THE WRECK OF

THE SS
RICHARD MONTGOMERY

A SUMMARY REPORT

The COASTGUARD Agency

an Executive Agency of the

Department of Environment, Transport and the Regions

29 September 1997

COASTGUARD

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INTRODUCTION

1. The SS RICHARD MONTGOMERY grounded and split in two off Sheerness in 1944 whilst carrying a cargo of bombs.

2. A large part of the cargo was successfully recovered at the time. No explosions occurred when the ship grounded or during the subsequent salvage operation, and none have occurred since.

3. It is probable that some of the munitions remaining on board are still capable of detonation but the likelihood of a major explosion is remote. Experts have consistently advised that the best way to keep the risk to an absolute minimum is to leave the wreck alone. The site is therefore designated a prohibited area under the Protection of Wrecks Act 1973.

4. Whilst the risk of a major explosion is remote, it is considered prudent to monitor regularly the condition of the wreck. Therefore routine surveys have been undertaken to assess the condition of the wreck and to check for any new signs of possible danger.

5. Until 1984 surveys were carried out by Ministry of Defence (MOD) salvage divers. In recent years the surveys have been undertaken by commercial diving contractors, working under MOD supervision. Following the 1993 survey, in view of the limitations placed on such methods by the poor visibility under water at the site, and on the recommendation of the MOD Salvage Organisation, it was decided that full advantage should be taken of the major advances in sonar technology, in preference to the use of diving surveys.

6. This survey, in 1996 was conducted on behalf of the Coastguard Agency (an executive agency of the Department of Environment, Transport and the Regions) by Sonar Research and Development Ltd of Beverley. It is the first of a series of three annual surveys to be undertaken by the company, following an initial survey carried out in 1995, and was completed in September 1996 under the supervision of the MOD's Salvage Organisation.

THE COASTGUARD AGENCY'S CONCLUSIONS AND RECOMMENDATIONS FOLLOWING THE 1996 SURVEY OF THE WRECK

THE EXISTING POLICY OF NOT DISTURBING THE WRECK

7. There is no evidence from the latest survey to change the consistently applied policy of not disturbing the wreck - that this remains a safer course than attempting to clear it. The survey has shown that the wreck continues to deteriorate slowly and that the tidal regime and seabed scour surrounding the wreck is imposing strains on its structure. It is possible that, due to the continual deterioration, other breaks in the hull could occur.

8. Following the 1996 survey a review was made by the Defence Evaluation and Research Agency of the information available as to the probable condition of the munitions still remaining in the wreck. The review concluded that the munitions would retain their explosive power but would be no more sensitive than in their normal state. Any fuses present in the wreck would have deteriorated to the extent that they were no longer functional. The white phosphorus filling of the smoke bombs is stable under water but is capable of spontaneous ignition if exposed to the air.

   RECOMMENDATION: that the wreck should remain undisturbed.

THE CONTINUAL OBSERVATION OF THE WRECK

9. The wreck remains under close observation under a contract let by the Secretary of State for Transport to Medway Ports to provide for the continual 24-hour guarding of the wreck. The Company are well placed and equipped to undertake this role and the contract has been operating to the Secretary of State's satisfaction.

   RECOMMENDATION: that the continual close observation of the wreck be maintained.

THE CONDITION OF THE MASTS AND DERRICKS

10. As a result of the survey in 1993 it was stated that the condition of the masts and derricks was such that serious consideration should be given to removing them in an attempt to stabilise the surrounding deck areas.

11. Advice was sought from MOD who made an inspection of the masts which found that they remained sufficiently robust to leave largely undisturbed, subject to ongoing inspection during subsequent surveys. As a consequence it was clear that the existing warning notices placed on the wreck could also remain in place.

RECOMMENDATION: that the masts, derricks and warning notices remain in situ, subject to ongoing inspection during subsequent surveys.

THE 1996 SURVEY OF THE WRECK

12. From time to time over some 20 years, and on the recommendation of the Committee on Hazardous Wrecks, surveys of the wreck have been arranged in order to monitor conditions. The most recent survey was conducted in September 1996 by Sonar Research and Development (SRD) Limited under contract to the Secretary of State for Transport. The survey was organised by the Coastguard Agency and was supervised by the Chief Salvage Officer to the Ministry of Defence (Navy). The survey made use of a high resolution electronic scanning sonar system developed by the contractor and linked to a microprocessor system to produce a detailed survey of the seabed, over a wide area in the vicinity of the wreck. Both the MOD and the Coastguard Agency were satisfied that the survey was properly and competently carried out in compliance with the contract.

SUMMARY OF THE SURVEY

13. Equipment was installed on the survey vessel on 25th September 1996 at Great Yarmouth. This operation was completed by two engineers from SRD. The system was fully checked and calibrated ready for the survey to commence on 26th September 1996. After a short period of sea trials the vessel made its way to Sheerness.

14. The requirement to fully survey the wreck of SS RICHARD MONTGOMERY and an area of 400 metres around it was met.

A series of close sonar runs around the wreck and over the top of it were conducted. This produced a large quantity of data enabling a detailed analysis of the wreck's disposition to be undertaken. The 1996 survey also benefited from the considerable technological gains made in Kinematic DGPS navigation systems during the previous year.

The wreck's orientation and position remained unchanged from the 1995 survey. The differences between the 1995 survey and the 1996 survey are summarised below:

Seabed material was accumulating particularly to the west of the middle of the forward section and directly to the north and south of the wreck outside of the 10-metre contour.

Seabed material had also been lost. Scouring had modified the seabed topography since 1995 with an increase in scour depths at the bow, the stern and in the vicinity of the break, and along the seabed adjacent to the eastern

side of the wreck. Using the 1995 survey area as a base value a net loss of 10, 084 cubic metres of material had been measured, with the majority of the lost material being within a 200m radius of the wreck.

The area of seabed supporting the after section of the wreck had increased by 1% since 1995. The area of seabed supporting the forward section had increased by 11% since 1995.

The anomalies in the structure of the wreck recorded in 1995 were all detected again in 1996. The increased volume of data on the wreck, the use of a more accurate navigation system and improved techniques enabled the anomalies to be reported in greater detail. No significant changes were detected between 1995 and 1996.

15. Weather

The survey was carried out during a period of increasing south westerly winds. The survey area was in the lee of the Isle of Sheppy and sea conditions remained workable throughout the duration of the survey, although some weather helm was carried.

16. Shipping

The survey area lies at the eastern extremity of Sheerness Middle Sand and is to the south of the Great Nore anchorage and north of the Medway Approach Channel. During the course of the day there were several shipping movements, none of which impeded survey operations.

DETAILS OF THE SURVEY

17. SCOPE OF WORK

An area of 400 metres was surveyed around the wreck in directions except the south. Following discussion with the MOD Salvage Officer the requirement for the southern limit of the survey area was determined to be the Medway Channel. The wreck was examined in detail, and no loose material on the seabed adjacent to it was detected. However, an area of small contacts in the midway break of the wreck was detected at the post processing stage. The position of the wreck structure prevented the full identification of those contacts, which could be a seabed feature, an indication of further deterioration of the wreck or material spilling from it.

18 ANALYSIS OF THE SURVEY DATA

The SS RICHARD MONTGOMERY ran aground on Sheerness Middle Sand in 1944. Since her grounding, the presence of the wreck had caused localised changes in the seabed topography. The most noticeable change is the scouring that has occurred around the wreck. Scouring has caused the wreck to settle into the seabed and has had the effect of making the wreck appear to sink into the seabed profile.

19 In general hydrographic surveys have shown that sand banks are at their shallowest over neap tide periods. This survey took place over the spring tide period to ensure that the survey vessel could pass over the wreck in safety at high water. Therefore the depths obtained over the shallowest parts of the banks may not necessarily be the least depths.

The survey showed that the 15-metre contour is more extensive than shown on the published chart. This contour now extended some 10 to 30 metres from the east side of the wreck into two elongation's to the west side of the wreck. On the east side, the contour is at its maximum distance from the wreck opposite the centre part of each section. The elongation at the stern extends some 80 metres from the bow on a bearing of 238°, at the stern the elongation is shorter at only 25 metres to the south west. From the colour contour plot (ANNEX D) it can be seen that the shallowest parts of the wreck are at a similar depth to the shallow parts of the Sheerness Middle Sand.

A monochromatic gradient plot at ANNEX C reveals details of the ship's structure. This plot also reveals details of small seabed topographical features such as sand ripples over the area.

When compared with the 1995 survey, which was also carried out at Spring tides, it can be seen that the scouring process which had effectively "sunk" the wreck over the last 52 years is continuing.

20 COMPARISON WITH 1995 DATA

This section of the report examines the differences between the 1996 survey and that conducted in 1995. In general the majority of differences of depth of the seabed are small and within 0.25 metres. These small differences could be accounted for by differences in tidal conditions, differences in meteorological conditions, and instrumental precision. This data shows the high level of precision and repeatability that can be expected with the Seabed Visualisation System. Differences in excess of 0.3 metres probably represent real changes in seabed topography.

The following features within the survey area may be observed from the solid contour plot (ANNEX D):

The Wreck Site
The Medway Dredged Channel
The Sheerness Middle Sand
The Great Nore Anchorage.

a. The wreck site occupies the central part of the survey area. This area is enclosed by the 9-metre contour and may be considered to be the area of seabed topography most influenced by the presence of the wreck.

b. The Medway dredged channel occupies the southern part of the survey area, which is orientated in the region of 072°/252° and is bounded by the southernmost 9-metre contour in the survey area.

c. The Sheerness Middle Sand occupies the central part of the survey area. This sandbank is most extensive in the western part of the survey area, it is broken by the wreck site and continues to the east of the wreck site. The 6- metre contour of this feature is continuous to the north, and to the south this feature is continuous along the 8-metre contour.

d. The Great Nore Anchorage forms a north-eastern boundary to the survey area.

Over the years the most significant changes have occurred at the wreck site and in the area of the Sheerness Middle Sand adjacent to the central part adjacent to the port side of the forward section of the wreck.

21 DIFFERENCES AT THE WRECK.

No significant changes in position or orientation of the wreck were observed as a result of the 1996 survey. From the comparison plot and contour plots it could be seen that the depth of scouring to the east of the wreck site had increased markedly almost along the entire length of the wreck, reaching maxima at the break and at the bow and stern. It was also noteworthy that some deposition had occurred to the west of the wreck at the centre of the forward section. This deposition could be seen as an extension of the western part of the Sheerness Middle Sand.

By observation of the area in contact with the seabed it appeared that the aft section was virtually unchanged and the forward section was supported by another 56.32 square metres of material.

In 1996 a greater debris area was detected in the vicinity of the break in the wreck. This area of debris was to be expected. The possibility that the debris was present but remained undetected in 1995 could not be ruled out. Therefore the 1996 survey should form the base level from which further comparisons of the anomaly can be made during subsequent surveys

22 FINDINGS

As a result of the 1996 survey, the following findings could be stated:

a. The wreck remains a significant influence on the seabed topography of the survey area.

b. A proportion of the increase in scouring reported in 1996 may be attributed to the effect of stronger tidal streams experienced around the autumnal equinox.

c. Further scouring may undermine the wreck, which could have an adverse effect upon its integrity.

d. The contractor's Seabed Visualisation System had shown good repeatability and a very valid comparison had been made with the 1995 survey results.

23 It was not possible to prevent any changes occurring to the wreck because of its size and condition and the danger which would be caused by any deliberate interference with it.

24 It was clear that the site of wreck should remain undisturbed and continue to be designated a prohibited area under the Protection of Wrecks Act 1973, under the close observation of the Medway Ports. The conditions did not exist for a "controlled" explosion nor for the clearance of the wreck.

COASTGUARD

1. TECHNICAL DESCRIPTION OF SURVEY OPERATIONS

The vessel was mobilised at Great Yarmouth, and the tide gauge and Kinematic DGPS base station were established at Sheerness on 25 Sept. After a short period of sea trials, MV Greyhound Tracker made passage to Sheerness. Survey operations started on 26 September with a confidence check whilst alongside. The vessel then sailed for the work site which is some two miles north east of Sheerness. System calibrations were completed in just over an hour. Once the calibration factors had been computed and checked, their values were entered into the Seabed Visualisation System and the survey was started.

The survey was conducted using pre-set north/south run lines. Two sets of line data were generated; one set to cover the whole area at a 15-metre interval, and another set to cover the wreck examination area at a 10-metre interval. Each line was identified with a number and a total of 56 lines were generated to cover the whole survey area. Twelve shorter lines, at 10-metre intervals, were generated to cover the immediate vicinity of the wreck, these too were numbered.

Over the period of high water a series of high resolution passes were made around the wreck using the port transmitter only. Run lines closest to the wreck were conducted at either slack water or down tide. Two sets of transverse lines at standard resolution were run across the wreck at the Master's discretion.

MV Greyhound Tracker transferred 60 metres when reversing course. Therefore to exploit her handling characteristics every fourth line was sounded during the first sweep of the area, then every second line was used to infill gaps. Further infill was carried out as required, although some gaps in coverage were apparent in the shallow areas. The area immediately to the west of the wreck was sounded before high water. The wreck was surveyed over the high water period. The area to the east of it was sounded after high water and finally the area to the west to cover Sheerness Middle Sand was surveyed last of all. Any remaining gaps were infilled by conning the vessel around a coverage display.

Small gaps in coverage may have been present in the vicinity of buoys and especially in shallow water. The final part of the survey was conducted towards a very low water, greatly increasing the risk of grounding the transducer arrays and small gaps in the shallow areas were the result. These gaps did not have a detrimental effect upon the achievement of the aims of the survey.

Tidal streams were not measured, but by observation it could be seen that they were setting strongly approximately east/west. The set of the tidal stream could be easily seen on the buoys which mark the danger area around the wreck. In consultation with the master, the vessel worked on the downtide, or "safe" side of the wreck.

2 GEODETIC CONTROL

The survey was referred to the WGS 84 Datum, WGS 84 Spheroid, and plan data was presented at various scales on the Transverse Mercator projection using the Universal Transverse Mercator Grid Zone 31(Central Meridian 3° East).

3 NAVIGATION

Primary positioning was provided by an Ashtech Z-12 RTZ Kinematic DGPS system consisting of 1 base station and 1 rover station. The base station was positioned at Sheerness Signal Tower trig 51° 26' 47".0169 N 000° 44' 39".7054 E. Secondary positioning was supplied by a Scorpio DGPS system. The Kinematic DGPS was used exclusively for this task.

4 SOUNDING DATUM AND TIDE GAUGE

Chart datum at Sheerness, 2.90 metres below Ordnance datum Newlyn, was chosen as the sounding datum. Data was reduced to sounding datum using tidal data from Sheerness, no co-tidal data was used. On line tide readings were obtained using a radio link to an SRD portable tide gauge, whose datum was referred to the tide gauge at Sheerness. The tidal data was compared with data from the permanent tide gauge at Sheerness, and a good agreement was obtained.

5 SEABED VISUALISATION SYSTEM

The Seabed Visualisation System provides a continuous electronic scan of the seabed. This system was configured with three sets of transducers designated centre, port, and starboard. The port and starboard transmitters were high resolution, and the centre transducer was standard resolution. The whole area was surveyed using standard resolution. A detailed high resolution survey of the wreck was carried out over the high tide period.

The transducer array was attached to a hinged pole which was supported by an aluminium cross beam. The rig was further supported by a gate which held the array in position. When out of water the weight of the array and pole was supported by a block and tackle and further secured with rope sea lashings.

6 PERIPHERAL INSTRUMENTS

The following peripheral instrumentation was used:

Heading	Brown SGB1000 portable gyro
Motion	TSS335b
Position (Primary)	Ashtec Z-12 RTZ Kinematic DGPS
Position (Secondary)	Scorpio Marine DGPS system
Tide	SRD portable tide gauge.

7 CALIBRATION

The system was calibrated by comparing data sets taken on the same ground on reciprocal courses. Two sets of lines were run, with the second data set being perpendicular to and crossing the first. The data was then processed to compute the calibration factors. By adjustment of the transducer offsets swathe matching was achieved and these values were used for the survey.

The gyro was checked alongside at Great Yarmouth upon mobilisation, and found to be ½° high. A check against the transit formed by the leading lights at Great Yarmouth confirmed this. A closing check at Great Yarmouth on 27 September also found the gyro to be ½° high.

A sound velocity of 1508 m/sec was used.

8 DATA GATHERING

The Seabed Visualisation System stores raw data and on line processed data on 500 Mbytes discs. Data was gathered at a position resolution of 20 cm for standard resolution data, and at a positional resolution of 10cm for high resolution data. Both data sets were gathered with a vertical resolution of 1cm.

9 ON LINE DATA PROCESSING

The data was processed on line to give an assessment of data coverage and quality. Further data processing to remove noise spikes and to compose high resolution representations of the wreck was carried out at SRD's premises. The post processing separates the standard resolution data from the high resolution passes around the wreck

10 SEABED-POST PROCESSING

All seabed and wreck data was processed at standard resolution. The data processing procedure was a staged process consisting of:

a. Filtering of on line data to detect and remove spurious returns.

b. Visual inspection of adjacent swathes.
c. Creation of Digital Terrain Model (DTM)
d. Visual inspection of printed data.
e. Final Chart Printing.

11 WRECK POST PROCESSING.

Data obtained during the standard and high resolution passes of the wreck was processed as follows:

a. Replay of Raw Data.
b. Application of Tides.
c. Visual Inspection of on line data and the removal of any spurious returns.
d. Visual inspection of adjacent swathes.
e. Creation of DTM.
f. Visual Inspection of printed data.

In order to assess the extent of the seabed supporting the wreck, the wreck echoes were filtered out of the records using manually set gates.

12 NAVIGATION AND POSITIONAL DIFFERENCES

In order to obtain a wholly valid comparison between the data sets especially in the area of the wreck, the 1996 data was shifted 3.21 metres to the east to conform with the 1995 data. This difference in position between 1995 and 1996 is attributed to the use of the highly accurate Kinematic DGPS in 1996, although it is confirmed that the navigation system chosen in 1995 was working within its specifications. Kinematic DGPS has undergone a number of recent developments which now make it the best system. In 1995 Kinematic DGPS was still being proven, especially for dynamic work such as this, and the continuity of signal could not be guaranteed.

ANNEX B

CONTENTS

THE HISTORY OF THE WRECK

THE HISTORY

1. The SS RICHARD MONTGOMERY was a Liberty ship, 441' 6" long and 7146 gross tons, of a mass-produced design not necessarily intended for more than a single voyage. The ship sailed from the USA to the UK in August 1944 with some 7000 tons of bombs. On arrival, it was anchored in the Thames Estuary, at its confluence with the Medway, off Sheerness. On almost the next tide, however, the ship's anchor dragged and it drifted on to a bank running east from the Isle of Grain (at 51°78'57"N 00°47'12"E) about 700' north of the Medway Channel. The ship grounded amidships on the crest of the bank and - this being a weak spot on this design - shortly afterwards broke its back. The wreck now lies in some 15 metres of water, with the masts protruding at all states of the tide.

2. The wreck lies about one and a half miles from Sheerness and the Isle of Grain and five miles from Southend. It lies on a bank across the tide.

3. The wreck is not an obstruction to navigation - indeed, it serves to mark for other shipping the bank on which it grounded.

4. Intensive efforts were made after the grounding to unload the cargo and about half was removed. The two stern holds were probably emptied. The other holds were less accessible. When the wreck flooded, it had to be abandoned. The remaining cargo represents some 1700 tons of explosive material; the balance being the heavy bomb casings etc.

Responsibility for the wreck

5. The UK Government has assumed de facto responsibility for monitoring the wreck - firstly through the Board of Trade and, since 1983, through the Department of Environment, Transport and the Regions. It has relied upon expert advice provided by a Committee on hazardous wrecks comprising various experts from the Ministry of Defence, the Home Office and the Health & Safety Executive, together with the Port of London Authority and the Medway Ports . The Committee sought advice from US experts on the contents of the wreck, the design of the munitions carried, and the nature of the hazards they posed. The Committee is now formally disbanded, but the Department still has access to the experts if needed.

The Committee on Hazardous Wrecks

6. The Committee's consistently firm advice was that no attempt should be made to disturb the site. In the Committee's opinion, any such action would increase the likelihood of the very explosion that must be avoided if at all possible.

The explosives on board

7. The Committee's advice was based on the most exhaustive information available about the types of explosives involved, and the likely effect upon them of age and/or contact with sea water. The bombs thought to be on board are of two types. The bulk are standard, un-fused TNT bombs. In addition, some 800 fused cluster bombs are believed to remain. These bombs were loaded with TNT. They could be transported fused because the design included a propeller mechanism at the front which only screwed the fuse into position as the bombs fell from an aircraft. All the bombs could therefore be handled - with care - when the accident occurred.

Condition of the explosives

8. TNT does not react with water and is extremely stable, particularly if stored at a steady, low temperature. As it has been contained in metal bomb cases there has probably been little change in its chemical or explosive properties as a result of the long period of immersion.

9. When the condition of the munitions was first assessed there was considerable concern over the possibility of the formation of very sensitive copper compounds from reaction between the lead azide in the detonators with the brass components of the fuses of the cluster bombs. This would have been a possibility whilst the fuses contained significant amounts of air but as the fuses will probably all have been flooded for many years and the sensitive compounds referred to are all soluble in water this is no longer considered to be a significant hazard

Risk of an explosion

10. The break in the ship has already exposed the contents of No 3 hold, where most of the cluster bombs were believed to be stored, but without an explosion occurring. There are two reasons why a cluster bomb fuse in an unstable condition could explode without even setting off the cluster bomb to which it is attached. The fuse is not screwed into the main charge, and the main charge might now be wet or non-explosive. The same reasons make it even less likely still that such a fuse could detonate the main cargo.

11. It is believed that, left to itself, the wreck will break up gradually. There is a good prospect that all the ordnance will get wet in this process and will become neutralised. Even if the water has not already rendered them inert, a small explosion at any distance from the wreck will not set off the bulk of the cargo. The risk would significantly increase, however, if the wreck were to be disturbed by moving it or attempting to unload it.

12. The risk of a major explosion is believed to be remote and is probably becoming even less likely with the passage of time. It may eventually pass altogether, but this is not likely to be for some considerable time. It would probably be very

dangerous to try to find out, particularly if this involved significant interference with the wreck site.

KEILCE explosion

13. The policy of not interfering with the wreck was reinforced by experience in 1967 with the wreck of the KEILCE, which was lost in 1946 carrying a similar amount of explosive and lying about 5km from Folkestone harbour. This wreck was disturbed in the course of efforts to clear it and an explosion occurred.

Measures taken to contain the danger

14. The site is the only one designated as a dangerous wreck under the Protection of Wrecks Act 1973. It is an offence to interfere with it in any way. This augments measures taken in the 1960s which included additional buoys and a Notice to Mariners designating the site as a "foul area" where trespassers would be liable to prosecution. Medway Ports at the Port of Sheerness keep a close watch on the site by sight and by Radar, and maintain buoys and warning notices under contract to the Coastguard Agency.

ANNEX C

MONOCHROMATIC GRADIENT PLOT