



Maritime &  
Coastguard  
Agency

# SS Richard Montgomery: Survey report 2025

October 16<sup>th</sup> 2025

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# Abbreviations

CD	Chart Datum
DFT	Department for Transport
EAG	Expert Advisory Group
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
LIDAR	Light Detection and Ranging
MBES	Multibeam Echo Sounder
MCA	Maritime and Coastguard Agency
MOD	Ministry of Defence
NEQ	Net Explosive Quantity
PPK	Post-Processed Kinematic
SIS	Seafloor Information System
SSRM	SS Richard Montgomery
UKHO	United Kingdom Hydrographic Office
VORF	Vertical Offshore Reference Frame
VTS	Vessel Traffic Monitoring Service
WCD	Water Column Data

# 1 Executive Summary

## 1.1 Background

- 1.1.1 The SS Richard Montgomery (SSRM) is a US Liberty ship which went aground in the Thames estuary in August 1944 whilst carrying a cargo of munitions. Although immediate efforts were made to salvage the cargo, the vessel broke in two, flooded and sank before the salvage operations could be completed.
- 1.1.2 The wreck lies adjacent to the Medway approach channel and is approximately 1.5 miles from the town of Sheerness and 5 miles from Southend. Around 1,400 tons of explosives remain on board the wreck which is designated under Section 2 of the Protection of Wrecks Act 1973.
- 1.1.3 Surveys of the wreck are undertaken to provide information on its condition, to identify any changes or deterioration and to inform future management of the wreck. This report details the results of the 2025 full survey.

## 1.2 Survey Overview

- 1.2.1 The 2025 survey data was gathered from the area shown in Figure 1.



Figure 1. Location and extent of the SS Richard Montgomery full survey area.

## 1.3 Key Results

- 1.3.1 The forward section of the wreck tilts towards the east. This is an ongoing development and the increase in tilt can be seen over several years.
- 1.3.2 Six Key Areas and 97 features over the wreck have been used to compare changes over the years to quantify the change and deterioration. All areas but Key Area 6 show little to no change. Key Area 6 has collapsed between 2024 and 2025.
- 1.3.3 Comparing the 2024 and 2025 full surveys, the surrounding seabed has depth changes around +/-0.3 m, with local areas reaching up to 2.5m change. In the immediate surroundings of the wreck, the largest depth change is seen at the aft with 0.8 m depth increase.
- 1.3.4 In the surveyed surrounding seabed, 159 targets have been noted in previous surveys with an additional 9 targets identified during the 2025 full survey.

# 2 Introduction

## 2.1 Background

- 2.1.1 The SS Richard Montgomery (SSRM) was a US Liberty Ship of the EC2-S-C1 class, constructed by the St. John's River Shipbuilding Company in Jacksonville, Florida in 1943. In August 1944, the ship left the US with a cargo of munitions and travelled across the Atlantic in convoy bound for the UK and then on to France.
- 2.1.2 On arrival in the Thames estuary on 20th of August 1944, orders were received to anchor off Great Nore. Unfortunately, this was too shallow for the heavily laden vessel and, as the tide fell, the SSRM dragged its anchor and went aground on Sheerness Middle Sand, a sandbank running east from the Isle of Grain and to the north of the Medway approach channel. By that evening, the vessel was already reported to be badly hogged (curved-up in the centre and sagging at the ends) and an explosive like sound was heard. This sound was the steel hull plates splitting forward of the bridge.
- 2.1.3 On 23 August, stevedores from Gravesend were engaged to discharge the cargo. However, on the afternoon of the following day, the ship's hull cracked even further, and the bow holds flooded. By 8 September, the ship broke its

back completely. Divers reported that the crack extended down both sides of the hull, with the vessel clearly open on the starboard side, but the cargo discharge continued. Royal navy personnel were brought in to finish the cargo removal, but they were hampered by deteriorating weather and safety fears as the vessel gradually sank. The salvage operation was abandoned with approximately 1,400 tons net explosive quantity (NEQ) of munitions remaining within the forward section of the vessel in holds 1, 2 and 3.

- 2.1.4** The vessel remains on Sheerness middle sand, lying in two sections in its own scour pit and sitting on exposed bedrock which is believed to be London clay. The SSRM lies across the tide, and all three masts are visible above the water at all states of the tide (see Figure 2).



*Figure 2. Photograph of the three masts of SSRM seen during low tide.*

## 2.2 Management

- 2.2.1** The SSRM wreck is designated as a dangerous wreck 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 for Transport. The wreck is clearly marked on the relevant admiralty charts, the prohibited area is marked with four lit cardinal

buoys and twelve red danger buoys, and the wreck is under 24hr surveillance by Medway Vessel Traffic Monitoring Service (VTS).

- 2.2.2** Although the wreck is thought to be stable if left undisturbed, it is routinely monitored. Regular surveys of the SSRM are undertaken to provide information on its condition, identify any changes or deterioration and inform future management strategy. The survey results are shared with the independent Expert Advisory Group (EAG) formed in 2017 to advise the Department for Transport (DFT) on managing the SSRM. There are plans to reduce the height of the three masts, which should prevent further deflection of the connected decks, minimise future potential deterioration and mitigate the risk of collapse onto the decking below.
- 2.2.3** A variety of methods have been used to monitor the wreck. Since 2002, multibeam sonar technology has been the favoured method of survey. Although occasional diving operations are carried out on the wreck, multibeam sonar is faster, more cost-effective and provides greater levels of detail, repeatability, and reliability than diver surveys. This is in part due to the very poor visibility and high tidal range in the Thames estuary which makes diving operations very challenging.

## 2.3 This Report

- 2.3.1** This report is a summary of the July 2025 full survey findings, including a comparison with the 2023, 2024, and 2025 full survey datasets. The year-on-year comparisons of survey data are used to help identify and quantify any deterioration of the wreck and it provides a longer view of the condition and rate of deterioration of the wreck structure.
- 2.3.2** The data analysis covers the entirety of the wreck and identifies 97 features on the wreck which have been used in successive surveys as markers for measuring levels of change. In addition to this there are six key areas which have repeatedly demonstrated levels of accelerated deterioration and are therefore a specific focus of each survey (Figure 3).
- 2.3.3** This report also includes the results of the surrounding seabed survey. The seabed survey aims to identify changes in the local seafloor topography that may have implications for the wreck's stability or for the neighbouring Medway approach channel. It also aims to locate items of debris on the seabed within

the survey area, including debris that may have originated from the wreck and debris from other sources.

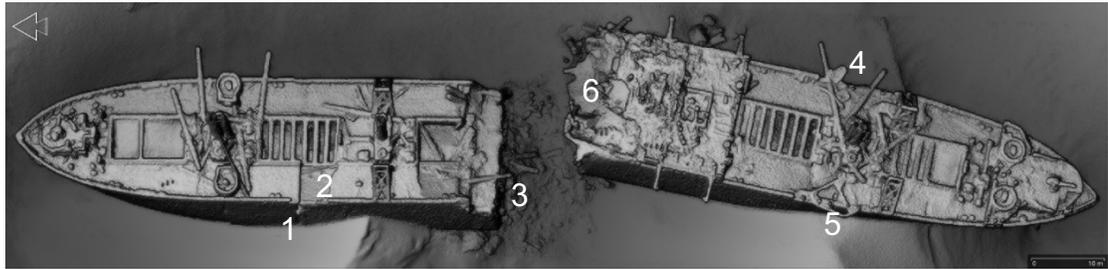


Figure 3. SSRM top-down image showing the six key areas.

## 3 The Survey

### 3.1 Survey Requirements

**3.1.1** The scope of work as defined by the Maritime and Coastguard Agency (MCA) includes the following objectives:

- a) Comprehensive multibeam echosounder (MBES) survey of the entire wreck.
- b) MBES survey of the prohibited area and the seabed out to at least 400 m distance from the wreck, including the edge of the dredged channel in the vicinity of the prohibited area.
- c) Laser scan survey of the masts and other structures which are visible above the waterline.
- d) Process the data and directly compare it to previous survey results to identify and highlight any areas of structural change or deterioration.
- e) Produce a detailed survey report which includes details of any changes noted and comparisons with results from previous surveys.

### 3.2 Survey Area

**3.2.1** The survey area for the full survey is shown by the white line in Figure 1.

### 3.3 Survey Operations

**3.3.1** The MBES seabed survey outside the exclusion zone took place on the 27<sup>th</sup> of July 2025. The laser scanning of the masts as well as the MBES and WCD survey of the area inside the exclusion zone (including the wreck itself) was performed on the 28<sup>th</sup> of July 2025.

### 3.4 MBES

**3.4.1** The MBES data was collected with a Kongsberg EM2042 MBES.

Table 1: M/V Lode equipment specifications used for data collection in 2025 SSRM full survey.

<b>Equipment specifications – M/V Lode</b>	
Primary Horizontal & Vertical Positioning	Kongsberg Seapath 130 with Trimble VRS now RTK corrections
Primary Heading Sensor	Kongsberg Seapath 130
Acquisition / Processing	EIVA Navipac and Kongsberg SIS
Multibeam Echosounder (MBES)	Kongsberg EM2042
MBES motion reference unit	Kongsberg Mini MRU60
Sound Velocity Measurement	Valeport Swift SVP
Laser Scanner System	Ouster OS1
Acquisition	EIVA NaviScan

**3.4.2** Global Navigation Satellite System (GNSS) data from Kongsberg Seapath navigation system was logged using Kongsberg Seafloor Information System (SIS) software. The recorded GNSS data was post processed using TerraPos resulting in a Post-Processed Kinematic (PPK) GNSS solution combined with the ordnance survey active networks, with 3 reference stations (MAIS, MART, SHOE) completely covering the survey area. This improves the real-time positioning to a  $\pm 5$  cm accuracy by using Rinex data from the reference stations together with clock and satellite corrections to recompute the real time positioning. The post-processed solution then replaces the online navigation and GPS height, after thorough quality control and comparison with the online navigation in EIVA NaviEdit.

**3.4.3** Reduction to the project vertical datum was performed by using the GNSS height solution and applying a geoid model in EIVA NaviEdit. The geoid model is derived from the United Kingdom Hydrographic Office (UKHO) VORF model and is used to reduce the bathymetry data to Chart Datum (ETRS89, UTM31N).

- 3.4.4 The vertical uncertainty values for the Seapath 130 system are less than  $\pm 0.05\text{m}$ , when post processed.
- 3.4.5 The MBES data has been cleaned in NaviModel using both manual cleaning and surface filtering, where the method chosen depends on the nature of the seabed and careful testing of surface filters for optimization. The cleaned data was then written back to NaviEdit and exported as FAU-files for final density and quality control in Caris.
- 3.4.6 The images in this report have been taken in NaviModel.
- 3.4.7 This survey has maximised the data density to ensure full and complete ensonification of the SSRM and the surrounding seabed (Figure 4).

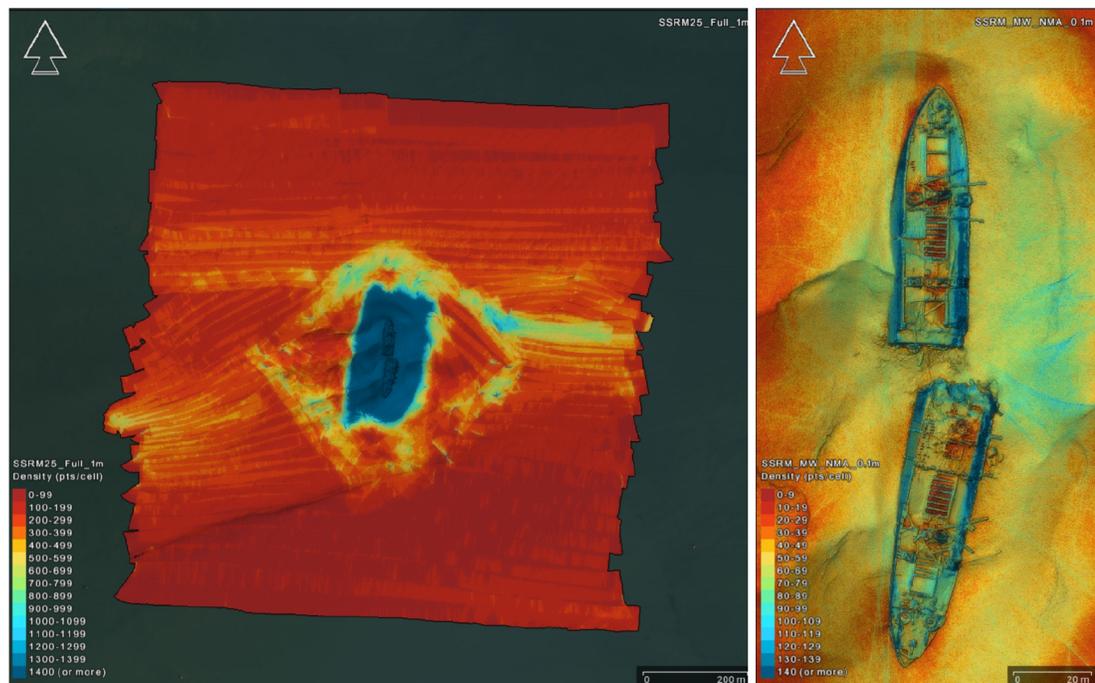


Figure 4. Density plot of the MBES data in the 2025 full survey area and the wreck, showing points per  $1\text{m}^2$  of the surrounding seabed (left), and points per  $0.1\text{m}^2$  of the main wreck (right).

### 3.5 Laser Scanning

- 3.5.1 Laser scan lines were acquired using an Ouster OS1 digital lidar sensor mounted on M/V Lode. Multiple lines were run in various directions within the vicinity of the wreck to achieve full coverage and data density around the masts, overlapping the MBES data.
- 3.5.2 In addition to the laser scan data photographs were taken of the three masts from various directions (Figure 2).

## 4 Results – The Wreck

### 4.1 Overview

- 4.1.1** This section of the report details the output of the survey data acquired from the wreck (Figure 5). Results of survey data from different years are combined and compared to identify changes in the structure of the wreck.

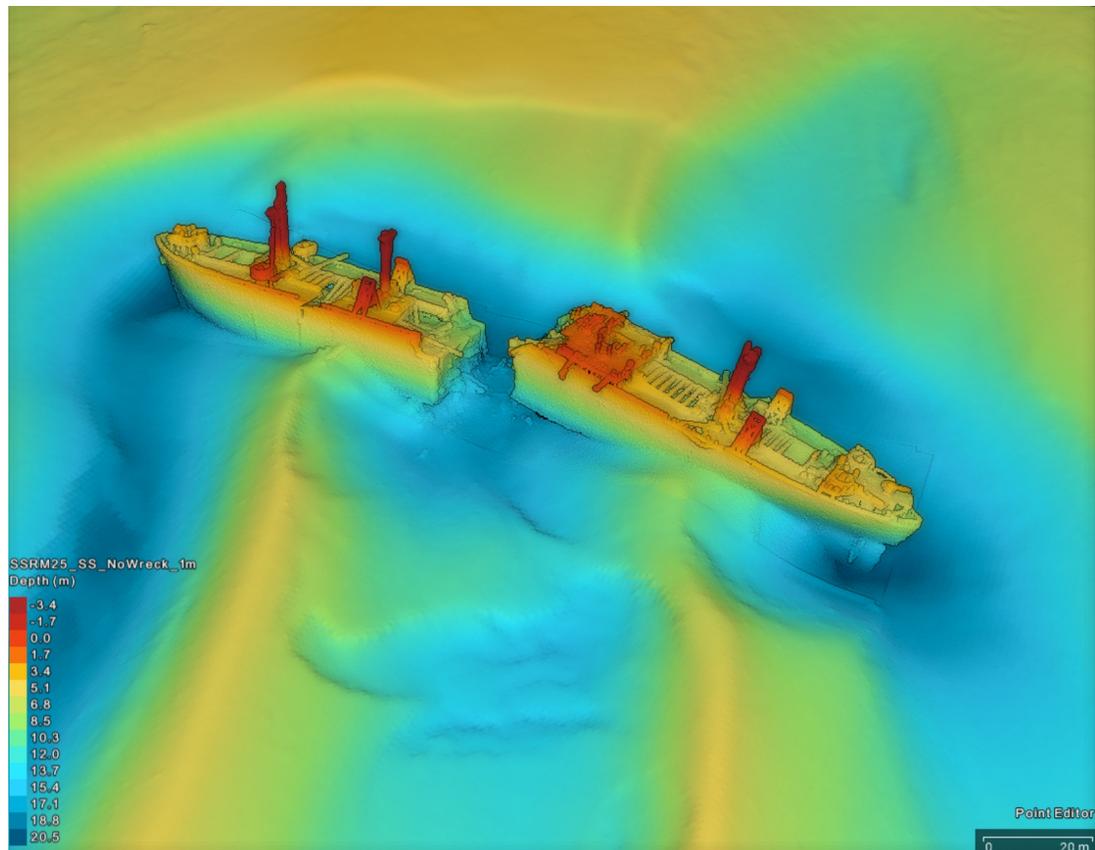


Figure 5. Overview picture of SSRM. Point cloud data, including lidar, overlaid on a digital terrain model of the surrounding seabed.

### 4.1 Features

- 4.1.1** Over the whole of the wreck, 97 specific features have been used in successive surveys as comparison points for quantifying change and deterioration (Figure 6 and Figure 7).
- 4.1.2** As observed in previous surveys, the forward section has shown an increased tilt each year, and results from the 2025 survey shows a continued increased tilt, indicating continued instability in the forward section of the wreck (Figure 8 and Figure 9). A full list of the features and comments on observed changes between 2024 and 2025 full surveys is listed in Appendix C.

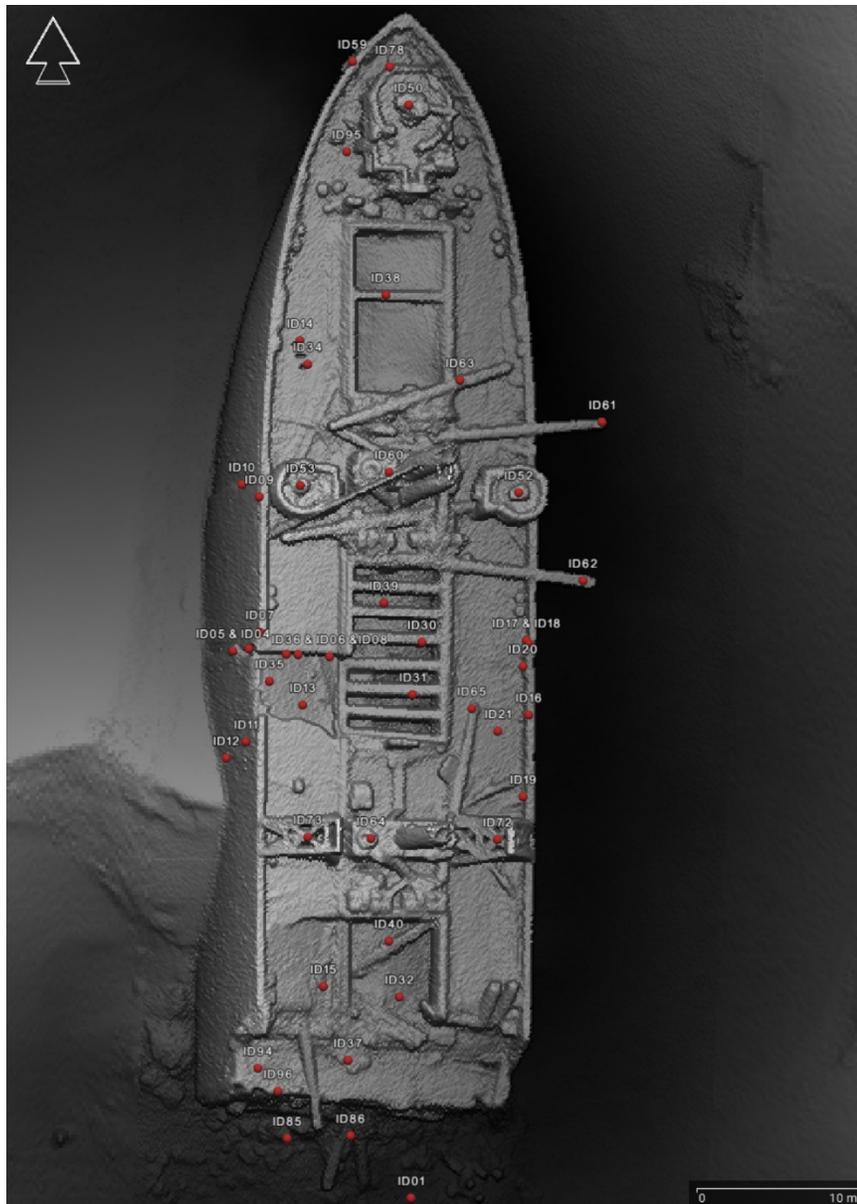


Figure 6. ID features on the forward section.



Figure 7. ID features on the stern section.

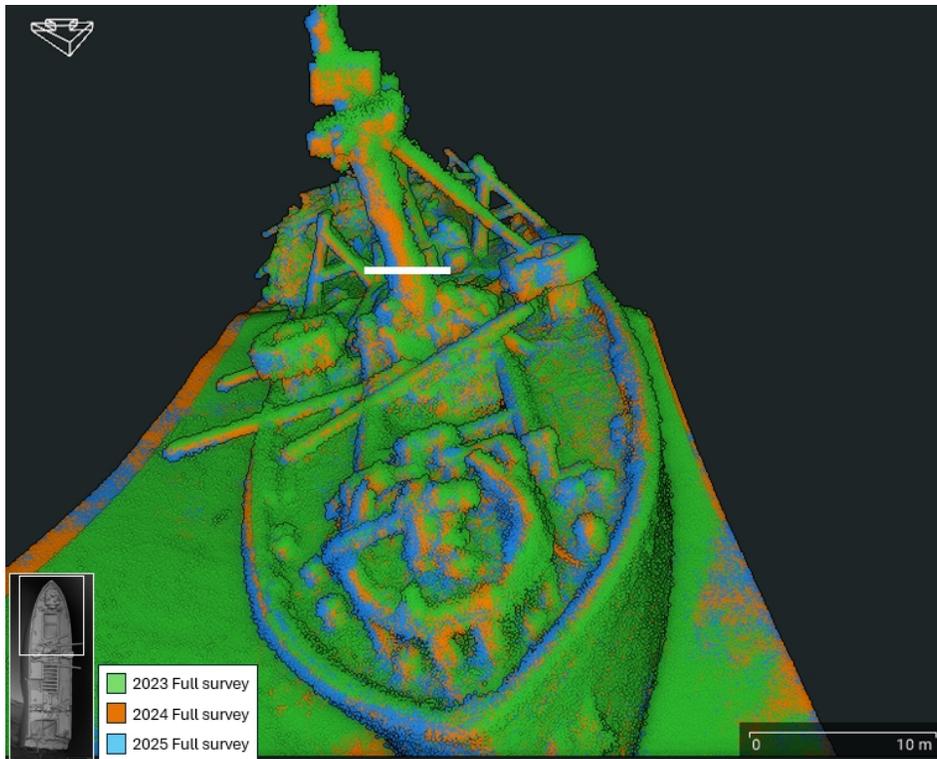


Figure 8. Point cloud view of increased tilt of forward section. The white line represents the horizontal cross section in Figure 9.

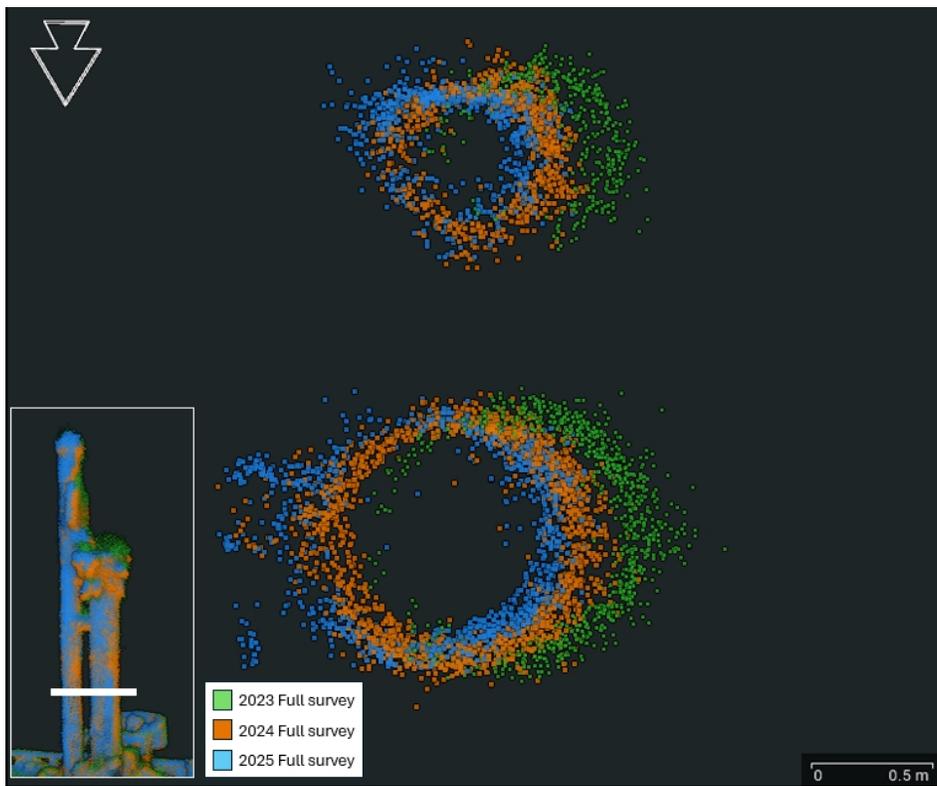


Figure 9. Horizontal cross section MBES points of the masts of the forward section of the wreck. The image shows the increased tilt observed between full surveys of 2023, 2024, and 2025.

## 4.2 Key Areas

- 4.2.1** In addition to the 96 features, six Key Areas across the wreck have been highlighted during previous surveys as key areas of significant structural change (Figure 3). The changes observed in the 2025 full survey is further described below.
- 4.2.2 Key area 1 & 2 (ID04 & ID08)– Crack in the hull and collapse of cargo hold deck (port side)**
- 4.2.3** The forward section of the Richard Montgomery is seriously hogging almost exactly halfway along the No. 2 Hold Hatch. This hogging has resulted in a crack appearing on the upper part of the port side while the lower part of the starboard side is significantly buckled giving the appearance that the forward part of the wreck is splitting in two and pivoting about the starboard rim of Hold 2. The flexing of the upper deck has caused a portion of the upper deck and half of the Hold 2 hatch cover supports to collapse through into the ‘tween deck space (Figure 10).
- 4.2.4** The crack in the hull is well defined in the full surveys of 2023, 2024, and 2025 (Figure 11). There is no apparent change to the crack between the three surveys.
- 4.2.5** Overlaying the 2023, 2024, and 2025 full survey data on a cross section shows the extent of the upper deck collapse (Figure 12).

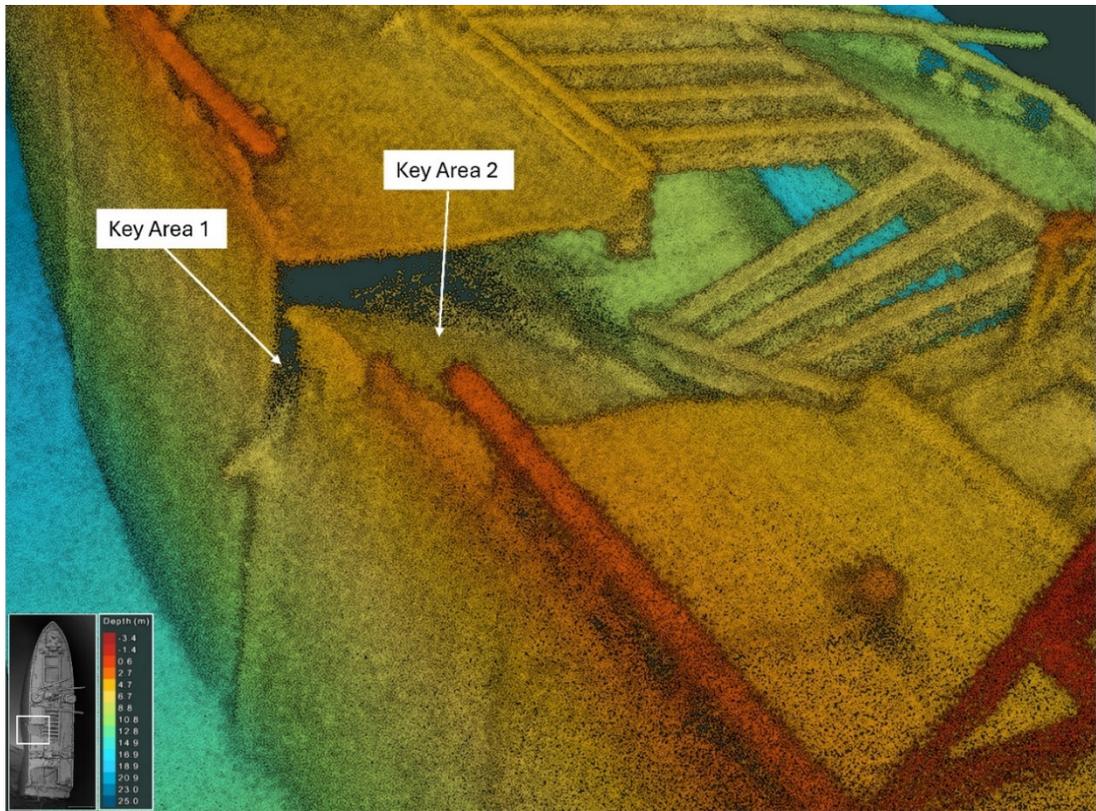


Figure 10. Point cloud image of key areas 1 and 2.

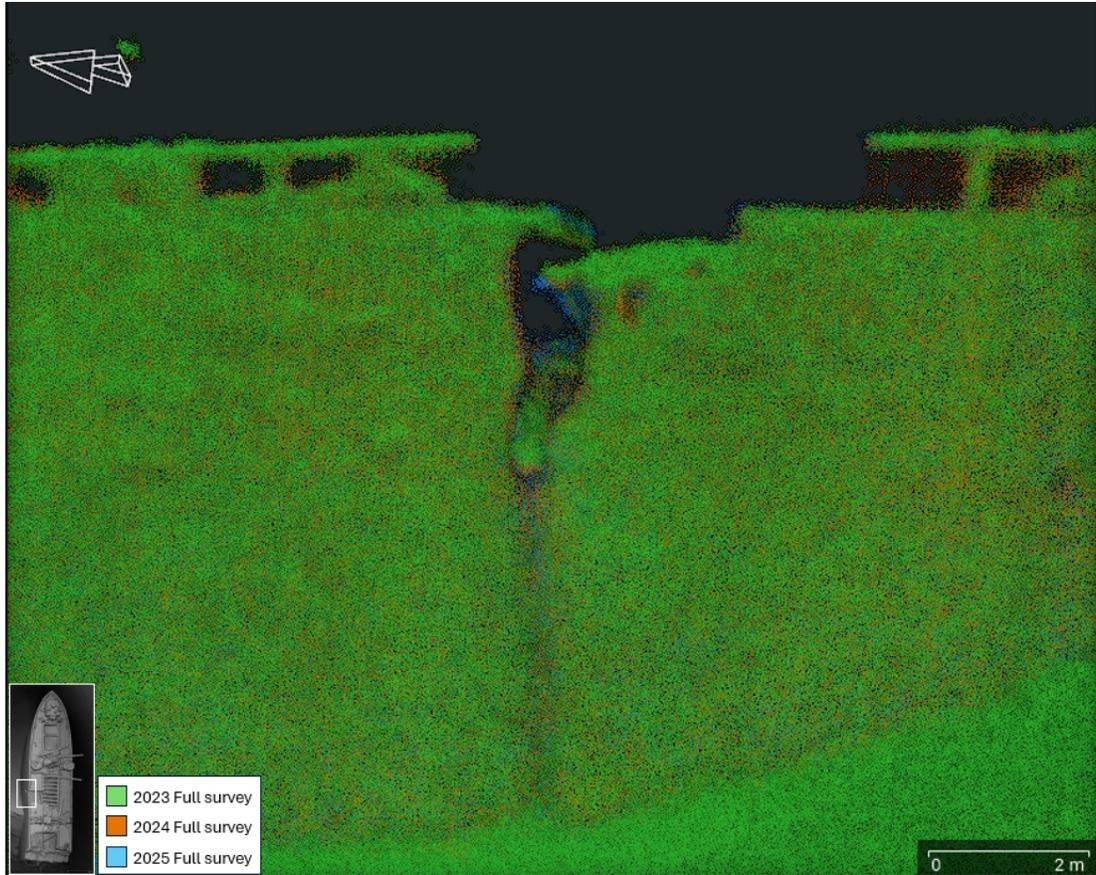


Figure 11. Point cloud cross section comparison of the wreck showing Key Area 1, the crack in the hull.

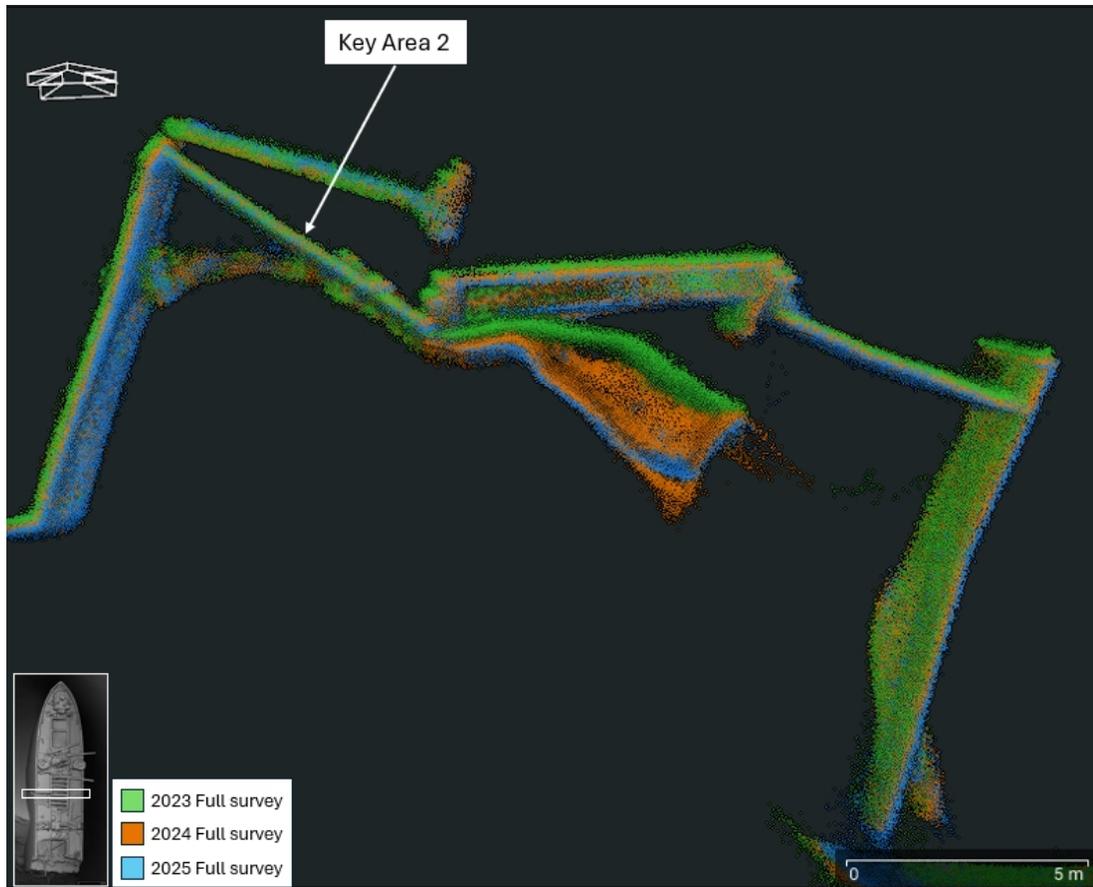


Figure 12. Point cloud cross section of the wreck showing Key Area 2, the collapsed cargo deck of Hold 2. The collapsed upper deck shows no difference between the 2023, 2024, and 2025 full surveys.

#### 4.2.6 Key area 3 (ID96) – Port side aperture

4.2.7 Figure 13 shows the apertures on the bulkhead at the aft end of the forward section. No structural differences were found between the 2023, 2024, and 2025 full surveys (Figure 14).

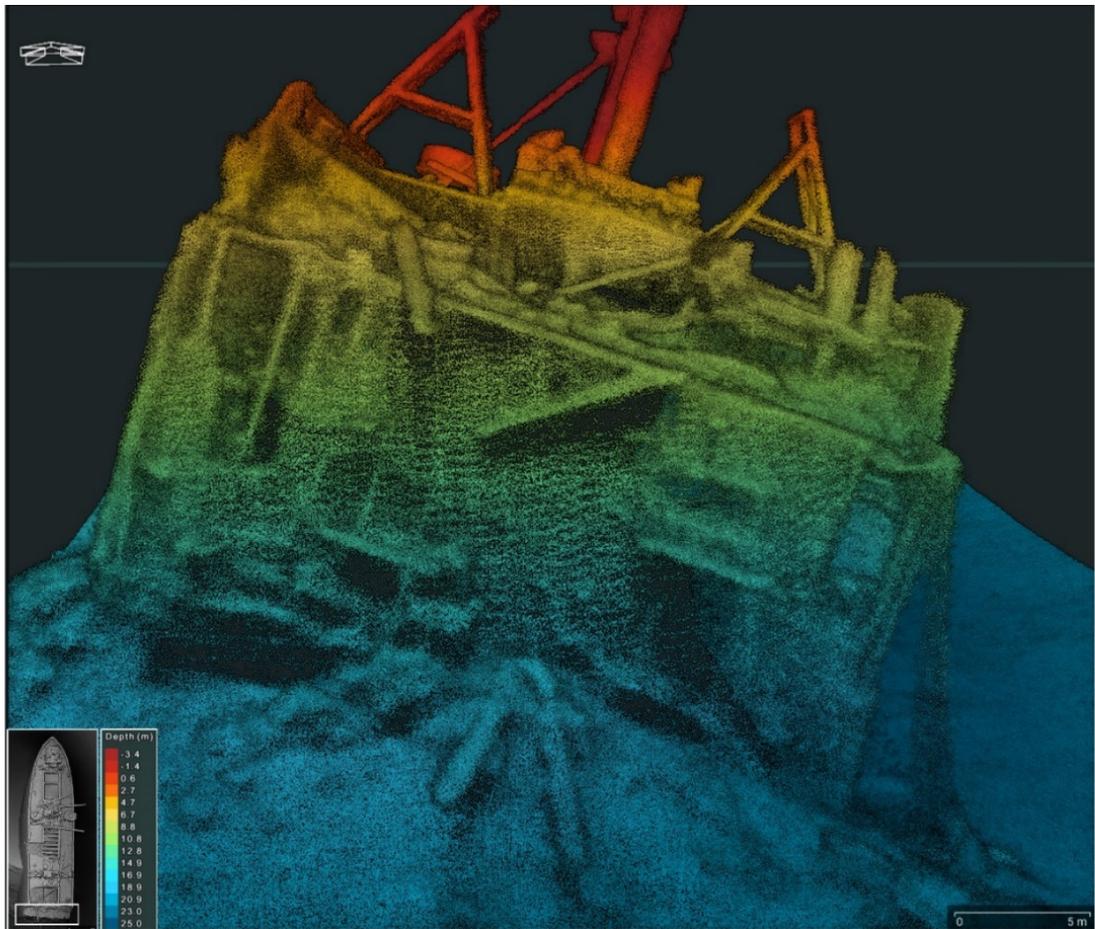


Figure 13. Point cloud image of the aperture from 2025 full survey (aft end, forward section), key area 3.

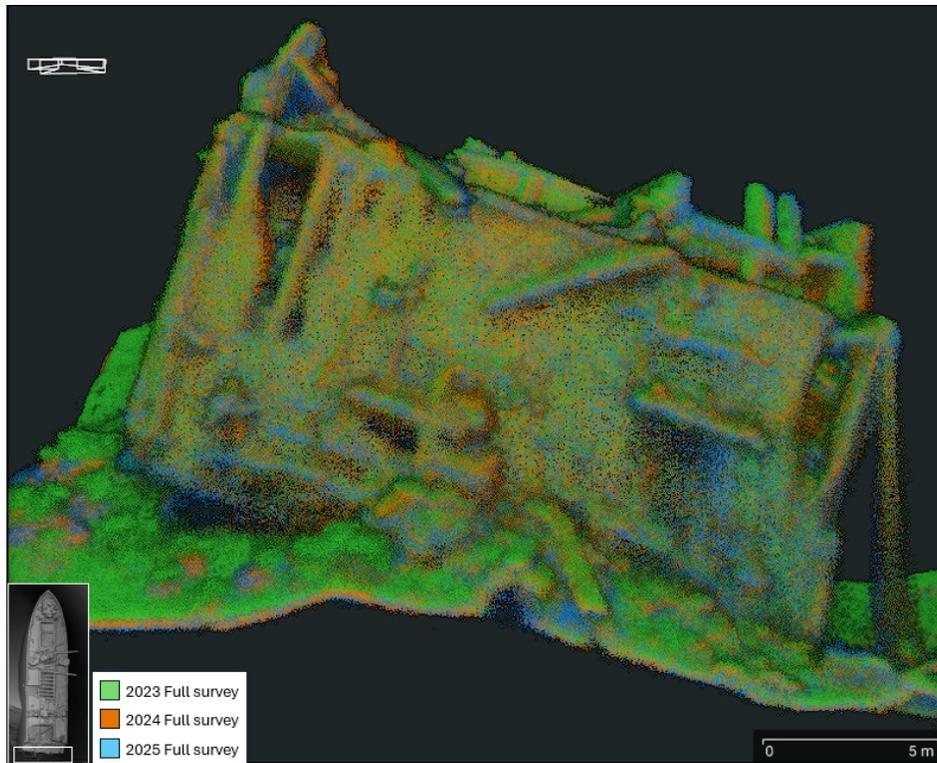


Figure 14. Comparison of aperture in the bulkhead to rear of hold 3 with data from full surveys of 2023, 2024, and 2025.

#### 4.2.8 Key area 4 & 5 (ID22, ID24 & ID25) – Split in the deck and hull

Key areas 4 and 5 represent the two ends of the same feature, namely a transverse crack across the rear hull section (Figure 15 and Figure 16). No notable differences can be seen between the 2023, 2024, and 2025 full and surveys (Figure 17 and Figure 18).

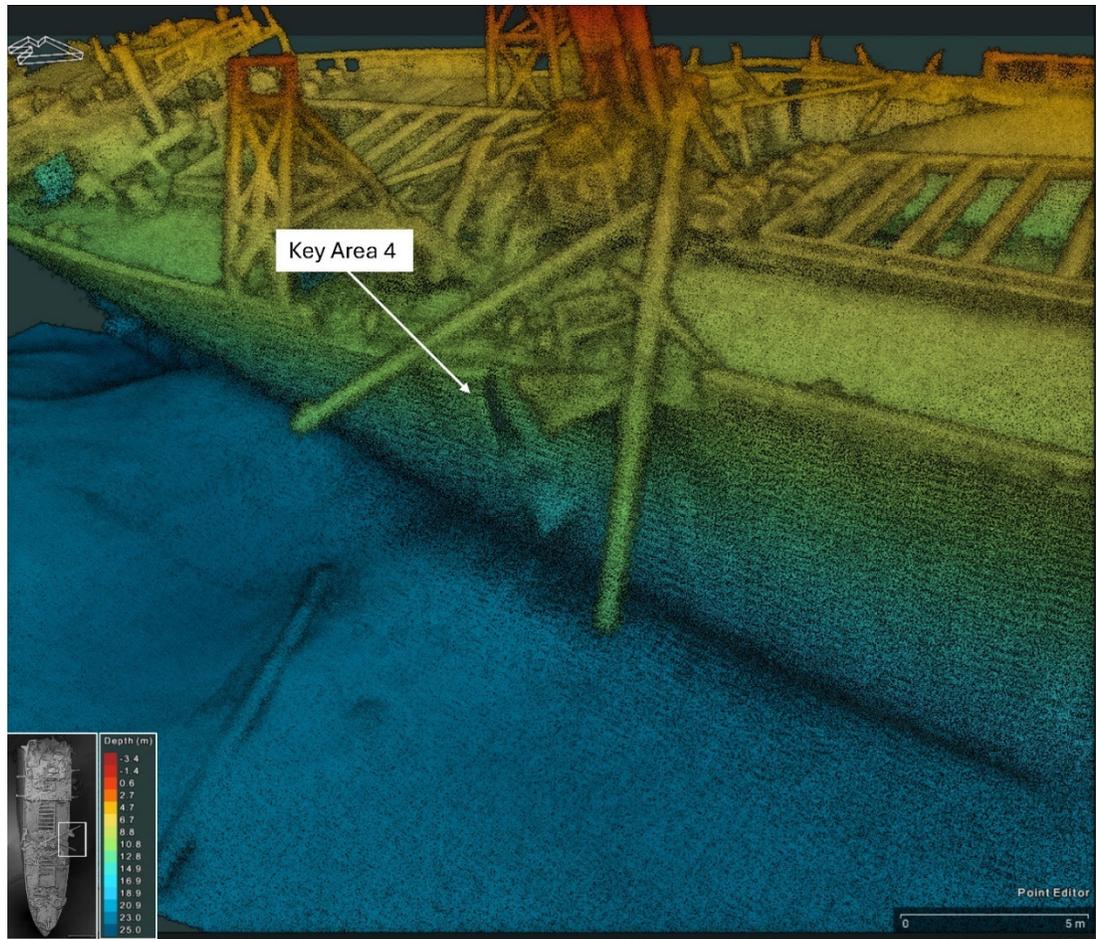


Figure 15. Point cloud image of the split in the hull, Key Area 4, 2025 full survey.

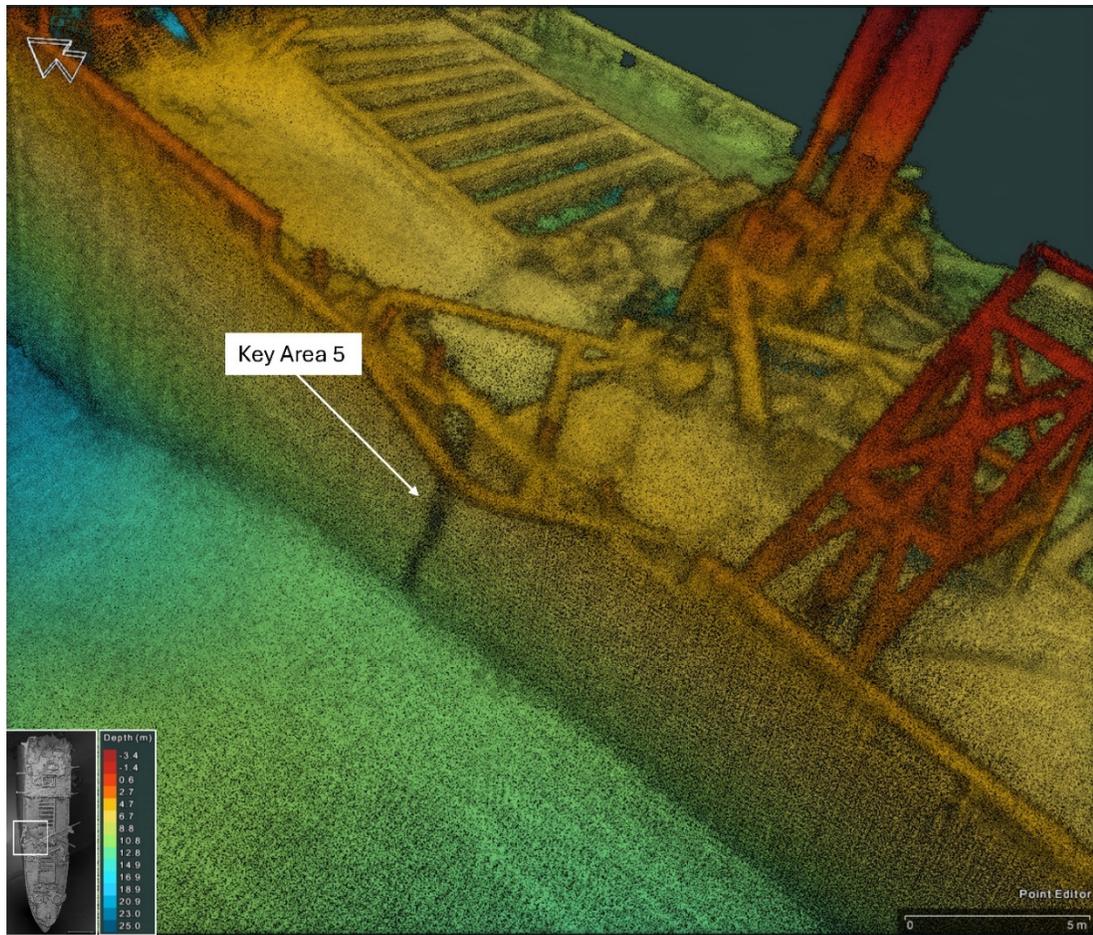


Figure 16. Point cloud image of the split in deck, key area 5, 2025 full survey.

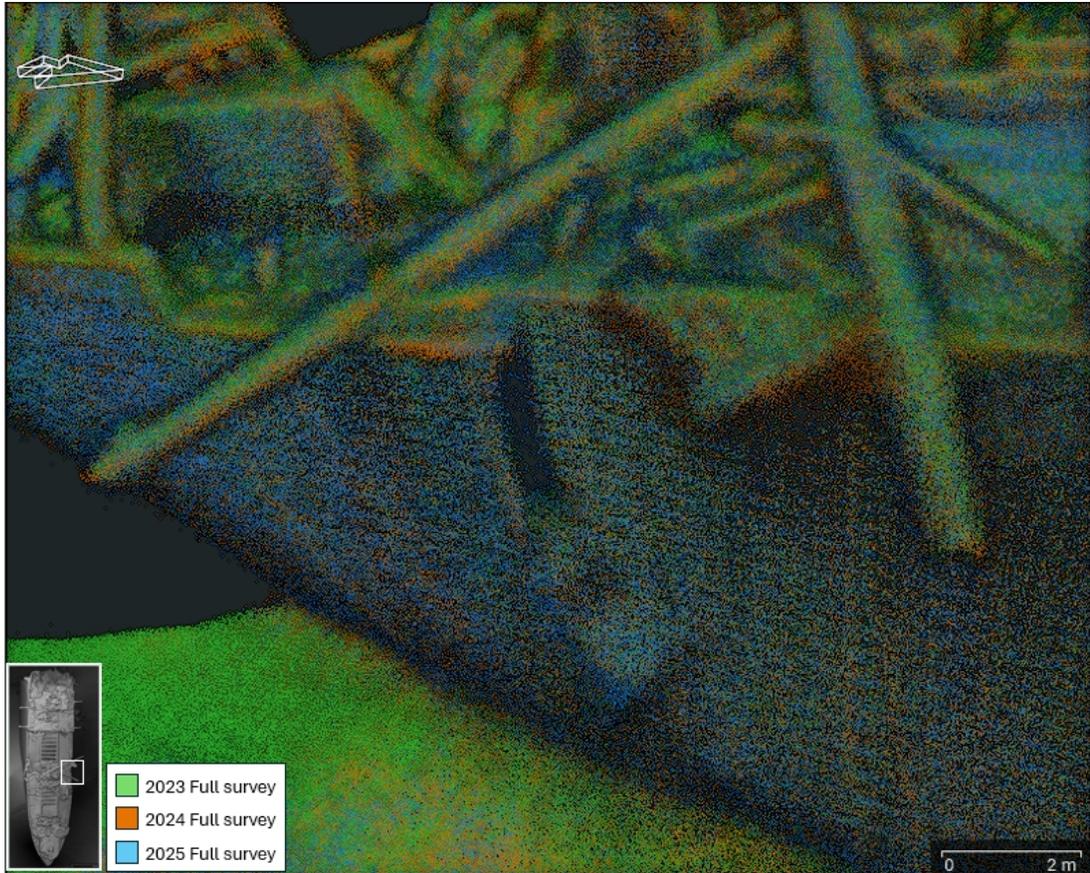


Figure 17. Point cloud view of key area 4 – the split in the hull. No difference can be seen between the 2023, 2024, and 2025 full surveys.

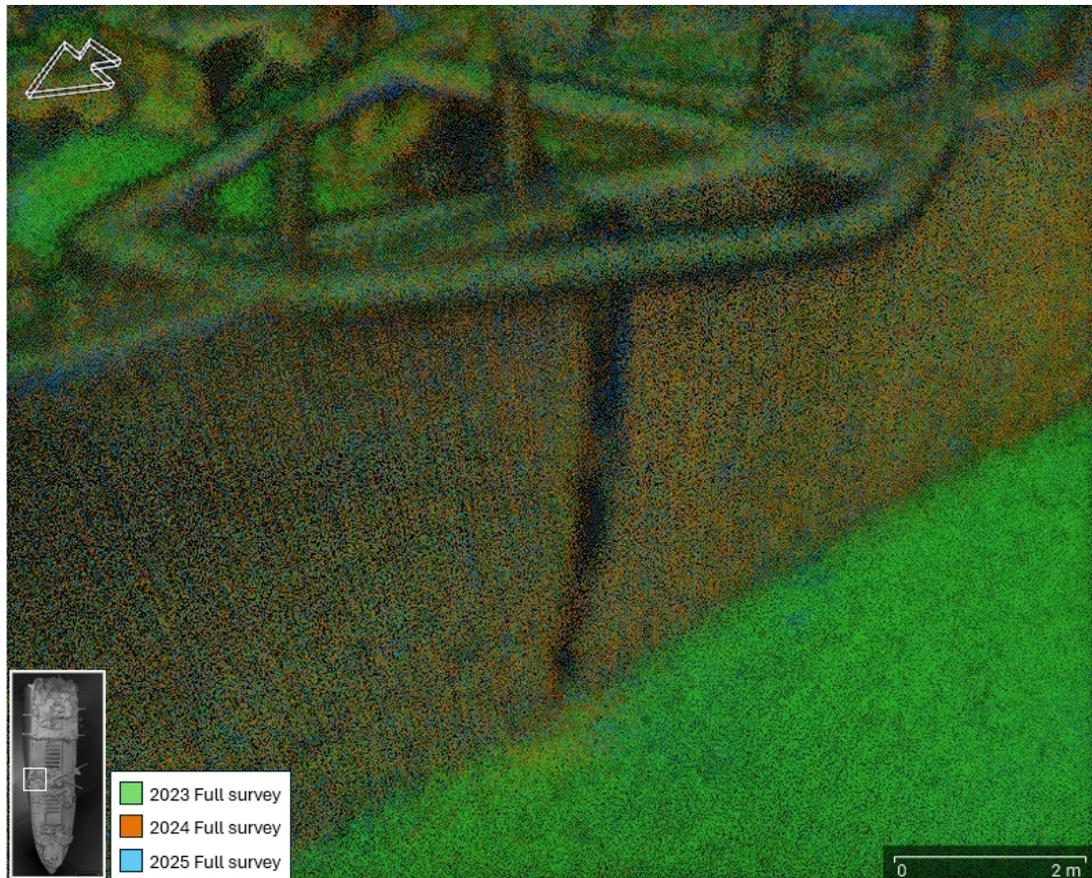


Figure 18. Point cloud view of key area 5 – the split in the hull and split in the deck. No difference can be seen between the 2023, 2024, and 2025 full surveys.

#### 4.2.9 Key area 6 (ID43, ID45 & ID46) – Boiler room casing, collapsing bridge deck and the collapsing boat deck

4.2.10 Key area 6 (Figure 19) was left unsupported when the ship broke in two back in 1944. Consequently, it has been badly affected by wave and current action and is steadily collapsing and falling into the gap between the two halves of the vessel (Figure 22). This area has shown significant degradation in earlier surveys, and a significant further collapse has occurred between the 2024 and 2025 full surveys, with a total displacement of 2 m, and a vertical displacement of 1.2 m between point A and B (Figure 20). Several objects on deck have been displaced (Figure 21).

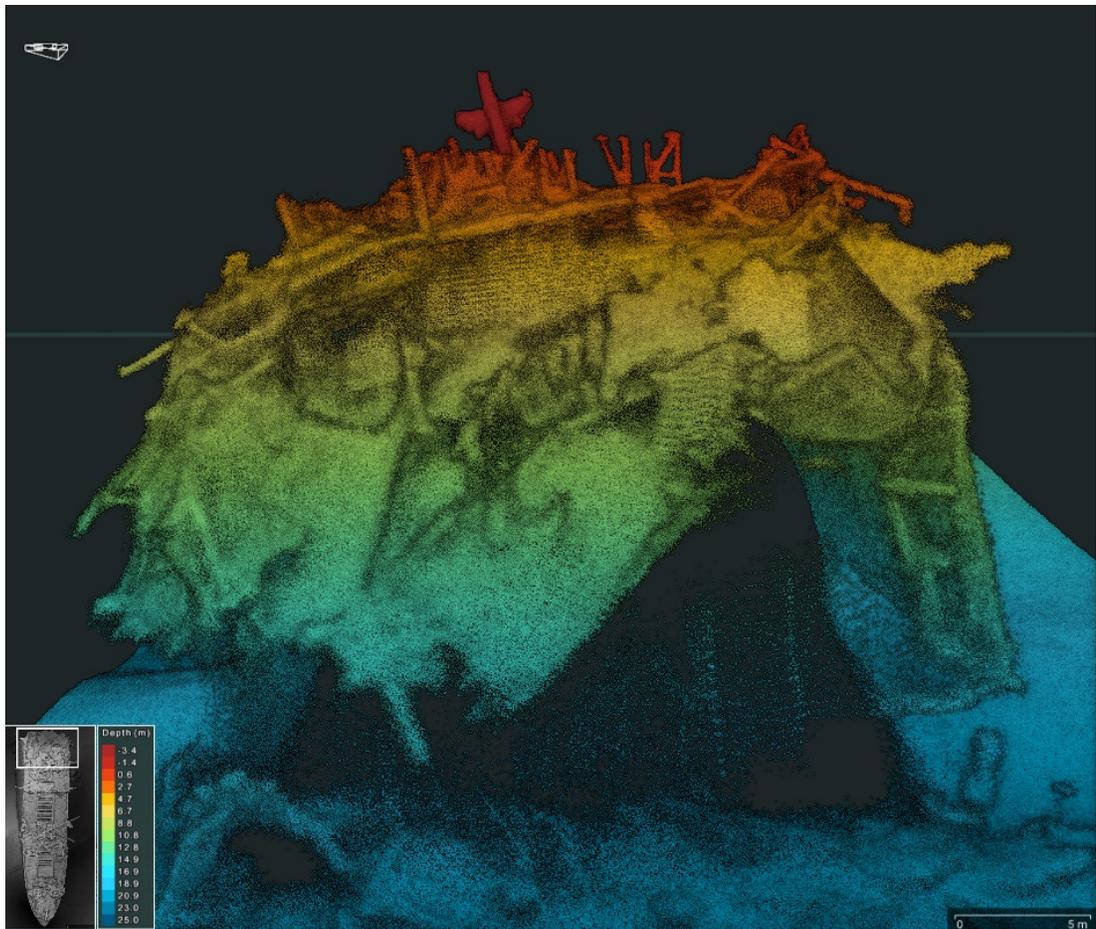


Figure 19. Point cloud image of the collapsing bridge area, Key area 6.

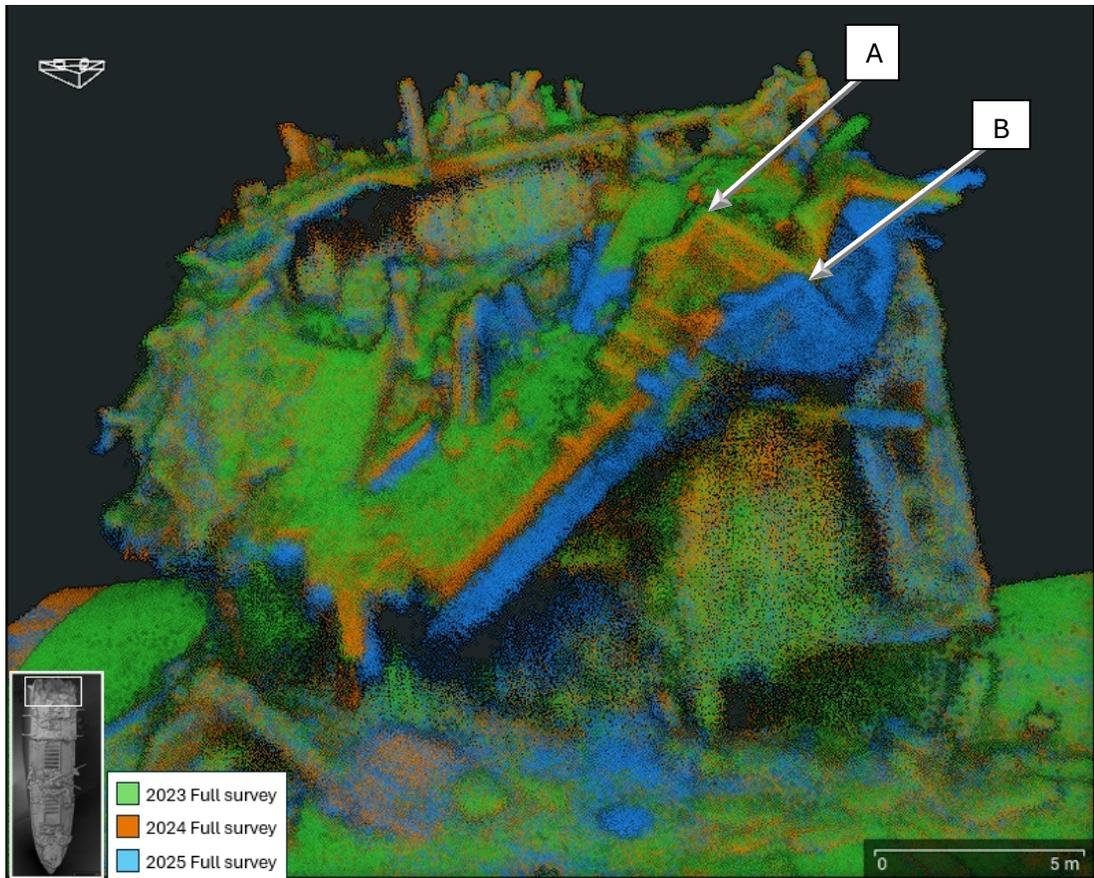


Figure 20. Point cloud view of key area 6 showing a further collapse of the deck, most significant between the 2024 (A) and 2025 (B) full surveys. Total displacement is 2.0 m, with a vertical displacement of 1.3 m.

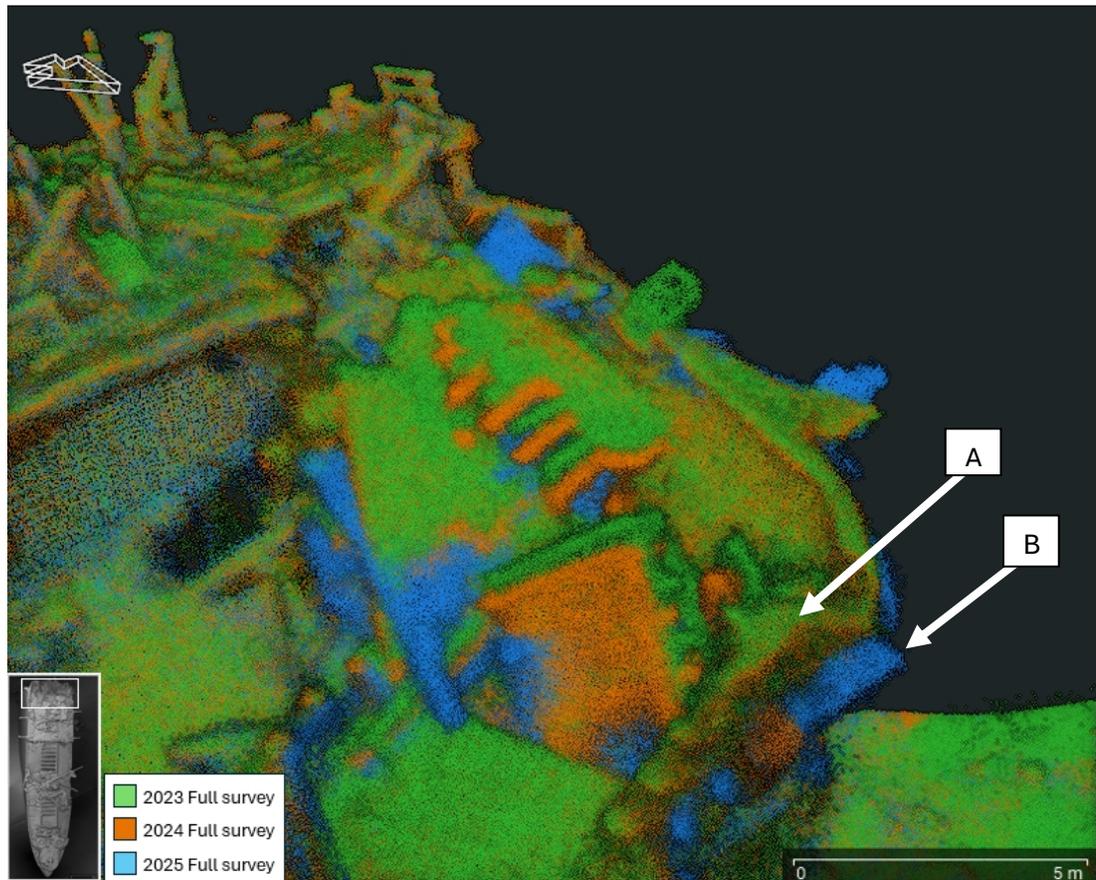


Figure 21. Point cloud view of Key area 6. Deck collapsing with displacement of several objects. Points A and B from Figure 20 for reference.

### 4.3 Debris Between the Hull Sections

- 4.3.1 There have been smaller changes between the 2023, 2024, and 2025 full surveys, highlighted in black circles in Figure 22. The changes show a displacement of some debris, but also potential burial or removal of objects.
- 4.3.2 The area between the two black lines (Figure 23) outlines the seabed between the bow and stern sections. The degree of change is displayed with a difference model between full surveys of 2023 and 2025. The changes can either indicate a removal of an object, or a displacement of an object, as well as a change in depth of the sediment surface.

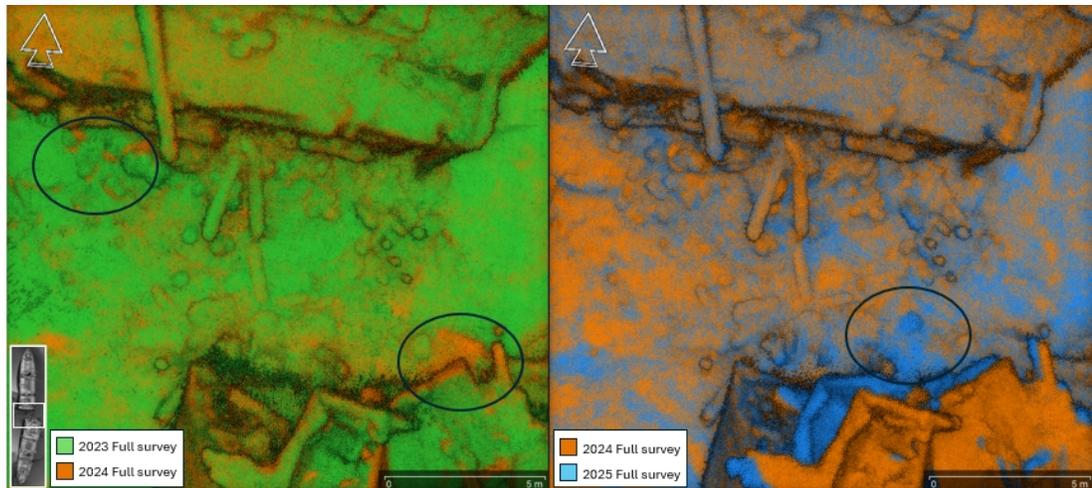


Figure 22. Point cloud image of the area between the two bow and stern sections of SSRM. The black circles show where a change has occurred between full surveys of 2023 and 2024 (left), and 2024 and 2025 (right).

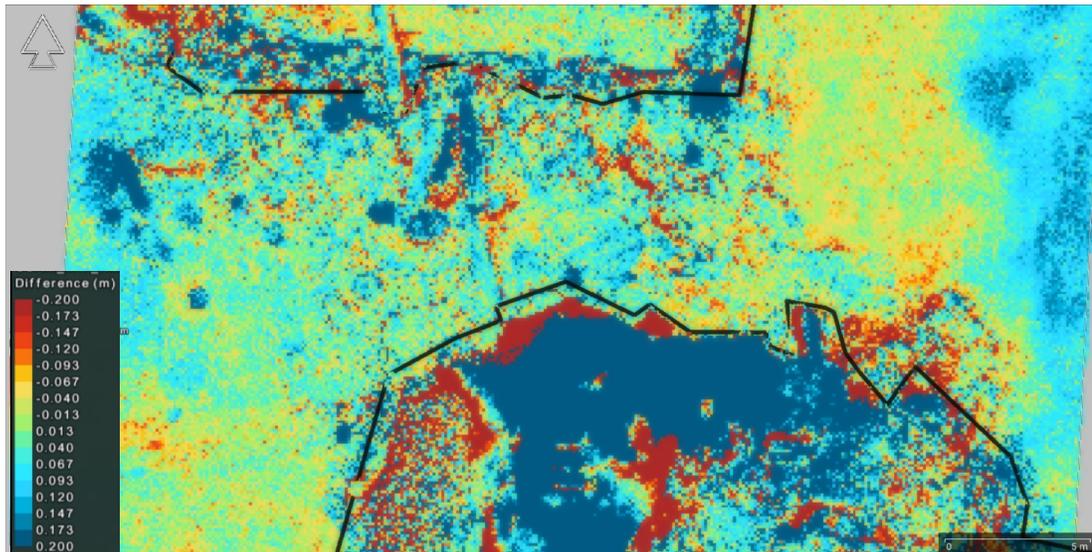


Figure 23. Difference model showing the difference in depth between the 2023 and 2025 full surveys. Between the two black lines is the area between the forward and the aft section, containing debris from the wreck.

## 4.4 Cargo

**4.4.1** When the SSRM grounded it was carrying some 6,127 imperial tons of cargo, mainly munitions. Of these, 2,954 tons were salvaged from the rear two holds (holds 4 and 5) and a small portion from the no 3 hold 'tween deck space (area between two decks).

**4.4.2** The small portion salvaged from the no 3 hold 'tween deck space was the 2 tons of bursters leaving 86 tons of fuses in 1,522 wooden cases and 117 tons of fine assemblies in 11,230 metal crates in this space. It is likely that the cylindrical

debris seen in this area in previous surveys are some of the metal crates holding the tail fin assemblies.

**4.4.3** All the holds on liberty ships are divided into a 'tween deck area located between the Upper Deck and the Second Deck, and the lower hold underneath the Second Deck. Hatch covers cover both the hatch on the upper deck and the opening through the Second Deck into the lower hold. Sedimentation is visible to various degrees in all five holds. Since lower holds cannot be visible in the data, it is difficult to determine if sedimentation has occurred in these areas.

**4.4.4** Cargo was carried in the lower holds, in the 'tween deck spaces and on the Upper Deck. Contemporary records indicate that the SSRM held cargo in all holds and all 'tween deck spaces but only carried a very small amount on the Upper Deck.

**4.4.5 Hold 1**

**4.4.6** Hold 1 is the forward most of the five holds on SSRM and, in addition to the 'tween deck space and the lower hold, hold 1 also contained a third layer of storage at the bottom of the lower hold known as the deep tanks in which additional cargo or ballast could be carried.

**4.4.7** The hatch cover is missing as are all but one of the hatch cover supports. Sediment has settled in the 'tween deck space to a considerable depth, filling the starboard side almost to the top of the starboard side hatch coaming. The port side remains clear above the horizontal from the starboard hatch coaming. There are some undulations in the sediment surface between 2023, 2024, and 2025 full surveys, with the most prominent change in depth in the aft end of Hold 1 happening between 2023 and 2024 (Figure 24).

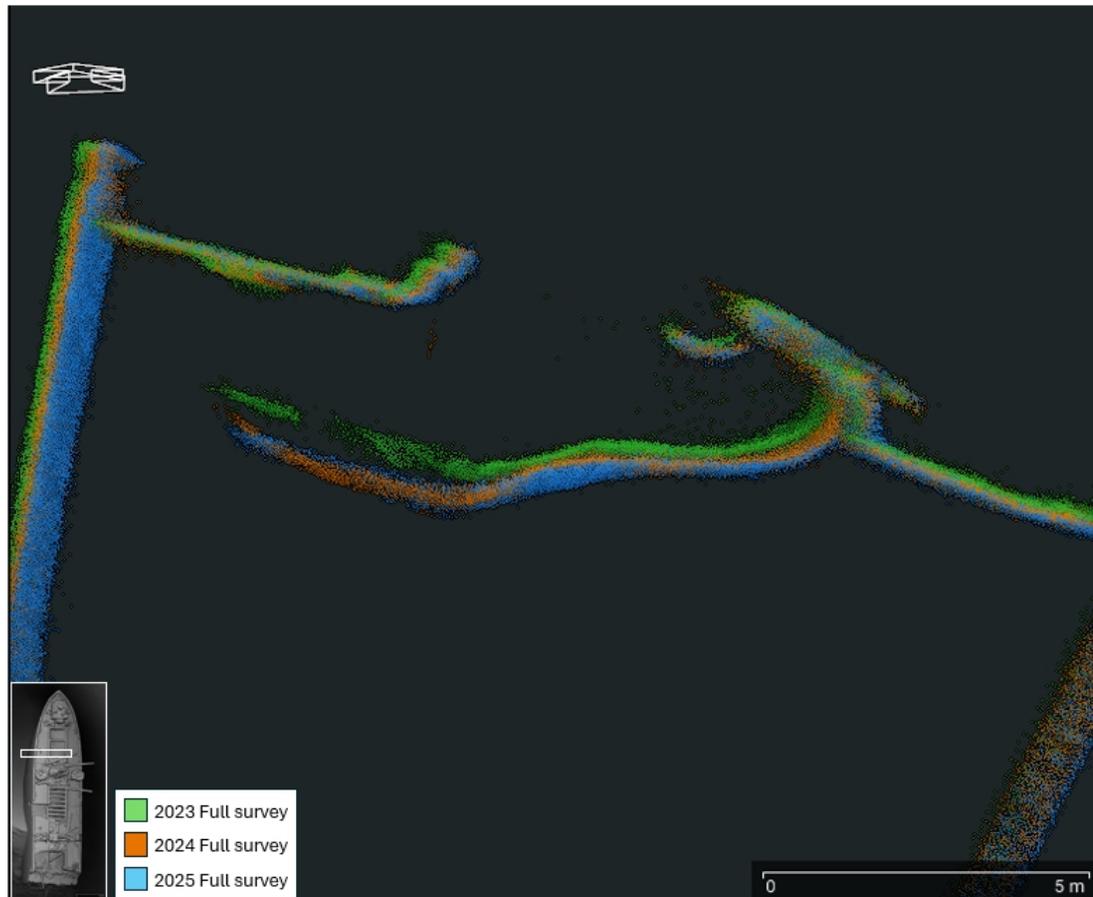


Figure 24. Cross section through the hull at the aft end of hold 1.

#### 4.4.8 Hold 2

4.4.9 Hold 2 is the second from forward hold. As with hold 1, the outer hatch cover is missing although all the cover supports are in place. The forward section of the wreck is splitting near the mid-way along the hold 2 hatch, and this has resulted in part of the upper deck collapsing into the ‘tween deck space bringing the connected hatch cover supports with it.

4.4.10 There has been a significant drop in the ‘tween deck between 2023 and 2024, as well as 2024 and 2025 full surveys (Figure 25 and Figure 26). The drop in the ‘tween deck is in the aft end of Hold 2, in connection to the area where the forward section of the wreck splitting in two (see section 4.2.3).

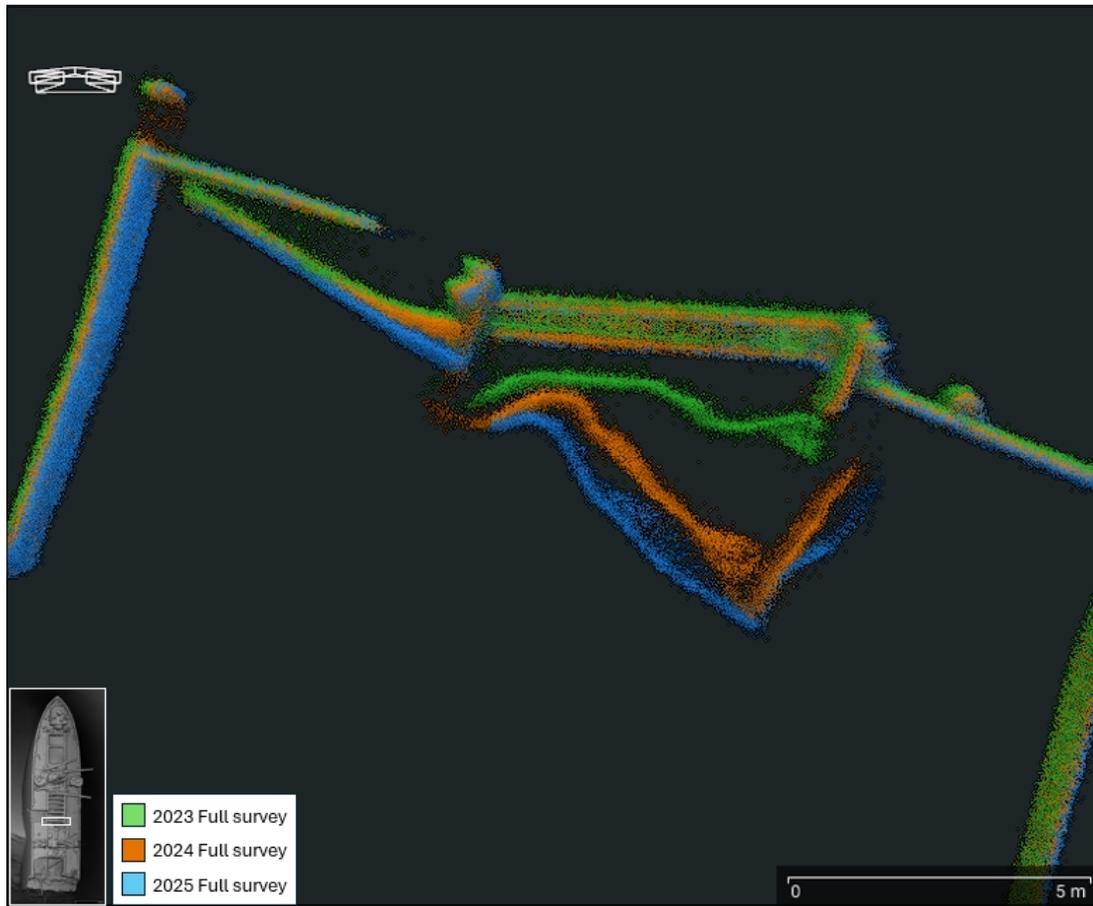


Figure 25. Point cloud cross section of the wreck showing the collapsed cargo Hold 2 deck and hatch supports. The collapsed deck is in connection with the area where the collapse of the forward part of the wreck is splitting in two (see section 4.2.3).

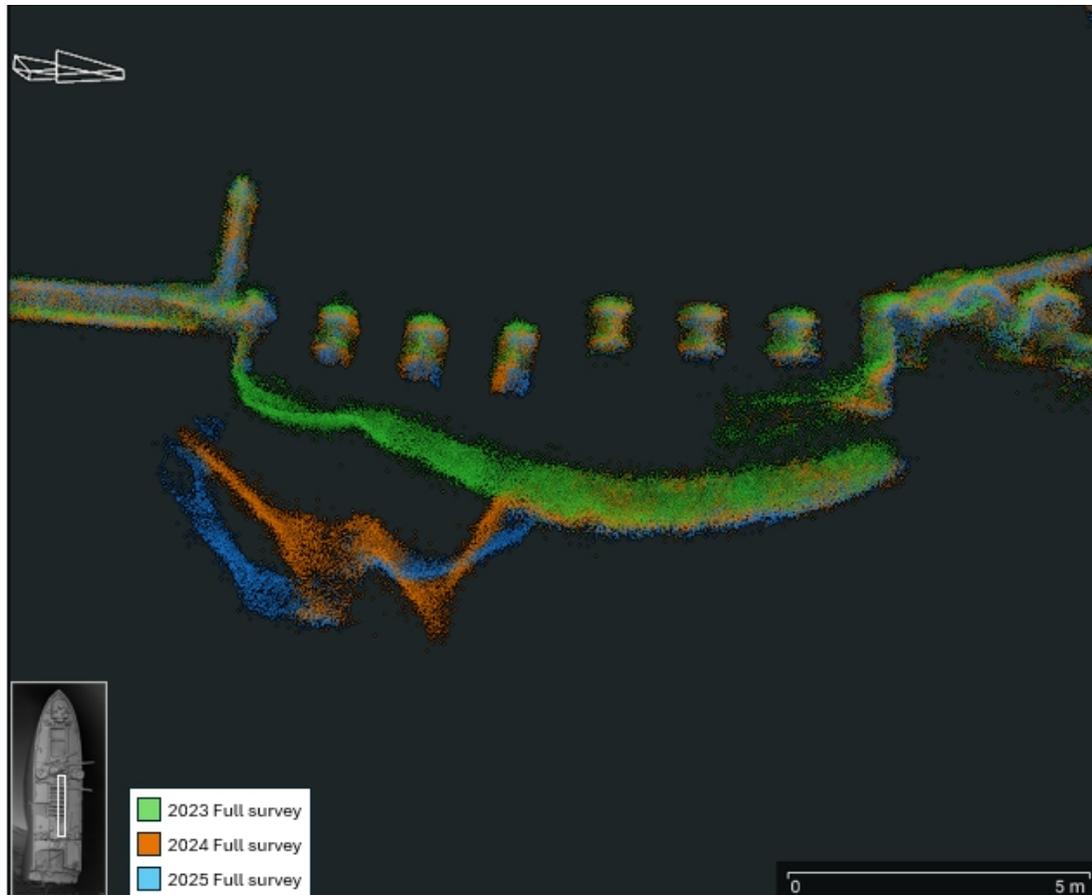


Figure 26. Point cloud cross section of the wreck showing the collapsed cargo Hold 2 deck and hatch supports. The collapsed deck is in connection to the area where the collapse of the forward part of the wreck is splitting in two.

#### 4.4.11 Hold 3

4.4.12 Hold 3 is the rearmost hold of the forward section. The rear bulkhead of this hold forms the rearmost part of the forward section, the vessel having broken in two immediately aft of that bulkhead. Although the lower hold remained with the forward section, the bulkhead at the rear of the 'tween deck space and the section of the upper deck above it were carried away leaving this area open. The outer hatch cover has gone as have all the cover supports although there is a beam, most likely a cover support, lying on the starboard side.

4.4.13 Sediment accumulation is largely limited to the forward part that still retains the protection of the upper deck. Except for some undulating, there are no large difference of the sediment depth in Hold 3 (Figure 27).

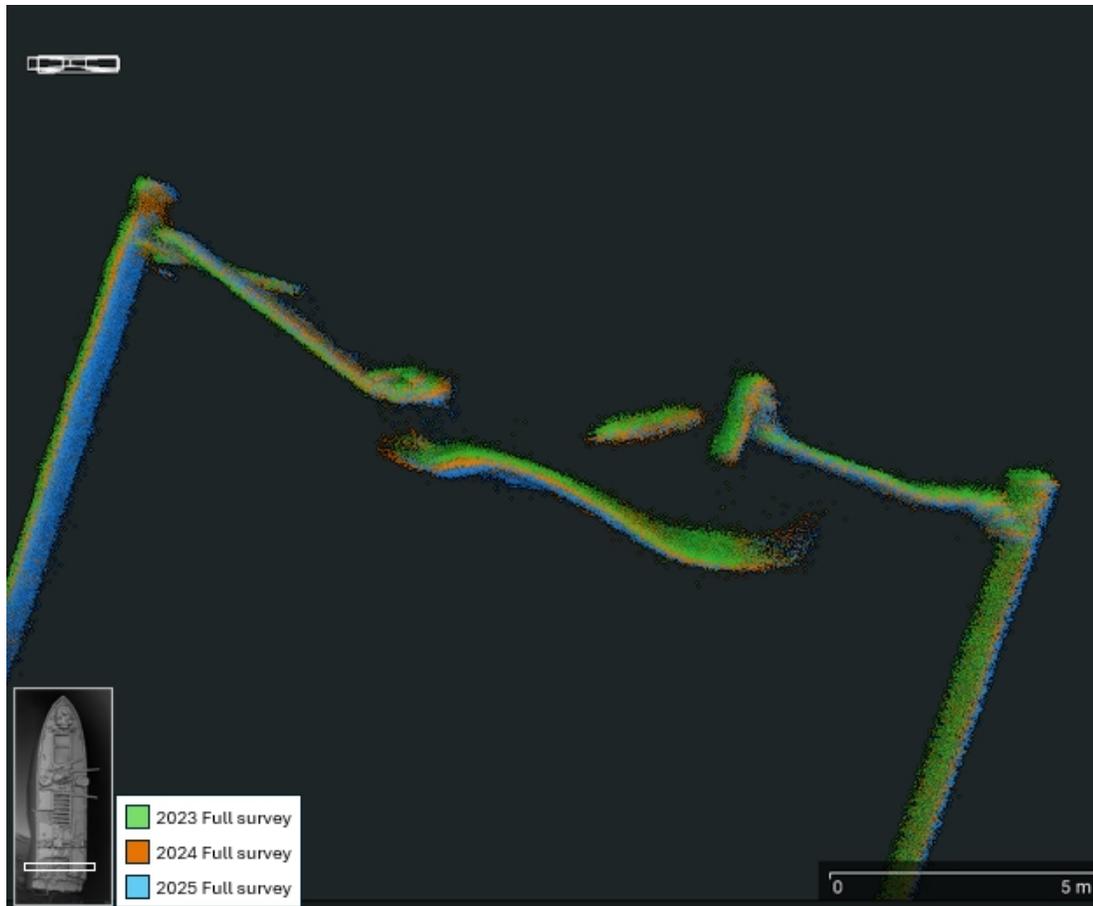


Figure 27. Cross section through the hull at the middle of Hold 3.

#### 4.4.14 Hold 4

4.4.15 Hold 4 is the most forward of the two holds in the stern section. Since the two stern holds are reported to have been emptied during salvage operation conducted soon after the grounding it is not known if the lower hatch covers were replaced. However, since the upper hatch supports are in place it seems likely that the salvors did replace the covers once they were finished.

4.4.16 The surface and sediment level in the forward part of hold 4 is largely unchanged between the 2023, 2024, and 2025 full surveys (Figure 28).

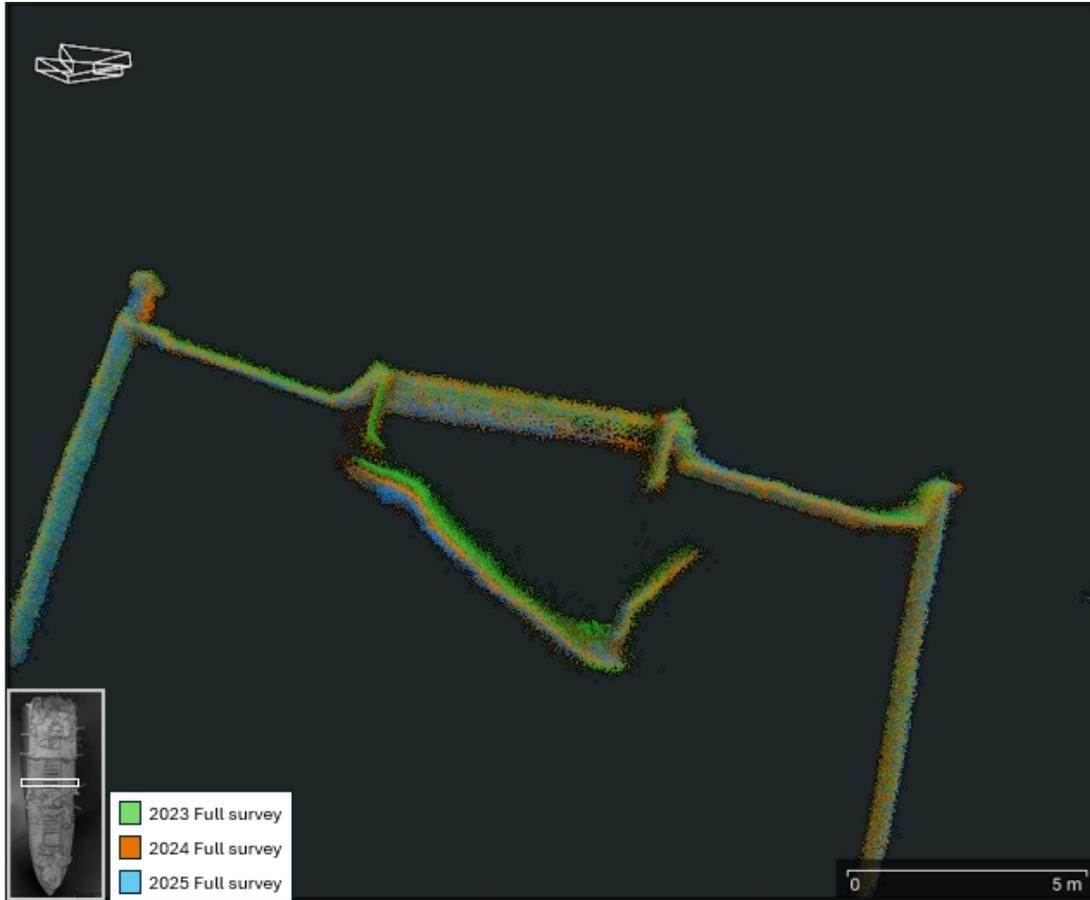


Figure 28. Cross section through the hull at the aft end of hold 4.

#### 4.4.17 Hold 5

4.4.18 Hold 5 is the rear most hold. The forward four of the six hatch cover supports remain in place. There is no indication that the second deck nor the lower hatch cover have collapsed. A slight shift is observed in the sediment between the surveys (Figure 29).

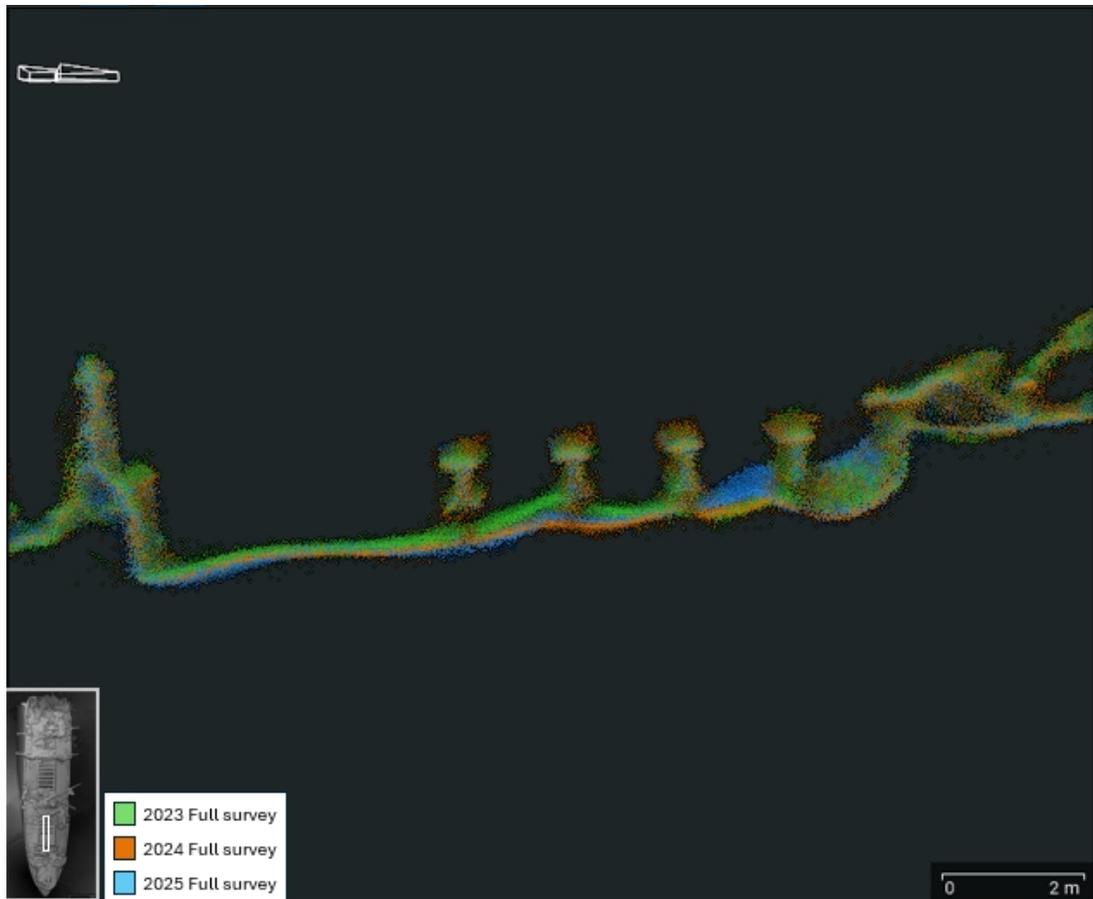


Figure 29. Cross section through the hull at the forward end of Hold 5 showing a slight shift in sedimentation between 2023, 2024, and 2025 full surveys.

## 5 Results – Seabed Survey

### 5.1 General

**5.1.1** The seabed data collected is of high quality and adheres to the density requirement. Previously identified seabed targets from the gazetteer of observations were overlain and the presence of the targets was noted, and new targets added.

**5.1.2** An overview of the full survey area is illustrated in Figure 30.

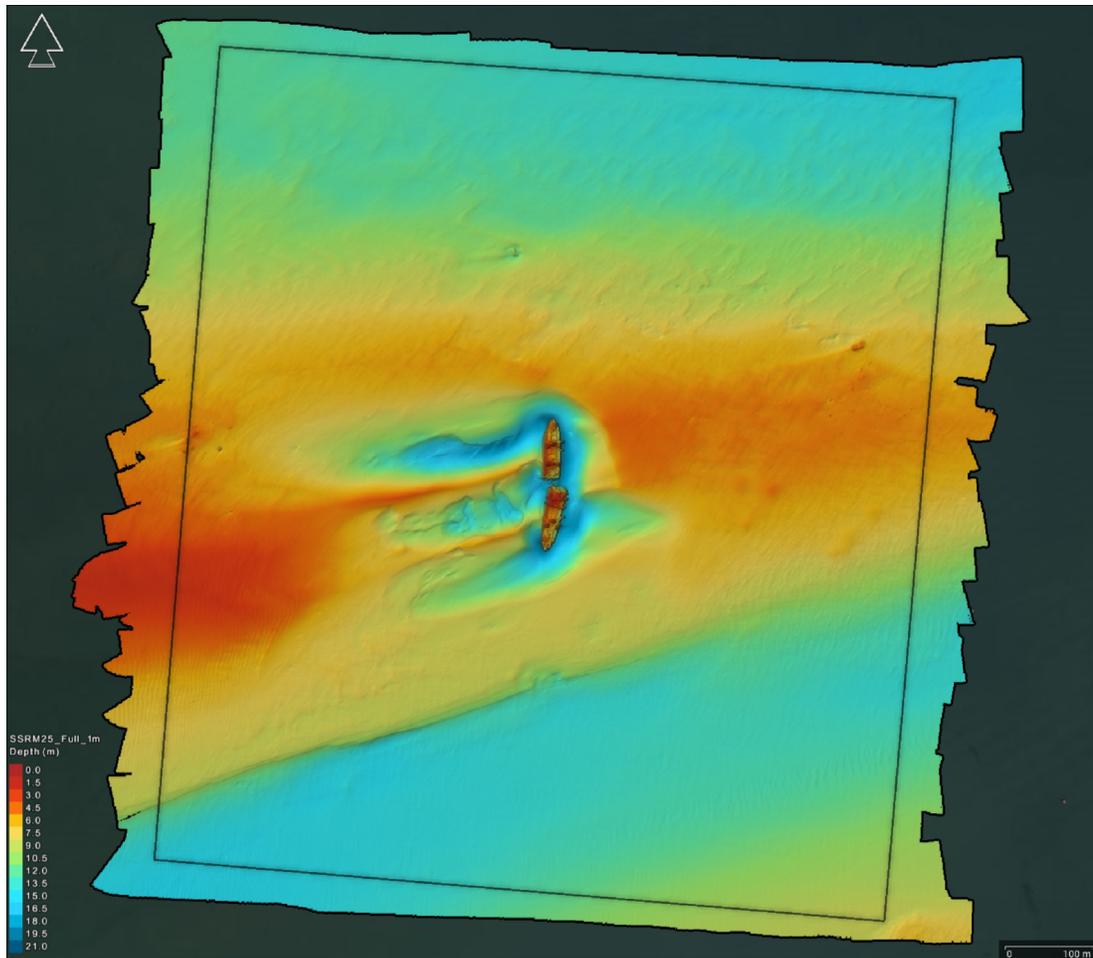


Figure 30. Minimum surface of SSRM and the surrounding seabed.

- 5.1.3** The change in depth between the years 2024 and 2025 is visualized in Figure 31. Most of the surrounding seabed have depth changes within +/-0.3 m, with more local areas reaching up to 2.5 m difference.
- 5.1.4** In the immediate surrounding of the wreck, the largest change between the 2024 and 2025 Full Survey data can be seen at the aft of the wreck where there is a depth increase of approximately 1.4 m (Figure 32). Comparing the 2023 and 2025 data, the greatest change is seen on the western side of the front section with a depth increase of approximately 2 m (Figure 33).

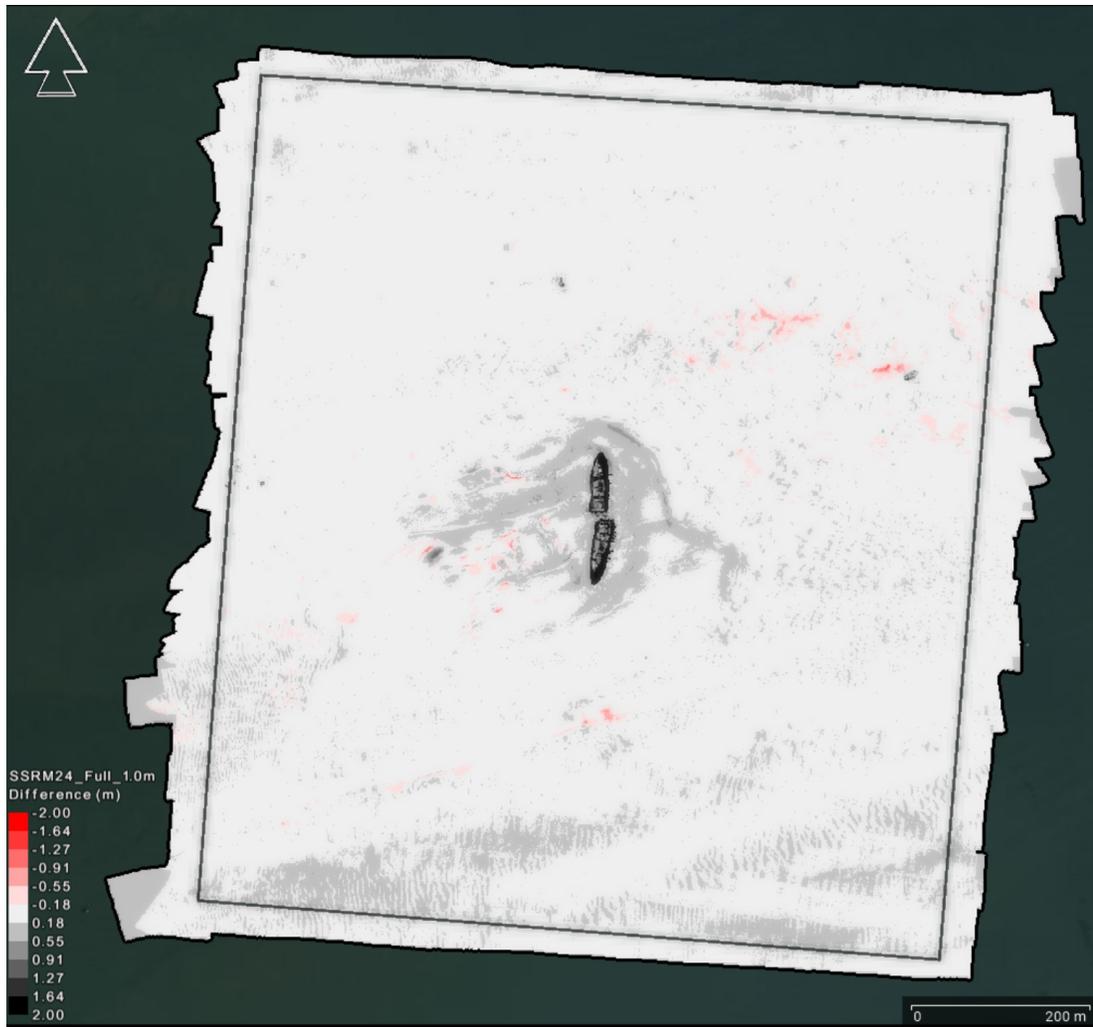


Figure 31. Difference model showing the depth changes between the 2024 and 2025 full surveys. Areas in gray have a reduced depth and areas in red have an increase in depth in 2025 compared to 2024.

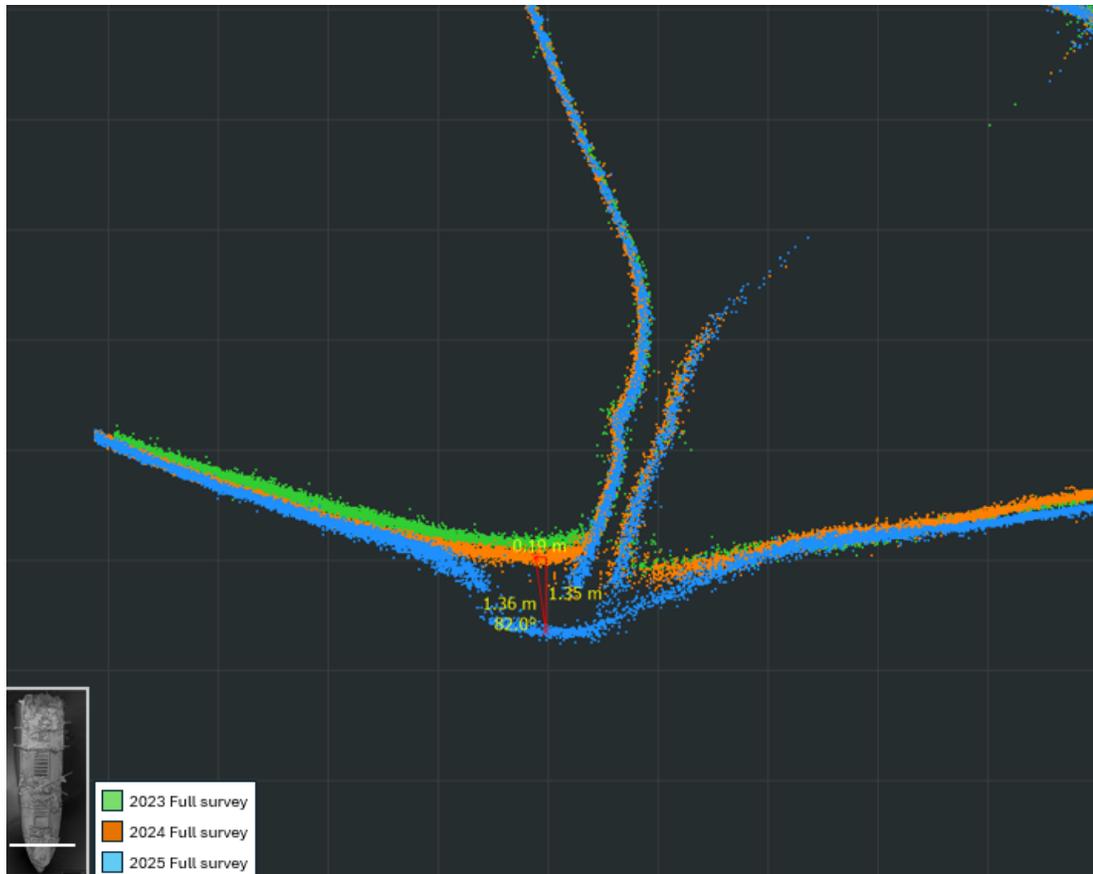


Figure 32. Cross section by the aft section of the wreck where depth difference in the immediate surroundings of the wreck is the greatest at 1.3 m between 2024 and 2025 full surveys.

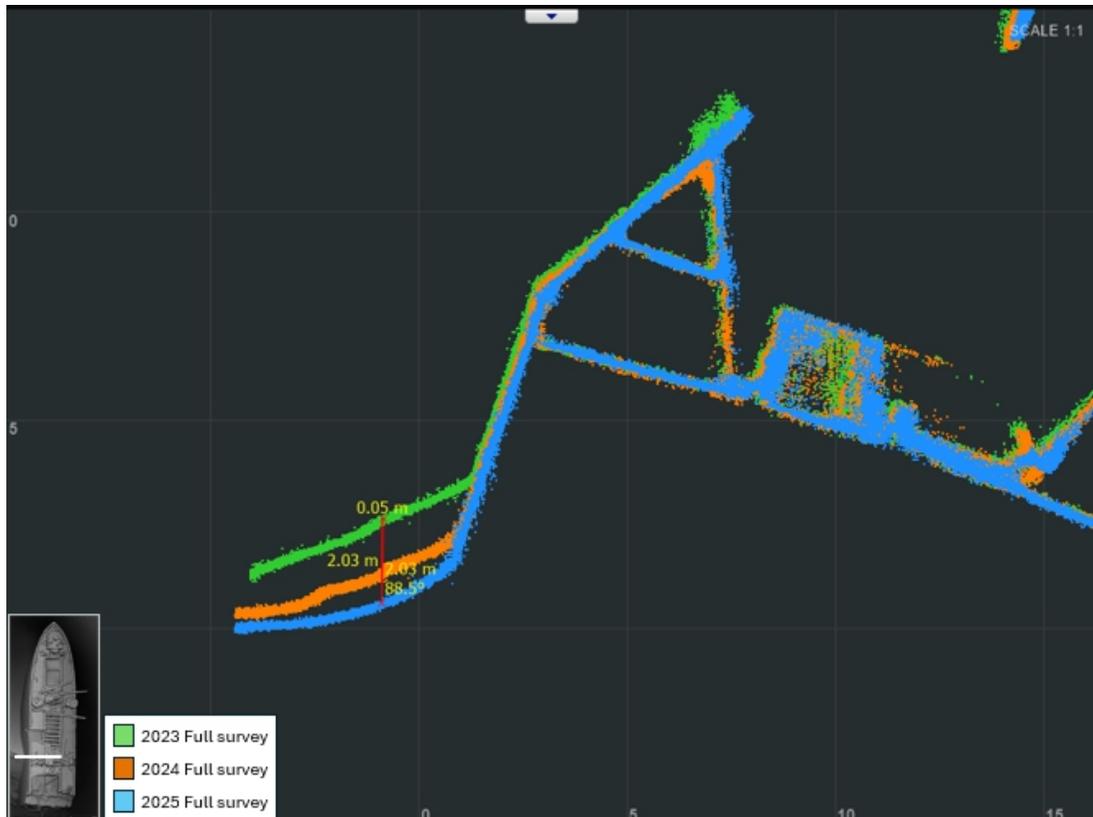


Figure 33. Cross section where depth in the immediate surroundings of the front section of the wreck has increased by 2 m between 2023 and 2025.

## 5.2 Seabed Contacts

**5.2.1** The 159 targets from 2024 target list were compared with the bathymetry of this year out of which 100 targets were present, 18 targets were listed as plausible, and 38 targets were not visible in the data of 2025. A further 9 targets were identified and added to the list, resulting in 109 present targets of the now 168 targets listed in Appendix B – Gazetteer of Observations (Figure 34).

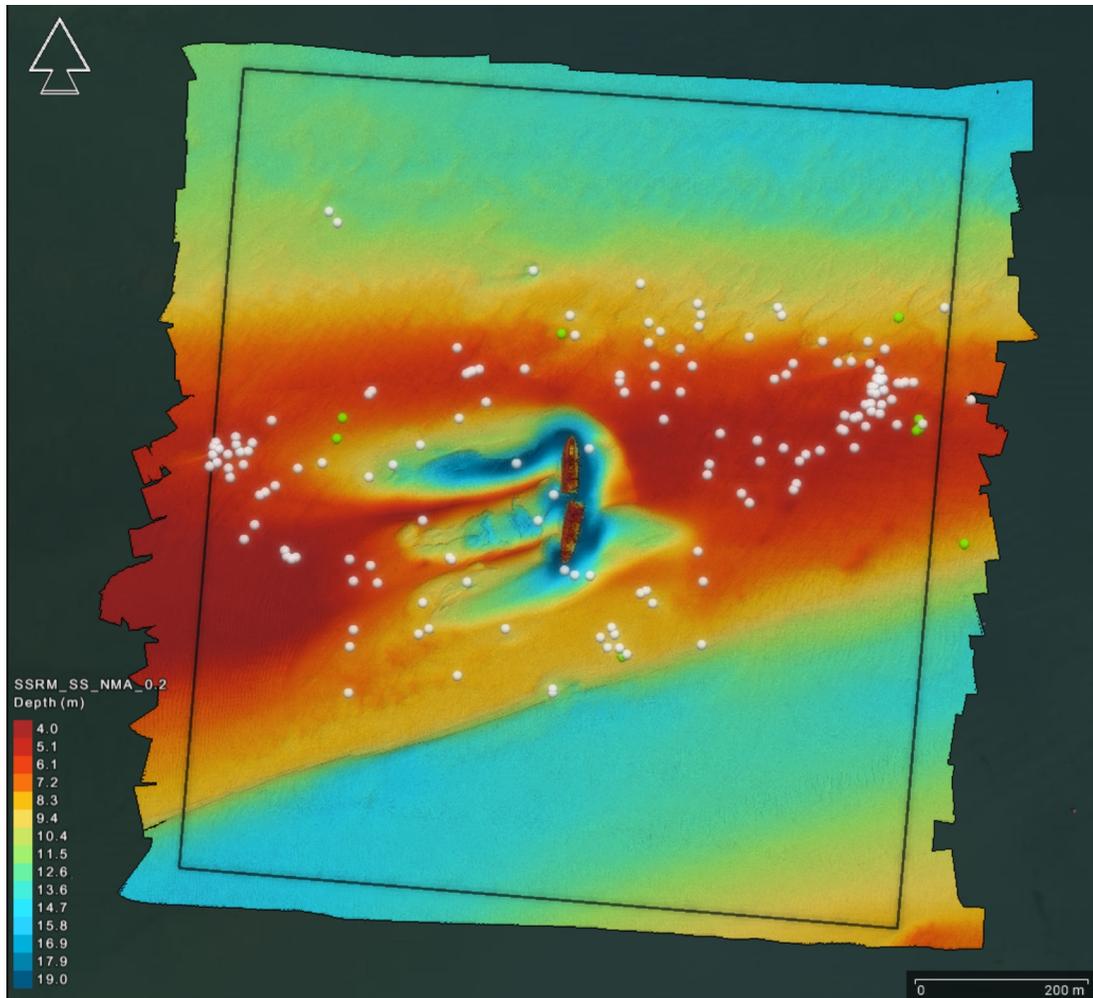


Figure 34. The SSRM survey area with seabed contacts, 2024 contacts in white, 2025 new contacts in green.

## 6 Conclusions

- 6.1.1** The 2025 full survey successfully covered all significant portions of the wreck with high quality MBES and laser data. All Key areas and features are well ensonified, providing good resolution of the whole wreck and a complete overlap of the MBES and laser data on the masts. The surrounding seabed was very well ensonified.
- 6.1.2** The significant change observed on Key area 6, with a displacement of approximately 2 m, highlights the rate of deterioration of SSRM. Furthermore, the continued increase in tilt of the forward section as well as the continued erosion of surrounding seabed, confirms the importance of regular surveys of the wreck.



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