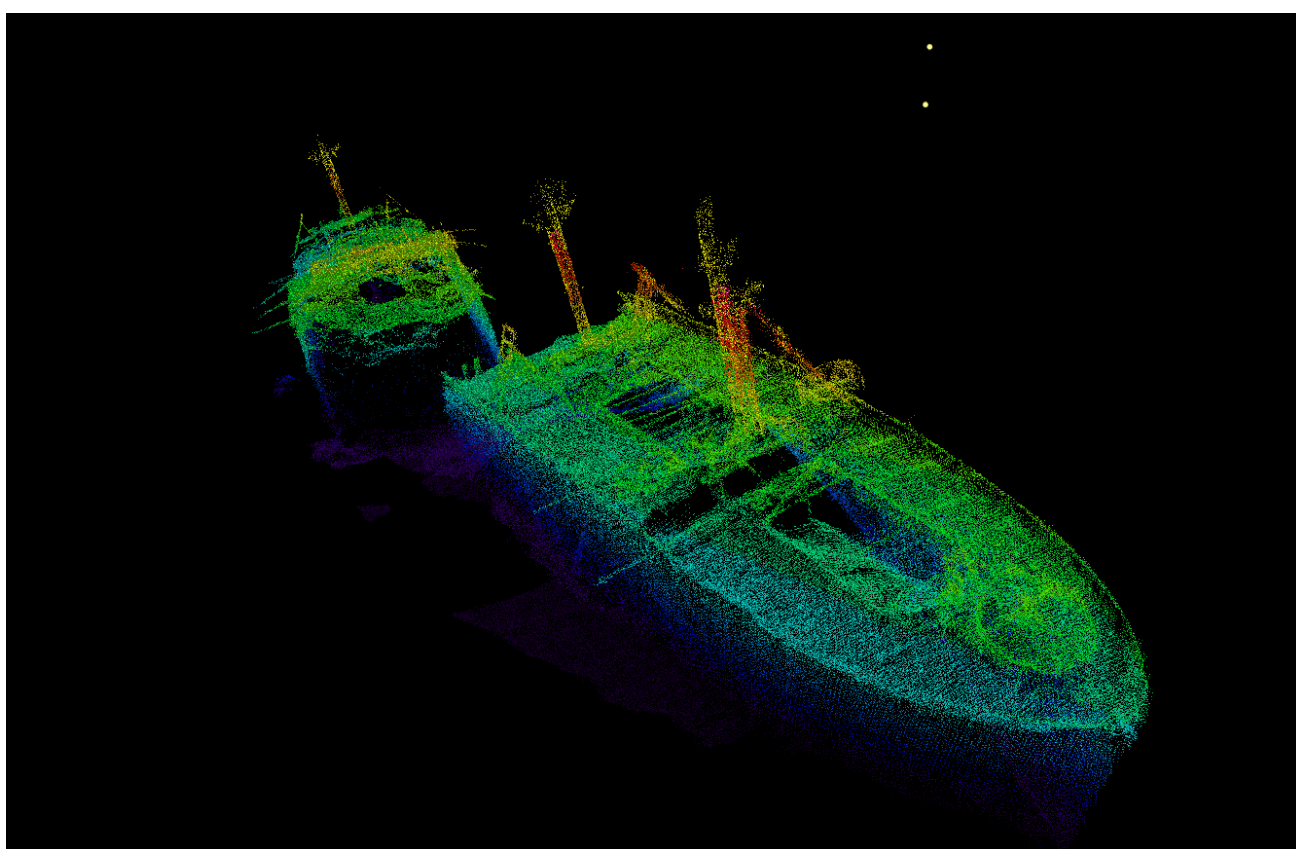


SS Richard Montgomery 2008 Survey Report



1. Executive Summary

1.1 In October 2008, the Maritime and Coastguard Agency commissioned a repeat high-definition multibeam sonar survey of the wreck of the SS Richard Montgomery and the prohibited area around it. The aim was to gather information about the current state of the wreck for comparison with previous surveys. Particular attention was to be paid to the masts and to areas where previous surveys have identified signs of deterioration.

1.2 The 2008 survey used a multibeam sonar unit that can be rotated to 40 degrees from vertical. This is the first time that the wreck has been surveyed using the sonar head in a rotated position. The 2008 survey of the wreck also included the use of laser scanning technology to gather data on the masts, which could then be knitted with the multibeam data to give a visual representation of the masts both above and below water, as well as an indication of their general condition and orientation.

1.3 The general state of the wreck continues to be one of slow deterioration. Observations made during the 2008 survey include:

- The orientation, list and pitch of the two sections of the wreck remain unchanged
- The wreck appears fully supported by seabed sediment at both bow and stern. since 2006 (which in turn had not measurably changed since 2005).
- The overall condition of the hull continues to be one of slow deterioration, as would be expected of a wreck of this age.
- Laser scanning data suggests that all three masts remain perpendicular to the mast housing and deck as far as it is possible to measure.
- The main crack in the hull at hold 2 has not increased in size since the 2006 survey.
- An aperture in the bulkhead aft of hold 3 appears to have increased in size by c. 200cm since 2006.
- 2008 data indicates that collapsed deck plating on the port side of hatch 2, noted in 2005 and 2006, has dropped a further 15cm since 2006.
- Data gathered using the sonar head in a tilted position suggests that some cracks noted in previous surveys may have been shadows in the data rather than actual areas of deterioration.

1.4 The survey also encompassed the seabed up to 400m around the wreck in order to identify any loose or isolated wreckage and to visualise the sediment build up adjacent to the wreck itself. Targets noted from previous surveys were relocated and no significant changes were apparent, although the 2008 survey was able to enhance some of the locational data related to these targets. A topographical representation of the sediment around the wreck was generated and comparisons made with previous surveys demonstrate that the wreck is still fully supported by seabed sediment. Data gathered during the 2008 survey has not shown any changes in seabed sediment that are likely to influence the stability of the wreck.

2. Introduction

2.1 The *SS Richard Montgomery* was a Liberty Ship built by the St. John's River Shipbuilding Company, Jacksonville, USA in 1943. The ship sailed from the USA to the UK as part of a convoy in summer 1944 with a cargo of munitions. On arrival in the Thames Estuary, the vessel was directed to anchor in the Great Nore Anchorage, off Sheerness. On the next tide, however, the ship's anchor dragged and the vessel drifted on to a bank running east from the Isle of Grain north of the Medway Approach Channel. The ship grounded amidships on the crest of the bank and shortly afterwards broke in two. The aft section of the ship was salvaged at the time, but approximately 1,400 tons Net Explosive Quantity (NEQ) remains in the forward section of the wreck. The wreck lies across the tide close to the Medway Approach Channel and her masts are clearly visible above the water at all states of the tide.

2.2 When the *SS Richard Montgomery* split in two, the break occurred at the bulkhead between Hold 3 and the Engine Room and, although this break caused extensive damage, the bulkhead remained intact with the cargo in lower Hold 3 still contained within.

2.3 The wreck is designated under section 2 of the Protection of Wrecks Act 1973, which means that there is a prohibited area around the wreck and it is an offence to enter within this area without the written permission of the Secretary of State. The wreck is clearly marked on the relevant Admiralty charts and the prohibited area around the wreck is ringed with four cardinal buoys and twelve red danger buoys. The wreck is under 24 hour surveillance by Medway Ports.

3. Background

3.1 In October 2008, the Maritime and Coastguard Agency commissioned a high-definition multibeam sonar survey of the wreck of the *SS Richard Montgomery* and its surrounding area in order to gather information about the current state of the wreck and seabed sediment, and to compare this with previous survey data. In particular, information was sought on the condition of the masts, the general state of the hull and the surrounding seabed. The survey was conducted by NetSurvey Ltd in conjunction with the Port of London Authority.

3.2 Although in the past divers have been employed on the site to undertake survey and remedial work, visibility on site is often little more than a few centimetres. For this reason, remote sensing technology such as multibeam sonar is able to provide more reliable information which is measurable, repeatable, enables visualisation of the entire wreck and its environment, and can be directly compared to previous survey data in order to highlight any changes.

3.3 Using multibeam sonar and laser scanning technology, the 2008 survey has provided three-dimensional images of the wreck both above and below water, providing detailed information on the condition of the wreck in 2008.

4. Survey Methodology

4.1 The 2008 survey encompassed all areas of the hull and all debris around the wreck and between the two sections of the hull. Particular attention was paid to the masts both above and below the waterline, and all evident splits, cracks, buckling and apertures were visualised and quantified where possible. A topographical survey of the surrounding seabed out to 400m was also undertaken.

4.2 As with previous multibeam surveys, the 2008 data is fully geo-referenced and can therefore be directly compared to data gathered in previous years and can also be used as a datum against which any future surveys can be measured.

4.3 The wreck survey used a high-resolution Reson Seabat 7125 multibeam sonar unit on a moonpool mount. This provided images of higher resolution than earlier surveys of the wreck. The moonpool mount allowed the sonar head to be rotated to 40° so that it could 'look' directly at the hull, allowing the collection of data that might not be acquired through a traditional survey from above. This is the first time that the wreck has been surveyed using the sonar head in a tilted position. The surrounding seabed survey was conducted using a Reson Seabat 8125 multibeam sonar unit, as has been used for previous surveys of the area.

4.4 The 2008 survey also incorporated the use of laser scanning technology to capture data on the three masts and other upstanding features. This laser scanning data was then knitted with the multibeam sonar data to provide a more complete picture of the wreck.

Survey Results

5. Condition of Hull

5.1 In general terms, the survey results indicate that the wreck still appears to be in reasonable condition given its age and location. However, the results of the 2005 and 2006 multibeam surveys indicated that ongoing corrosion has effected the overall structural integrity of both sections of the hull, although, this is perhaps to a lesser degree than might be expected for a wreck of this age. The results of the 2008 survey build on these previous surveys and demonstrate continued, slow deterioration of the hull with increased hogging and corrosion. The 2008 data also suggests that some aspects of previous survey data which have been interpreted as cracks in the hull may actually be shadows in the data. Even if this is the case, this does not materially change the overall situation as one of slow but steady deterioration.

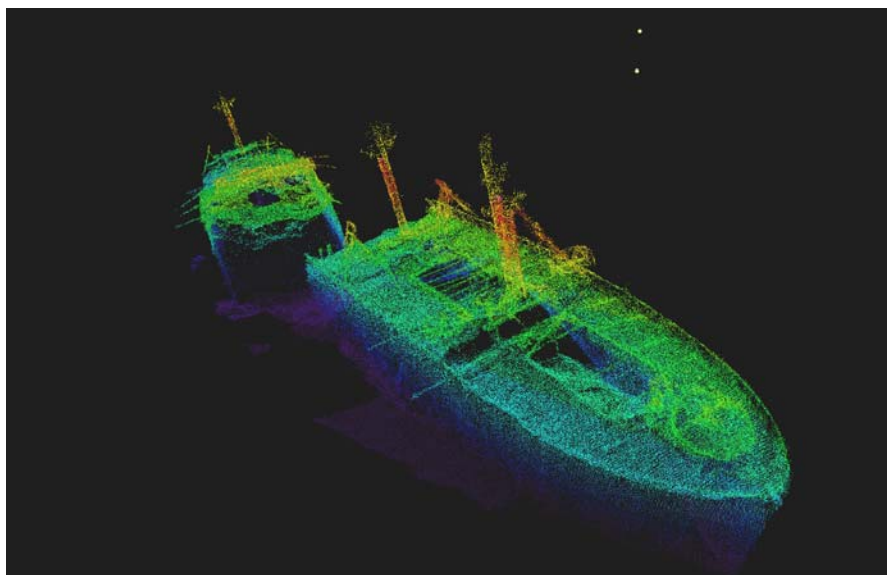


Figure 1 Multibeam sonar and laser scanning data 2008

5.2 Although the survey gathered detailed information about both sections of the wreck and the surrounding seabed, attention was particularly focused on the masts, the area around the break in the two sections, the crack at hold 2, sediment support at bow and stern, and the area of collapsed decking on the port side of hatch 3. The stern section of the wreck is known to have been salvaged at time of loss and, for this reason, the areas of specific focus are mostly on the forward section of the wreck where the remaining cargo is situated.

6. Orientation, List and Pitch

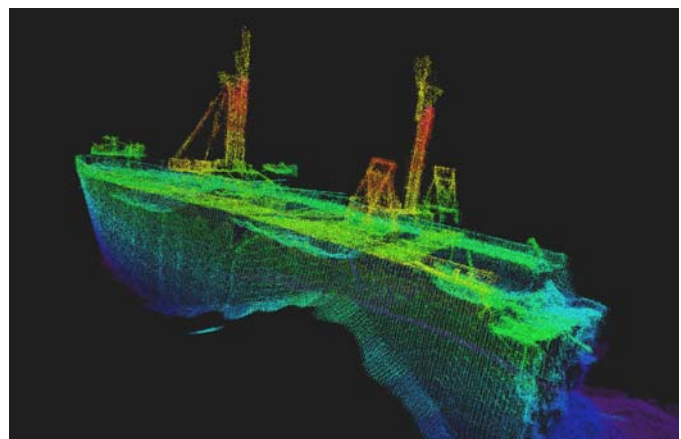
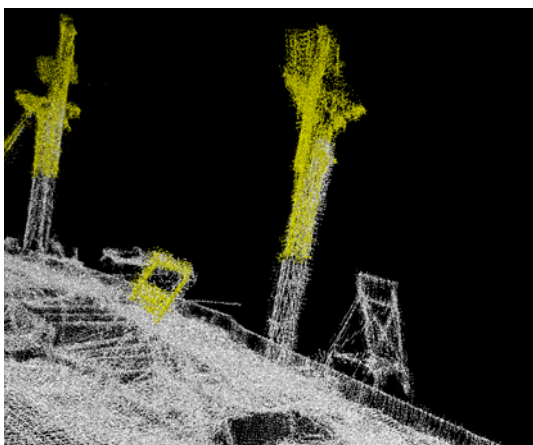
6.1 The wreck of the SS Richard Montgomery is in two sections, with the break at the bulkhead between the aft end of hold 3 and the engine room. This break occurred at time of loss in 1944. The data gathered during the 2008 survey confirmed that, within measurable limits, the attitudes of the two sections of the wreck remain the same as in 2006. Similarly in 2006, the survey results showed that the orientation, list and pitch of the two sections had not measurably altered since the 2005 survey.

6.2 The forward section of the wreck is aligned 1° east of UTM grid north, lists 17° to starboard and lays bow down by approximately 9° . The aft section is aligned 12° east of UTM grid north, lists 14° to starboard and lays with the stern down by approximately 3° .

6.3 Data from 2005, 2006 and 2008 (and to a lesser extent 2002) indicates that the wreck has settled into its current position on the seabed and its orientation and angle of list have not measurably changed.

7. Masts

7.1 The wreck sits at an average depth of 15m and all three masts are visible above the water at all states of the tide. All three of the masts lean to starboard (as does the wreck itself, see section 6 above) and extend up through the area of maximum wave energy, potentially leading to a more accelerated rate of deterioration than is experienced by the rest of the hull. For this reason, the three masts were a particular focus of the 2008 survey.



Figures 2 & 3 Multibeam & laser data for masts on bow section

7.2 Two different datasets were collected for each of the masts. This consisted of multibeam sonar data gathered whilst using the sonarhead in a tilted position and, secondly, laser scanning data. Figures 2 and 3 above show the laser and multibeam data knitted together in order to provide measurable details of the wreck in its entirety, both above and below water. Although previous multibeam surveys have provided a very high standard of physical data and visualisation, the masts have been outside of the range of these surveys. The laser scanning and multibeam data acquired during the 2008 survey is the first time that the masts have been surveyed and visualised in this way.

7.3 Both the multibeam and laser data showed that, although both the masts and the hull itself list to starboard, and despite the fact that the masts bear the additional stresses of exposure to wind and wave action, all three masts appear to remain perpendicular to the mast housing and deck as far as it is possible to measure.

7.4 All three masts appear to be in generally good condition given their age and their environment. However, heavy marine growth may be obscuring areas of corrosion. As previous multibeam surveys have not provided details on the masts, there is no comparable dataset with which accurate and reliable comparisons can be made. It is possible to assess the data gathered in 2008 along side the various photographic records of the masts above water and a comparison of the 2008 data with photographic records of the masts above water in 2005 appears to suggest that no major deterioration has occurred in that time (see figures 4 & 5 below).

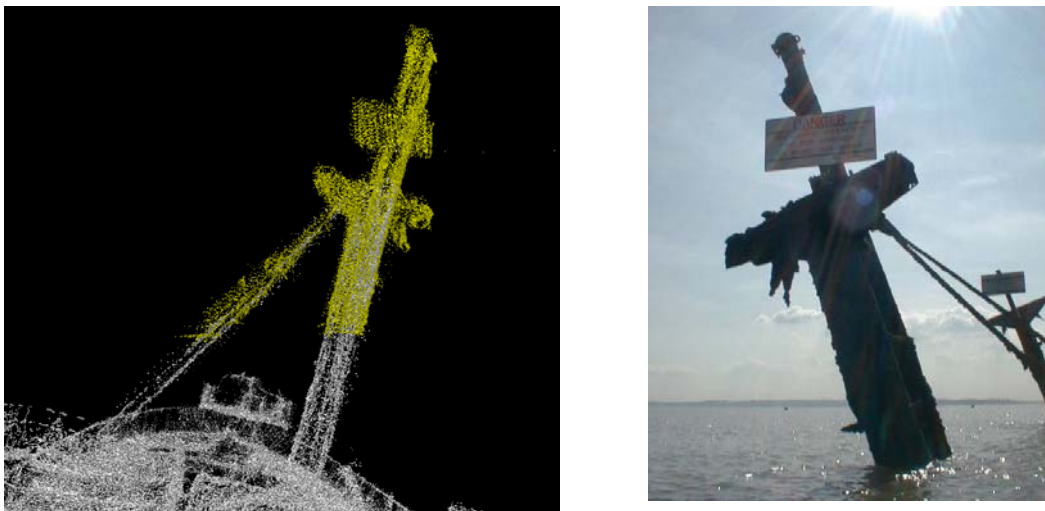


Figure 4 & 5 Foremast multibeam & laser data 2008 and photographic record 2005

8. Evidence of Hogging

8.1 Multibeam sonar data from both the 2005 and 2006 surveys noted that both sections of hull were hogged, but this level of hogging did not change measurably between 2005 and 2006. The 2008 survey data indicates a slight increase in the level of hogging since 2006.

8.2 Evidence for an increased level of hogging in the bow section includes a further collapse of the port side deck plating by Hatch 2 (from 0.35m in 2006 to 0.5m in 2008) and what appears to be a more pronounced bulging of the hull plating on the port side by Hold 2 (see fig.6 below).

8.3 This bulging in the area of Hold 2 has been identified in previous surveys and is probably the result of the weight of the cargo in an area where the structure is likely to be weakened due to the split in the hull plating. This distortion was apparent in 2005 and had not measurably changed in 2006. However, the survey report for 2006 did suggest that the effects of the weight of the cargo in this area of the hull were likely to become more pronounced as the steel corrodes. As can be seen in the images below (fig. 6), a visual inspection of the 2008 data shows that this bulging does appear to have become slightly more pronounced since 2006, although it has not been possible to provide a specific measurement of it.

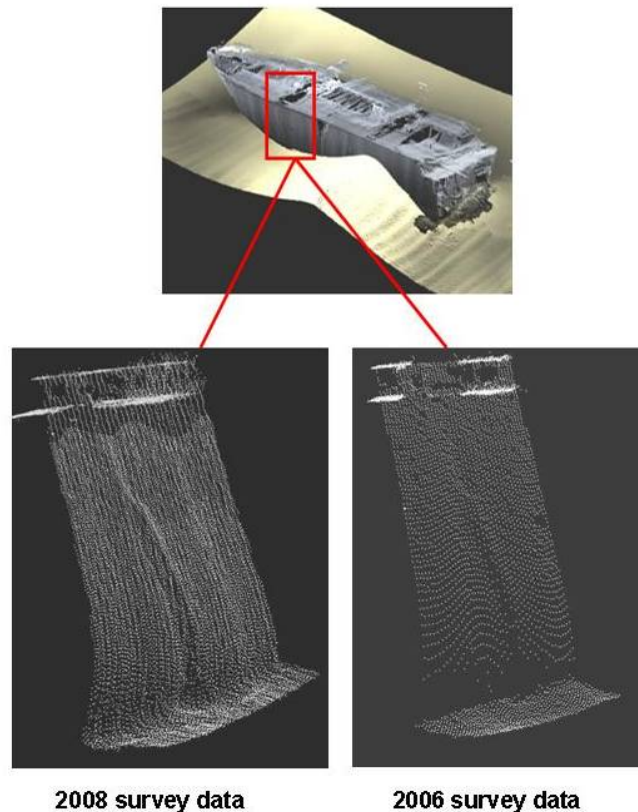


Figure 6 More pronounced buckling of hull plating in 2008 data

9. Changes and Deterioration Observed

9.1 As must be expected, the wreck is subject to slow but active and ongoing corrosion and this can be demonstrated through the results of successive multibeam sonar surveys, including the 2008 survey. However, using the sonar head in a tilted position to look directly at the hull, it has been possible to gather a greater density of data on some areas of the wreck than has previously been the case. This additional data suggests that, in a few discrete areas of the hull, features previously identified as cracks might actually have been acoustic shadows. However, this does not materially alter the overall picture of the wreck as being one of slow but continual deterioration.

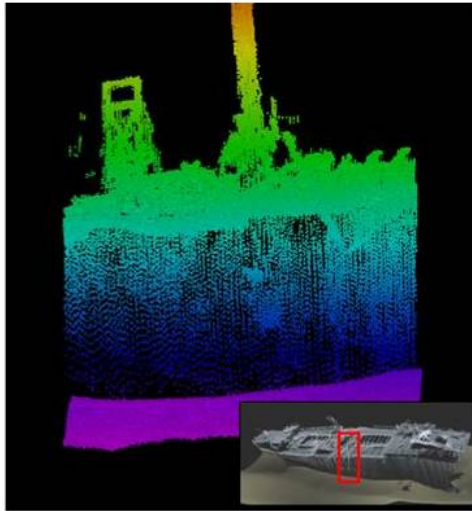


Figure 7 Aft Starboard section by mizzen mast, no cracks visible

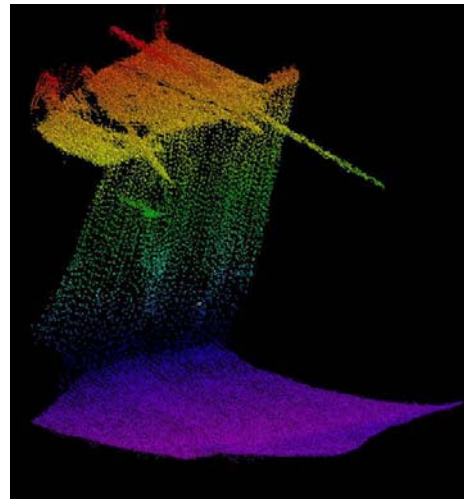


Figure 8 View down side of hull showing overhanging debris & no visible cracks

9.2 Using the data gathered during the 2008 survey and comparisons with surveys from previous years, a number of observations can be made on the general state of the wreck and surrounding seabed, as well as specific areas of the hull. For example, a number of apertures have been noted in previous surveys, particularly in areas where the steel plating is relatively thin, for example the bulwarks. These apertures were relocated and examined during the survey and most apertures had not significantly increased in size since 2006.

9.3 The main aperture and crack on the port side at Hold 2 has not increased in size since 2006, however, the partially collapsed deck plating at this part of the wreck appears to have dropped a further 15cm since 2006. Smaller holes in the tween deck level on the starboard side of Hold 2 may have increased slightly in size since 2006, but by such small amounts that accurate measurement is difficult. On the stern section of the wreck, a split in the deck plating on the starboard side now appears as a hole next to fallen debris (probably a cargo handling boom) which has sagged approximately 0.3m.

9.4 The 2008 survey noted that, whilst the bulkhead at the aft of the bow section is still largely intact, the visible level of corrosion has increased since 2006. On the starboard side of the bulkhead, an aperture noted in the 2006 survey appears to have increased in size by c.200cm. This is the largest area of change noted in the 2008 survey.

9.5 A tear in the bulkhead on the upper port side has been noted in most previous surveys and probably occurred at time of sinking. The area around this tear has corroded over time and an aperture was noted in the 2006 survey through which the outline of cargo was discernible. However, this aperture has not increased in size since 2006.

9.6 Although the escape of cargo material through apertures in the bulkhead cannot be completely ruled out, a full investigation of the entire prohibited area and beyond has shown absolutely no indication of any cargo spillage. Furthermore, the bow section has settled with the bow down by approximately 9° and cargo material would effectively have to roll 'uphill' in order to escape through these apertures.

10. Cargo

10.1 A salvage operation was begun immediately after the grounding of the SS Richard Montgomery in 1944. The records of this operation show that the salvage of cargo in the stern section of the wreck was successful, but that the ship sank completely before the clearance of the bow section could be completed. Approximately 1,400 tons NEQ remains in the bow section.

10.2 Given that the bow section of the wreck remains largely intact and continues to provide containment for the cargo, previous diver and sonar surveys have been able to provide only a small amount of direct evidence for the remaining cargo.

10.3 The multibeam sonar survey in 2006 provided measurable data on the contents of lower Hold 3, upper Hold 2 and 'tween deck cargo at Hold 1, confirming diver observations from previous surveys and contemporary reports of the salvage operation. The 2008 survey was again able to visualise material in the 'tween deck area at Holds 1 and 2, with no discernable differences since 2006. However, interpretation of the 2008 data suggests that the indications of 'tween deck cargo in Hold 2 might possibly be sections of the collapsed hull plating rather than cargo. It was hoped that, by using the sonar head at a tilted angle, the 2008 survey would also provide enhanced visualisation and quantification of cargo material in Hold 3. Unfortunately, this was not possible.

10.4 The debris field between the two sections of the wreck was also surveyed. A comparison between the multibeam surveys undertaken in 2002, 2005, 2006 and 2008 indicates that no changes have taken place in the size and shape of this debris and there is no evidence of any cargo material having spilt from apertures in the bulkhead or elsewhere on the wreck.

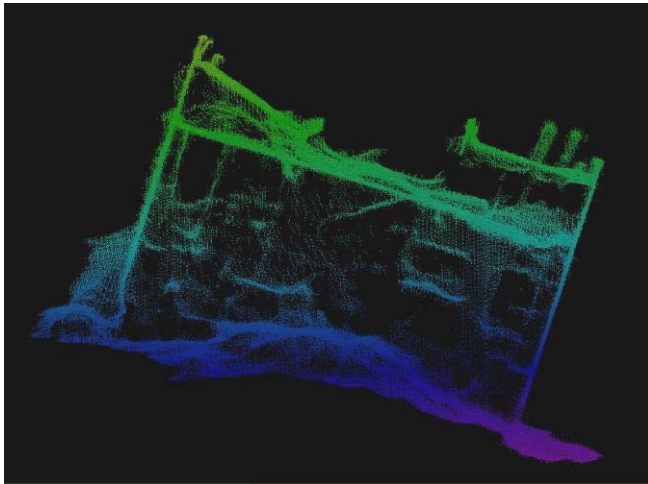


Figure 9 View of bulkhead & debris mound 2008

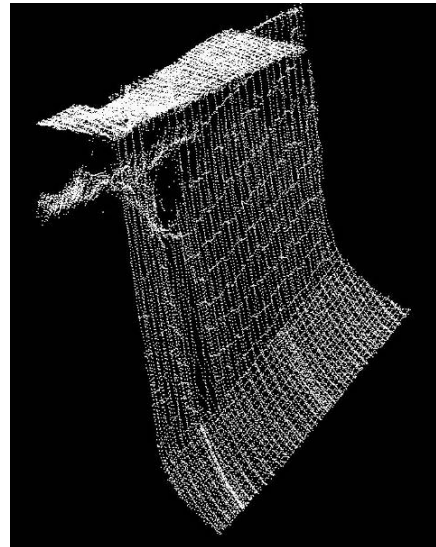


Figure 10 View along port side of Bow section showing material inside hull

11. Seabed Survey

11.1 Sonar surveys of the wreck of the SS Richard Montgomery also include a full seabed survey within the prohibited area. This seabed survey aims to locate and identify scattered debris and to provide details on the movement of sediment around the wreck site. The 2008 survey shows that both the bow and stern sections of the wreck are still fully supported by the seabed and that further sediment has gathered around the bow since 2006. The measured depth around the forefoot in 2006 was approximately 20m, and this depth was measured at approximately 18m in 2008.

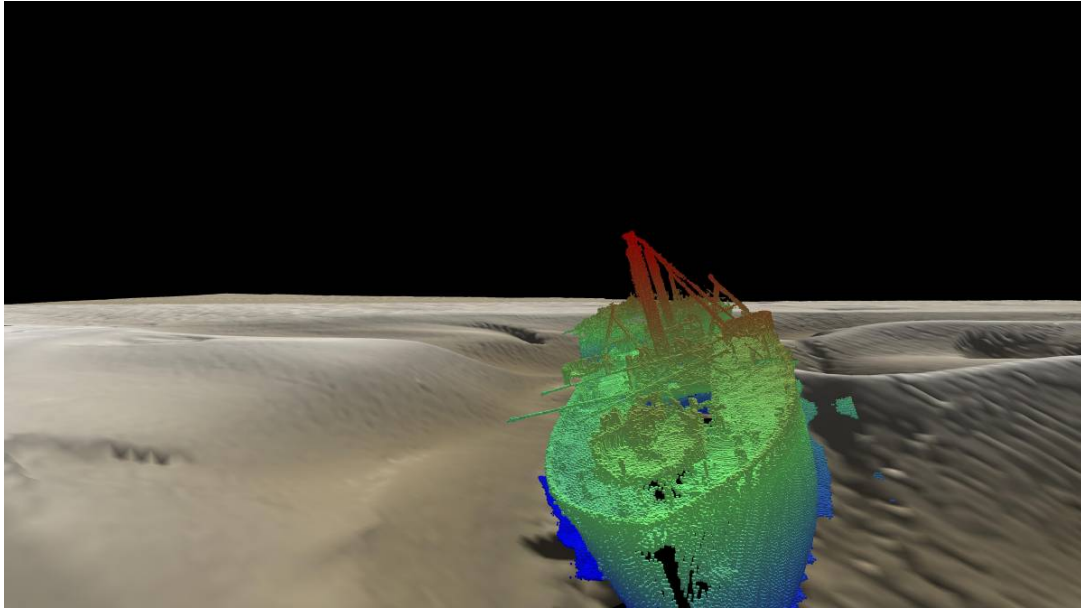


Figure 11 The wreck and surrounding seabed (2008)

11.2 The 2008 survey identified 37 seabed targets within the prohibited area. These targets include the sinkers for the four cardinal buoys and twelve danger buoys that surround the wreck, sinkers from previous buoys, a spread of debris unrelated to the Richard Montgomery including what has previously been identified as a boiler, and the wreck of what is probably a Thames barge. Some changes were noted in these seabed targets, for example, the debris previously identified a boiler appears less distinct in shape and size, and the location of the Thames barge wreck has been corrected. However, none of these changes noted in seabed targets are material to the condition or stability of the Richard Montgomery.

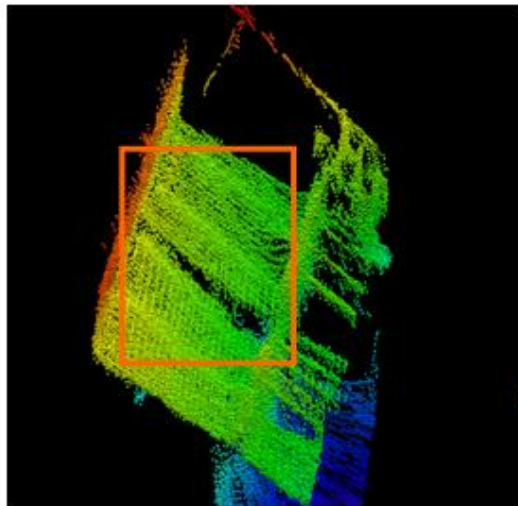
12. Conclusions

12.1 The density of data gathered during the 2008 survey, in conjunction with the use of the sonar head in a tilted position and the addition of laser scanning technology have allowed for a more complete visualisation of the wreck. This includes all upstanding features both above and below the waterline. The survey builds on data gathered in previous years and demonstrates that the overall picture is one of slow but constant deterioration. Although many areas of the hull have not measurably changed since the 2006 survey, as noted above, there are areas where further collapse of deck plating has occurred and apertures have increased in size.

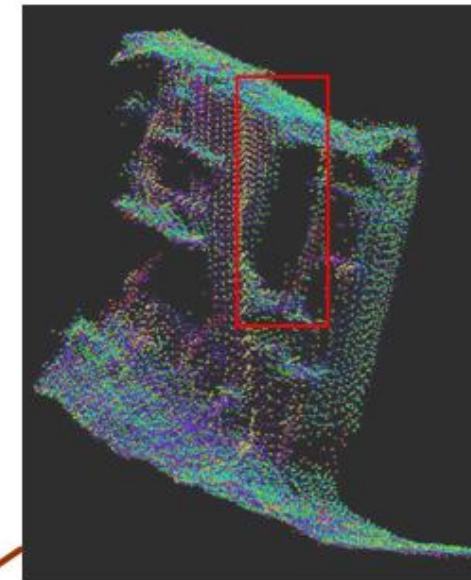
12.2 The bow and stern both appear to be supported by seabed sediment, unlike in 2005. This support should help to prevent any further hogging of the bow section. However, the 2006 survey also showed that the wreck was fully supported, yet there is evidence (see section 8) of increased hogging since then. This is perhaps evidence of the mobility of sediment beneath bow and stern between surveys.

12.3 Further surveys to a similar or higher standard should provide a tool for monitoring and year on year comparisons of the wreck in order to help determine the rate of deterioration, to identify any significant changes in condition or stability and to inform decision-making on future management plans. Accurate geo-referencing is fundamental to this, allowing for direct comparisons of datasets and confidence in the results of these comparisons.

SS Richard Montgomery 2008 Survey Results

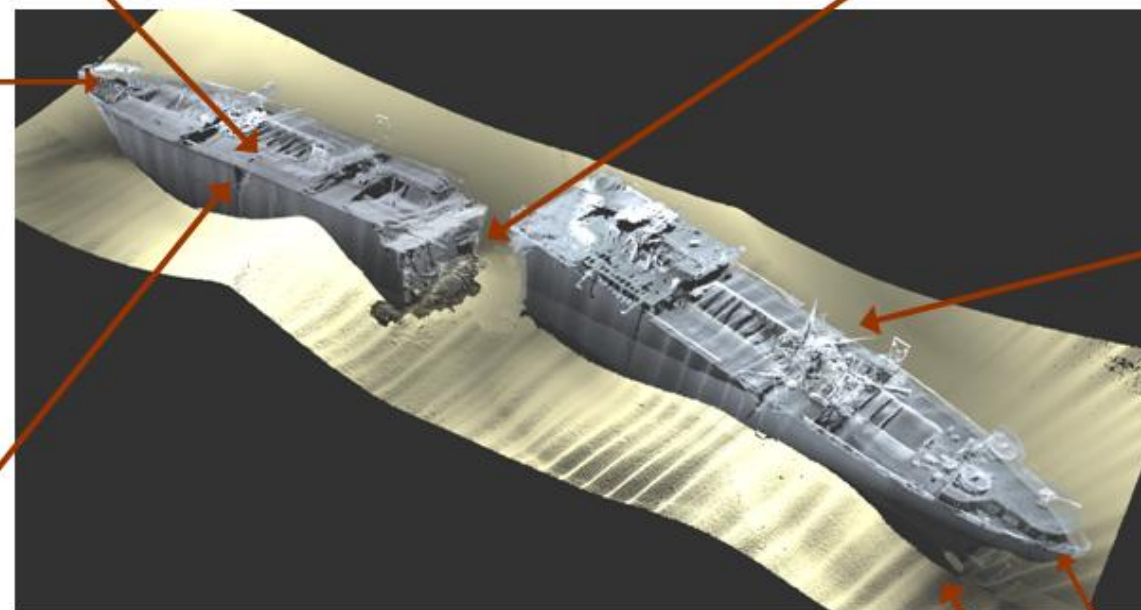


Deck plating collapse increased from 0.35m in 2006 to 0.5m in 2008

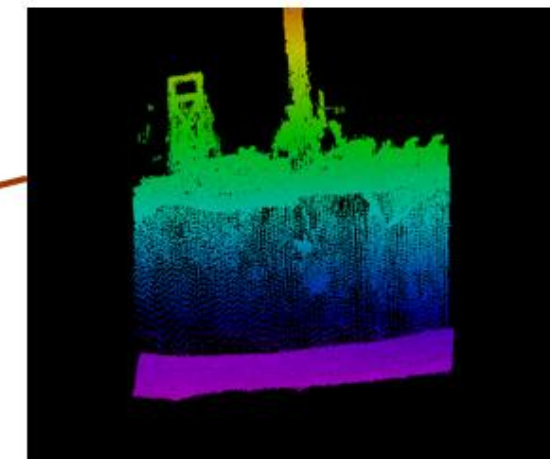


Hole in bulkhead at aft end of the bow section, stbd side, has increased in size by c.200cm since 2006

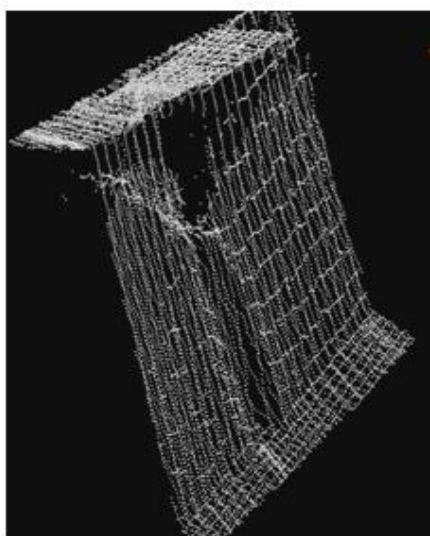
Bow



Stern



Cracks in hull identified in previous surveys, but new data gathered in 2008 shows no evidence of cracks.



The hole & crack on the port side at hold 2 has not increased since 2006 survey

Bow and stern sections both fully supported by seabed sediment.