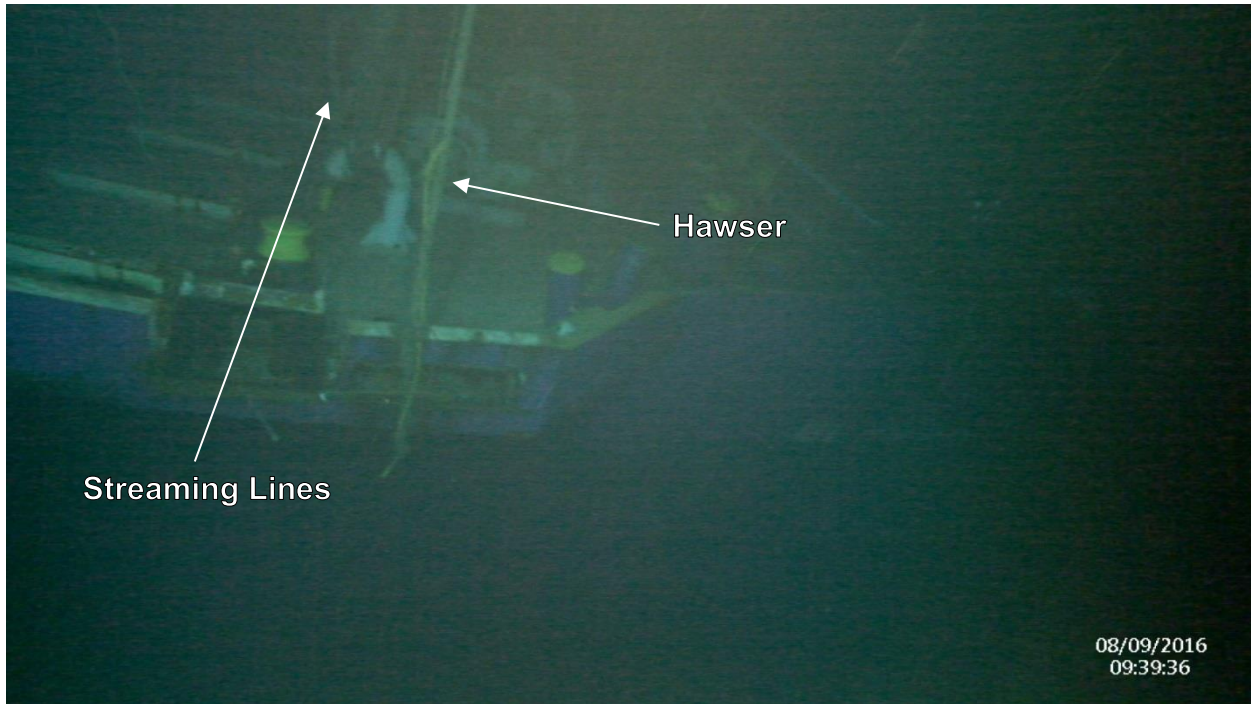


Figure 93. Region: Starboard – Frame 18 Source: Mission III Vehicle: CURV 21

A hawser at frame 18 threaded through a roller chock and streaming upward. Multiple lines are snagged and streaming upward from a vent at approximately frame 20.



Figure 94. Region: Bow Source: Mission II Vehicle: AOV

Alternate view of toppled foremast laying from starboard to port, fore to aft.

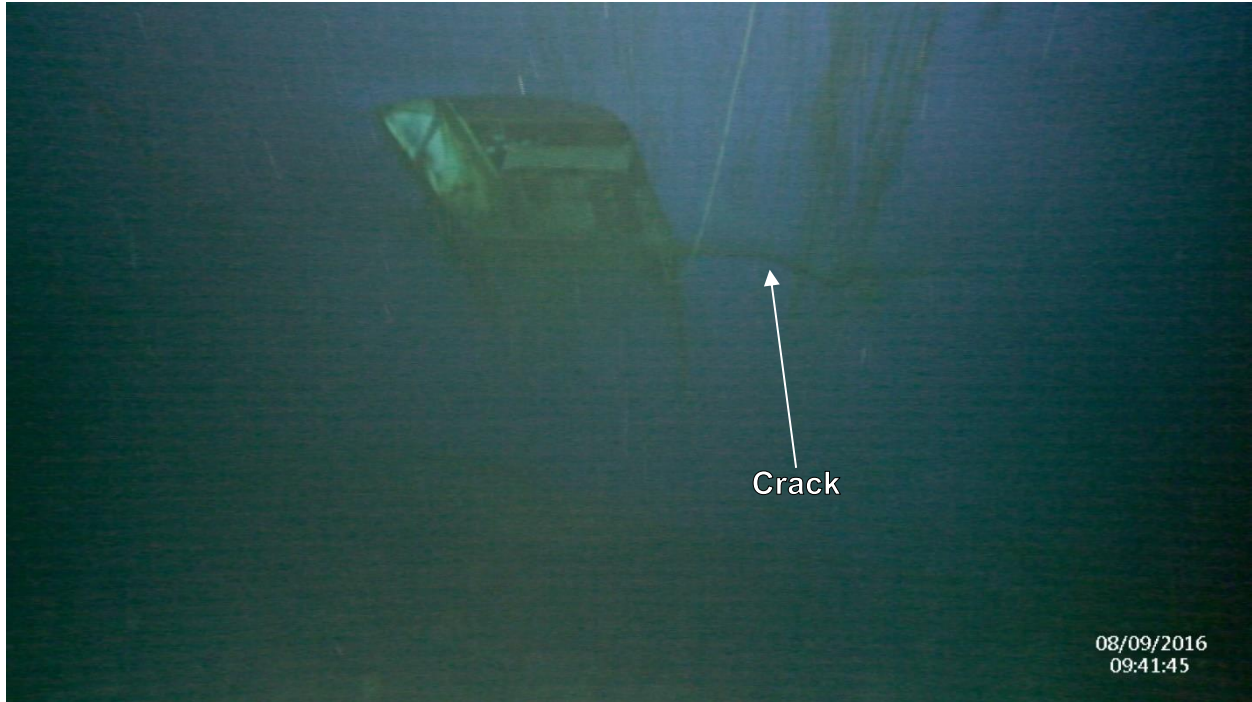


Figure 95. Region: Starboard – Frame 18 Source: Mission III Vehicle: CURV 21

Mooring vent opening at second deck, frame 26. Crack in main hull extending from lower forward corner of vent to approximately frame 20 (second deck). The crack length is estimated to be 12 feet. Rust marks are vertical along the hull.

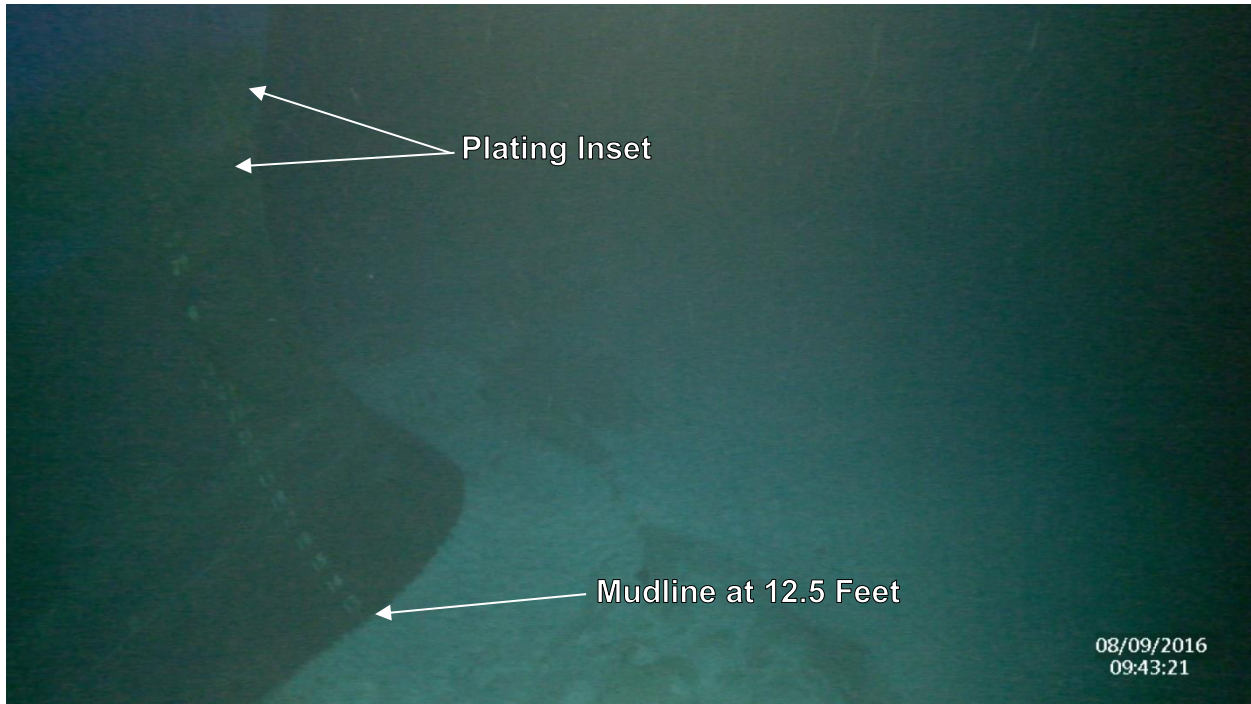


Figure 96. Region: Starboard – Bow Source: Mission III Vehicle: CURV 21

View of starboard bow region at mudline. Mudline is at 12.5-foot draught. Plating inset is in three areas beginning at 24-foot draught line and upwards.

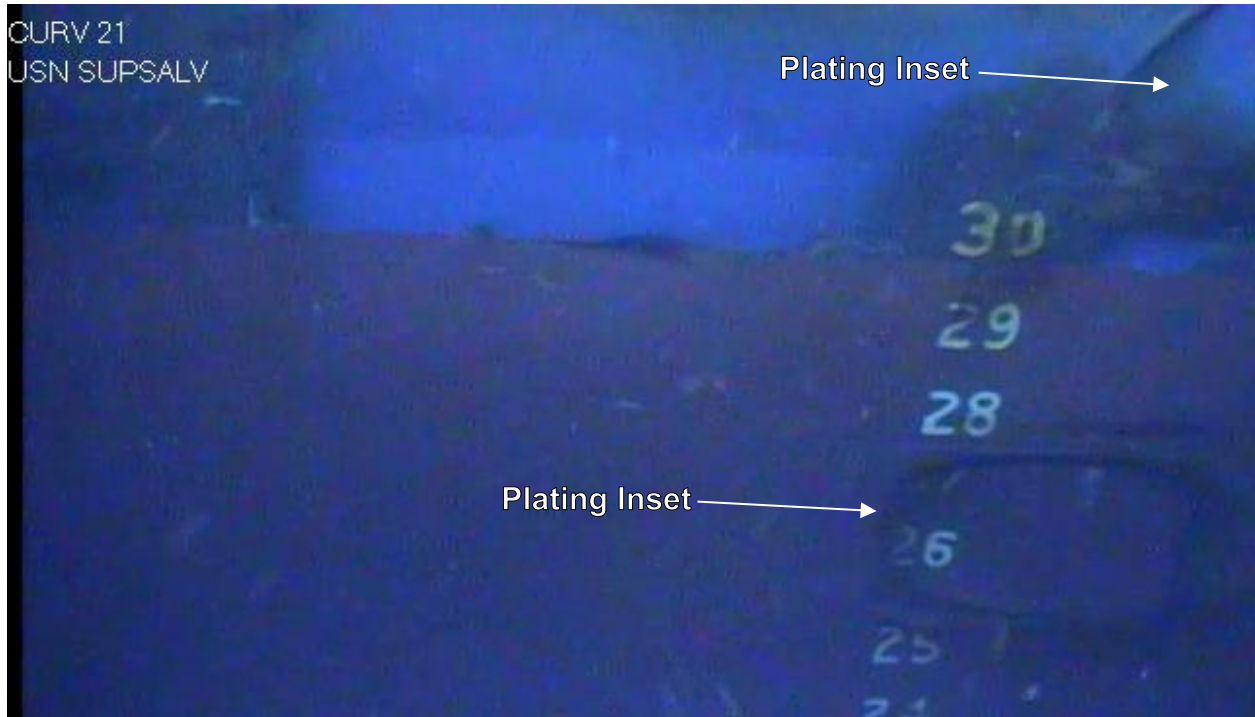


Figure 97. Region: Starboard – Bow Source: Mission I Vehicle: CURV 21

Hydrostatically inset plating from stem bar to frame 2 near 26-foot draught mark.



Figure 98. Region: Starboard – Bow Source: Mission II Vehicle: AOV

Starboard anchor is shown in place.

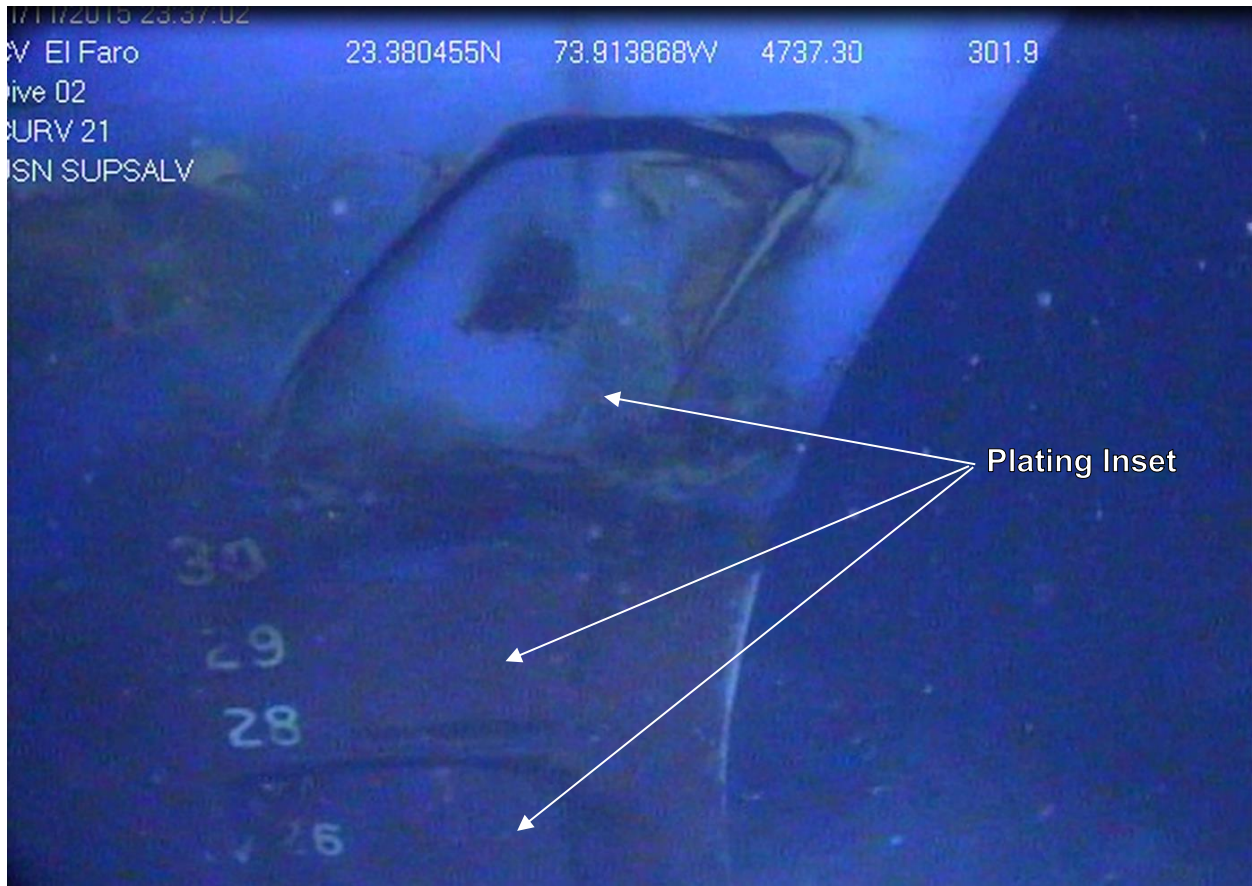


Figure 99. Region: Starboard – Bow Source: Mission I Vehicle: CURV 21

Alternate view of hydrostatically inset plating in region determined from structural drawings to be a stem casting void space. The damage in the upper portion spans from the forward stem to frame 2.



Figure 100. Region: Main Deck (forward) – Bay 14 Source: Mission II Vehicle: AOV

An image of the top deck over the area of bay 14.

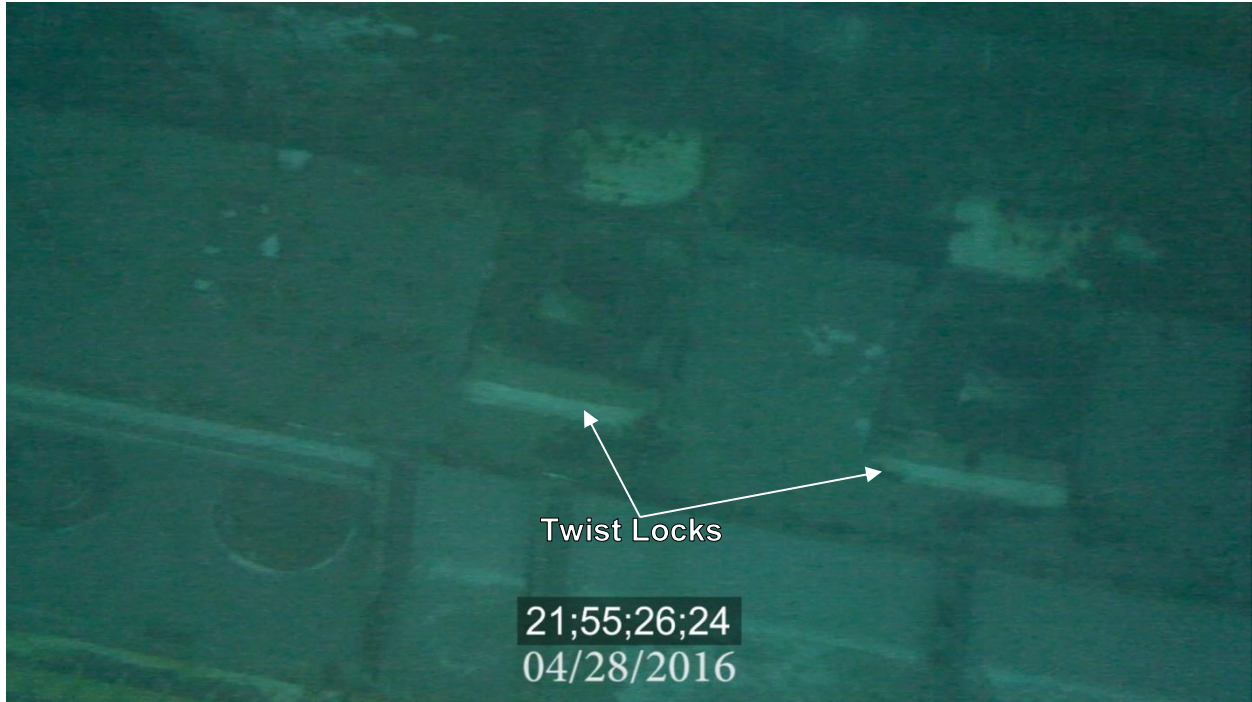


Figure 101. Region: Main Deck (forward) – Bay 14 Source: Mission II Vehicle: AOV

Failure region of deck sockets in vicinity of bay 14. Twist part of the lock is in place inside the bay socket. The bay socket appears to be intact. From the reviewed video, there does not appear to be bay socket failure or pad eye/D-ring failure.



Figure 102. Region: Main Deck (forward) – Bay 14 and 15 Source: Mission II Vehicle: AOV

Transfer beams in place and undamaged in the vicinity of bays 14 and 15.



Figure 103. Region: Main Deck – Bay 13 Source: Mission II Vehicle: AOV

Frame 134/10 looking toward the port side. The outboard section of transfer beam on the port side is missing. From the review of the recordings, bays 12, 13, 14 and 15 do not have containers remaining on deck.



Figure 104. Region: Main Deck (forward) – Bay 13 Source: Mission II Vehicle: AOV

Absence of starboard side main deck rail aft of frame 134/28. Fire station no. 39 is missing.

Superstructure (Deck House)

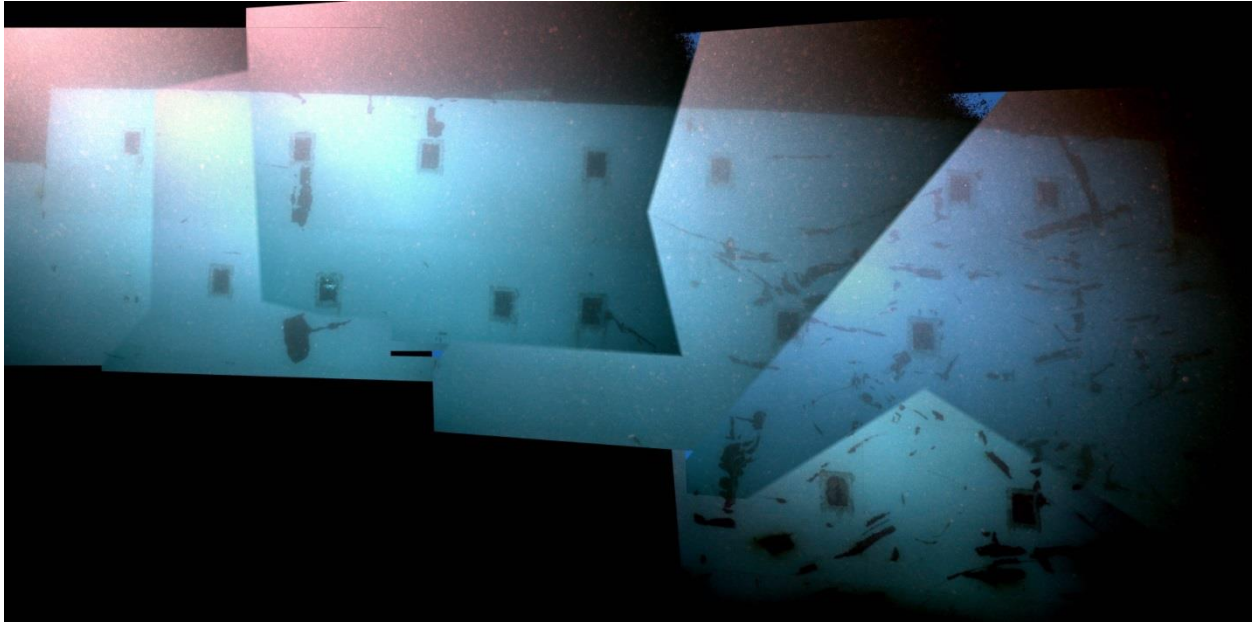


Figure 105. Region: Deck House – Fwd Source: Mission II Vehicle: AOV Mosaic Image

A mosaic image showing a portion of the front of the deckhouse. The boat deck level is shown at full width (uppermost row of windows), the next deck up is the lower navigation bridge deck, which is the uppermost existing deck. More scratching is on the port side of the forward face of the deck house. The structure associated with the top two decks of the deck house is absent from the photographed structure. The two missing decks are the lower navigation bridge deck and the navigation bridge deck. The structure for these decks appear to have completely separated from the house.



Figure 106. Region: Deck House – Fwd Source: Mission II Vehicle: AOV Mosaic Image

The forward upper port portion of the deck house is shown. The uppermost windows are on the boat deck. Scratching on the lower portion of the image is predominately side to side. Higher up on the deck house, the scratches are generally oriented to the port side.

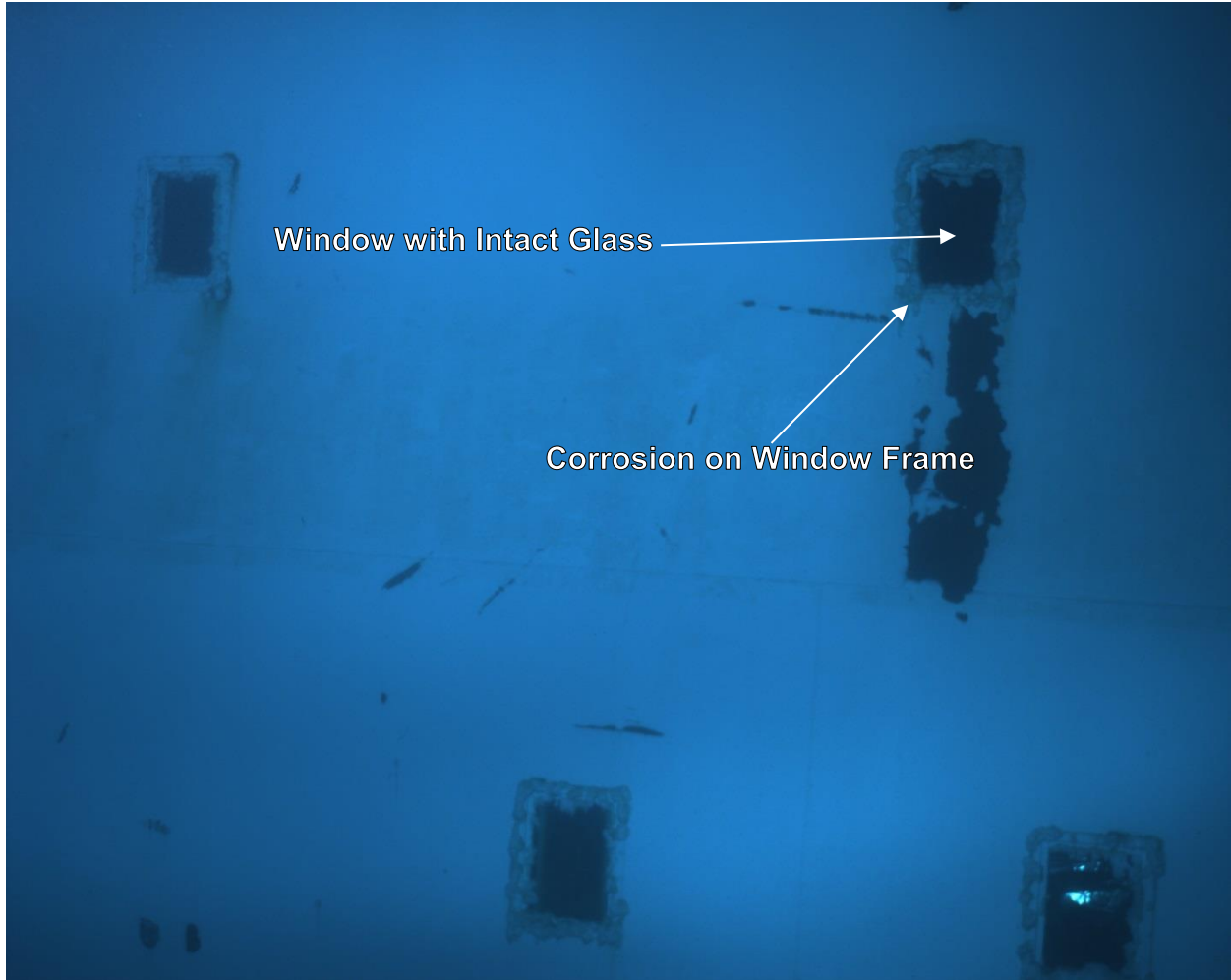


Figure 107. Region: Deck House – Fwd Source: Mission II Vehicle: AOV

A close up image of windows on the forward portion of the deck house. All window glass throughout the deck house appears to be intact. Corrosion is exhibited around the windows on the aluminum window frames.

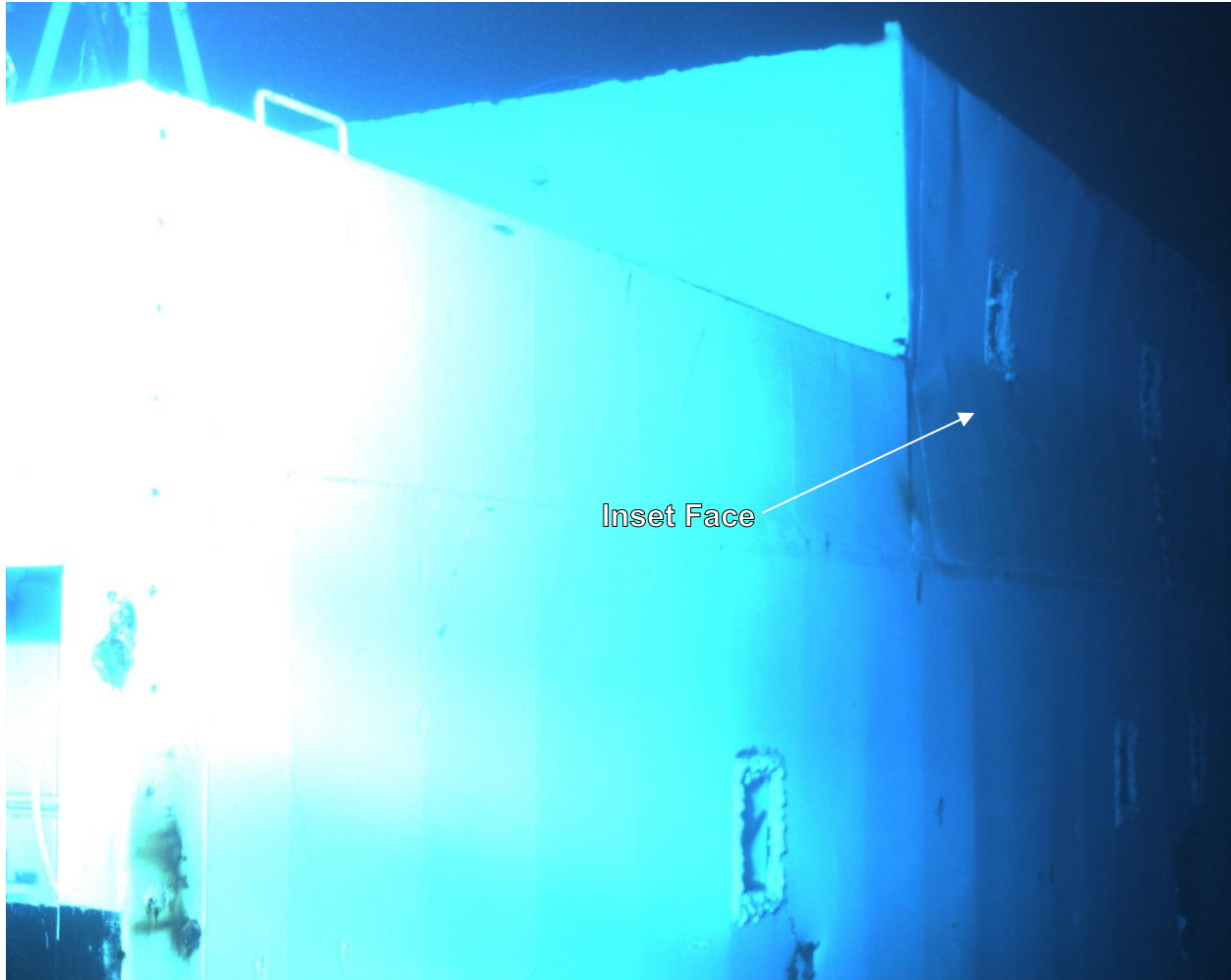


Figure 108. Region: Deck House – Fwd Source: Mission II Vehicle: AOV

The image shows the deck house front inset on the starboard side between the boat deck and the lower navigation bridge.



Figure 109. Region: Deck House – Fwd Source: Mission II Vehicle: AOV

The starboard side of the forward face of the deck house above the starboard breezeway. The upper windows shown belong to the upper deck, the lower windows belong to the CO2 (fire suppression) flat deck.

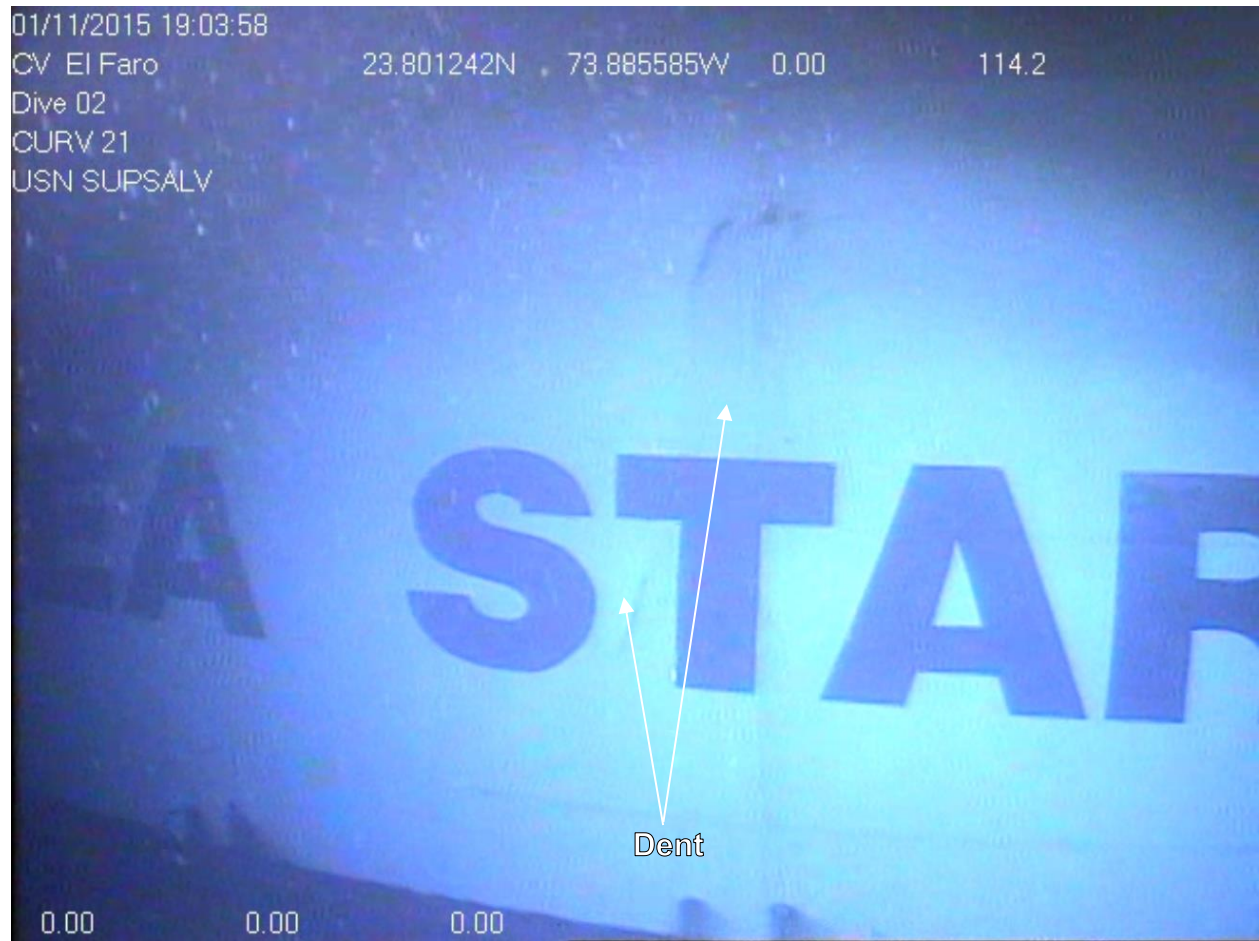


Figure 110. Region: Deck House – PORT Source: Mission I Vehicle: CURV 21

A dent between the “S” and “T” as well as above the “T” in “STAR.”

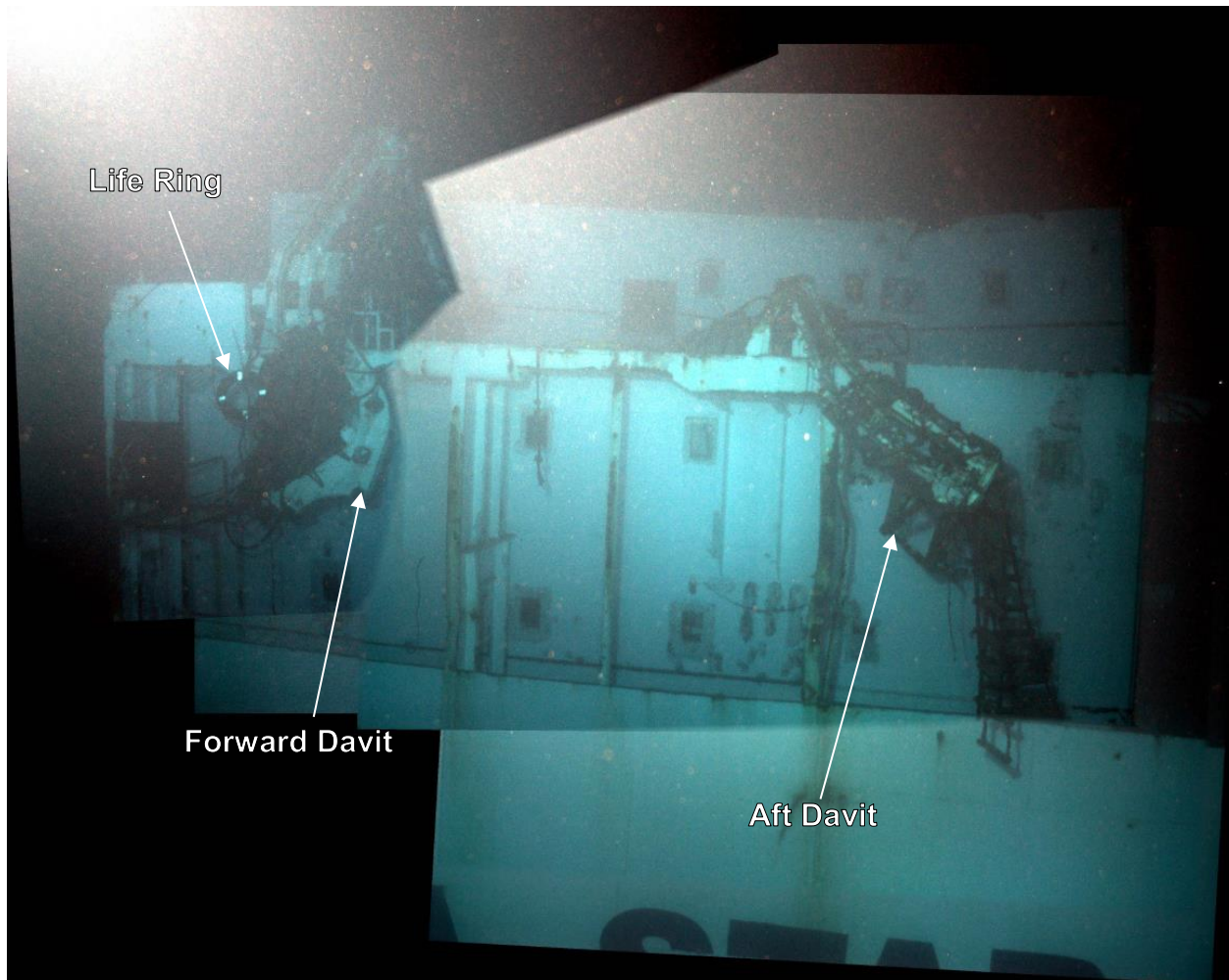


Figure 111. Region: Deck House – PORT Source: Mission II Vehicle: AOV, MOSAIC Compilation

The port side of the deck house showing the life boat launch area. The left side of the image is forward. To the left of the image, an intact life ring is present. The forward davit track is in place but the forward davit is down and turned aft. The aft davit track is broken loose and pulled aft and over the port side.



Figure 112. Region: Deck House – PORT Source: Mission II Vehicle: AOV

Alternate view of the port side forward davit track. The image is taken from above the deck house looking toward the port boat deck.

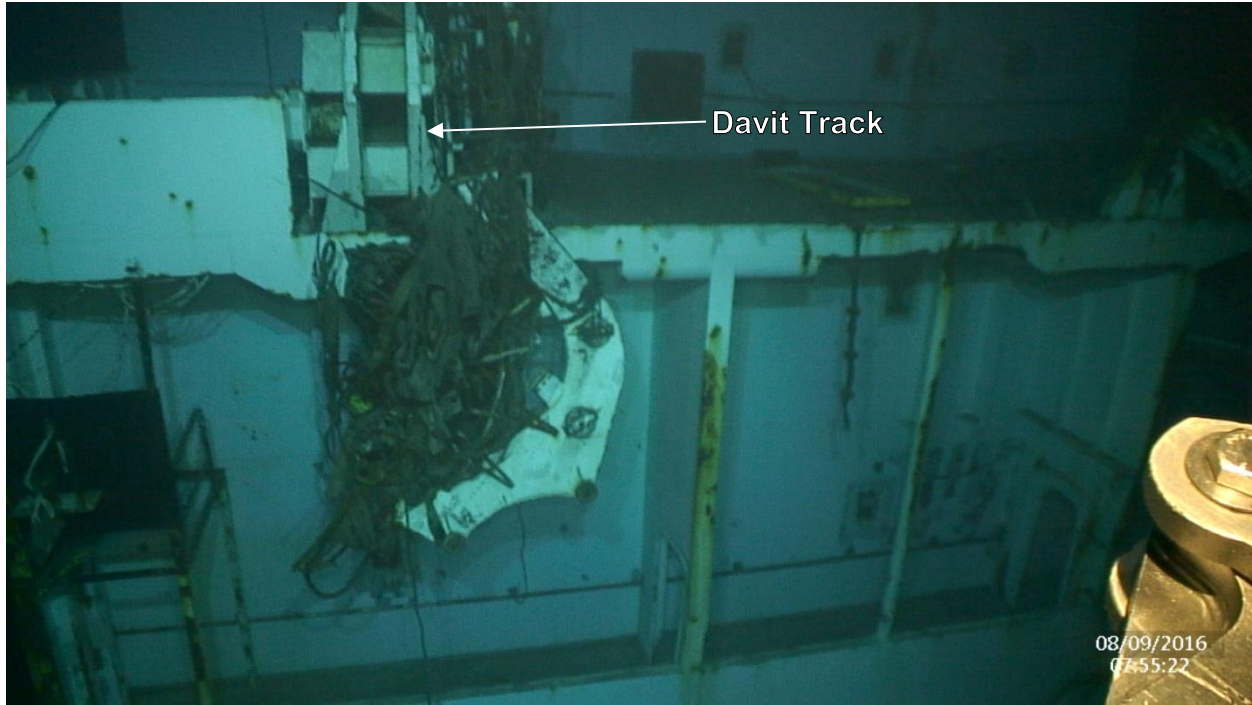


Figure 113. Region: Deck House – PORT Source: Mission III Vehicle: CURV 21

Alternate view of the port side forward lifeboat davit track.



Figure 114. Region: Deck House – PORT Source: Mission III Vehicle: CURV 21

Alternate view of the port side forward davit track. There is evidence of a dent between the second and third window on the port side boat deck exterior bulkhead.

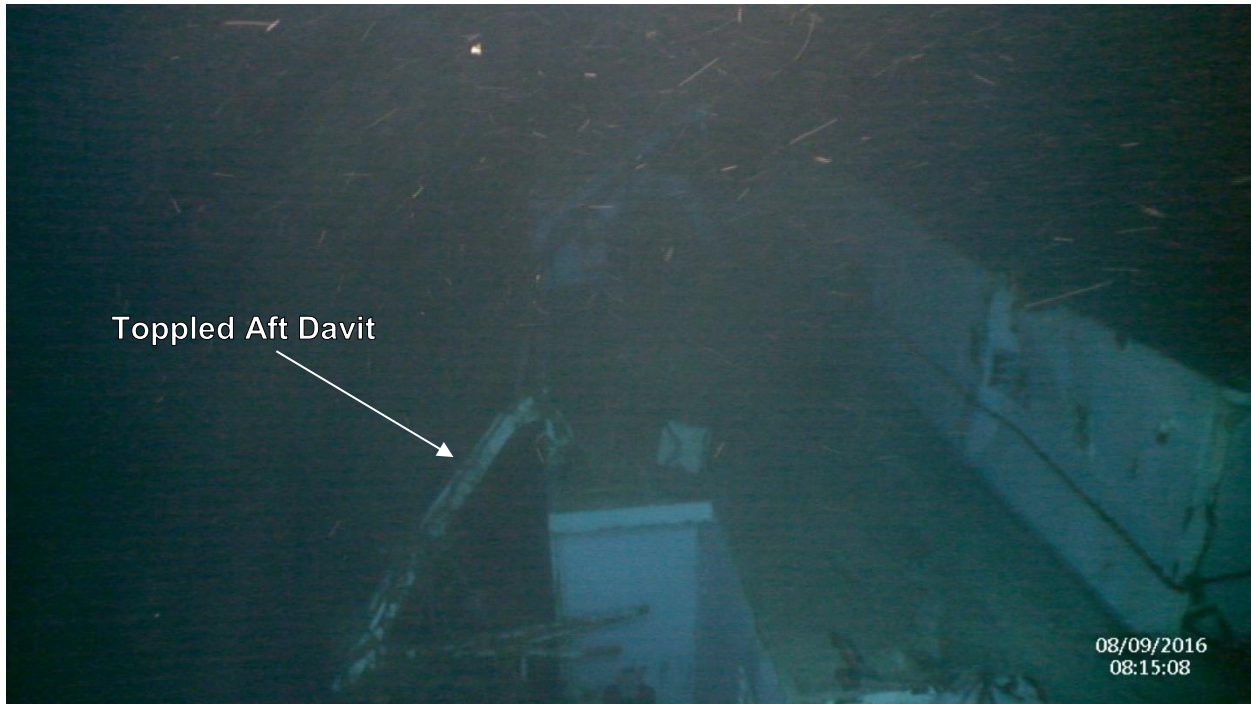


Figure 115. Region: Deck House – PORT Source: Mission III Vehicle: CURV 21

Looking forward, an alternate view of the port side aft davit track toppled over (center foreground) and dent on bulkhead of port side boat deck.

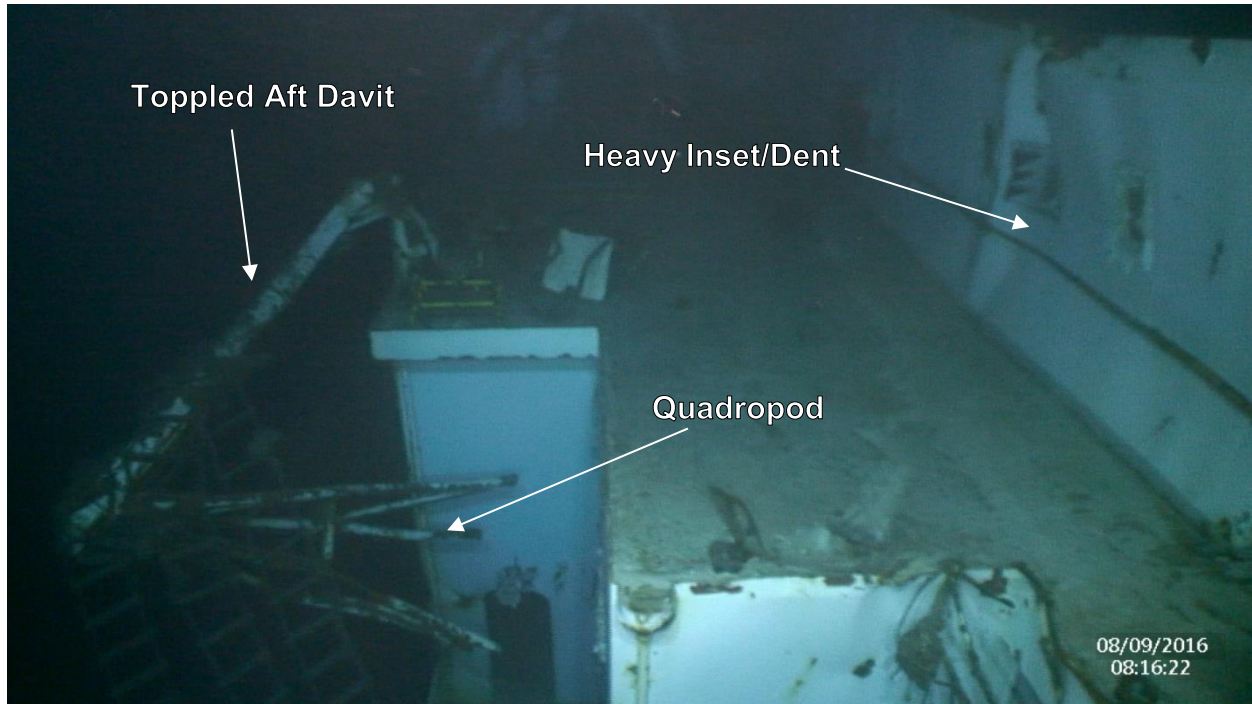


Figure 116. Region: Deck House – PORT Source: Mission III Vehicle: CURV 21

Looking forward, the port aft davit trackway is toppled and bent aft. The trackway quadropod is torn outboard, rotated 90 degrees and hanging over the port side. The deck house bulkhead on the port side boat deck is heavily set in and indented between frames 170 and 175.



Figure 117. Region: Deck House – AFT Source: Mission III Vehicle: CURV 21

A view of the aft side of the deck house looking forward. The uppermost door is to the interior of the boat deck. The bent ladder on the left is from the boat deck to the cabin deck. The two exterior doors are missing, as is the majority of the handrails on the exterior ladder landings.



Figure 118. Region: Deck House – AFT Source: Mission III Vehicle: CURV 21

View through aft port side door on boat deck. Above the door, the lower navigation bridge deck supporting structural transverse channel is twisted upward with its C-channel face exhibiting deep scratches and denting. The deck of the lower navigation bridge deck is dished downward into the space of the boat deck.



Figure 119. Region: Deck House – AFT Source: Mission III Vehicle: CURV 21

View through aft port side door on boat deck. Interior bulkheads that would normally be visible through this passageway appear to be missing.



Figure 120. Region: Deck House – AFT Source: Mission III Vehicle: CURV 21

The elevator shaft terminating at the lower navigation bridge deck is on the right. Metal debris surrounding the elevator shaft is bent upward and aft. The image is looking forward and starboard.



Figure 121. Region: Deck House – AFT Source: Mission III Vehicle: CURV 21

The lower navigation bridge deck port side of the elevator casing is torn off of the structure and bent aft. Image is looking port to starboard.



Figure 122. Region: Deck House – AFT Source: Mission III Vehicle: CURV 21

Alternate view of top of elevator casing. The elevator bulkhead which is hanging off the deck house structure has a dark box attached labeled "FIRE DAMPER." Good imagery was not captured of the lower aft port side of the deck house.



Figure 123. Region: Deck House – AFT Source: Mission III Vehicle: CURV 21

Lower view of figure 122.

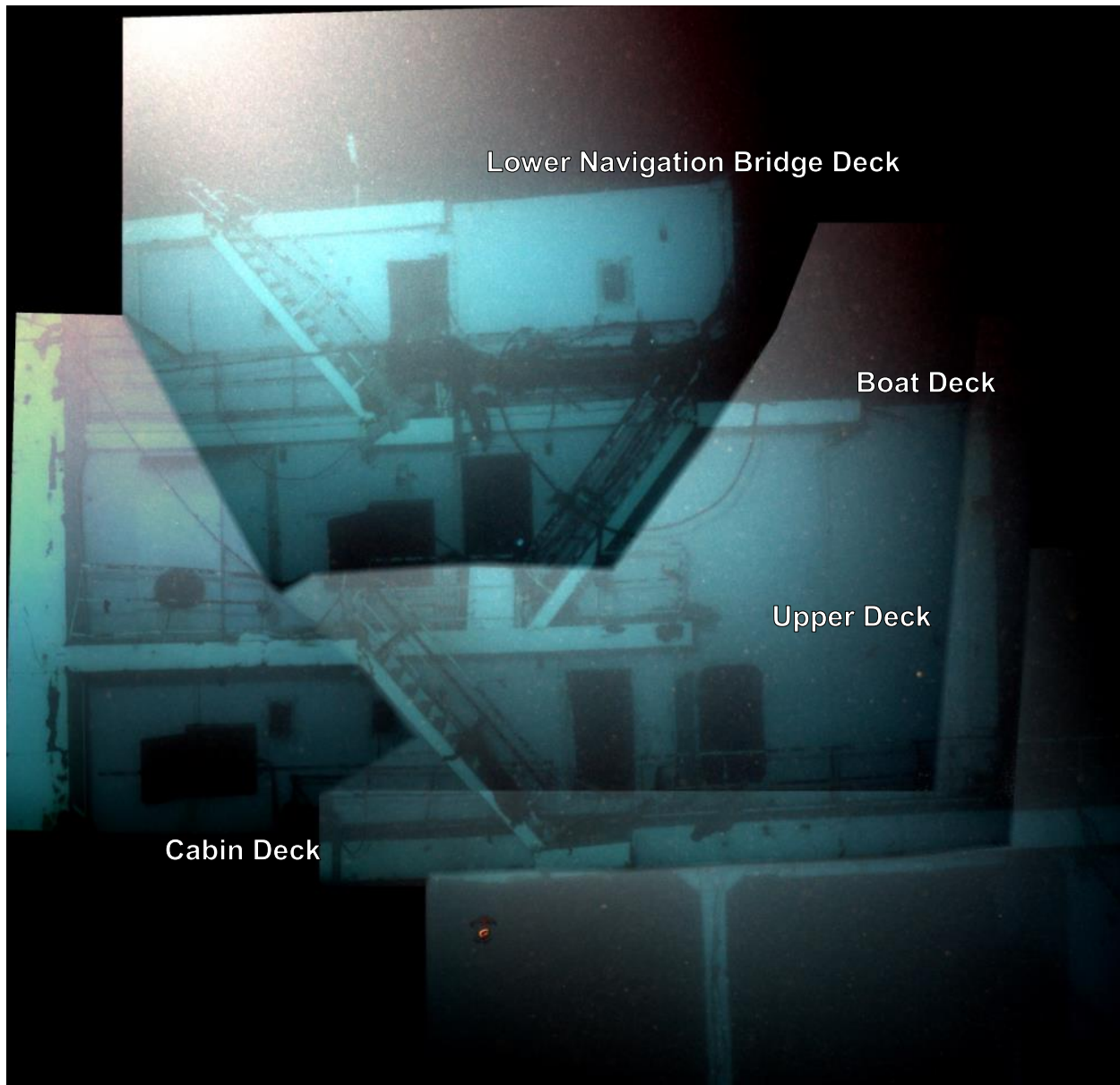


Figure 124. Region: Deck House – AFT Source: Mission II Vehicle: AOV Mosaic Image

A mosaic image of the aft starboard side of the deck house. The aft deck house ladders are intact. The uppermost ladder is from the lower navigation bridge deck to the boat deck, the 2nd ladder from top is from boat deck to cabin deck, the third is from cabin deck to upper deck and the main deck is at the bottom of the image. All exterior passageway doors are missing with the exception of a water tight door that forms a passageway to the reefer storage space on the upper deck/mess deck.

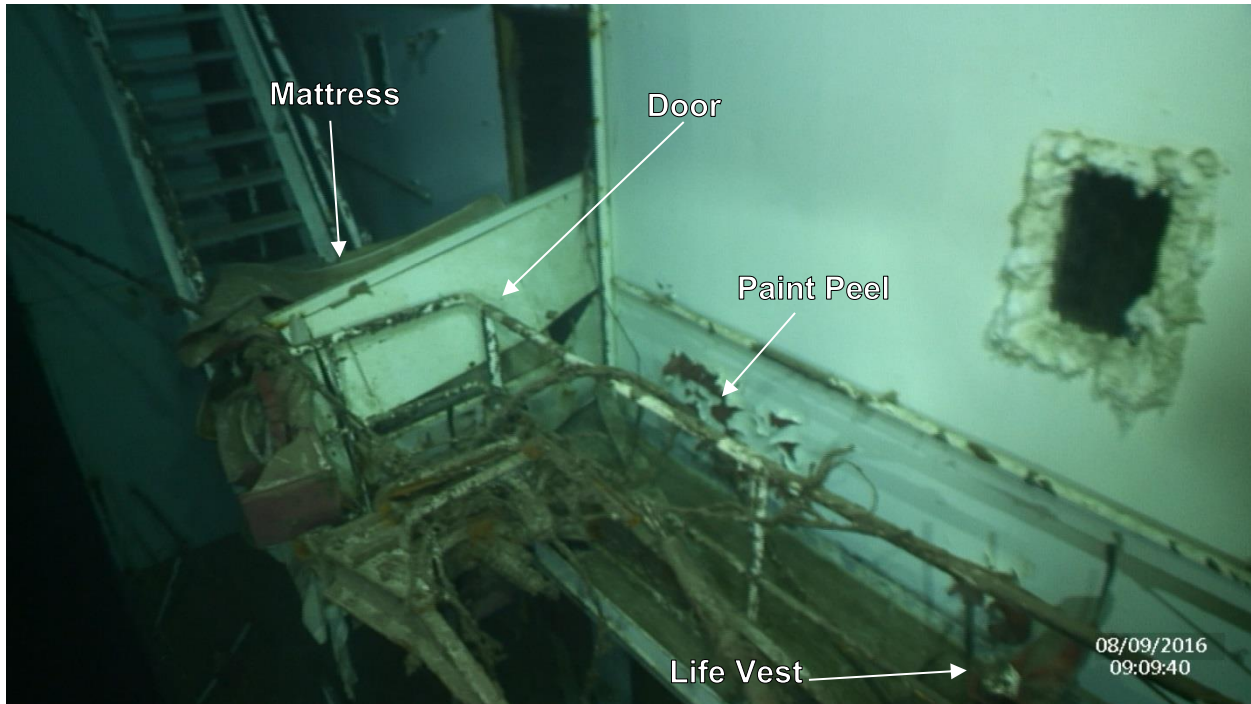


Figure 125. Region: Deck House – AFT Source: Mission III Vehicle: CURV 21

Starboard side of the aft deck house at the boat deck. This image shows a mattress and bi-fold joiner door displaced. There is an area of paint peel near the doorway. A tangled life vest with reflective tape is seen near the bottom right of the image.



Figure 126. Region: Deck House – AFT Source: Mission III Vehicle: CURV 21

View into aft doorway from boat deck looking inside into the ship's treatment room. The bulkhead from the passageway to the treatment room is missing. Some debris appears toppled within the room.



Figure 127. Region: Deck House – AFT Source: Mission III Vehicle: CURV 21

View of deck house aft starboard side boat deck (above) and cabin deck (below). A life jacket, or Personal Flotation Device (PFD) with reflective material is entangled on the boat deck walkway against the house forward of the top of the ladder down to the cabin deck. A laundry machine from the crew laundry room appears to be resting on the aft railing on the cabin deck. The brown athwartships structure appears to be an I-beam with associated piping from the boiler exhaust casing.



Figure 128. Region: Deck House – AFT Source: Mission III Vehicle: CURV 21

Closer view of PFD with reflective material entangled on the boat deck exterior landing (walkway).



Figure 129. Region: Deck House – AFT Source: Mission III Vehicle: CURV 21

Close-up view from inset view of PFD with reflective material entangled on the boat deck walkway.

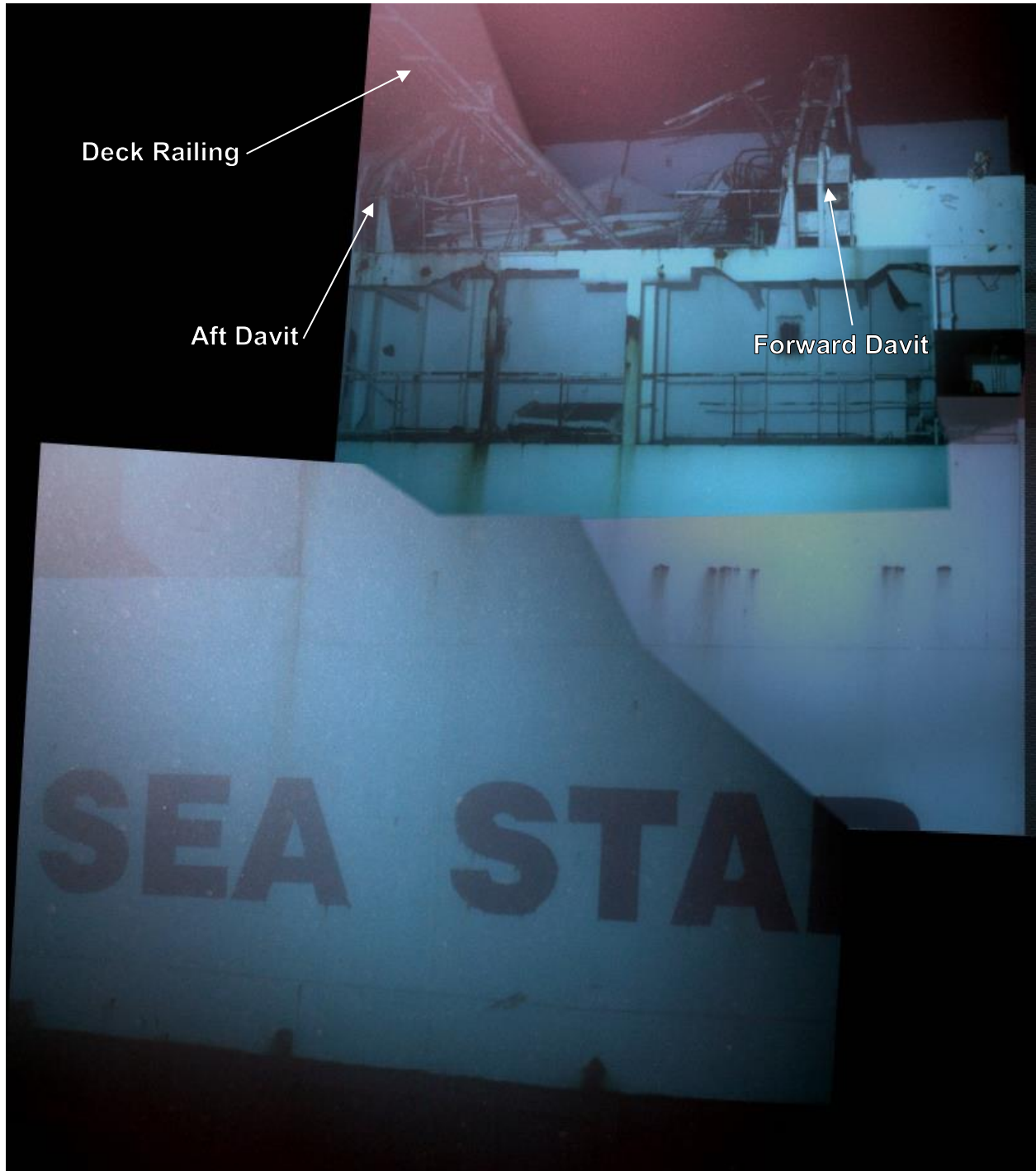


Figure 130. Region: Deck House – STBD Source: Mission II Vehicle: AOV Mosaic

A mosaic image of the starboard side of the deck house from the main deck to the lower navigation bridge deck. Both lifeboat davit tracks appear to be in place and intact. What appears to be main deck rail is resting on the boat deck, partially over the aft davit trackway assembly. The stern is to the left side of the image, and the bow to the right.

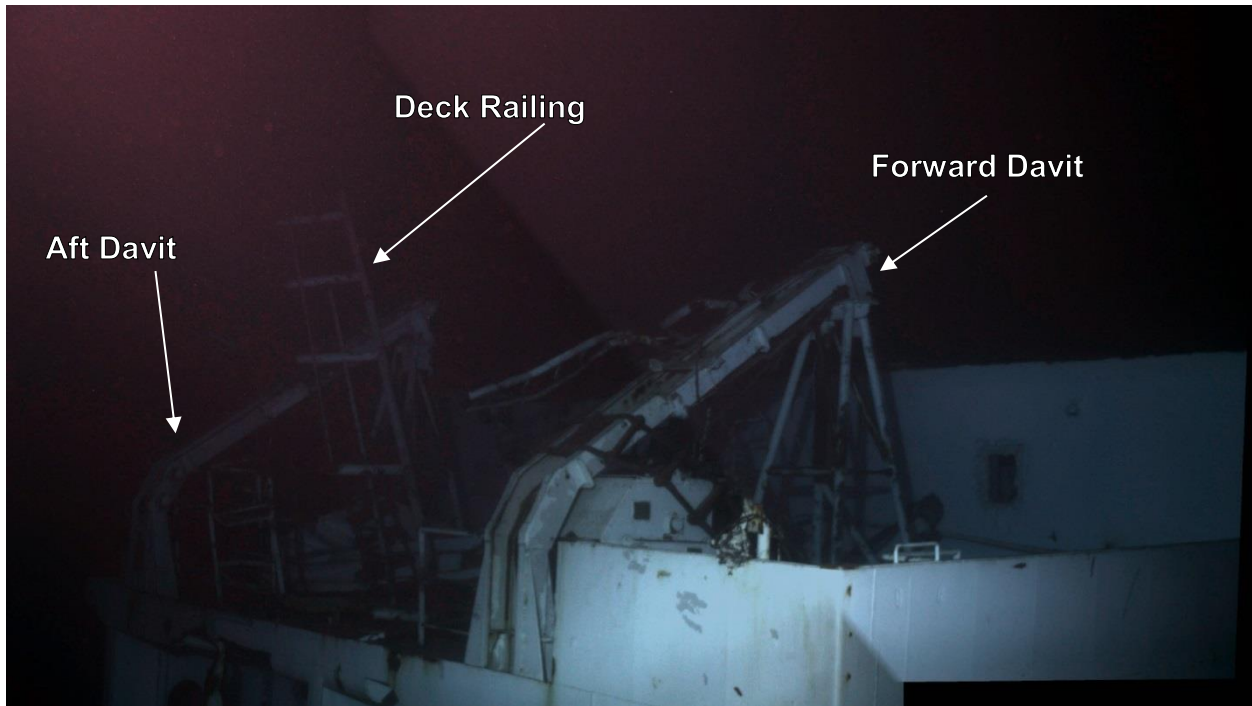


Figure 131. Region: Deck House – STBD Source: Mission II Vehicle: AOV Mosaic

Alternate view of starboard side boat deck taken from the forward starboard corner of the deck house looking aft. Forward davit is in foreground.



Figure 132. Region: Deck House – STBD Source: Mission I Vehicle: CURV 21

Close up view of the starboard forward davit and davit trackway assembly. The davit arm is displaced and resting on the deck. The davit arm cable is still attached to the forward davit trackway and davit arm. In the lower left side of the image, the underside of the navigation bridge deck's starboard bridge wing deck plate and structure is visible, resting upside down on the starboard boat deck.

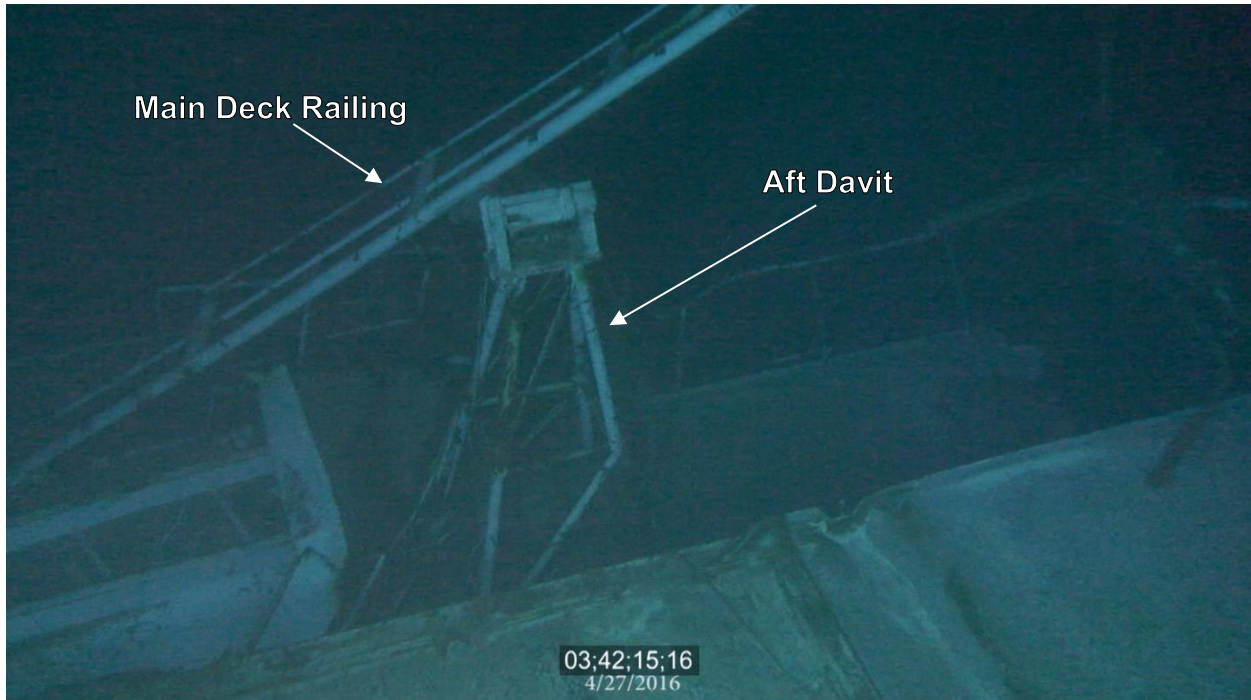


Figure 133. Region: Deck House – STBD Source: Mission I Vehicle: CURV 21.

An alternate view of the aft starboard davit assembly. The photograph is taken from over the top of the deck house (lower navigation deck) looking to starboard and slightly aft. A section of main deck hand rail is resting on top of the starboard aft boat deck assembly.

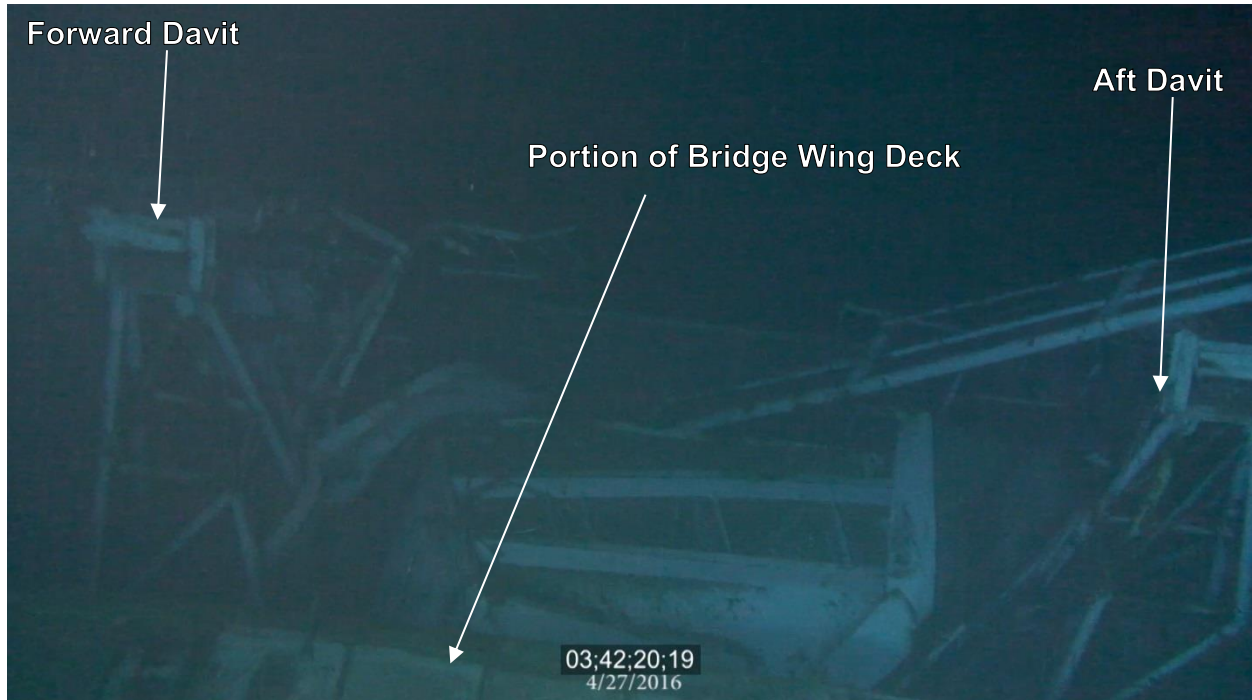


Figure 134. Region: Deck House – STBD Source: Mission I Vehicle: CURV 21.

An alternate view of the forward starboard davit assembly (on left) and aft davit assembly (right). The photograph is taken from over the top of the deck house (lower navigation deck) looking to starboard and slightly forward. A portion of the bridge wing deck is resting upside down between the two davit assemblies.

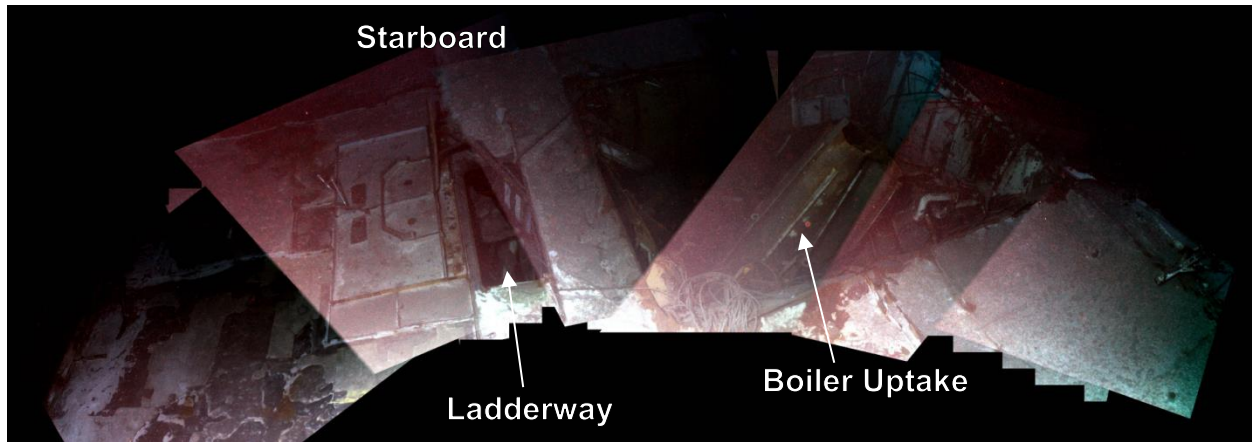


Figure 135. Region: Deck House – Top Source: Mission II Vehicle: AOV MOSAIC Image

A photographic mosaic image of the remaining surface of the lower navigation bridge deck. The orientation of the mosaic is looking toward starboard. The forward portion of the deck is located to the left of image. The boiler casing is visible to the right of the mosaic and the ladderway to the boat deck just left of center. The ladder within the ladderway appears to be missing. Toilet/shower unit flat bar perimeter outlines and some associated plumbing is just left of the ladderway. Flat bar associated with previously attached joiner bulkheads is visible throughout the deck. In general, the decks are heavily deformed.

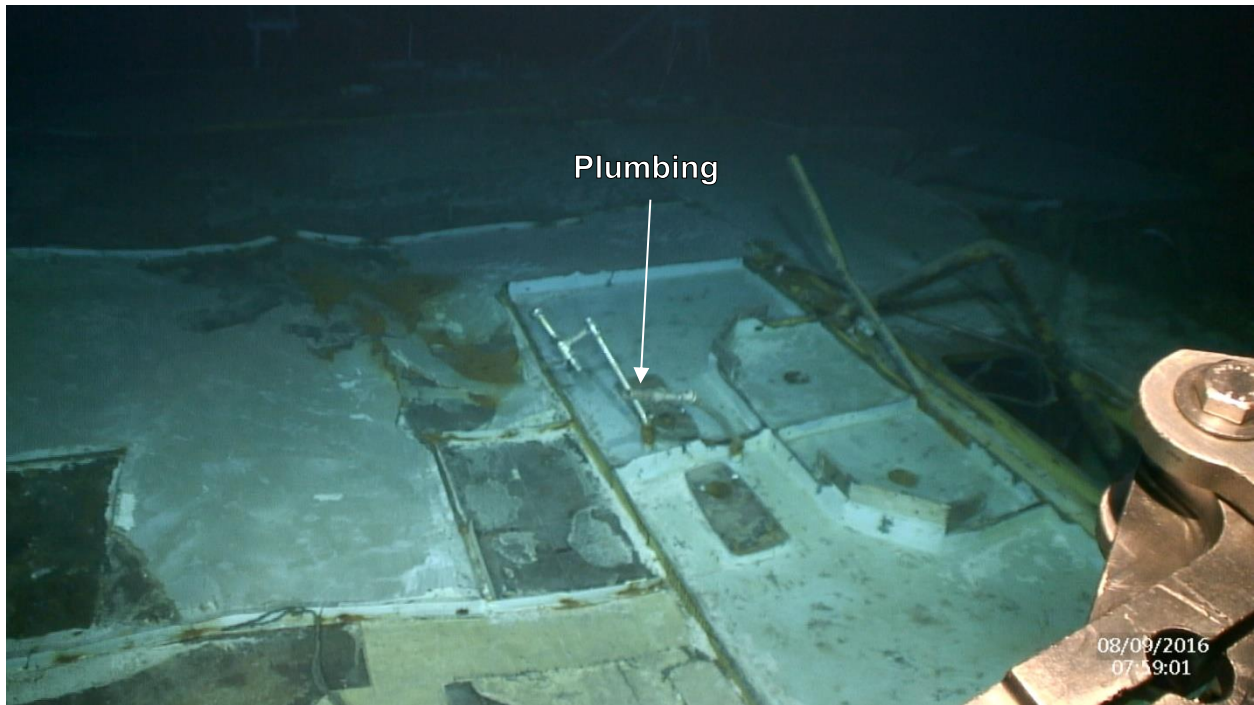


Figure 136. Region: Deck House – Top Source: Mission III Vehicle: CURV 21

A close up image of the lower navigation bridge deck. Some plumbing associated with toilet/shower units in staterooms is visible at frame 168 on centerline. Deformation of the deck is visible throughout.

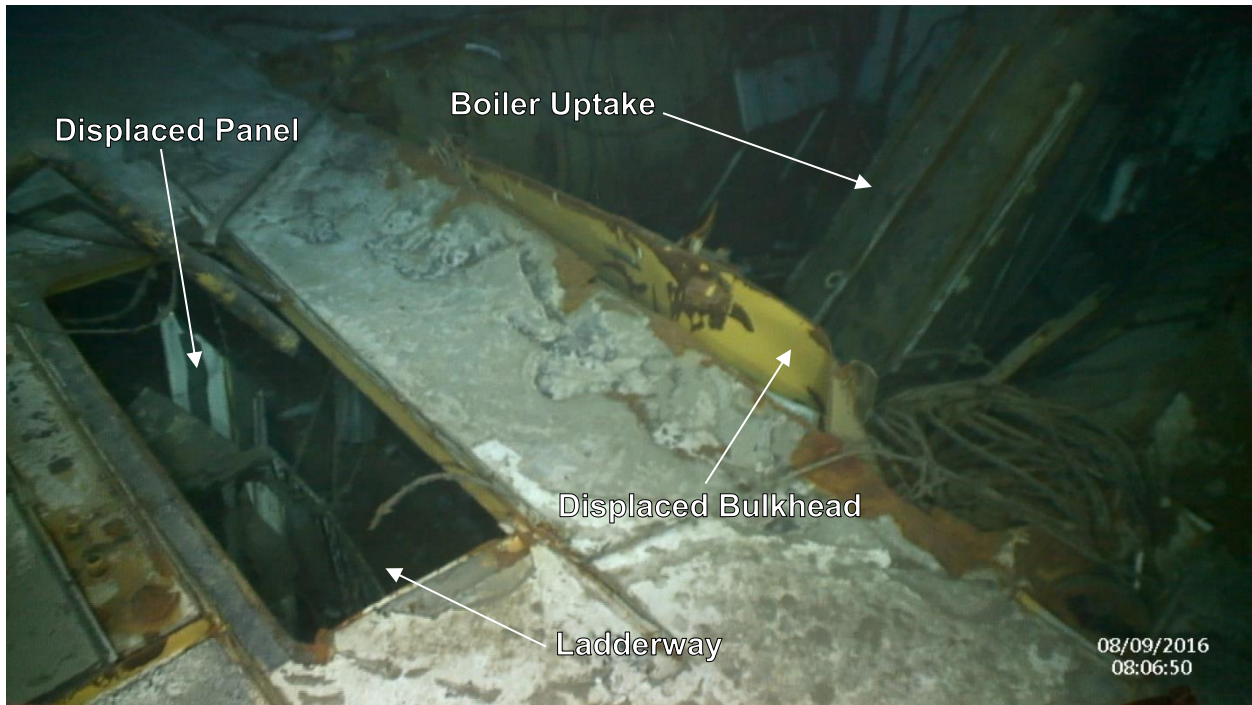


Figure 137. Region: Deck House – Top Source: Mission III Vehicle: CURV 21

Close up image of ladderway, going down from lower navigation bridgedeck, at frame 169 (rectangle cut-out at left). Ladder is missing from the ladderway passage. Interior panel with green and white stripes visible through the passageway is displaced from its original position.

On the right side of the image is the view looking into the boiler casing, a yellow bulkhead is displaced aft from its original position. The portion shown of the boiler uptake (dark tube with vertical stiffeners) is bent aft. Debris is scattered throughout the boiler casing.

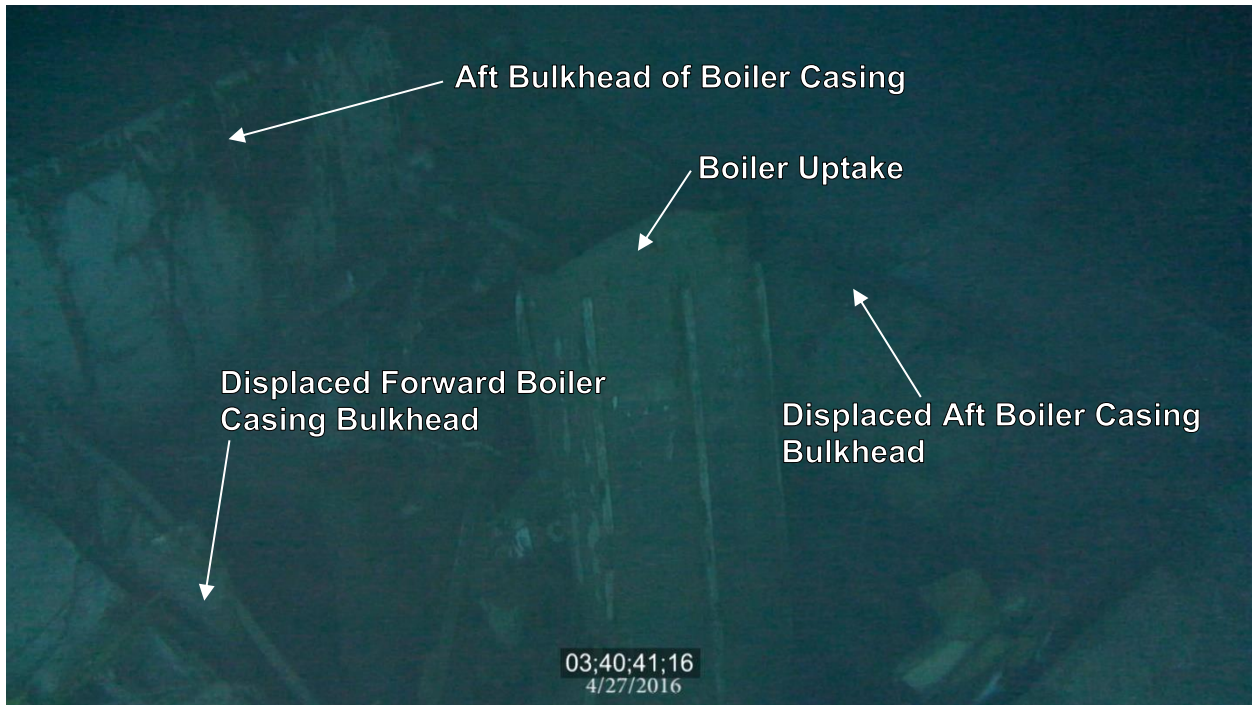


Figure 138. Region: Deck House – Top Source: Mission II Vehicle: AOV

An alternate view of the boiler uptake displaced aft. The view is looking from starboard to port and aft, just above the lower navigation bridge deck. The white bulkhead in the upper left corner of the image is the aft bulkhead of the boiler casing. The bulkheads surrounding the boiler casing are bulged inward on the starboard, aft and port sides. The boiler uptake is broken off at the lower navigation bridge deck. Aft of the boiler uptake, the top of the direct contact (DC) heater is visible.

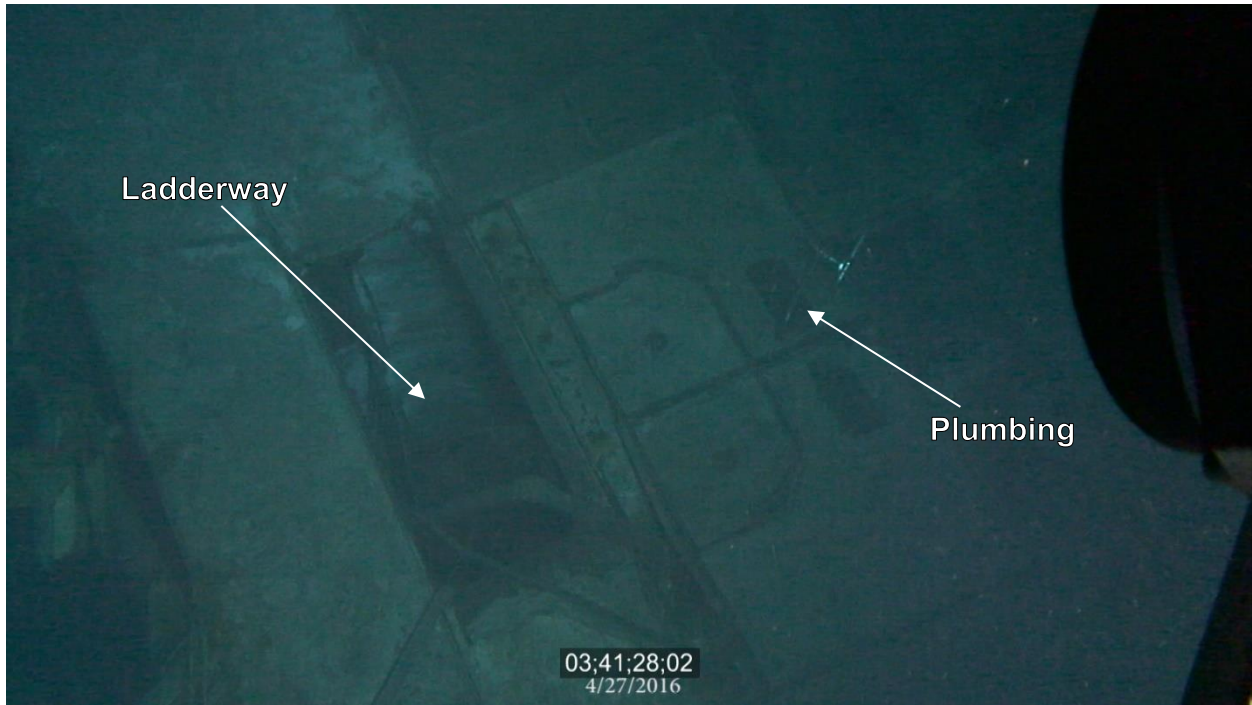


Figure 139. Region: Deck House – Top Source: Mission II Vehicle: AOV

The ladder associated with the ladderway to the lower navigation bridge deck is visible resting on the boat deck.

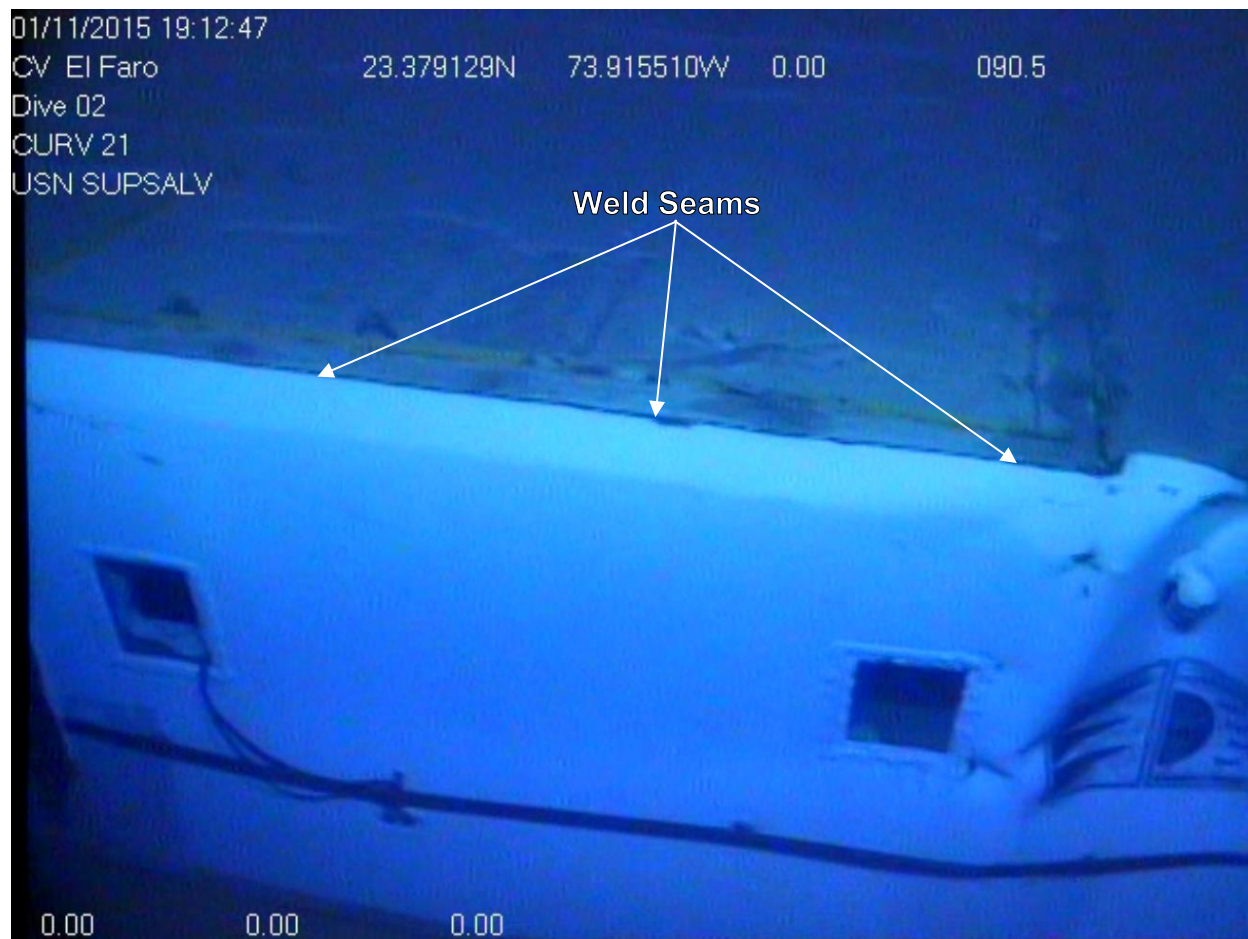


Figure 140. Region: Deck House – Top Source: Mission I Vehicle: CURV 21

The aft port side of the lower navigation bridge deck looking toward starboard. The weld seams to the exterior bulkheads of the lower navigation bridge deck appear to have failed evenly and cleanly along the examined perimeter of the vertical exterior bulkheads.

BRIDGE (HOUSE TOP)



Figure 141. Region: Bridge Source: Mission II Vehicle: AOV Mosaic Image

The forward side of the wheelhouse and navigation bridge deck looking aft. All the windows are missing. The starboard forward corner (lower left side of image) is deeper into the seabed than other corners, and the seabed is mounded forward of the corner. The windscreen bulwark is bent inward at the deck level and has mud pushed forward of it. The main mast is missing and its three mast legs have been severed from the wheelhouse top. The railings around the perimeter of the wheelhouse top are missing or severely bent and broken. There is a navy-blue bag on the wheelhouse top at just forward of centerline.

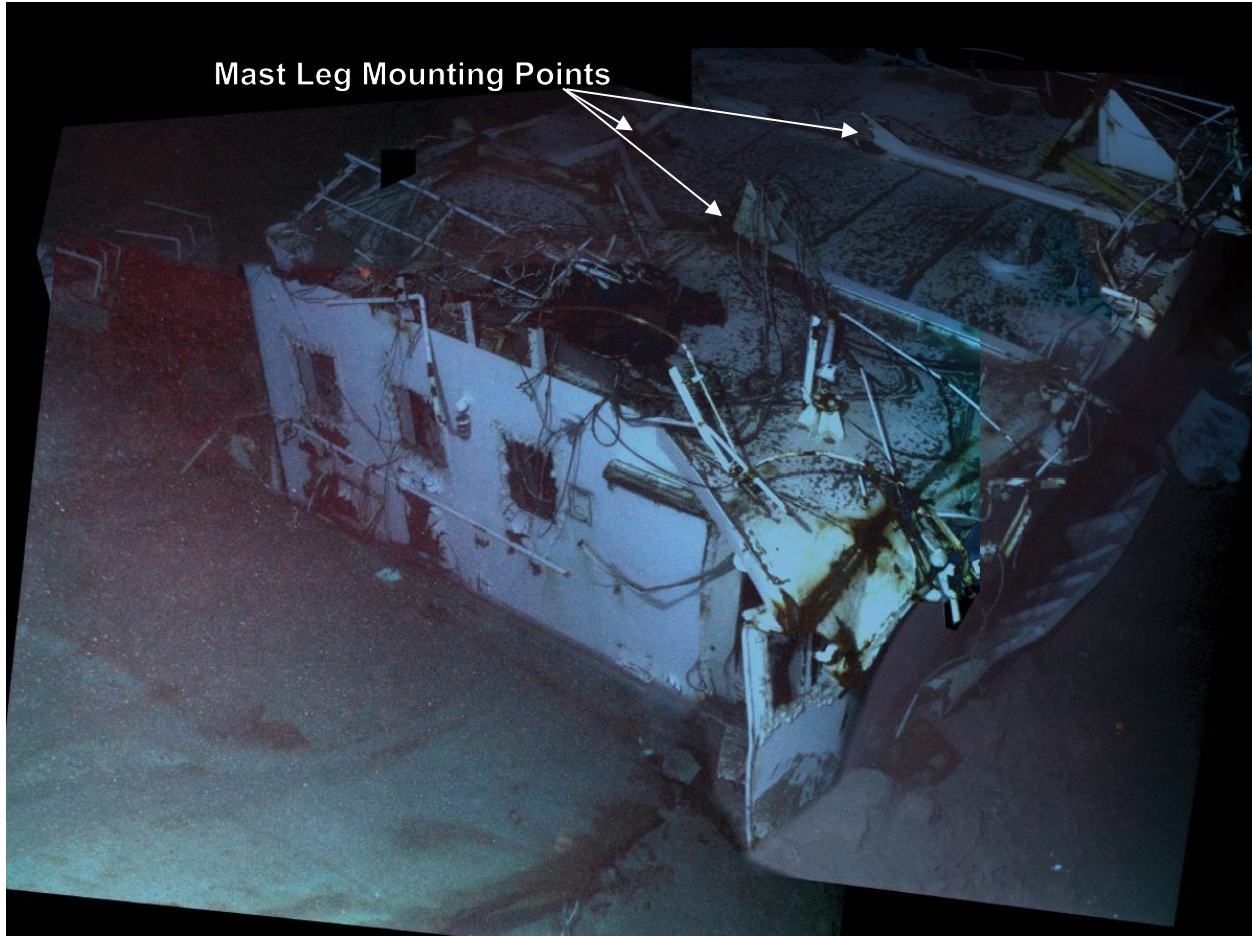


Figure 142. Region: Bridge Source: Mission II Vehicle: AOV Mosaic Image

The forward starboard corner of the wheelhouse and navigation bridge deck looking down and aft. All the windows are missing. The starboard forward corner (lower center of image) has seabed mud mounded forward of the corner. The windscreen bulwark is bent inward at the deck level and has mud pushed forward of it. The three mast legs have been severed from the wheelhouse top. The railings around the perimeter of the house top are missing or severely bent and broken. The stack is missing from the aft side of the wheelhouse.

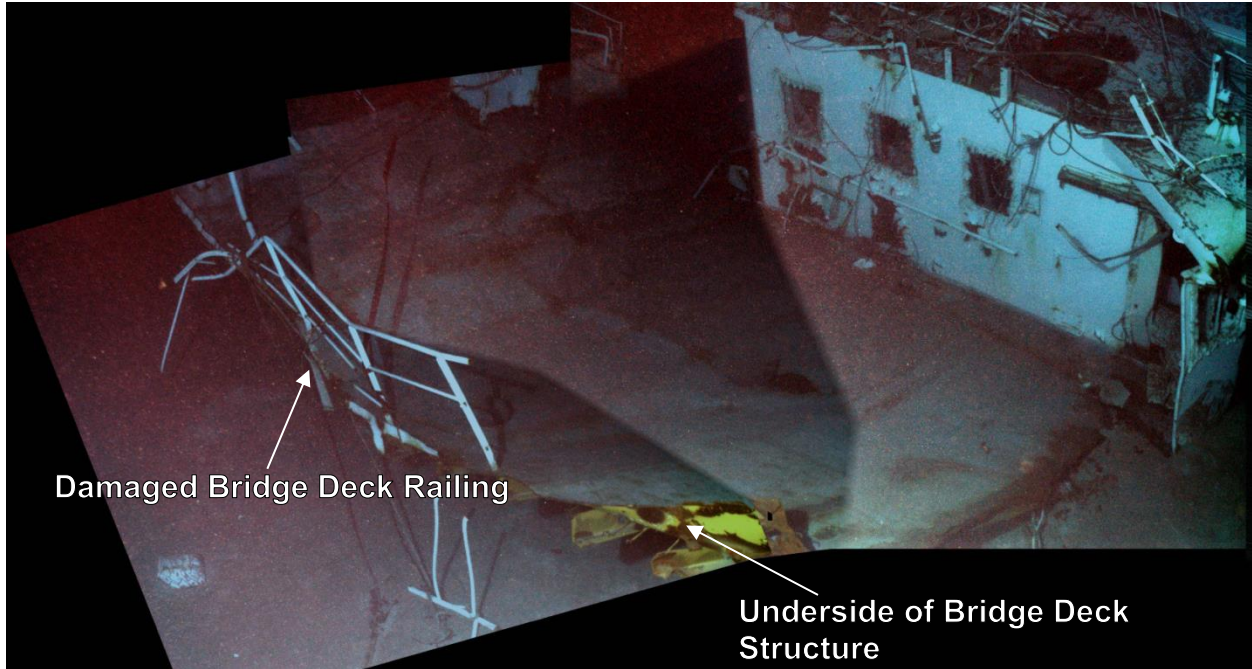


Figure 143. Region: Bridge Source: Mission II Vehicle: AOV Mosaic Image

The starboard corner of the navigation bridge deck looking down and aft. The bridge wing, which would extend to the left side of the exposed yellow structure, is missing. All exterior bulwarks that would have been beneath the navigation bridge deck are missing. The navigation bridge deck appears to be bent upward (curving) from the wheelhouse to the outboard deck edge. The railings around the perimeter of the navigation bridge deck are missing or severely bent and broken.

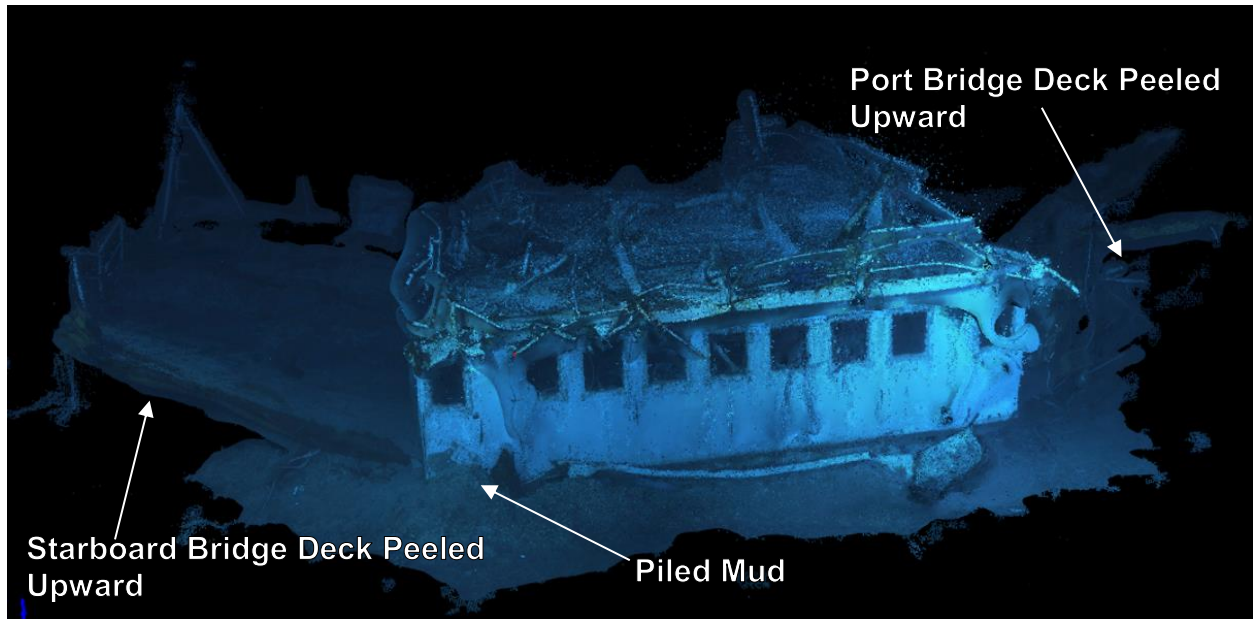


Figure 144. Region: Bridge Source: Mission II Vehicle: AOV- NTSB Point Cloud 3-D Model

The forward side of the wheelhouse and navigation bridge deck looking aft. The navigation bridge decks on both port and starboard sides are bent upward from the wheelhouse as they extend outboard. The bridge wings are missing. All exterior bulwarks that would have been beneath the navigation bridge deck are missing. Mud appears to be piled forward of the wheelhouse, and the starboard forward corner of the wheelhouse appears driven deepest into the seafloor.



Figure 145. Region: Bridge Source: Mission II Vehicle: AOV

View of forward port corner of wheelhouse (upper left). Underside of the navigation bridge deck is curled upward and backward. Joiner work and wiring associated with the lower navigation bridge deck accommodations can be seen under the curled navigation bridge decking

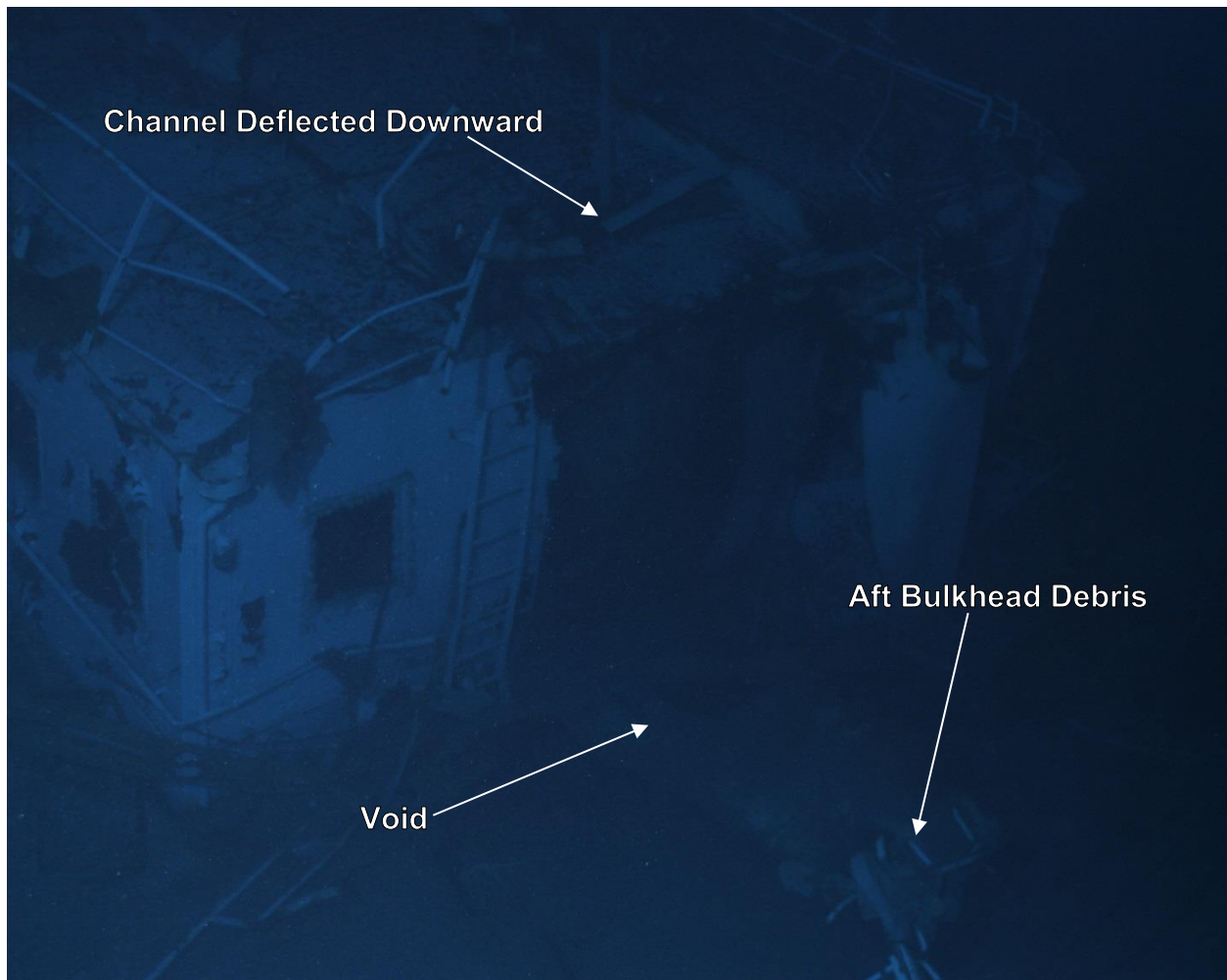


Figure 146. Region: Bridge Source: Mission II Vehicle: AOV

A view of the aft bulkhead of the wheelhouse taken from the aft port quarter. There is a void present between frame 170 and 172. Debris and the bulkhead from this area is removed from the house and bent aft. The channel is deflected downward where the rear mast leg was planted. The wheelhouse top also is deflected downward at centerline where the mast mounting channel is deflected most severely.

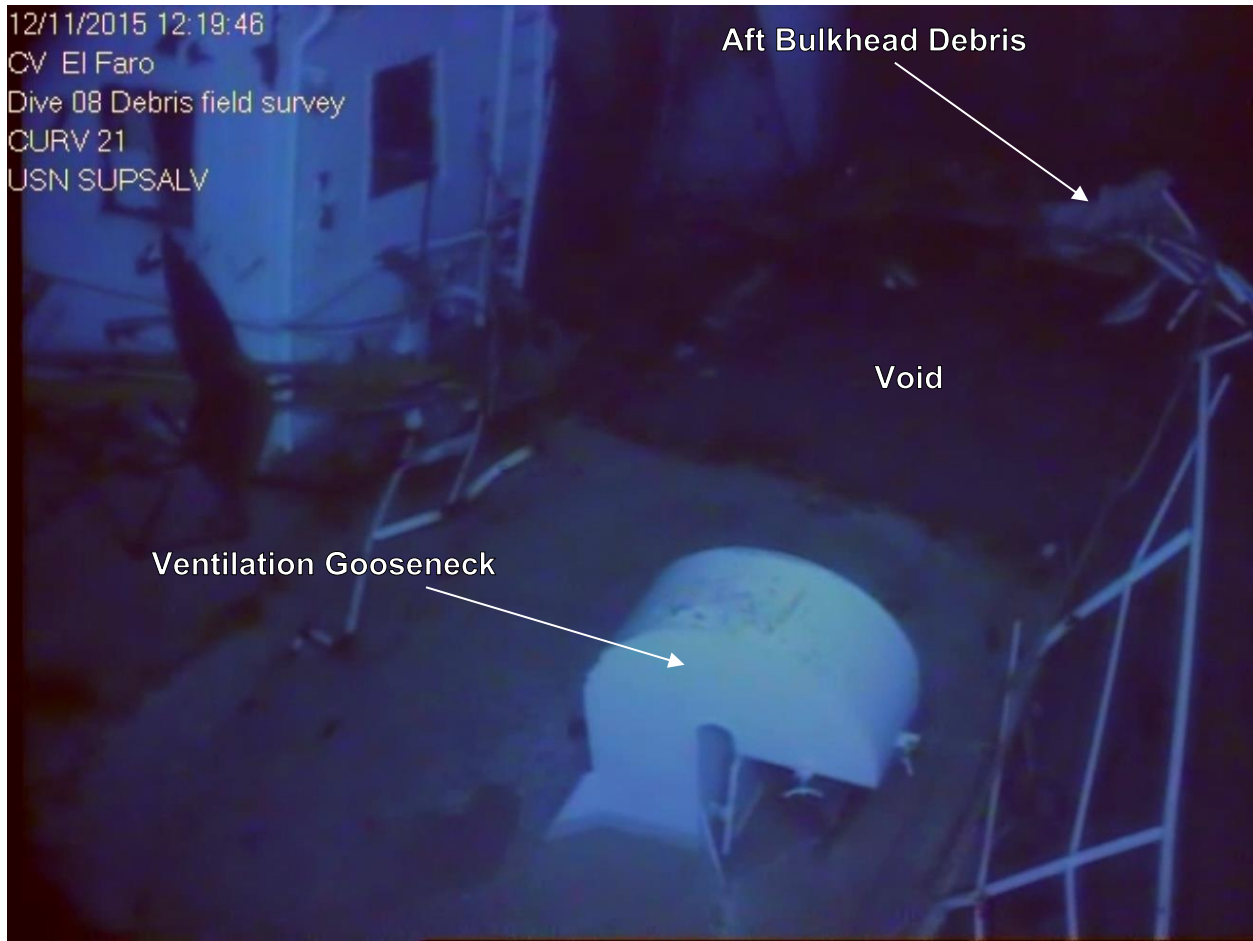


Figure 147. Region: Bridge Source: Mission I Vehicle: CURV 21

Alternate view of the aft bulkhead of the wheelhouse taken from the port quarter. Ventilation gooseneck at frame 174 is in position. Stack is separated from the house top, and is located nearby in the debris field.

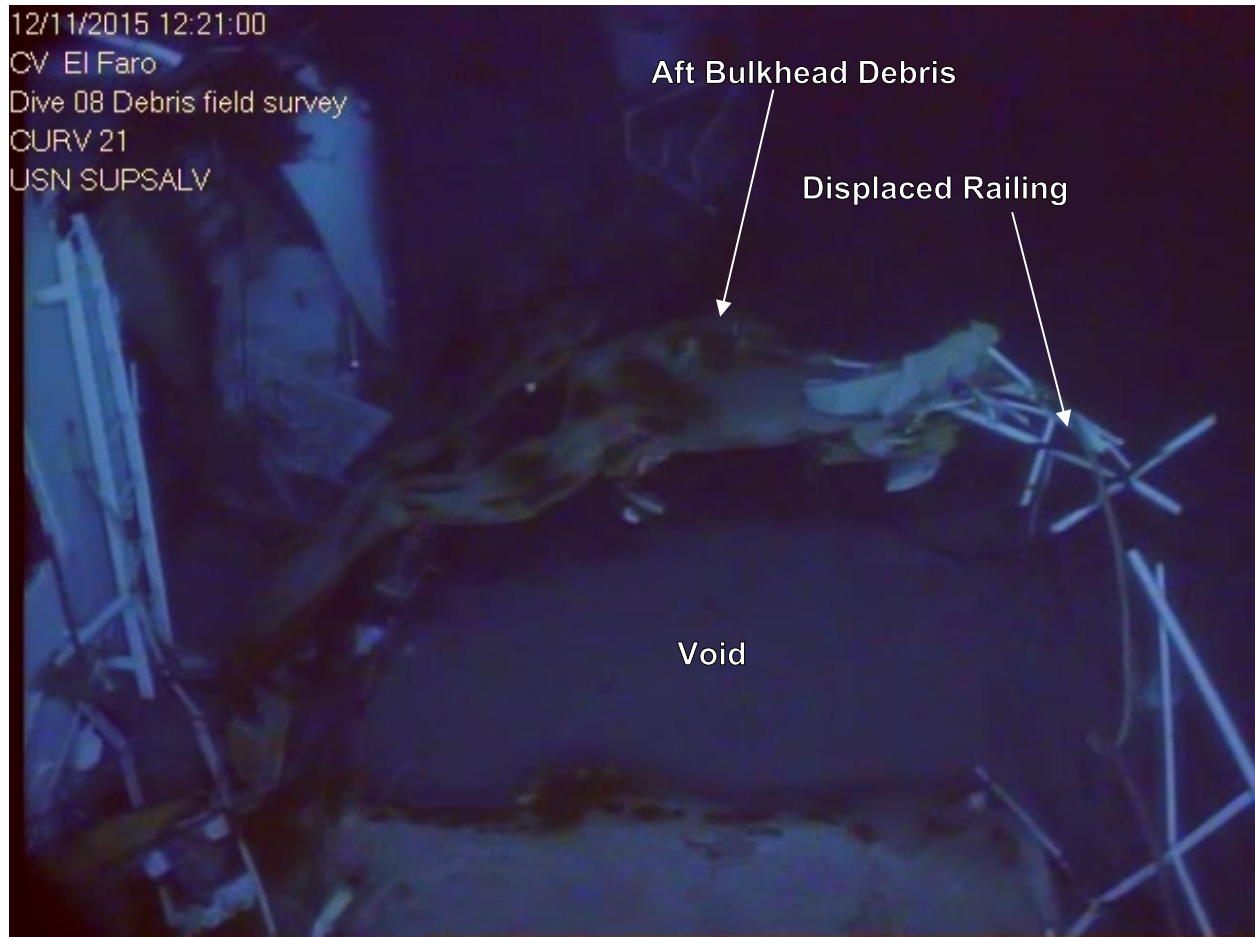


Figure 148. Region: Bridge Source: Mission I Vehicle: CURV 21

Alternate view of the displaced aft bulkhead between the wheelhouse and the ship's missing exhaust stack. Handrail at the top of the wheelhouse is still attached to the displaced section of bulkhead.

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CV El Faro

Dive 08 Debris field survey

CURV 21

USN SUPSALV



Figure 149. Region: Bridge Source: Mission I Vehicle: CURV 21

View from port side of wheelhouse. Windows are missing. Aft most window appears intact. A white object is resting against the aft most window.



Figure 150. Region: Bridge Source: Mission I Vehicle: CURV 21

Additional view (see figure 143) of the underside of the port navigation bridge deck looking port to starboard. Deck is displaced upward, back and to starboard. No exterior vertical structural or bulkheads remain attached below the navigation bridge deck plating. Some associated joinerwork from spaces below remain attached.

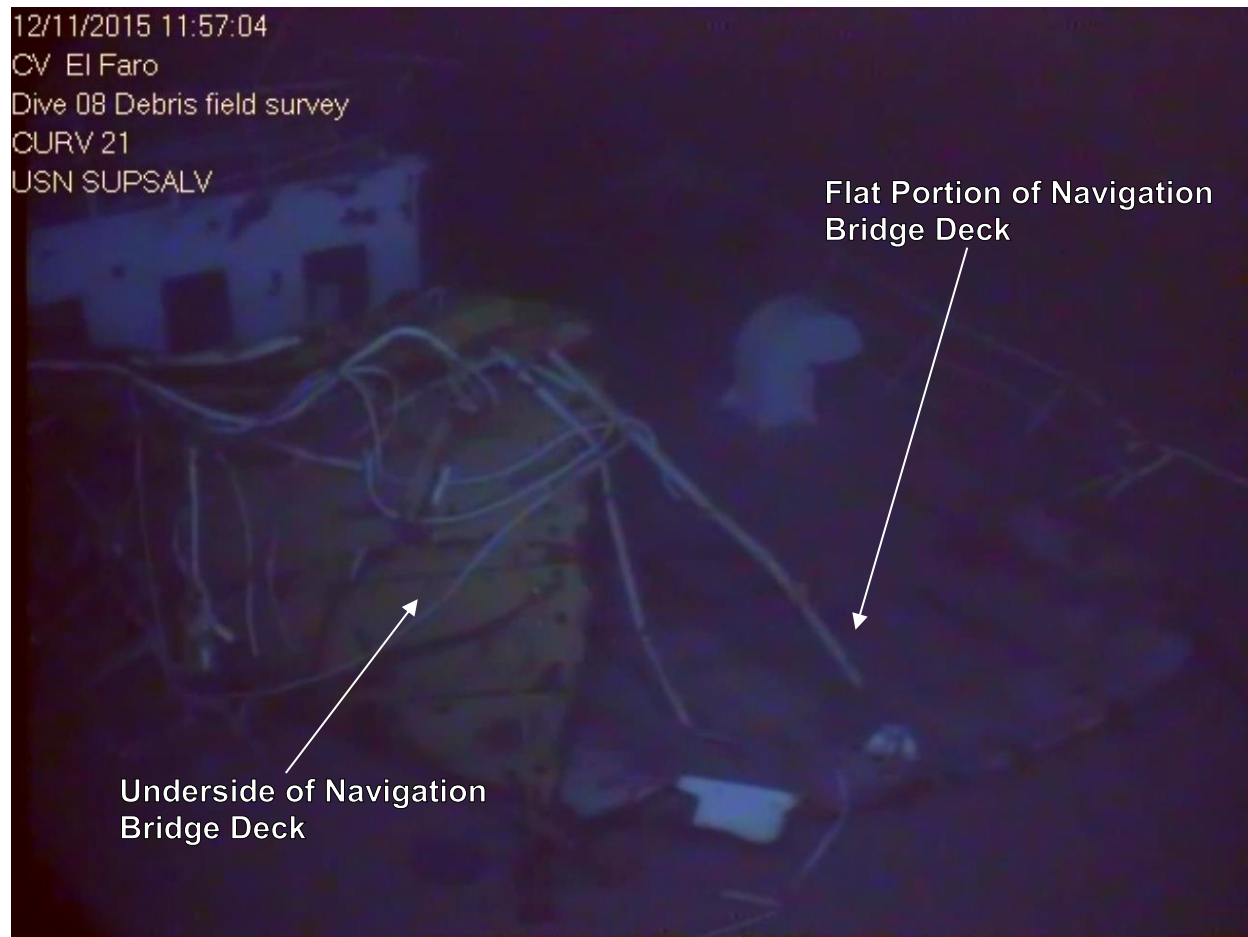


Figure 151. Region: Bridge Source: Mission I Vehicle: CURV 21

Another view of the underside of the port navigation bridge deck looking port and aft. Deck is displaced upward, back. After 2/3rd section of navigation bridge deck remains flat.

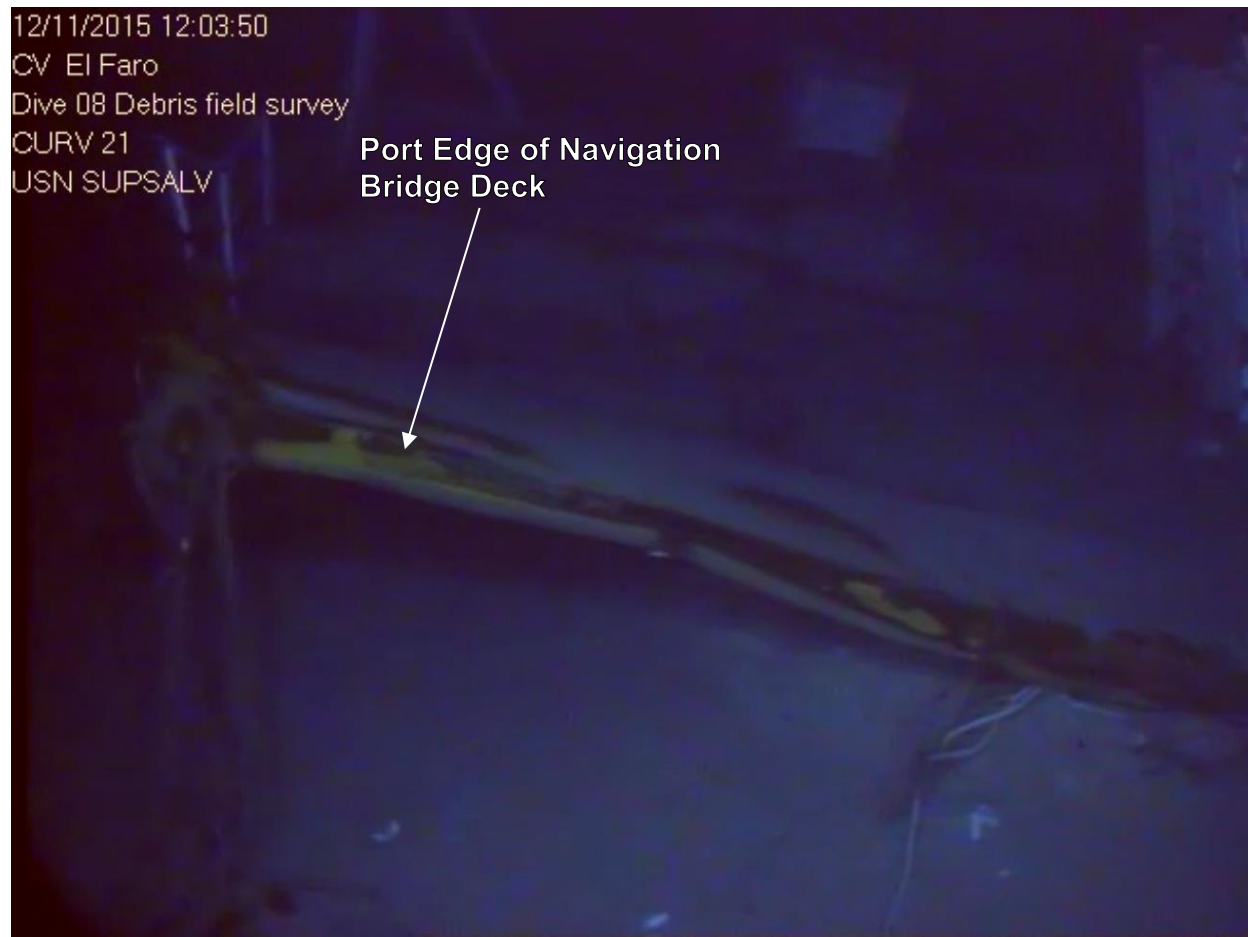


Figure 152. Region: Bridge Source: Mission I Vehicle: Curve 21

View of the port edge of the navigation bridge deck looking starboard.

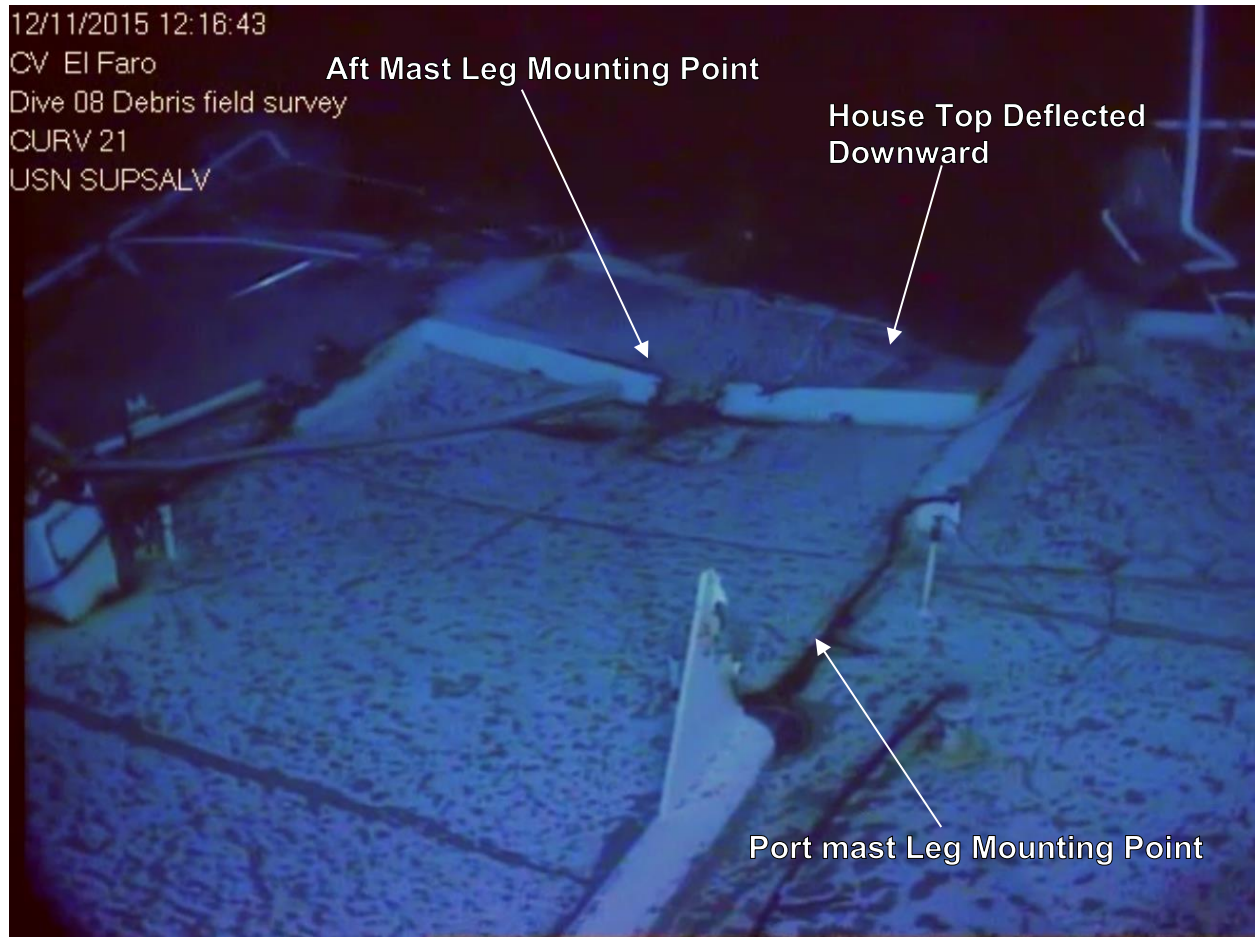


Figure 153. Region: Bridge Source: Mission I Vehicle: CURV 21

View of the wheelhouse top looking aft. Lower center of image shows main mast port leg mounting bracket is severed and both port and starboard mast longitudinal mounting channel sections are missing from house top. Aft mast leg transverse mounting channel is missing section at house top centerline, where aft mast leg was mounted. House top is deflected downward at centerline where aft mast leg landed.

STACK

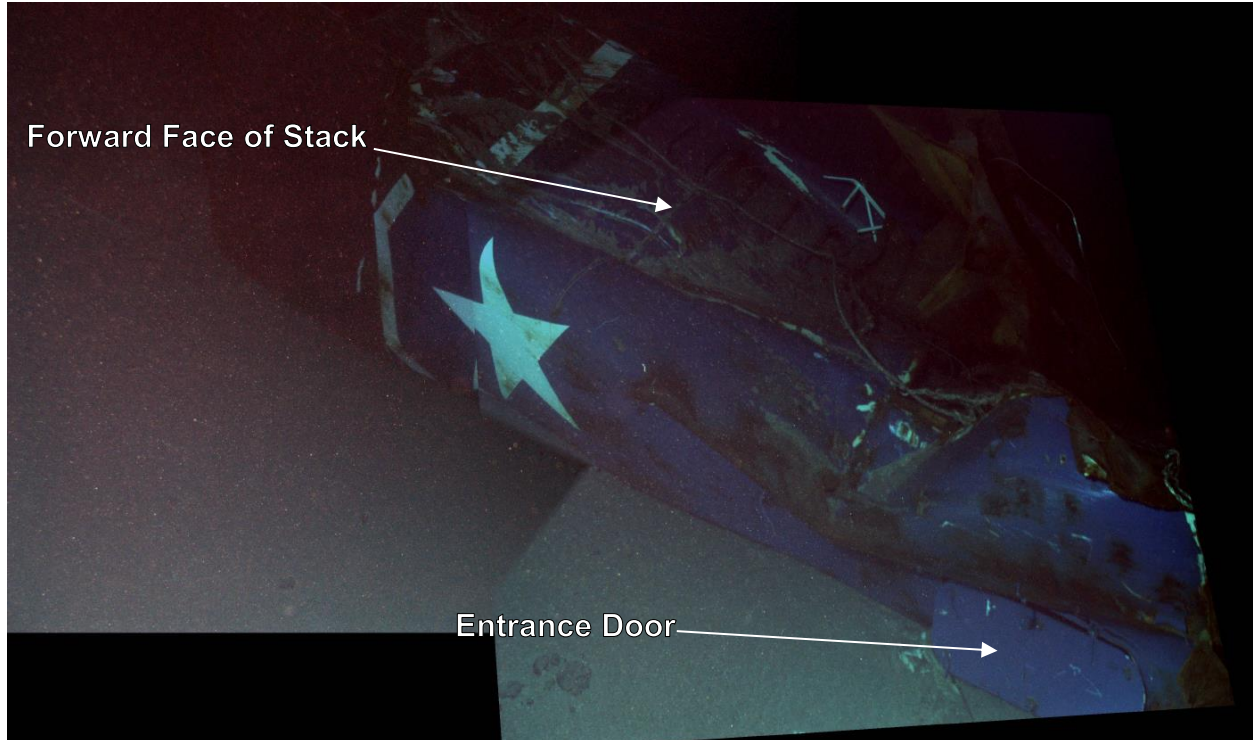


Figure 154. Region: Stack Source: Mission II Vehicle: AOV - Mosaic Image

View of the stack on the seafloor. The forward face of the stack is facing up and missing steel plating. The forward face is scratched, dented and deflected inward (aft) over its length. The stack is largely intact, with its 6-dog entrance door attached, but open (lower left side of image). The boiler uptake funnel is missing from the top of the stack.

MAST

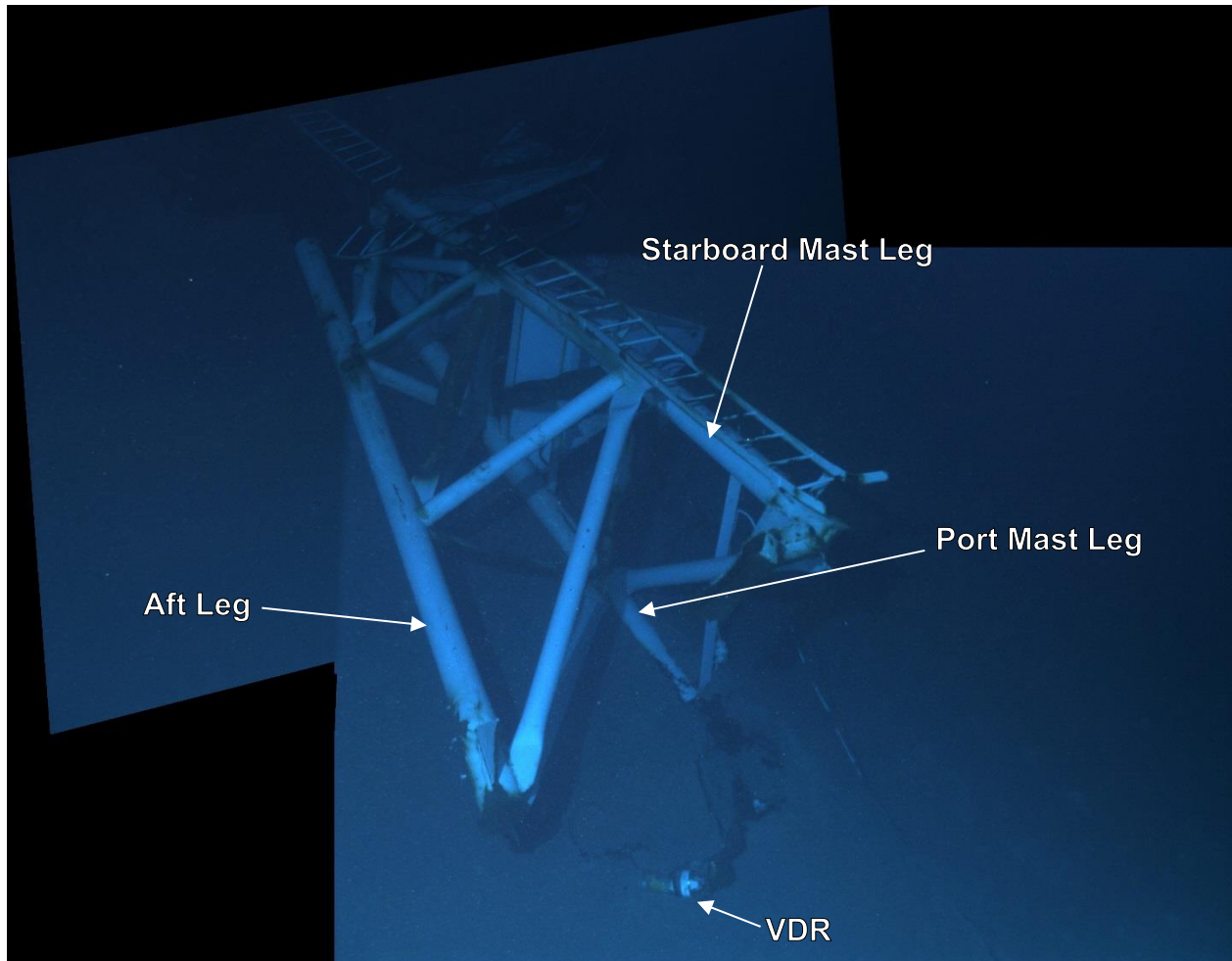


Figure 155. Region: Mast Source: Mission II Vehicle: AOV Mosaic Image

View of the mast and VDR capsule on the seafloor. The three mast legs are in the foreground. The starboard leg of the mast is upward, the aft leg is in the left foreground and the port leg with attached VDR is in the mud below the starboard leg.

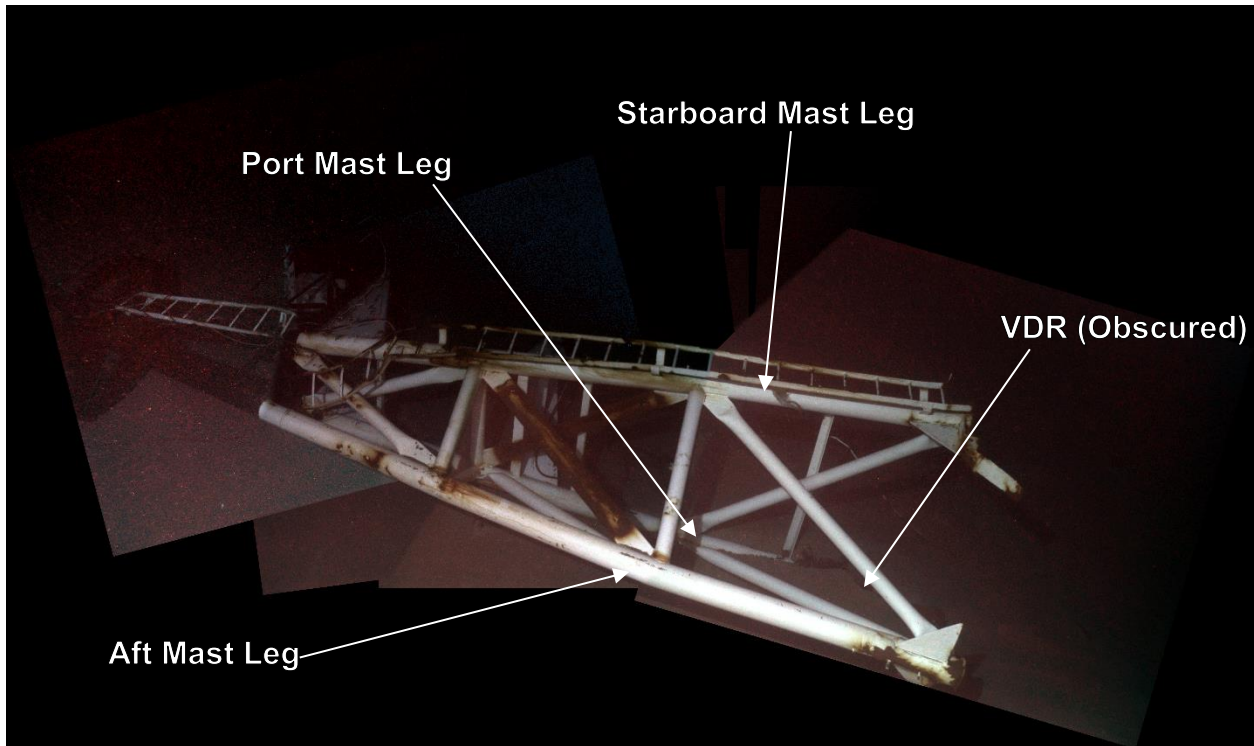


Figure 156. Region: Mast Source: Mission II Vehicle: AOV Mosaic Image

Side view of the mast and VDR capsule on the seafloor. The tripod mast's large structural members are intact. The starboard mast leg is up, the port foot with VDR is in the mud, and the aft foot is in the foreground.

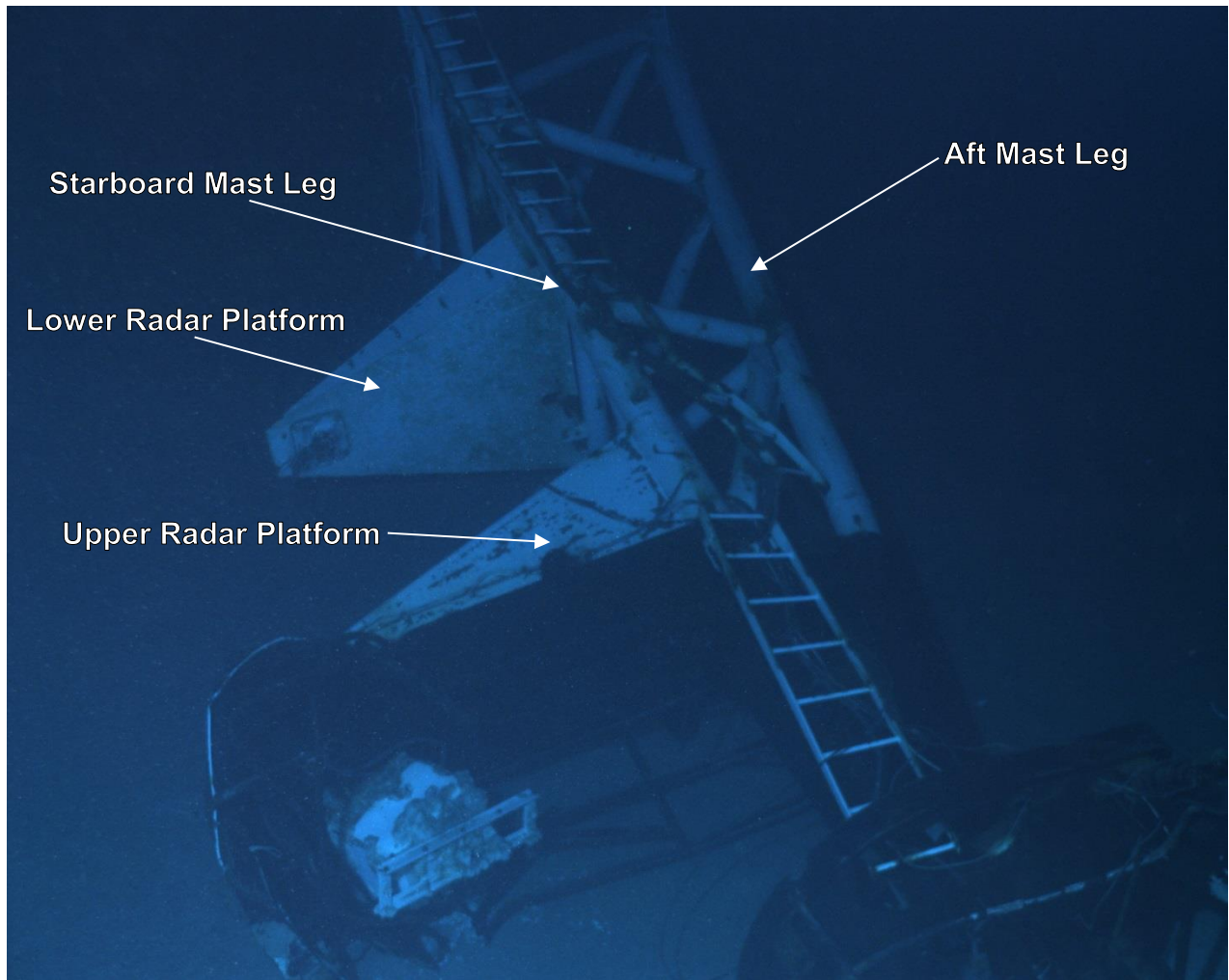


Figure 157. Region: Mast Source: Mission II Vehicle: AOV

Mast pictured from above with mast top in foreground. Ladder is on the starboard mast leg, aft leg of tripod mast is to the starboard side of image. Two radar platforms are attached to the forward side of the mast tripod structure. The lower-mounted and smaller (triangular white plate) platform, and an upper and larger (black rectangle with triangular white support bracket) platform are visible from above. The overall tripod structure has an aft-ward bend as it transitions toward its top.

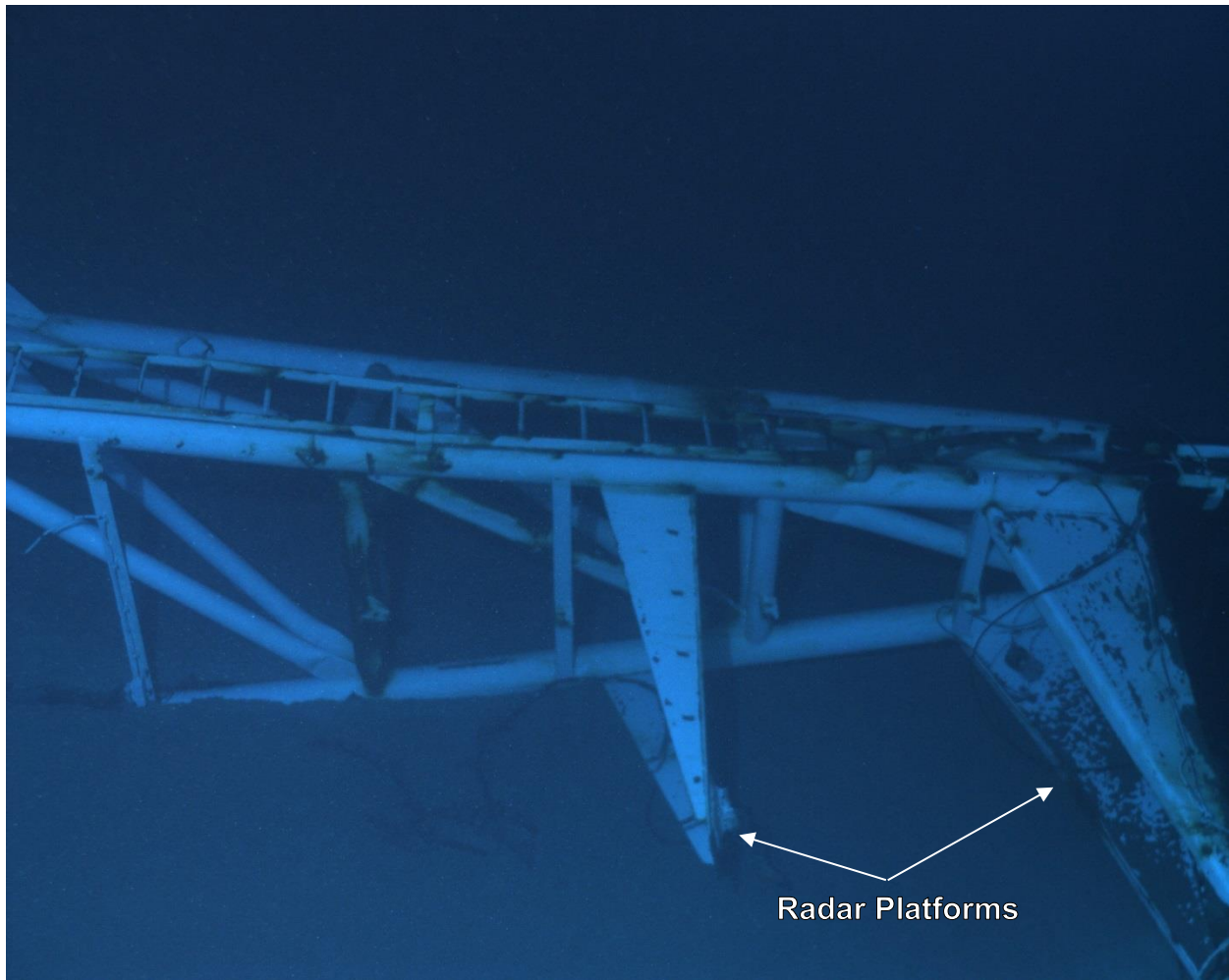


Figure 158. Region: Mast Source: Mission II Vehicle: AOV

Mast pictured facing forward side of mast structure. Ladder is on the starboard mast leg. Both upper and lower platforms are attached to the forward side (port and starboard mast leg stanchions) of the mast and all four triangular plate support brackets are attached. The overall mast structure has a pronounced aft-ward bend as it transitions toward its top.

LIFEBOAT

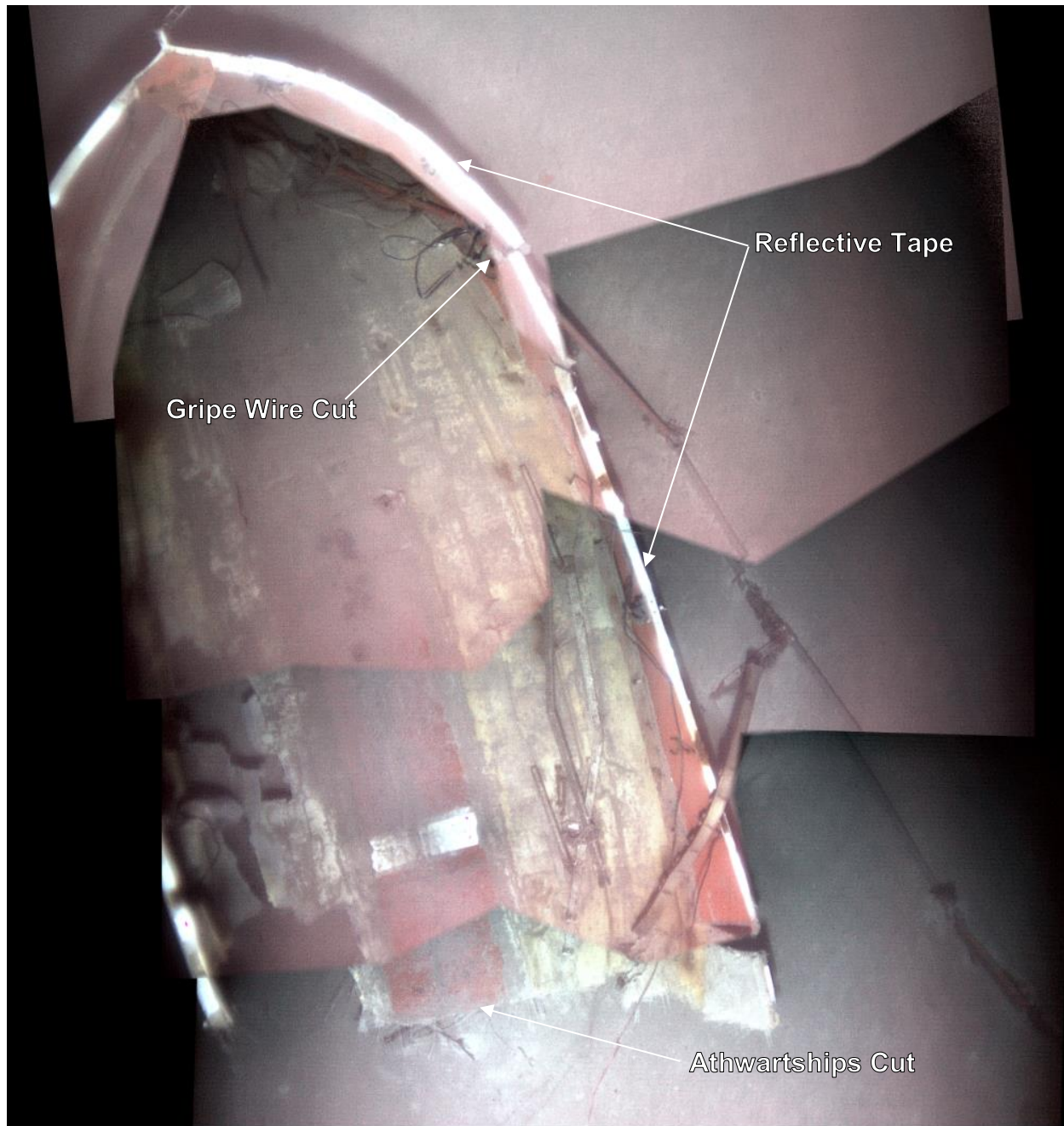


Figure 159. Region: Lifeboat Source: Mission II Vehicle: AOV Mosaic Image

Top view of lifeboat on seafloor. Boat cut completely athwartships where gripe wire would have been when boat was stored (bottom of image). Boat fiberglass hull partially cut by other gripe wire (top center of image). Bench seats and other internals missing. Reflective tape on topside of gunwales illuminated.

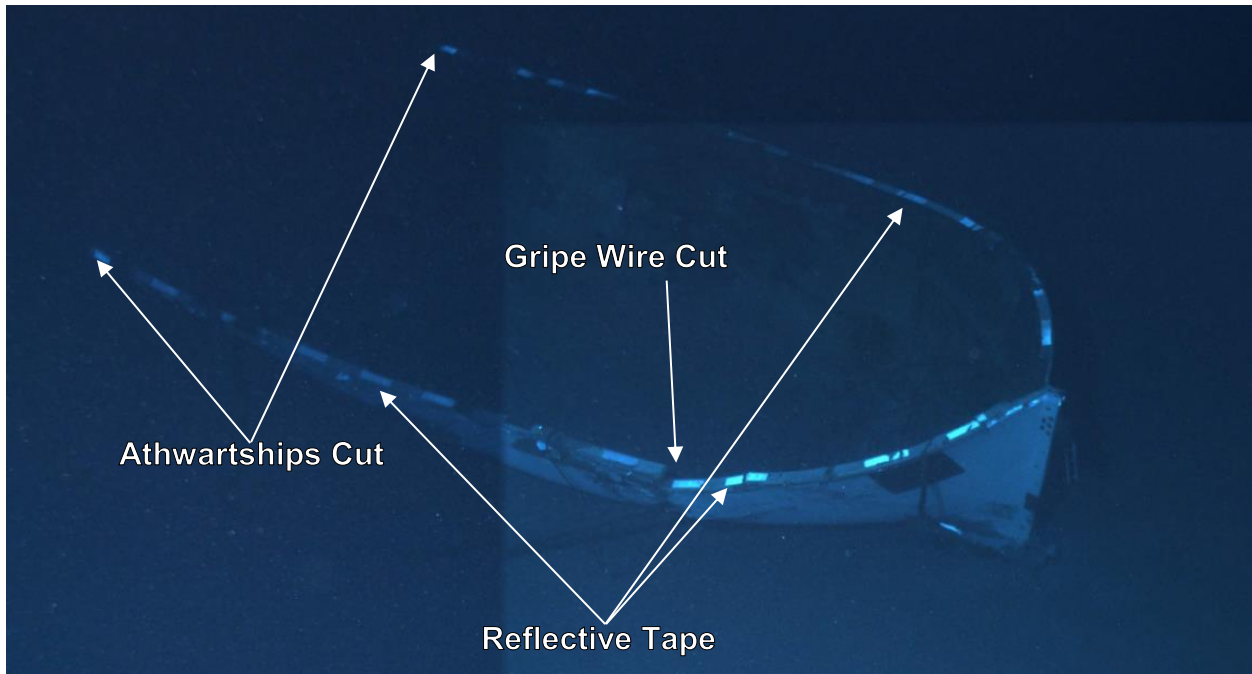


Figure 160. Region: Lifeboat Source: Mission II Vehicle: AOV Mosaic Image

Alternate view of lifeboat on seafloor. Reflective tape on topside of gunwales illuminated. Hull fiberglass partially cut where gripes would have been located (lower right side of image). Hull is cut away where reflective tape ends (upper left of image).