

SS RICHARD MONTGOMERY SURVEY REPORT 2003



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Executive Summary

1. The SS Richard Montgomery was a Liberty Ship which sank off Sheerness in 1944, carrying a cargo of munitions. The munitions were partly salvaged at the time, with approximately 1,500 tons of explosives still remaining onboard, in the bow section of the wreck.

2. Previous surveys show the wreck to be in a stable condition, and whilst the risk of a major explosion is remote, it is considered prudent to monitor the condition of the wreck by undertaking surveys on a regular basis.

3. The Maritime and Coastguard Agency undertakes surveys of the wreck on behalf of the Department for Transport, in order to assess the stability of the wreck and to observe any changes and monitor these for evidence of deterioration. Various types of survey have been undertaken over the years, including diver surveys, sonar surveys and hull thickness surveys.

4. In 2003 an ultra-sonic hull thickness survey was commissioned in order to determine any significant changes to the condition of the hull since the last diving survey in 1991. Also included was a study of the main cracks, the scour pits and the acquisition of a sample of hull plating.

5. This report into the condition of the wreck of the SS Richard Montgomery shows that there has been very little change in the hull thickness since the first ultra-sonic hull-thickness survey in 1981, although the stern area of the forward section appears to be eroding at a slightly accelerated rate due to its exposed location. Comparisons are drawn between ultra-sonic hull-thickness surveys commissioned in 1981, 1991 and 2003.

6. A study of the cracks in the hull shows some changes to the main crack by No 2 Hld. Hull material from the edges of this crack appears to have eroded away in the top 3 meters from deck level downwards.

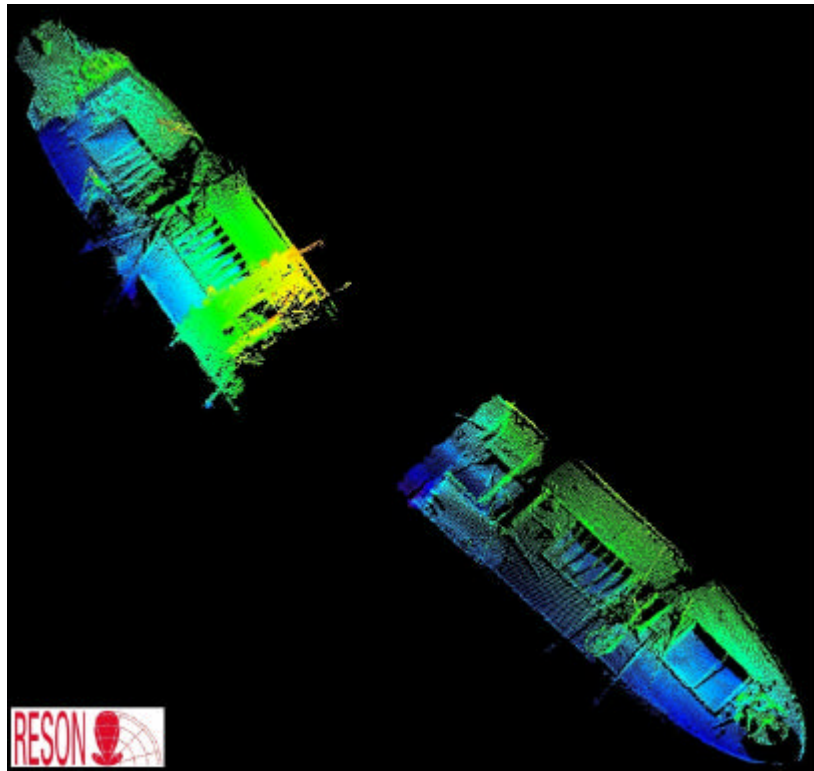
7. The scour pits below the bow and stern areas of the forward section of the wreck are not considered significant and should not compromise the stability of the wreck. In the past it has been suggested that the existence of a significant crack at No 2 Hold coupled with possible significant erosion under either end of the forward section of the wreck might lead to this section breaking into two parts. Given that the wreck is shown on current evidence to be well supported by the seabed along its entire length, this scenario is considered less probable than previously thought.

8. It is recommended that a further hull-thickness survey is undertaken in 10 years time, and that the main crack is monitored in the meantime for signs of widening or further erosion. It is recommended that future surveys continue to

use thorough and scientific methodologies in order to enable the future comparability of surveys.

Introduction

1. This report draws together information from surveys which have been undertaken on the SS Richard Montgomery since 1981. It focuses primarily on the ultra-sonic hull thickness surveys, but also includes a qualitative study of the progress of the main crack in the port bow section of the wreck, a study of the scour pits at either end of the forward section of the wreck and a metallurgical analysis of a sample of the hull.
2. The report focuses on the diver surveys which have been undertaken, rather than sonar surveys. However, an image captured via multi-beam sonar in 2002 is included to give an idea of the lay-out and orientation of the two parts of the wreck. The information provided in this report is based on the reports provided by contractors, and is augmented by video footage of the operations.
3. Operations on this site are hampered by poor underwater visibility and strong currents, making the survey of this wreck hazardous. Operations were carried out to the highest safety standards to ensure the safety of divers.



Multi-beam image of the SS RICHARD MONTGOMERY from 2002. As portrayed she is lying with her bow to the bottom right (north).

Background

4. The SS Richard Montgomery is a US Liberty ship which was carrying a large cargo of munitions during World War II. She grounded, split into two, and subsequently sank in 1944 off Sheerness. She lies across the tide on a sandbank, close to the Medway Approach Channel, with her masts protruding at all states of the tide. Salvage efforts at the time of the grounding removed approximately half of the munitions, but there are still approximately 1,500 tons of explosives contained within the forward holds.

5. The wreck is designated under Section 2 of the Protection of Wrecks Act 1973 and there is a no-entry exclusion zone around the wreck which is marked with buoys. It is also under 24-hour radar and visual surveillance by Medway Ports.

6. The Maritime and Coastguard Agency undertakes regular surveys of the SS Richard Montgomery to monitor the condition of the wreck. This has been achieved by a variety of methods, varying from the traditional diving surveys to, in recent years, a series of sonar surveys encompassing a wider area around the wreck. Hull thickness measurements have been undertaken approximately once per decade.

2003 Survey

7. The 2003 survey was undertaken on behalf of the Maritime & Coastguard Agency by Falmouth Divers Ltd.

8. The objective for this survey was to obtain ultra-sonic hull thickness measurements of the hull from set points along the port bow section. The munitions in the aft holds were salvaged at the time of sinking, so measurements of this part of the wreck were not considered necessary. The starboard side of the bow section has a number of pieces of overhanging debris, which could cause entanglement for divers, so with this in mind it was decided that measurements from the port bow section would be sufficient to inform the Maritime & Coastguard Agency of any significant changes to the hull. It is also in the port bow section of the wreck where a large crack has been observed and assessed over the years. The study of this crack was a further requirement for this survey. A study of the scour pits at either end of the forward section of the wreck was also undertaken in order to ascertain the level of seabed support for the wreck. In addition a small piece of the hull was to be removed for further metallurgical study.

Ultra-Sonic Hull Thickness Results

9. Measurements were taken at 7 m intervals, from positions: 1 m above seabed level, 600-900 mm below deck level, and 300 mm inside the gunwales on the deck.

10. Three methods of datum control were used to confirm positions and in order to aid repeatability on subsequent surveys as follows:

- i) datum lines hung from G-clamps at known points on the vessel
- ii) marked with a painted patch on the vessel hull with a circular steel area in the centre for the thickness probe,
- iii) this was backed up with a USBL acoustic positioning system, to guide divers to the appropriate site in poor visibility.

11. The results are as follows:

	Deck	Below Deck	Seabed level
Minimum	10.10 mm	08.70 mm	12.00 mm
Maximum	18.30 mm	16.70 mm	17.60 mm
Average	14.01 mm	13.70 mm	14.55 mm

Crack Survey

12. There is a crack in the port side of the forward section of the wreck, at No 2 Hatch, which runs up the hull and across the deck to the hold.

13. The 2003 survey identified that there is a gap in the gunwale of 22 cm at the top, reducing to 17 cm at deck level. The forward and stern sections are misaligned by 5 cm. The hull crack is 101.6 cm wide at 1 m below deck level and is 106.6 cm wide at 2 m below deck level. The crack was 15 cm at 3 m below deck level. At this point there was some debris protruding from the crack. At 4 m below deck level, the crack was 7 cm. At 5 m below deck level the crack was 6 cm. The crack closed completely at 16 cm below the 5 m mark. It is suggested that the central section of the Y – shaped crack may have broken away, to account for the larger crack size.

14. The deck crack associated with the hull side crack was measured 18 cm wide at 1.2 m from the gunwale. At 2 m from the gunwale it was 14 cm. The aft section of the plate was 15 cm lower than the forward section

Study of Scour Pits of Forward Section

15. A diver study of the scour pits at either end of the forward section of the wreck was undertaken to ascertain the level of seabed support. No significant scour was observed, with only a 0.5m gap at the foot of the bow.

Metallurgical Analysis of Hull Sample

16. Testing of the hull sample was carried out on behalf of the Maritime & Coastguard Agency by Bodycote Materials Testing Ltd.

17. A section measuring approximately 20 cm x 20 cm was acquired from the apex of the Y-shaped crack, at approximately 3 m below deck level during diving operations with a view to undertaking analysis of a section of the hull of the wreck.

18. Micro-examination of the section was carried out, at a magnification of up to x 1000. The micro-structure showed a coarse grain structure typical of rolled carbon steel. No significant defects were shown.

19. The centre of the plate was 10 mm thick, with corrosion accounting for up to 29% of the total thickness. At the edge, where the plate was thinner, corrosion accounts for up to 11% of the total plate thickness.

20. This is likely to represent a 'worst case scenario', as the sample was acquired from the edge of a break, which is exposed to wave and tide action and is therefore likely to be more degraded than other parts of the hull. These results provide some information about levels of corrosion, but given the exposed nature of the location of the sample, these results could not be used to extrapolate corrosion levels for the wreck as a whole, especially since original plate thickness would have varied across the hull.

1991 Survey

21. The survey was undertaken on behalf of the Maritime & Coastguard Agency by Shiers Services Ltd

22. An ultra-sonic hull thickness survey was undertaken on the port side of the wreck as well as a survey of the cracks in the hull.

Ultra-sonic Hull Thickness Results

23. Measurements were taken at 7 m intervals at 1 m above seabed level, at 600-900 mm below deck level, and 300 mm inside the gunwales on the deck.

24. The results from the bow section are as follows:

	Deck	Below Deck	Seabed level
Minimum	06.10 mm	04.00 mm	10.20 mm
Maximum	14.20 mm	14.80 mm	18.90 mm
Average	11.28 mm	12.80 mm	14.03 mm

Crack Survey

25. The 1991 survey stated that "Much of the hull plate particularly in stern section is badly corroded and easy to break away by hand. Area of crack has general buckling of plates in bank approx 3 m wide. Gap 50 cms at greatest point. Plate on stern section completely corroded. Strengthener can be felt in bow section. Difference in deck levels at split are 14 cm. Stern section lower than bow section."

1981 Survey

26. This survey was undertaken by the Royal Navy.

Ultra-sonic Hull Thickness Results

27. Measurements from this survey are not directly comparable with subsequent surveys as no record was made of the methodology, and the measurements locations appear to be somewhat arbitrary. However, it still provides an indication of hull thickness at that time.

	Deck	Hull
Minimum	08.70 mm	05.40 mm
Maximum	21.30 mm	23.40 mm
Average	15.40 mm	13.40 mm

Crack Survey

28. The 1981 survey states that “The split is 5 cms wide at the hatch coaming and widens to 10 cms across the port side of the deck, breaks the bulwark (at the corner of a freeing port) and grows down the ship side widening to a 15 cms gap before disappearing into the silt level 6 metres below bulwark level. Plating is buckled with splinter fractures to a width of 1 metre on each side of the gap. On the Main Deck, the plating on the forward side of the gap in the region of the port scupper is now 7.5 cms higher than the plate opposite.”

Analysis and Comparison of survey results

29. The main constraint on any conclusions drawn from this summary report on the past three ultra-sonic hull thickness surveys, must be the varying positioning methodologies used, which casts some doubts over the comparability of the results. It is clear, however, that little consistent change can be seen which indicates dramatic changes to the hull thickness. The 2003 survey suggests that the greatest levels of erosion are taking place at the exposed stern area of the forward section.

Ultra-sonic Hull Thickness Results

30. There appears to have been very little change to the thickness of the hull since 1981 when the first ultra-sonic hull thickness measurements were taken, which seems to indicate that the hull appears to be in a relatively stable condition.

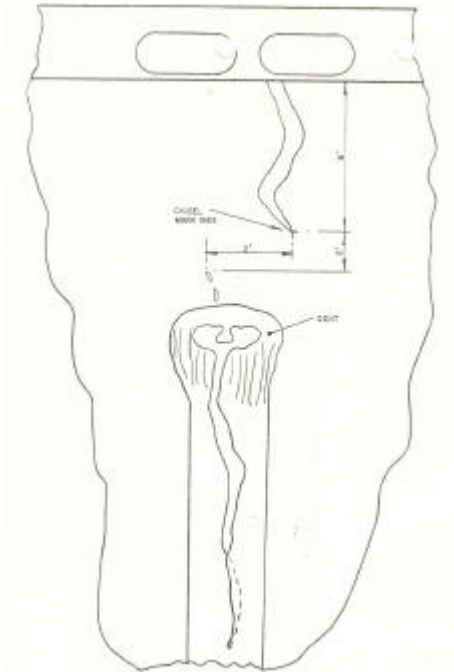
31. The average readings for the past surveys are presented below:

	Deck	Below Deck	Seabed level
2003	14.01 mm	13.70 mm	14.55 mm
1991	11.28 mm	12.80 mm	14.03 mm
1981	15.40 mm	13.40 mm	13.40 mm

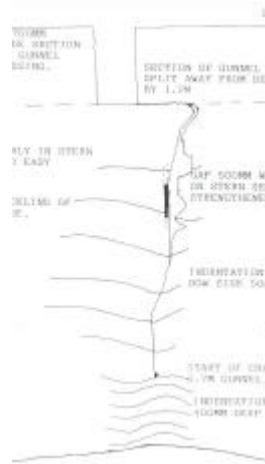
Crack Survey

32. There are drawings of the main crack at No 2 Hold from 1985, 1991 and 2003. These are presented alongside each other in order to give an idea of the changes over time. It will be observed that the crack has increased in width in the top three metres below deck level. However, there appears to be no significant increase in size below three metres. This suggests material falling away due to erosion around the break, rather than movement in the hull itself. From the drawings there appears to be some discrepancy over the size in the break in the gunwale. This may be due to either a misinterpretation on site (given the poor visibility) or may represent an actual change due to a shift in the wreck, though this seems unlikely as the deck crack has not materially changed in the last 10 years, and the lower part of the main crack does not appear to have altered.

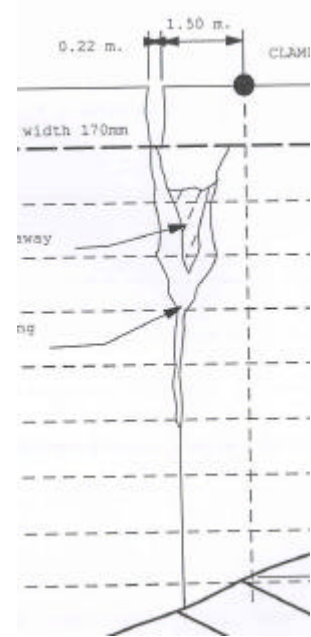
1985



1991



2003



Main crack on port side from surveys in 1985, 1991 and 2003. Approximately to scale

Conclusion and Recommendations

33. The ultra-sonic hull thickness survey results from 2003, when compared with the surveys from 1981 and 1991, show that there has been little appreciable change to the thickness of the hull plating of the Richard Montgomery in the last 22 years. The hull plating appears to be relatively stable and does not seem to be eroding unduly, although the stern area of the forward section at the break is considered to be eroding at a faster rate due to exposure to tidal action.

34. Some change in the main crack at No 2 hold has been observed, with some peripheral material eroding away, due to exposure to tide and wave action. The sample of hull plating, when analysed, showed that levels of corrosion of this section from the edge of the main crack varied from 11% to 29%. These findings cannot, however, be used as a measure of corrosion levels over the wreck as a whole, due to the exposed location of the sample.

35. It is recommended that another ultra-sonic hull-thickness survey is undertaken in 10 years time in order to monitor any change. The same methodology should be used as in the 2003 survey to ensure comparability.

36. It is recommended that a further detailed survey of the main cracks is commissioned in due course to monitor any further change to the cracks.

37. It may also be worth considering undertaking further sampling and metallurgical analysis on a more widespread basis in the future to gain a fuller picture of the corrosion of the hull plates. This would need to be undertaken using a set methodology which would enable comparison with original hull thickness measurements.

38. Any future surveys of the hull, whether through ultra-sonic measurement, or through sampling and metallurgical analysis or any other type of survey, must continue to be undertaken with the most rigorous methodology to ensure comparability of surveys. This is fundamental to the ability to record and assess changes to the wreck.