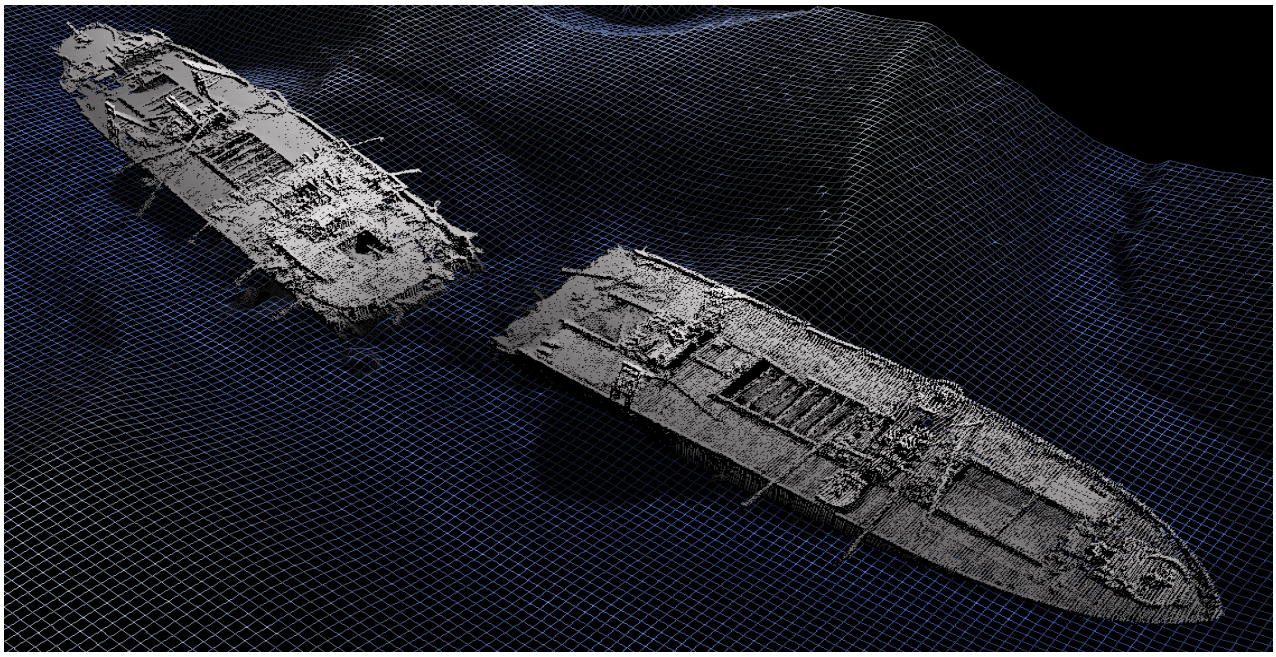
SS Richard Montgomery

Survey Report

2010



Maritime & Coastguard Agency
May 2012

1. EXECUTIVE SUMMARY

In June 2010 the Maritime and Coastguard Agency conducted a high-definition multibeam sonar survey of the wreck of the SS Richard Montgomery and the surrounding seabed. This was a repeat survey, the purpose of which was to gather physical data on the wreck and its environment. This data could then be used to assess the condition of the wreck structure and compare it with previous data in order to identify any changes or deterioration. The survey was conducted by the MCA vessel Hunter using a Reson 7125 SV high resolution multibeam sonar unit. The resulting data was processed and reported on by NetSurvey Ltd.

The data collected was of a good quality although a different survey vessel and sonar mounting system was used. This resulted in a 30cm 'Z' height offset between data sets and, therefore, the data produced has been shifted so that comparisons of key features could be made.

The results of the 2010 survey show that the wreck of the SS Richard Montgomery remains in a similar condition to that found in 2009. The majority of the wreck's structure appears to be stable. Little sign of deterioration since 2009 was evident and only small changes were noted in the wreck's structure and the surrounding seabed. The key points of the survey include:

- The overall list and orientation of the vessel remain the same;
- Over much of the wreck, no changes were noted;
- The crack in the hull on the port side at Hold 2 remains unchanged from the 2009 survey;
- The deck plating at Hold 2 shows a very small drop in height (c.5cm);
- Holes in the bulkhead aft of Hold 3 remain unchanged from 2009;
- Bulging in the hull plating shows little sign of change;
- The difference in orientation of the hull forward of the crack at Hold 2 has increased slightly; and
- Seabed sediment around the wreck remains in a similar condition to that seen in 2009, with some small areas of erosion.

The 2010 survey results also suggest that using a sonar unit that can be tilted is likely to improve the data quality, particularly in areas of the hull where there is overhanging debris or where the angle of list might obstruct a traditional downward facing sonar unit.

2. BACKGROUND & METHODOLOGY

2.1 Wreck History

2.1.1 The *SS* Richard Montgomery was a US Liberty Ship built by the St. John's River Shipbuilding Company, Jacksonville, USA in 1943. In August 1944, the ship left the US with a cargo of munitions bound for the UK and then on to France. After arriving in the Thames Estuary, the SS Richard Montgomery was ordered to anchor off Great Nore. However, the vessel dragged anchor and, on the falling tide, foundered on Sheerness Middle Sand, a sand bank running east from the Isle of Grain, to the north of the Medway Approach Channel. Almost immediately, the vessel hogged and the hull plates forward of the bridge began to split. An operation began to discharge the cargo. However, the ship broke its back, the forward section became completely flooded and, eventually, in September 1944 the vessel sank and the salvage operation was abandoned.

2.1.2 Although the stern section of the wreck was cleared, approximately 1400 tons (NEQ)[*] of munitions remain in the forward section of the wreck. The wreck lies across the tide close to the Medway Approach Channel, with her masts clearly visible above the water at all states of the tide.

2.1.3 The wreck is designated under section 2 of the Protection of Wrecks Act 1973[†]. 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, the prohibited area around the wreck is ringed with four cardinal buoys and twelve red danger buoys, and the wreck is under 24 hour surveillance by Medway Ports (under contract to the Maritime and Coastguard Agency).

2.1.4 Whilst the risk of explosion is considered to be remote, the wreck is regularly monitored. Surveys of the wreck are undertaken in order to provide information on its condition, identify any changes and to help inform future management strategy. In recent years, multibeam sonar technology has been utilised for these surveys because it is faster and provides a greater level of detail, accuracy and repeatability than would be achieved through a diving survey. This is mainly due to the very poor visibility and large tidal range in the Thames Estuary.

2.1.5 Multibeam sonar surveys are 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.

[*] Net Explosive Quantity
[†] Text of the Protection of Wrecks Act 1973 Protection of Wrecks Act 1973

2.2 Scope of Work

2.2.1 The survey was conducted by Reson Offshore Ltd UK from the MCA vessel Hunter and used a bow mounted Reson 7125 SV high definition multibeam sonar unit. After the survey was completed, NetSurvey Ltd processed the raw data, compared it to previous survey data and reported on the results.

2.2.2 The 2009 survey included laser scanning of those parts of the wreck which are visible above the waterline. This facility was not available as part of the 2010 survey, although a visual inspection was carried out.

2.2.3 The data coverage and reporting included full coverage of the wreck and the surrounding seabed out to a distance of approximately 400m. Specific attention was paid to detailing the hull, areas where deterioration has been noted in past surveys, the masts, overhanging rigging or debris including any material between the two sections of the wreck and any cracks, apertures or anomalies that were not present in previous surveys. The objective of the seabed survey was to identify any loose or isolated wreckage and show any sediment build up or scouring immediately adjacent to the wreck.

2.3 Survey Equipment

2.3.1 The equipment was installed and calibrated by Reson Offshore Ltd UK.

Fig. 1 – MV Hunter with Bow Mounted Reson unit

2.3.2 In combination with the Reson 7125 SV, an Applanix POS-MV inertial system was used to output real-time position, attitude and heading data. This sensor outputs heading and attitude to an accuracy of 0.02° and 0.01° respectively. The POS-MV is integrated with the Reson 7125 to apply time stamp

information to the swath data. As well as real-time data, the raw inertial and GPS data was recorded as a raw sensor file. This meant that the data could be post-processed using POSPAC MMS software and imported into the multibeam data at a later stage.

2.4 Data Processing

2.4.1 Once the survey data had been collected, a combination of POSPac MMS, Caris HIPS and Fledermaus software was used for data processing. The raw logged PDS files were imported into CARIS HIPS. The post-processed Smoothed Best Estimate of Trajectory (SBET) file was applied in order to update the ship's Navigation and GPS height. Following SV application, a GPS Tide was derived using the separation value calculated from previous Montgomery projects. The data was merged and total propagated uncertainly (TPU) calculated. The swath data was examined in CARIS HIPS in the form of a BASE surface for any systematic errors such as tide or sound velocity artefacts.

2.4.2 The HIPS multibeam data was then passed into the IVS 3D program Dmagic where it was then processed into a PFM[‡]. Once in the Fledermaus PFM format, the resulting surfaces can be output into a variety of surface models that include surface difference, profiles or digital terrain models. Fledermaus was used to perform all the analysis, measurements and screen captures for this report.

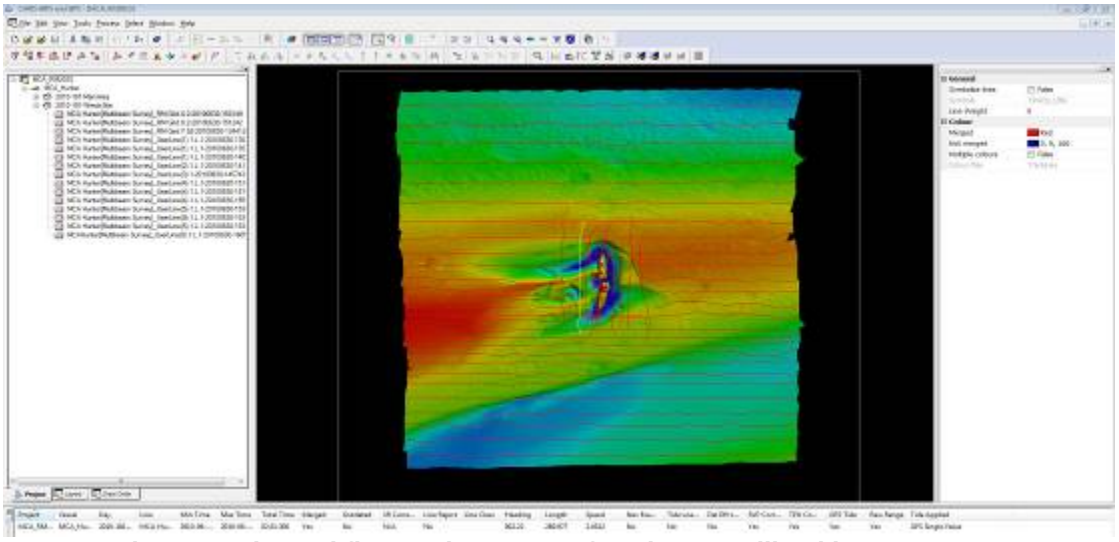


Fig. 2 - Caris workflow and BASE Surface image utilised by NetSurvey

2.4.3 The end result is a fully rendered point cloud which can then be compared with existing data sets.

[‡] PFM is a file extension. PFM files contain metric data.

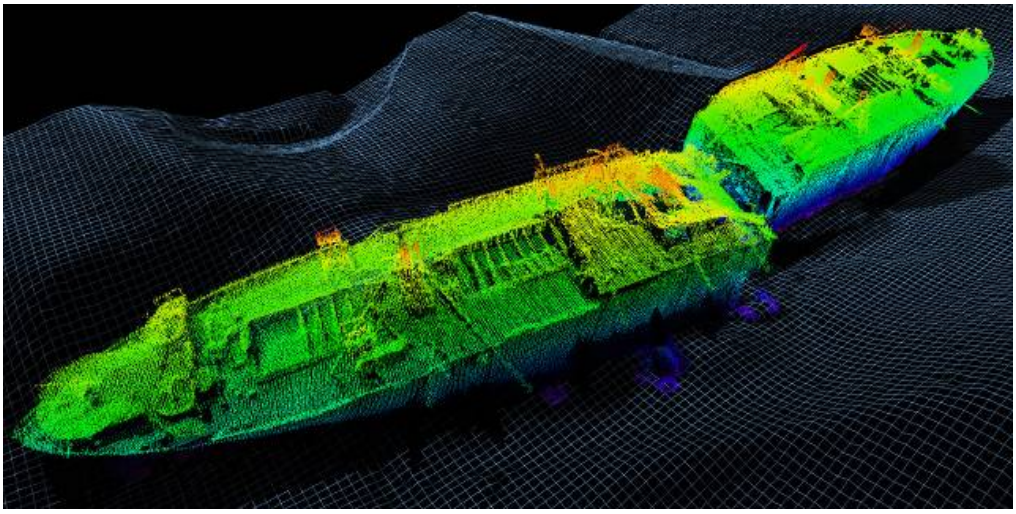


Fig. 3 - SS Richard Montgomery 2010 Point Cloud visualised in Fledermaus showing the bathymetry data coloured by height.

3. RESULTS

3.1 Overview

3.1.1 The data collected during the 2010 survey was of a high quality. The systems utilised were similar to those that have been employed in previous years so the clarity of the multibeam data as well as the positional data was expected to be as good as had been seen previously.

3.1.2 As the 2010 survey was conducted from a different vessel than previous surveys, a change in the 'Z' height value for the wreck was noted and was measured as approximately 30cm lower than in previous years. This overall change in height is related to the survey vessel set up and sonar head orientation. Once this shift of "Z" was applied, the data sets aligned well.

3.1.3 The 2009 survey utilised the tilted head capability of the survey vessel Galloper to insonify the sides of the vessel. The 2010 survey did not have that facility and comparison of the two data sets suggests that there are benefits to the tilted head capability.

3.1.4 The observations from this survey have been correlated against survey data from previous years and the ID numbers referred to in the text relate to the gazetteer of observations at Annex 1.

3.1.5 In general terms, the results of the 2010 survey clearly show that the list and pitch of the two sections of the vessel remain the same. The vessel continues to lay on a north south line with the bow of the vessel the most northward point. When compared with survey data from the previous year, the hull appears to be in a similar condition with only minor changes in some of the key features.

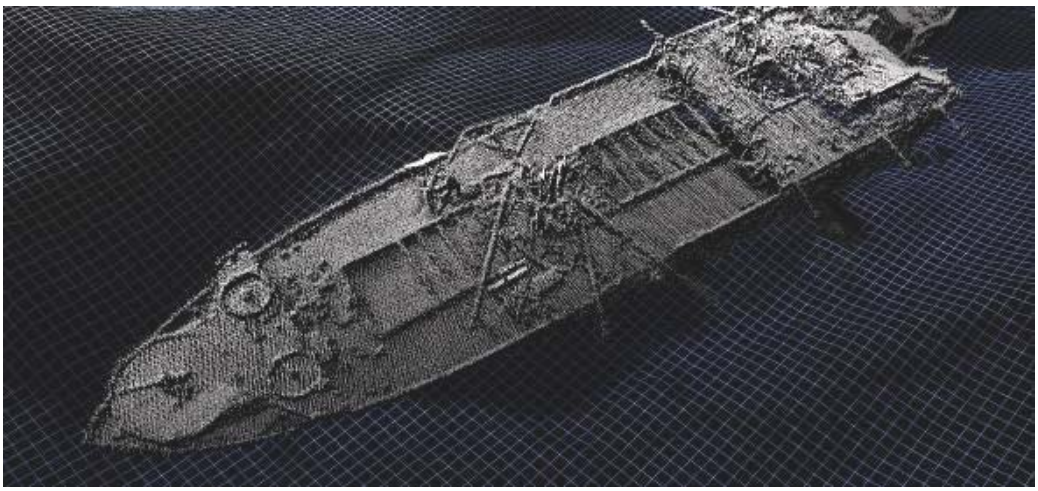


Fig. 4 SS Richard Montgomery stern section

3.2 Areas Highlighted by Previous Surveys

3.2.1 In previous surveys, four key areas have been identified as showing the greatest changes over time. These four areas are highlighted in fig.5 below and relate to:

1. the crack in the hull at hold 2
2. the drop in deck plating above hold 2
3. holes in the bulkhead aft of hold 3
4. crack in the hull plating on the starboard side of hold 4

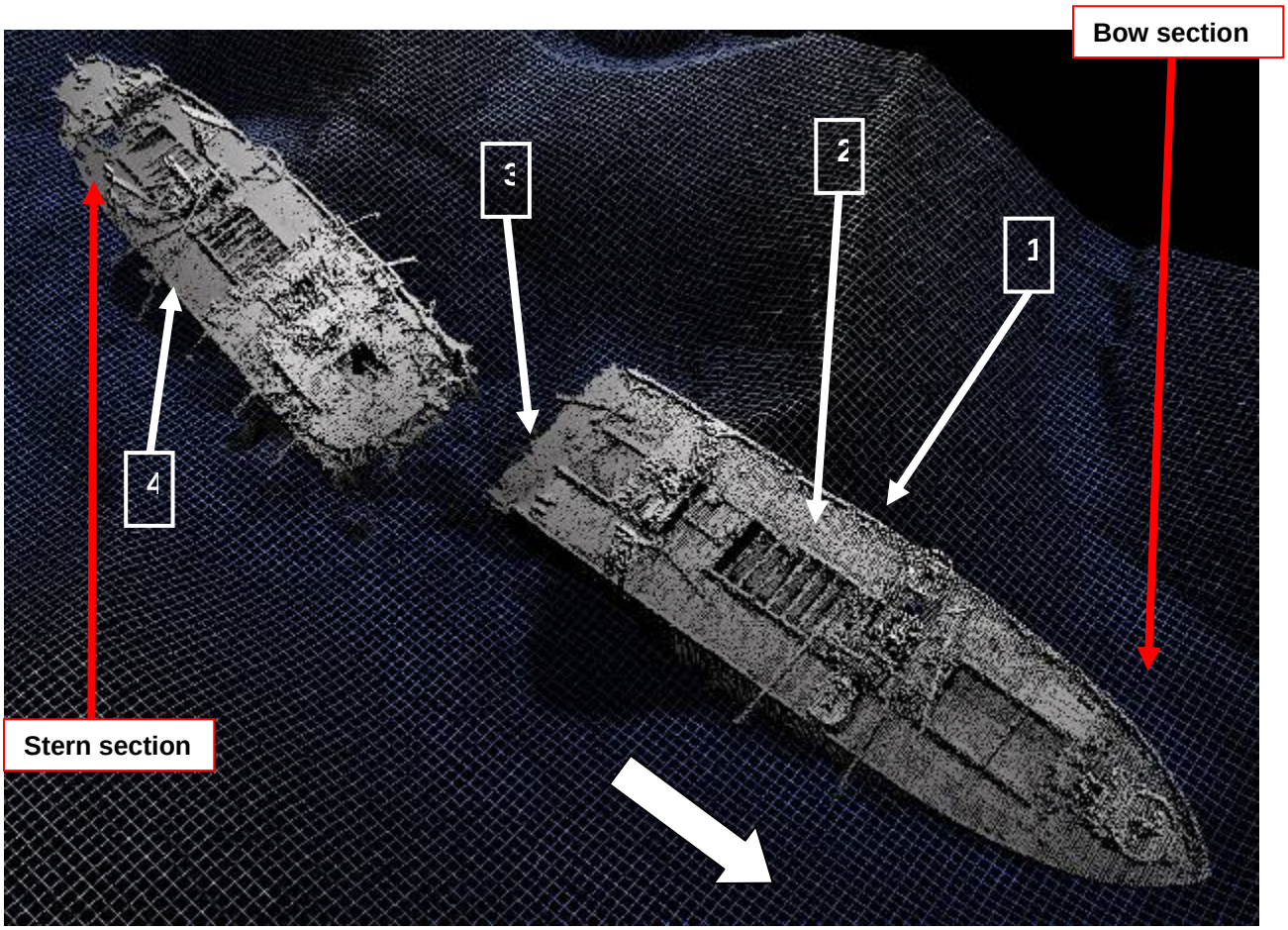


Fig. 5 - SS Richard Montgomery Overview with locations of key areas numbered.

3.2.2 The following sections detail the results of the 2010 survey as it relates to these four sections and highlight any changes in these features.

3.2.3 Area 1 – The crack at hold 2

The crack on the forward port side of the hull has been noted in surveys going back at least to the 1970s. When compared with data from 2009, the 2010

survey shows no apparent change in the size of this crack. The dimensions of the hole are approximately 1.27m by 2.20m.

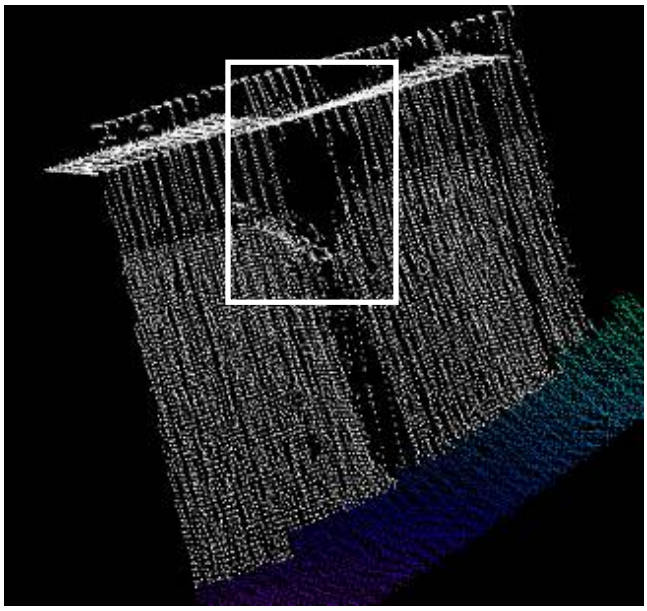


Fig. 6 - Area 1 – ID4 Crack in Hull on Forward starboard side.

The following images show 2009 data overlaid on 2008 data, and 2009 data overlaid on 2010 data. The colour difference allows for a visual interpretation of areas that have remained the same and areas where changes have occurred.

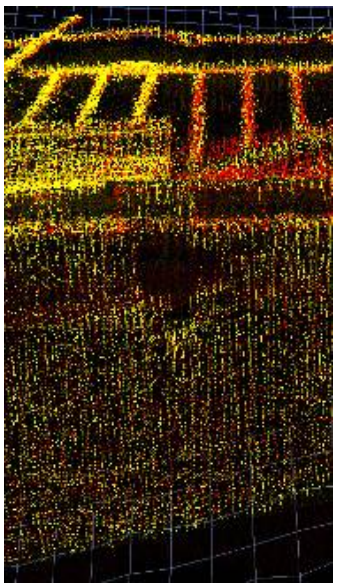


Fig. 7 Red = 2008 & Yellow = 2009

Fig. 8 Yellow = 2009 & Grey = 2010

3.2.4 Area 2 – The drop in deck plating at hold 2

The gradual collapse of deck plating above hold 2 is the section of the wreck which has shown the greatest change over time and the 2010 survey demonstrates that this continuing, albeit at an apparently slower rate than in 2008 and 2009. The collapse increased from 0.35m in 2006 to 0.5m in 2008 then to 1.10m in 2009 and now measures approximately 1.15m in 2010. Although the gradual collapse is continuing, the 2010 data potentially indicates a slowing in the rate of collapse or that it is being supported by another section of the hull.

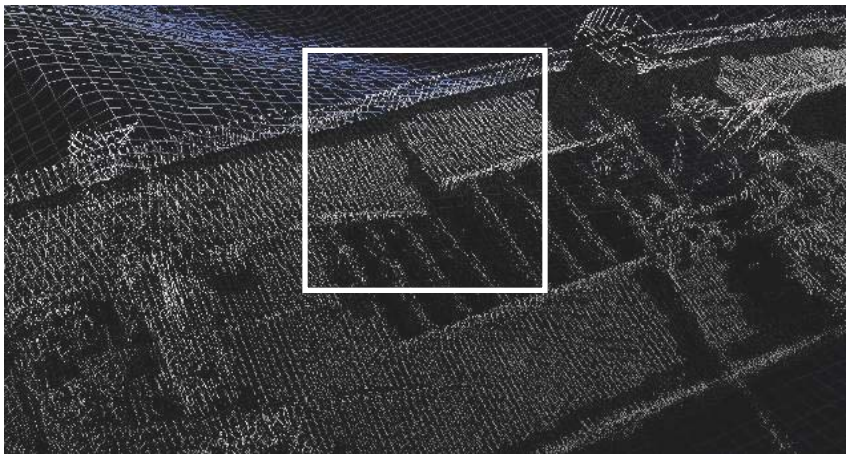


Fig. 9 - Area 2 – Deck plating at hold 2

The following images show 2009 data overlaid on 2008 data, and 2009 data overlaid on 2010 data. The colour difference allows for a visual interpretation of areas that have remained the same and areas where changes have occurred over time.

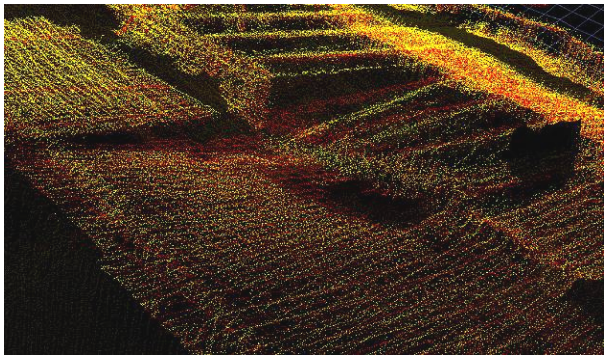


Fig. 10 Red = 2008 & Yellow = 2009

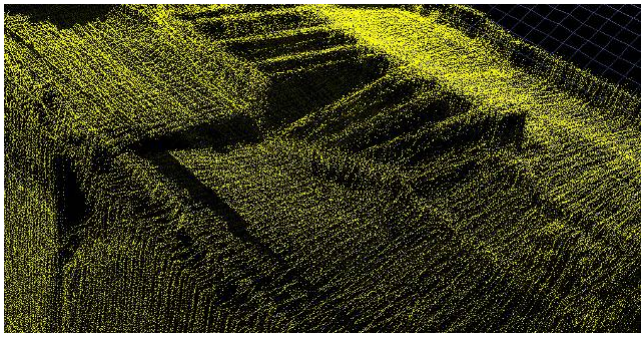


Fig. 11 Yellow = 2009 & Grey = 2010

3.2.5 Area 3 – Holes in the bulkhead aft of hold 3

The aperture on the aft starboard side of the forward section was unchanged in size in 2009 and, similarly, the 2010 data does not indicate any changes in this area of the wreck. The following images show the bulkhead from two different angles. Both are taken from the 2010 data set.

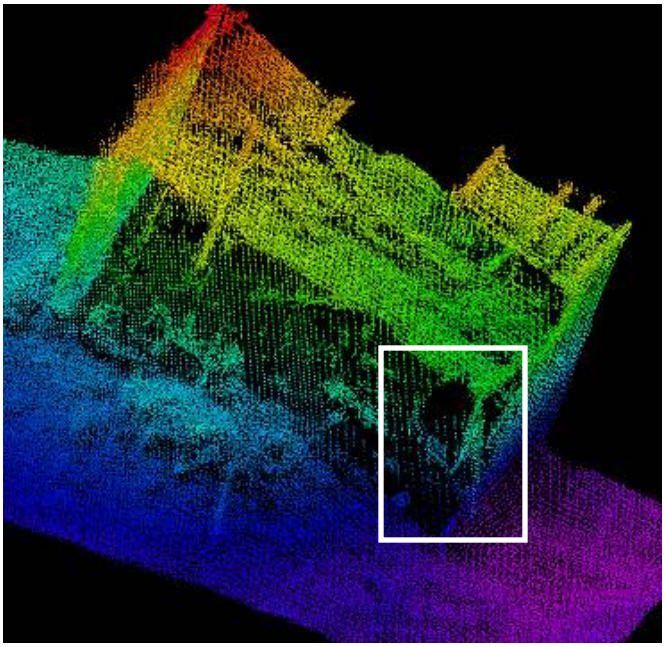


Fig. 12 Hole in bulkhead aft of hold 3, 2010

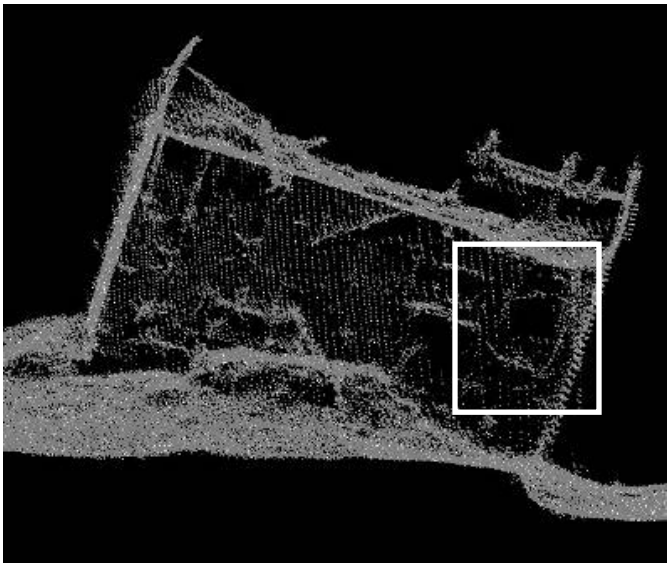


Fig. 13 Hole if bulkhead aft of hold 3, 2010

3.2.6 Area 4 - Split in hull plating on starboard side of hold 4

This split in the hull plating on the stern section of the wreck was identified in the 2009 survey using the multibeam unit in tilted mode. The 2010 survey data does not indicate any changes in this split. However, there was no tilted head function on the bow mounted sonar unit used for the 2010 survey and the density of data gathered in this awkwardly located area of the wreck makes it difficult to pick out the small detail of any potential changes.

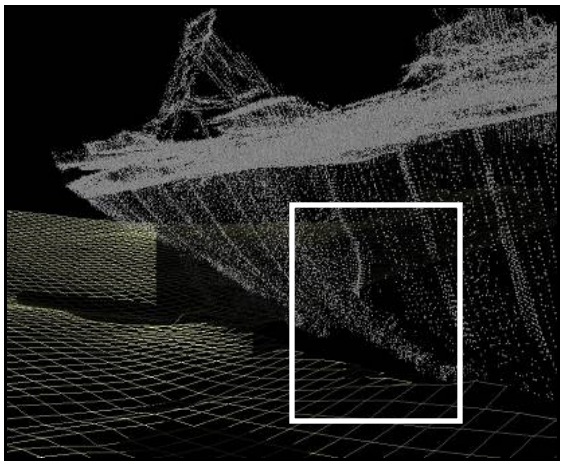


Fig. 14 Split in hull plating, stern section, 2009

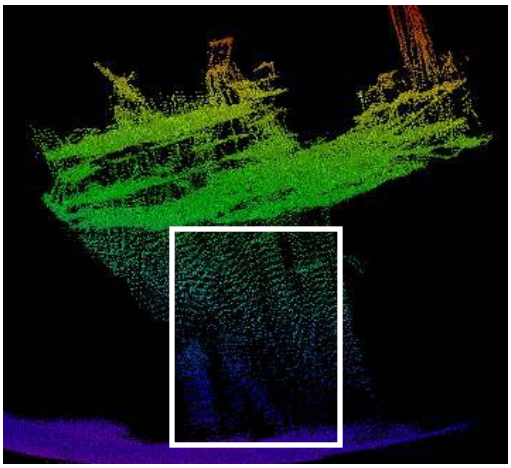


Fig. 15 Split in hull plating, stern section, 2010

3.3 Survey data comparisons over the rest of the wreck

3.3.1 The following sections detail the 2010 survey results over the rest of the wreck and the surrounding seabed. In general, very few areas of change were noted. Where areas of the wreck have not been specifically mentioned in the text below, this is because there was no change noted in the 2010 data set.

3.3.2 The bow section of the wreck has two masts. Both of these appear to be in place and near vertical in relation to the hull section. The 2010 survey did not note any changes to the masts when compared with 2009 survey data. This relates to visual and multibeam assessment only as there was no laser scanning as part of the 2010 survey.

3.3.3 The mast in the stern section of the wreck is also approximately vertical in relation to the hull and no changes were noted when the survey data for this area of the wreck was compared to the 2009 data set.

3.3.4 The various A-frames and gun tubs along the deck were all surveyed and compared with previous survey data. The 2010 survey data did not identify any changes from previous years. The stern gun also remains unchanged, with the barrel pointing upwards at approximately 19°. Similarly, the various cargo handling booms, anchors and propeller all remain unchanged in 2010.

3.3.5 The level of sediment build-up around the foot of the bow appears to remain unchanged from 2009, and the bow appears to be fully supported by the seabed as in 2009.

3.3.6 The buckling of the hull plating on the bow section of the wreck in the vicinity of the crack at hold 2 has been monitored throughout the multibeam sonar surveys. Although it is difficult to calculate specific measurements for this bulging, the 2010 data shows little sign of any change in this area and the bulging does not appear to have developed since 2009.

3.3.7 The 2008 survey data showed three holes in the port side gunwales adjacent to hold 2. In 2009, these holes appeared to be merging and the 2010 data shows that the holes remain in a similar condition to 2009.

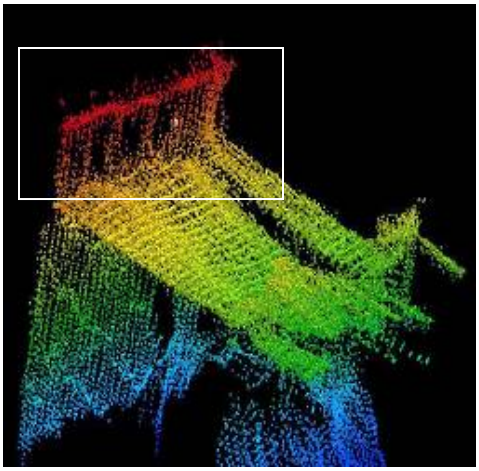


Fig. 16 holes in gunwales, 2008

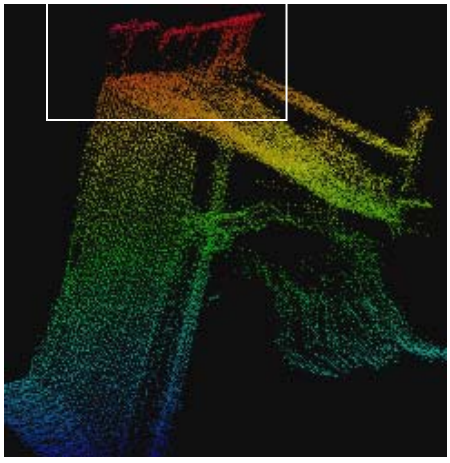


Fig. 17 Holes in gunwales, 2009

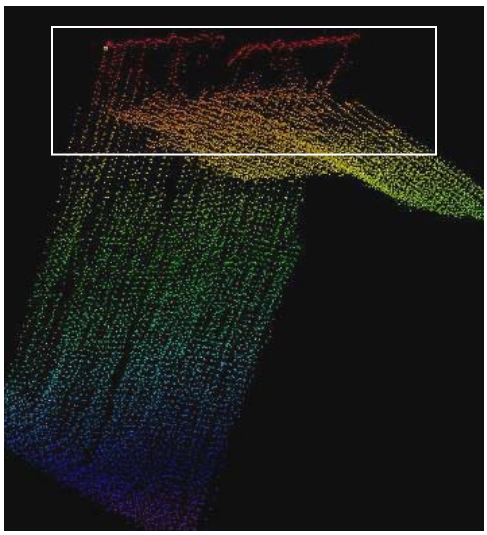


Fig. 18 Holes in gunwales, 2010

3.3.8 The survey data from 2009 appeared to show holes in the gunwales on the starboard side of the wreck adjacent to Hold 2. However, the 2010 survey data appears to show only the same holes present in 2008. This suggests that the holes that appeared in the 2009 data may actually have been shadows in the data.

3.3.9 Previous surveys have noted indications of the 'tween deck cargo visible in Hold 1. This is again visible in the 2010 survey data set and shows little evidence of change from the previous survey.

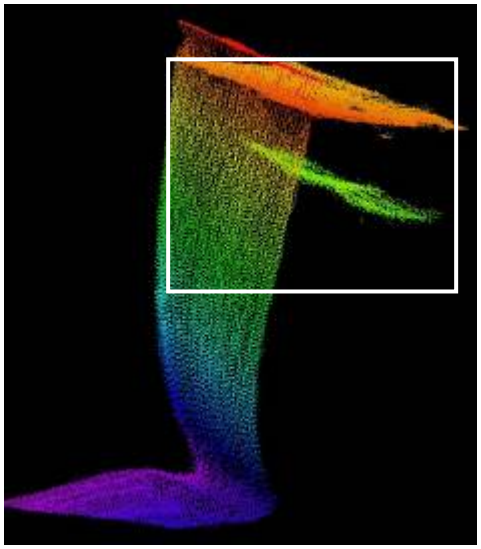


Fig. 19 'Tween deck cargo, Hold 1, 2008

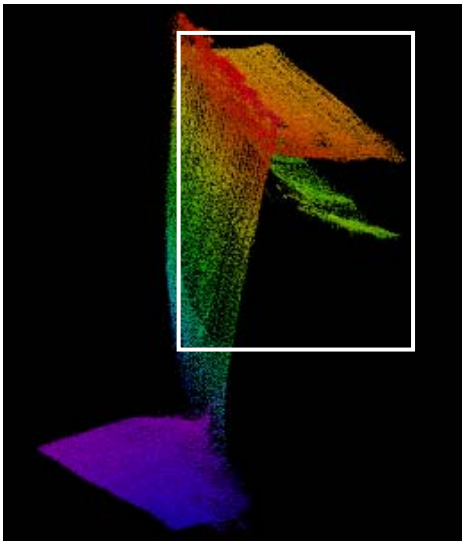


Fig. 20 'Tween deck cargo, Hold 1, 2009

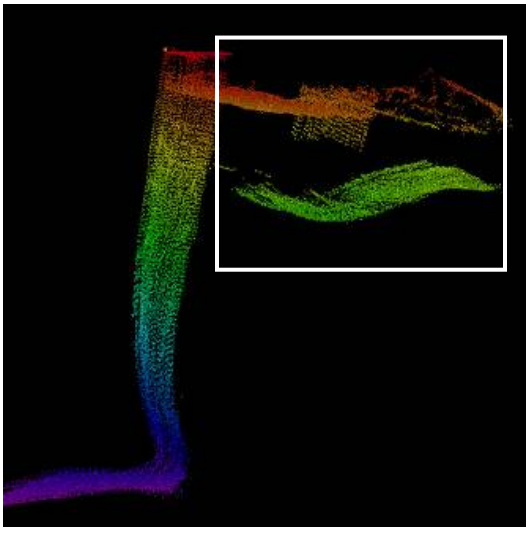


Fig. 21 'Tween deck cargo, Hold 1, 2010

3.3.10 Some ‘tween deck cargo has also been visible in Hold 3 in previous surveys. Hold 3 sustained significant damage when the vessel broke in two and sank and, therefore, the ‘tween deck area at Hold 3 is more open than the other holds. The 2010 survey data was also able to visualise general debris and cargo material in this ‘tween deck area, and it remains in a similar condition to previous surveys.

3.3.11 The images below show the damaged area at Hold 3 with two years of data overlaid in order to demonstrate any areas where change has and has not occurred.

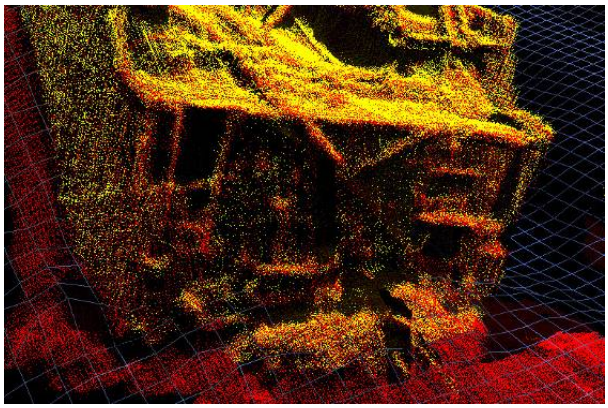


Fig. 22 2008 data (Red) – 2009 data (Yellow)

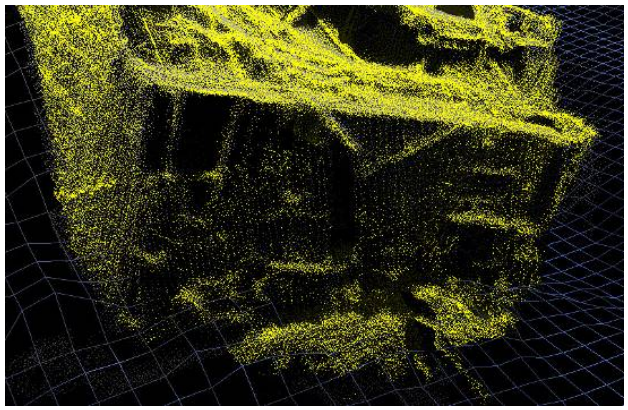
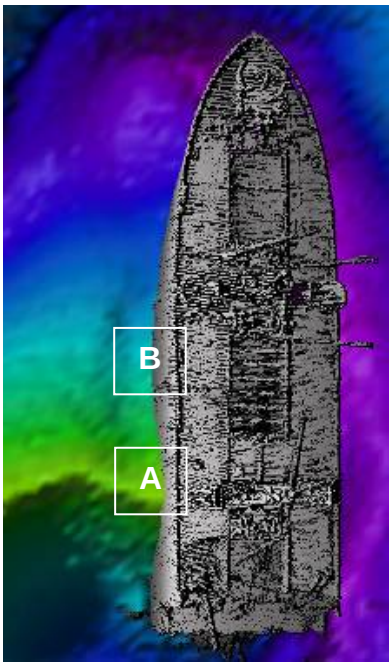


Fig. 23 2009 data (Yellow) – 2010 data (Grey)

3.3.12 In order to help assess whether the hull forward of the crack at Hold 2 is at a different orientation to the hull aft of the crack, vertical angles of the hull on either side of the crack were measured as part of the 2009 survey. This showed that there was a slight difference in orientation. This was repeated with the 2010 survey data. The results showed that, as in 2009, there is a very small difference in orientation forward and aft of the crack. This difference appears to have increased slightly since 2009.



2009 Data

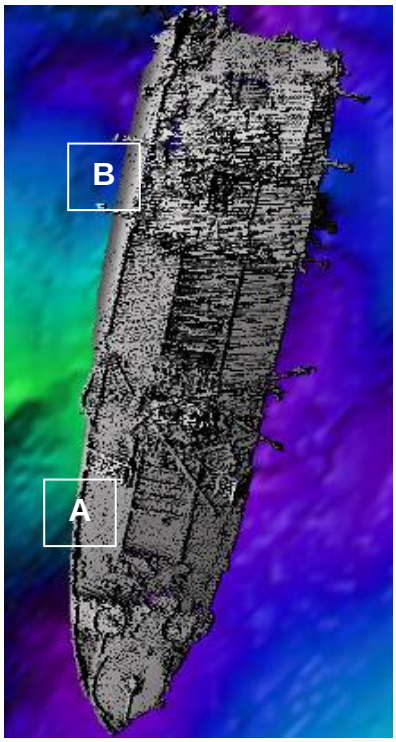
A = 20°

B = 18°

2010 Data

A = 21°

B = 17°



2009 Data:

A = 9°

B = 11°

2010 Data:

A = 10°

B = 14°

Fig. 24 Angle of orientation fore & aft of the crack at Hold 2

4. SEABED SURVEY

4.1 Seabed survey results

4.1.1 The seabed survey includes details of the scour and deposit patterns around the wreck.

4.1.2 The 2010 data shows that, in general, the surrounding seabed and features remain in a similar condition from those seen in 2009. There has been a slight removal of sediment from around the bow of the vessel on its starboard side and from around the stern on the port side. There appears to be slightly more deposition directly behind the wreck structure itself and into scours to the south of the wreck.

4.1.3 The scour pattern to the west of the wreck was identified as approximately 45m x 30m in 2009. The 2010 data shows that the scour pattern is still present and that its overall shape and position have remained constant over the year between the surveys. The dimensions are now approximately 45m x 35m.

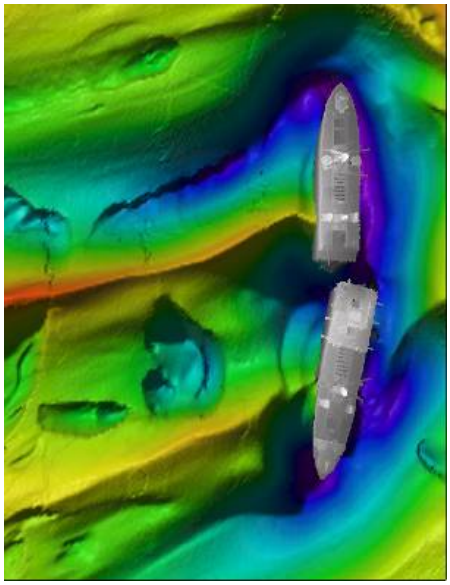


Fig 25. Scour pattern 2009

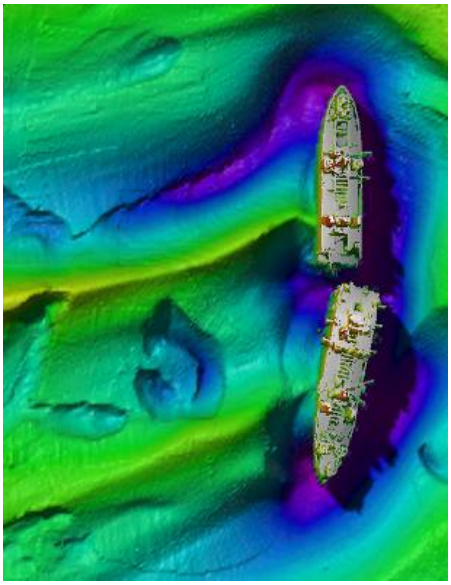


Fig 26. Scour pattern 2010

4.1.4 The distinct horse shoe shaped scour is still evident in the 2010 survey data. Directly to the north of this scour it appears that some of the sand wave has been eroded.

4.1.5 As was highlighted in previous reports, it is likely that the scouring of the sand around the wreck, caused by the speed of water as it flows around the vessel structure, has gradually allowed the structure to settle on the bedrock of

London Clay, and that there is probably no significant amount of sediment under the wreck itself. Both sections of the wreck list to starboard (upstream direction) which means some parts of the wreck are subject to greater forces to support it's own weight. The sandbanks forming on its port side are adding to the weight of the structure and are probably at least a partial cause of some of the deformation seen in both the bow and stern sections of the wreck.

4.1.6 The location of the major scours and areas of deposition remain the same with two distinct sand waves being formed by both the front and rear sections respectively. Between these is an area of scour that measures approximately 45m x 35m x 5m which remains constant in its overall shape and location.

4.1.7 The dredged channel to the south of the wreck shows some signs of increased deposition along its central length.

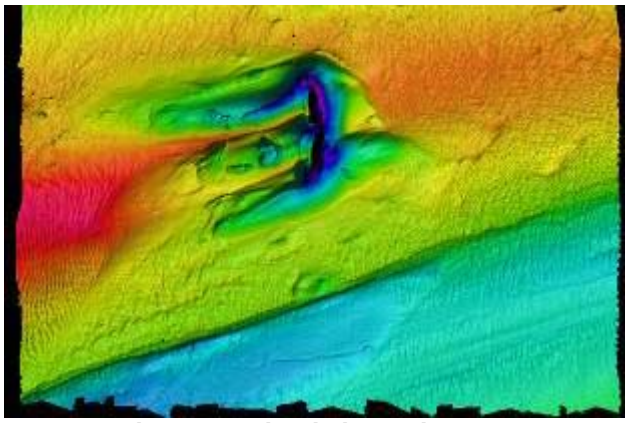


Fig 27. Dredged channel - 2009

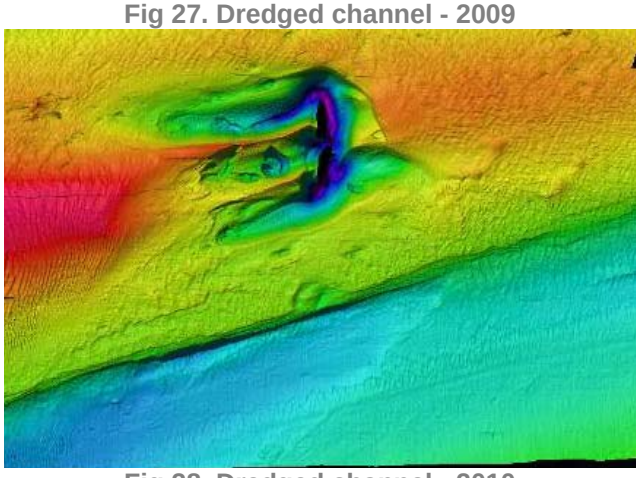


Fig 28. Dredged channel - 2010

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 The results of the 2010 survey show that the wreck of the SS Richard Montgomery remains in a similar condition to that found in 2009. The list and orientation of the wreck remain the same whilst only small changes are notable in the structure of the wreck and the surrounding seabed.

5.2 It would appear from checking the 2010 data against information gathered in both 2008 and 2009 that the rate of deterioration on some of the key features of the wreck, most notably the hold on the port side of the forward section, has slowed down. However due to the dynamic nature of the surrounding environment it is very difficult to make long term predictions regarding the future stability of the site itself.

5.3 Highlighted in the 2009 report were three key factors that would affect the future stability and deterioration of the site. These were the strength of the hull structure, the local environment around the wreck site and the condition of the munitions within the forward section.

5.4 The data collected during the 2010 survey of the SS Richard Montgomery shows only small signs of deterioration from the survey that was conducted in 2009. The wreck itself remains in exactly the same position with the same list and orientation. The hole on the port side of forward section remains unchanged from the survey in 2009. The area of collapse at Hold 2 shows only a very small sign of movement when compared to the previous year's data.

5.5 When compared with previous data sets, the results of the 2010 survey also suggested that using a sonar unit that can be tilted is likely to enhance data quality in some areas of the wreck. This is particularly relevant for areas of the hull where there is overhanging debris or where the angle of list might obstruct the view of a traditional downward facing sonar unit.

5.6 The area which immediately surrounds the wreck shows only small signs of change from the 2009 survey. The level of deposition and removal of sediment around the wreck remains small, but is most notable in and around the bow and stern sections. The scour that appears to the west of the vessel shows only small changes in its dimensions and characteristics.

5.7 Whilst the survey can visualise some areas of the cargo, the survey data cannot be used to predict the overall amount or condition of it.

5.8 It is recommended that monitoring of the wreck continues and that future surveys utilise a sonar head with a tilt capability where possible and are conducted in such a way as to ensure repeatability.