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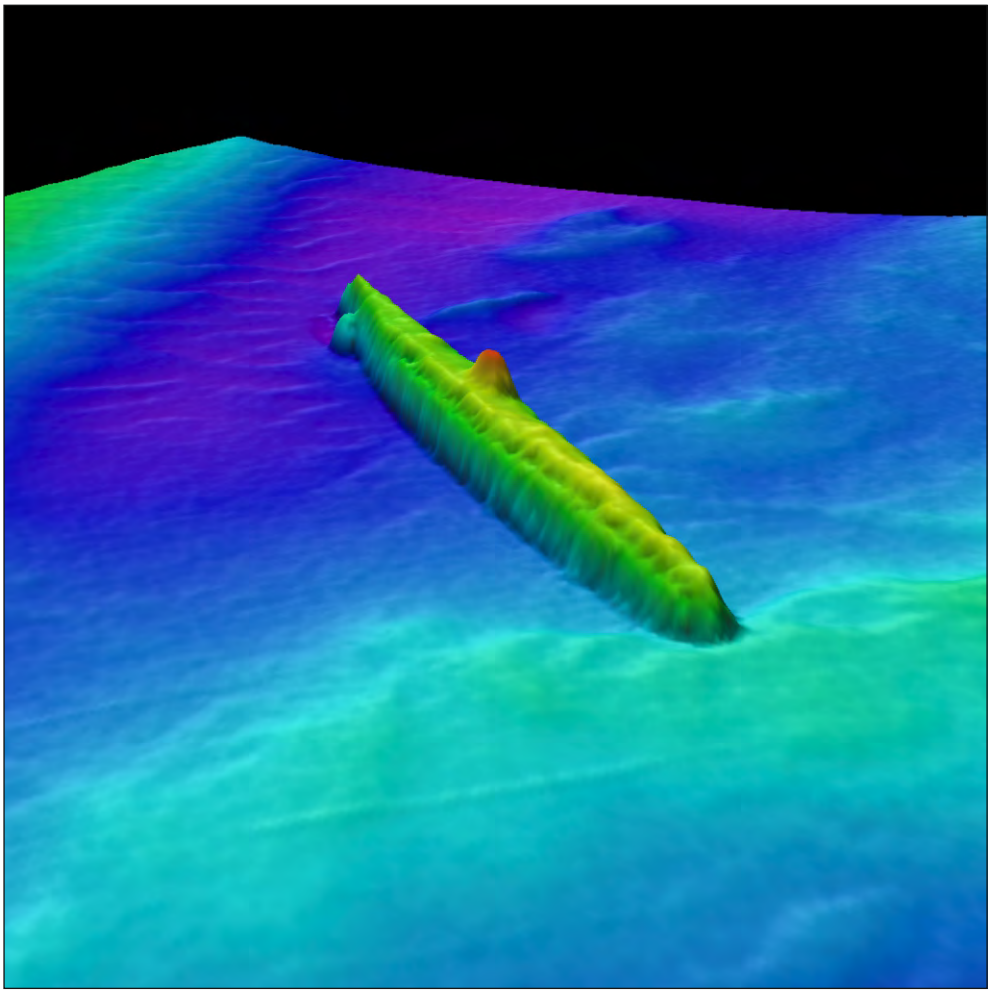
Archaeological Services in Relation to Marine Protection

U8
Off South Varne Buoy, English Channel

Undesignated Site Assessment



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Archaeological Services in Relation to Marine Protection

U8
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Undesignated Site Assessment

Prepared for:
Historic England

Prepared by:
Wessex Archaeology
Portway House
Old Sarum Park
Salisbury
WILTSHIRE
SP4 6EB

www.wessexarch.co.uk

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U8
Off South Varne Buoy, English Channel

Undesignated Site Assessment

Contents

Tables

Figures

Plates

U8
Off South Varne Buoy, English Channel

Undesignated Site Assessment

Summary

Wessex Archaeology was commissioned by Historic England to undertake a marine geophysical survey consisting of sidescan sonar and magnetometer of a 200m² study area within the geophysical survey area, centred on the UK Hydrographic Office position for the wreck of submarine U8 approximately 2km north-west of the South Varne buoy. This was to be followed by a diver survey however due to expensive safety requirements for diving operations the brief was altered to use an Autonomous Underwater Vehicle (AUV) to collect the geophysical data.

Wessex Archaeology was mobilised aboard the support vessel *Neptune* at Dover Marine on 10th August 2015. A survey of low and high resolution was commenced over the given location.

In total, 31 sidescan sonar, four multibeam bathymetry and nine magnetic anomalies were identified within the study area.

These features include any anomalies associated with the wreck itself and surrounding features of possible archaeological potential associated with the wreck. One anomaly has been designated as A1 - anthropogenic origin of archaeological interest. This has been identified as the structure of the wreck itself. A further five anomalies were designated A2 - uncertain origin of possible archaeological interest, due to their uncertain structure and distance from the wreck.

Based on analysis of reference and archival information and the latest geophysical data, U8 was assessed as either extremely or highly valuable against the non-statutory criteria for designation and has been recommended for designation under Protection of Wrecks Act 1973.

The character of the site is summarised in the following table, which focuses on seven topics for evaluating underwater wreck sites:

Area and distribution of surviving ship structure	Main submarine body 57.3m by 6.2m
Character of the ship structure	Mostly intact
Depth and character of stratigraphy	Less than one metre of hull buried
Volume and quality of artefactual evidence	Submarine body relatively intact with possible elements collapsed from their original position onto the seabed.
Apparent date of the ship's construction and/or loss	Launched in1911 and sunk in 1915
Apparent function	Attack submarine
Apparent origin	Germany

U8
Off South Varne Buoy, English Channel

Undesignated Site Assessment

Acknowledgements

The investigation was commissioned by Historic England and the assistance of Mark Dunkley, Alison James and Serena Cant is gratefully acknowledged.

The AUV survey was carried out by Adede BV with direction from Stephanie Arnott of Wessex Archaeology, with the assistance of the *Neptune* skipper and crew. Wessex Archaeology would also like to thank Bas Coolen of Adede for their assistance. The assistance of Dave Batchelor and Brian Robinson of *Neptune* is also gratefully acknowledged.

The geophysical data were processed by Laura Andrews, who also compiled this report with contributions from Stephanie Arnott and Peta Knott. The figures for this report were prepared by Kitty Foster. Quality control was provided by Stephanie Arnott and Louise Tizzard. The project was managed on behalf of Wessex Archaeology by Toby Gane.

U8
Off South Varne Buoy, English Channel

Undesignated Site Assessment

1 INTRODUCTION

1.1 Assessment Background

1.1.1 Wessex Archaeology was commissioned by Historic England to undertake an Archaeological Report of submarine U8 (UKHO 21102). The work was undertaken as part of the Archaeological Services in Relation to Marine Protection (Diving Contract) 2015-2017.

1.1.2 U8 was selected by Historic England as a site of special interest in relation to the ongoing commemorations associated with the First World War. The wreck is in a busy shipping area and had previously been dived by local dive clubs, both presenting potential threats to the site. Historic England requested an assessment of the current condition of U8 to establish whether further management of the site was required.

1.1.3 The wreck site is located in the English Channel, approximately 2km WNW of the South Varne buoy, and 16km south-south-east of Folkestone (**Figure 1**). The Study Area comprised a 200 x 200m box within the geophysical survey area, orientated with the tides south-west to north-east, centred on the United Kingdom Hydrographic Office (UKHO) wreck position.

1.1.4 The written brief and agreed scope of work (Historic England 2015) comprised a geophysical survey (sidescan sonar and magnetometer only) followed by a diver survey. However, during the planning stages of the surveys the method was altered as described below.

1.1.5 This report is the Archaeological Report and represents the findings and assessment of the geophysical data.

2 ASSESSMENT AIMS AND OBJECTIVES

2.1.1 The overall aim of the project was an undesignated site assessment, which was separated into the following primary and secondary objectives in the Brief (Historic England 2015):

2.2 Primary Objectives

- *Undertake a data audit comprising documentary research on the site as appropriate, to inform designation assessment;*
- *Contact the Receiver of Wreck and Historic England to gain a list of droits relating to the site;*
- *Establish links with local divers, dive groups and skippers to enable future site management options; and*

- *Undertake geophysical survey (sidescan and magnetometer only) to assess the presence/absence of heritage assets, and to establish extent, stability and character.*

2.3 Secondary Objectives

- *Undertake a diver survey of the remains to confirm position, extent, stability and character (plotted by diver survey) of the site;*
- *Locate and accurately position (plotted by diver survey and probing as appropriate) any additional archaeological material;*
- *Produce a structured record of field observations (including i) the collection of appropriate pH values and ii) the collection of footage suitable for broadcast); including photographic record of the site and basic site plan. Key artefacts are to be subject to detailed examination and recording (position by diver survey, taped measurements, photographs and video and written database entries).*

2.3.1 Due to expensive safety requirements for diving operations on this site, amendments were made to the archaeological brief. The U8 site is situated in a busy shipping channel, the southern Traffic Separation Zone. This zone keeps channel shipping apart by splitting it into east and west lanes. During planning, contact with Dover Maritime Rescue Co-ordination Centre (MRCC) resulted in a detailed list of safety requirements for planned diving operations.

2.3.2 One of the requirements of the MRCC was to have a guard vessel equipped with Class A Automatic Identification System (AIS) positioned further up the traffic separation lane from any vessel deploying divers or geophysical equipment to reduce the risk posed by approaching large vessels. This would have added a significant cost to both the geophysics and diving phases of work and would have caused the operation to go beyond the resourcing level allocated. As a result Wessex Archaeology explored other solutions.

2.3.3 The favoured option was to use an Autonomous Underwater Vehicle (AUV). As the support vessel would not be anchored, deploying divers or towing equipment, the MRCC were happy that a guard vessel would not now need to be deployed. The AUV survey was undertaken in August 2015.

2.3.4 Due to the revised site investigation method of AUV survey, it was not possible to achieve several of the objectives set by Historic England as they were dependent on having divers on the seabed. The objectives that could not be achieved by the AUV survey were:

- *Collecting pH values across the site*
- *Collecting video footage suitable for broadcast; and*
- *Examining key features and recording and documenting them in detail.*

2.3.5 Although the AUV was equipped with a GoPro camera to record footage whilst collecting geophysical data, the height from the seabed at which the vehicle had to be deployed coupled with the limited visibility of the water column meant that no footage of the U8 was captured. For this reason, external sources of video footage were obtained.

2.3.6 It was not possible to examine key features of the wreck in detail as the AUV collected general geophysical data only, as outlined below.

2.3.7 The recording level set in the Brief was Level 3a, whereby a diagnostic record is generated comprising ‘a detailed record of selected elements of the site’. This has been completed based on data collected by the AUV system.

2.3.8 The products requested for this site were:

- *an Archaeological Report suitable for public release (this document);*
- *an archive (documents, digital files and finds) generated and compiled to current accepted standards and deposited with the appropriate accredited repository; and*
- *finds logged appropriately with the Receiver of Wreck (not applicable).*

3 METHODOLOGY

3.1.1 All fieldwork procedures and standards complied with the relevant guidance by the Chartered Institute for Archaeologists (CIfA) as listed on their website (CIfA website, accessed June 2015).

3.2 Data Audit

A limited audit of existing primary and secondary sources relevant to the site location has been undertaken, however this does not amount to a full desk-based assessment.

Location Data

3.2.1 A wreck was first identified at this general location by the UK Hydrographic Office in 1977 (UKHO Wreck No. 21102). The wreck was at a general depth of 33m. Additional information about this wreck was recorded by the UKHO in following years including its orientation of 045/220 degrees, and its dimensions of 60m long and 6m high. In 1985 it was confirmed by the UKHO as a submarine of 53.9m length, 4.6m high and in a general depth of 32m, lying at 040/220 degrees.

3.2.2 Despite this wreck's identification as a submarine in 1985, it was mis-identified in the United Kingdom Shipwreck Index and Shipwreck Index of the British Isles in 1995 as a sailing smack (Monument Report 901747 and Larn 1995).

3.2.3 Whilst it was known for many years that a submarine wreck was at this location, there were conflicting views as to whether it was U8 or UB33. Historical documents record that both of these U-boats sank in this vicinity. This confusion has extended to artefacts raised from this area. The Receiver of Wreck has Droit 015/07 which relates to some sections of navigational lamp, a deck filler cap and breather vent that were raised from what was thought to be UB33. However the location from which these artefacts were raised has now been associated with U8 (Monument Report 901747). Another droit from the Receiver of Wreck is a ship's well and pelorus that were raised from a wreck thought to be U8 (Droit A/1038) (Monument Report 901747).

3.2.4 Due to the relatively close proximity of these two U-boats, there has been some confusion with identifying them and the artefacts raised from them. However, further investigation into the details of these wrecks has proven that the 36.9m long UB33 is facing up the channel and to the east of the 57.3m long U8, which is heading down the channel (McDonald 1994, 35 and Young and Armstrong 2006, 323).

3.2.5 The wreck site under investigation was conclusively identified as U8 by local diver, skipper and submarine researcher Dave Batchelor in 2003. The identity was confirmed as U8 from the collapsible gas exhaust columns on deck for the paraffin engine which is present on U8 but not UB33 (McCartney 2003, 149 and UKHO Wreck No. 21102). The U-boat was reportedly upright, heading south-west and very intact but with some damage to the casing (McCartney 2003: 149; McCartney 2014: 44; Young and Armstrong 2006: 313).

Documentary Data

3.2.6 *Seiner Majestät* (His Majesty's/SM) U8 was the last of four 500-ton coastal torpedo attack boats (U5-U8) built by Germanianwerft in Kiel for Kaiserliche Deutshce Marine (Rossler 2001: 23; Young and Armstrong 2006; 308). The vessel was ordered on 8th April 1908 and the keel laid at Yard No. 150 on 19 May 1909. U8 was launched on 14 March 1911 and commissioned to Kapitanleutnant Wilhelm Friedrich Starke on 18 June 1911 (Young and Armstrong 2006; 308).

3.2.7 The U-boat was 57.3m long, had a beam of 5.6m with a maximum height of 7.3m for the hull and conning tower and a draught of 3.6m (Rossler 2001: 328; Young and Armstrong 2006: 308). Built of steel with a double hull, U8 had displacement of 505 tons surfaced and 636 tons submerged (Rossler 2001; 328). Four 225hp Korting paraffin engines and two 520 hp electric motors powered the two bronze propellers (Young and Armstrong 2006; 308) (**Figure 2**). U8 could travel 13.4 knots surfaced and 10.2 submerged. It could travel 1,900nm at 13 knots surfaced or 80nm at 5knots submerged (Rossler 2001; 328) The top speed of 13.4 knots was still short of the planned 14.5 knots for which it was designed and never achieved (Rossler 2001: 23: Young and Armstrong 2006: 308). U8 could operate at a maximum depth of 50m and took 65 seconds to crash dive (Young and Armstrong 2006; 310).

3.2.8 The vessel was armed with two bow torpedo tubes and two stern torpedo tubes of 45cm diameter with a carrying capacity of six torpedoes. U8 was retrofitted with a reverse facing 105mm deck cannon by 1914 and when fully loaded carried 300 rounds of ammunition (Young and Armstrong 2006: 310).

3.2.9 U8 was operated by a crew of four officers and 25 ratings. From commissioning until 1 August 1914, Captain Wilhelm Friedrich Starke was the commanding officer (Young and Armstrong 2006: 310). The operational history of U8 prior to 1st August 1914 has not been researched. Konrad Gansser was at the helm for August 1914 while U8 was assigned to I. U-Flottille at Brunsbüttel. During this time U8 undertook a short uneventful patrol in the North Sea from 6-11th August 1914 (Young and Armstrong 2006: 310). The last commander of U8, Alfred Stoß (or Stoss), took up the post on 1st September 1914 (Young and Armstrong 2006: 310). From September 1914 to January 1915 Stoß led the U-boat on patrols from Brunsbüttel to the North Sea, Dover area and the north Scottish islands (Young and Armstrong 2006: 310).

3.2.10 In February 1915, U8 appears to have transferred from the Brunsbüttel to Ostend base. U8 left Ostend on 21st February 1915 on what was to become the vessel's most successful patrol. Working mainly in the eastern English Channel, U8 sank two British steamers, *Branksome Chine* and *Oakby* on 23rd February and another three the following day: *Harpalion, Rio Parana* and *Western Coast* (Young and Armstrong 2006: 310).

3.2.11 U8's final patrol, from which it did not return, began in company with U20 (the U-boat that infamously sunk the liner RMS *Lusitania*) when both vessels departed Ostend on 4th March 1915. The aim of the patrol was to sink as many enemy vessels in the shortest space of time and return to port.

3.2.12 There are several accounts of the sinking of U8 from both sides of the war. Whilst they mostly follow the same pattern of events, there are discrepancies in the timing. British accounts of events are recorded from several different eye-witness vessels (ADM 137/2096 176-240) and a summary of the official British account is recorded by Messimer (2006: 21-22). As the official documents were thrown overboard at the time of sinking, the German viewpoint is recorded in the 'Combat Report about the Sinking of SM U-boat U-8' by Captain Alfred Stoß. However as this was written over three years after the events, there is every

chance that the details are not entirely accurate. A translation of this report is given in *Verschollen* (Messimer 2006: 22-24) and an excerpt of the same is in *Silent Warriors* (2006: 312).

3.2.13 Captain Stoß records that U8, in company with U20, sailed from Ostend on 4th March 1915. Leaving U20 to pursue other patrol areas, U8 crossed the Ruytingen Bank minefield on the surface and then quickly encountered another new and dense minefield (Messimer 2006: 22; Young and Armstrong: 311). Due to fog reducing the visibility, U8 remained on the surface to obtain an accurate position fix before entering the Dover Strait. However the fog thickened and U8 dived to wait it out on the bottom close to South Foreland but a rocky bottom and strong current made this strategy to be untenable. Captain Stoß brought U8 to the surface but remained on batteries ready to dive at a moment's notice and headed west to the Strait.

3.2.14 The fog cleared and soon U8 was spotted by destroyer 1.5 nautical miles (nm) away with another 4 nm distant. U8 was forced to dive (Messimer 2006: 22; Young and Armstrong 2006; 311). HMS *Viking* reported sighting the U8 at 12:10 and fired shots at U8 causing it to dive (Young and Armstrong 2006: 311) however there is no mention of this attack in Captain Stoß' account, it was the destroyer approaching at fast speed that caused U8 to dive (Messimer 2006: 22).

3.2.15 U8 was trapped at the entrance to Dover Strait between two minefields to the north-east and two destroyers to the south-west. Captain Stoß knew that the tide would turn to flow west in an hour preventing them from making progress away from the destroyers and the rocky bottom was not a suitable hiding place (Messimer 2006: 22).

3.2.16 For the next four hours, the U8 was chased around the Dover Strait by several destroyers with clear skies providing nowhere to hide (McCartney 2014: 43). There is conflicting information about the details of events, however, what is clear is that U8 travelled a complicated submerged path in an attempt to evade the numerous destroyers on the hunt. Only the occasional periscope sighting gave the U8's position away.

3.2.17 One event that is uniformly consistent across all accounts is that an explosion occurred at 15:30. Stoß reports that after this explosion was heard in the distance, the diving planes did not respond indicating U8 may have fouled a net. No damage or entanglement was evident through the periscope.

3.2.18 By 15:55 the destroyers *Mohawk, Nubian, Cossack, Ghurka, Ure* and *Syren* joined the hunt for U8. Just before 16:00, HMS *Viking* fired an explosive sweep (Messimer 2006: 23) and *Ghurka* followed up with another one at 16:16 (Young and Armstrong 2006: 312).

3.2.19 At either 16:45 or 17:45 (depending on whether it is Young's or Messimer's translation of Stoß' account), Stoß went forward to investigate a suspicious sound and soon after a large explosion shook U8 and caused chaos throughout the U-boat. The lights went out, water started pouring in through seams in the hull, a fire started behind the starboard switch panel and the electric motors were flooded with seawater and batteries reacted with the seawater to produce toxic chloride gas. The most alarming effect of this successful attack by explosive sweep was that the U8 started pitching forward steeply. The crew were ordered aft as counter balance and the tanks were blown bringing the U-boat to the surface. The two destroyers *Ghurka* and *Maori* opened fire, making successful hits on the conning tower (Messimer 2006, 23). British records attribute this successful use of the explosive sweep to HMS *Ghurka* (Messimer 2006: 24; ADM 137/2096: 176-240).

3.2.20 Once on the surface, the U8 crew were ordered through the hatch while the captain and two other officers scuttled it by leaving the flooding valves open, shutting off the compressed air and also opening the main induction valve (Young and Armstrong 2006: 321). The log of *Ghurka* records that U8 sank at 17:12 (Young and Armstrong 2006: 312) and Stoß's account states that the U-boat sank just as he stepped off into the lifeboat (Messimer 2006: 23).

3.2.21 U8 was the first U-boat sunk in the Dover Strait and the first sinking U-boat ever captured on film. Numerous photographs of the crew evacuating U8 were taken by eye-witness destroyers and one of these images was taken by Surgeon Parkes and is now part of the Imperial War Museum collection (**Plate 1**).

3.2.22 There are conflicting second hand reports on whether or not U8 was visited by Royal Navy divers soon after the sinking. West writes that divers visited this wreck but he states that no records were made and it is unclear where he obtained this information (West 2013, 320). It would seem that sending Royal Navy divers down would be a fruitless exercise as it was known that the Germans threw all the important documents over the side as they were evacuating. Both McCarthy and Kemp state that it was not salvaged (Kemp 1997: 11; McCartney 2014: 45).

Survey Data

3.2.23 Apart from the UKHO completing geophysical surveys of the wreck, local dive clubs have routinely visited the site over the last decade or so.

3.2.24 Canterbury Divers have visited this wreck and provide details of the diving conditions on their website[1] . The U8 is described as lying in a scour of 35m with the decks at 32-33m and the greatest depth of 37m under the stern. The wreck is not obscured by major obstructions however many fishing weights, hooks and lines are hanging off the hull and a large net is attached to the stern.

3.2.25 It is known from the Canterbury Divers' website and several news reports that the propellers were salvaged sometime before 2014. One of the propellers was confiscated from a diver in Kent who had turned the artefact into a coffee table. In June 2015, after the salvager had been successfully prosecuted, the propeller was returned to the German Navy[2].

3.2.26 U8 was featured in a *Time Team* special in 2013. The Lost Submarine of WWI showed footage of U8 where key features of the wreck were evident[3]. The lower rudder is visible at the stern and a brief glimpse is given of the base of the deck gun. The conning tower with two periscopes is shown with blue rope wrapped around this feature and a breach in the hull forward of the conning tower on the port side is evidence of the explosive sweep damage. Further video footage of the wreck was made available from Brian Robinson of Folkestone British Sub-Aqua Club (BSAC). This video also shows the lower rudder extant but the upper rudder is shown too (**Plate 2**) along with the attached steering gear (**Plate 3**). The conning tower with two periscopes can be seen (**Plate 5**) and next to them is the open conning tower hatch (**Plate 6**). At the bow and on the starboard side, the anchor can still be seen in a stowed position (**Plate 7**).

[1] http://www.canterburydivers.org.uk/wrecks.html#u_8 Accessed 03/11/2015.
[2] http://www.kentonline.co.uk/folkestone/news/u-boat-propeller-turned-coffee-table-38811/ Accessed 03/11/2015.
[3] http://www.channel4.com/search/?q=The+Lost+Submarine+of+WWI%3A+A+Time+Team+Special Accessed 05/11/2015.

3.2.27 Further details of the extant remains are outlined by McCartney as part of his analysis of English Channel submarine wrecks (McCartney 2014: 44-45). As well as the features mentioned above he records a number of other diagnostic features of U8. The two collapsible communications masts are still extant, forward and aft on the main deck. Not only does the conning tower contain the remains of two periscopes, there is a third one forward along with a conical-insulator from a redundant communication system. The open conning tower hatch with missing cover is noted (**Plate 6**) as is the oversized double hatch for loading torpedoes under the deck (**Plate 4**) and an upper hatch for crew on the deck. However McCartney does not mention the collapsible engine exhaust columns on deck and Wessex Archaeology has not managed to obtain any images of this U8 feature from Dave Batchelor, the diver that recovered and still has this item.

3.2.28 Multibeam bathymetry data around the U8 area was acquired in 2007 by the Maritime and Coastguard Agency (MCA) Civil Hydrography Programme (CHP). This data was accessed through the UKHO INSPIRE portal and was used for comparison against the multibeam bathymetry data acquired by AUV during this current survey.

3.3 Geophysical Survey

3.3.1 The geophysical survey of the wreck of the U8 was conducted on 10th August 2015. As discussed in **Section 1,** due to the location of the U8 site it was not appropriate to use conventional towed geophysical equipment. The survey was therefore conducted using an AUV.

3.3.2 The survey was undertaken aboard the vessel *Neptune*, operating out of Dover Marina. The AUV was provided and operated by Adede BV, an unexploded ordnance (UXO) services company. Survey operations were observed and monitored by Wessex Archaeology staff who also provided input as to the survey parameters required.

Technical Specifications

3.3.3 The AUV used was an Iver3 model by Ocean Server. The AUV was fitted with Edgetech 2205 sonar transducers and a towed Marine Magnetics Explorer magnetometer. The Edgetech 2205 is an interferometric system that acquires sidescan sonar (SSS) imagery (pseudo-sidescan) and co-registered bathymetry data. It was operated with a range of 50m. Both high and low frequency data were obtained. Survey data were acquired covering a 200m x 200m box (the study area) centred on the UKHO location.

3.3.4 The AUV survey missions were planned using Vector Map software. A mission consists of a set of survey lines that are run as a single event. Only one line spacing, line length, orientation and height above the seabed can be used for all lines in a mission. Two missions were set up, one on either side of the wreck. Three lines were included in each mission, running parallel to the length of the wreck, south-west/north-east, with the closest line on each side 15m from the wreck and with the line spacing between individual lines in a mission set at 25m. Pairs of cross lines were also to be run at each end of the wreck, again with a spacing of 25m. Additional main lines were run at 25m each side of the wreck in order to try and obtain better quality images with the wreck positioned in the middle of the data. The lines were run at a height of approximately 10m above the seabed.

3.3.5 Survey positioning was provided by a Wide Area Augmentation System (WAAS) GPS receiver within the AUV when at the surface. When below the surface positioning was provided by a RDI Doppler velocity log, depth sensor and corrected compass. Positions were recorded as WGS84 geodetic co-ordinates in decimal degrees.

3.3.6 The AUV can only operate at slack water and with current speeds of up to approximately 1.5 knots. There were some technical problems with the AUV that meant that the cross lines to the north of the wreck were not successfully acquired. The eight main lines and two other cross lines were successfully acquired.

3.3.7 Data were downloaded from the AUV onto a hard drive when the vehicle was recovered to the surface.

Data Sources

3.3.8 The pseudo-sidescan sonar data were supplied to Wessex Archaeology in digital format in the form of .JSF files which were then converted to .COD files by Wessex Archaeology.

3.3.9 The marine magnetometer data were supplied to Wessex Archaeology in digital format in the form of .txt files appended to the vehicle telemetry log.

3.3.10 The bathymetry data were supplied to Wessex Archaeology by Adede in digital format in the form of tidally-reduced .xyz files for each individual line reduced to Lowest Astronomical Tide (LAT) datum.

3.3.11 Further multibeam bathymetry data were assessed. These data were acquired in 2007, through the MCA Civil Hydrography Programme (CHP) and accessed through the UKHO INSPIRE portal. The data were recorded in WGS 84 and provided digitally in raw ungridded .gsf format. The files were then converted to WGS UTM 31N during processing.

3.3.12 All subsequent positions for the survey have been expressed as WGS84 UTMz31N.

Data Quality

3.3.13 The geophysical data used for this report were assessed for quality and their suitability for archaeological purposes, and rated using the following criteria:

Table 1: Criteria for assigning data quality rating

Data Quality	Description
Good	Data which are clear and unaffected by weather conditions or sea state. The dataset is suitable for the interpretation of standing and partially buried metal wrecks and their character and associated debris field. These data also provide the highest chance of identifying wooden wrecks and debris.
Average	Data which are affected by weather conditions and sea state to a slight or moderate degree. The dataset is suitable for the identification and partial interpretation of standing and partially buried metal wrecks, and the larger elements of their debris fields. Wooden wrecks may be visible in the data, but their identification as such is likely to be difficult.
Variable	This category contains datasets with the quality of individual lines ranging from good to average to below average. The dataset is suitable for the identification of standing and some partially buried metal wrecks. Detailed interpretation of the wrecks and debris field is likely to be problematic. Wooden wrecks are unlikely to be identified.

3.3.14 The pseudo-sidescan data have been rated as ‘Good’ using the above criteria. Some snatching due to tidal currents and weather are visible within the data, but does not affect the data detrimentally to a large degree. The positioning accuracy of the sonar towfish was relatively good due to the known position of the AUV towfish. Although a lateral positional error of approximately 3m was noted this error was rectified during data processing.

3.3.15 The marine magnetometer data have been rated as 'Average' using the above criteria. Some of the data were affected by background noise and data spikes were visible. However, the spikes were removed during processing and the noise did not detrimentally affect the data to a large degree.

3.3.16 The multibeam bathymetry data from 2015 has been rated as 'Average' using the above criteria. Sufficient coverage has been acquired and the data is suitable for interpretation of objects on the seabed. However the low resolution used prevents the interpretation of much smaller objects.

3.3.17 The multibeam bathymetry from 2007 CHP data have been rated as 'Good' using the above criteria. Good coverage has been acquired and data can be displayed at a high enough resolution to be suitable for interpretation of smaller objects should they be present.

3.3.18 Both high and low frequency data were acquired. However, the high frequency data did not encompass the full extent of the range and only the low frequency data are of good quality and suitable for interpretation.

Data Processing

Pseudo-sidescan Sonar

3.3.19 The sidescan sonar data were processed by Wessex Archaeology using Coda GeoSurvey software. This allowed the data to be replayed with various gain settings in order to optimise the quality of the images. The data were interpreted for the wreck site and for any further objects of possible anthropogenic origin. This involves creating a database of anomalies within Coda by tagging individual features of possible archaeological potential, recording their positions and dimensions, and acquiring an image of each anomaly for future reference.

3.3.20 A mosaic of the sidescan sonar data is produced during this process to assess the quality of the sonar towfish positioning (**Figure 3**). The survey lines are smoothed, and any discrepancies in the navigation are corrected at this stage.

3.3.21 The form, size, and/or extent of an anomaly is a guide to its potential to be an anthropogenic feature, and therefore of its potential archaeological interest. A single, small, but prominent anomaly may be part of a much more extensive feature that is largely buried. Similarly, a scatter of minor anomalies may define the edges of a buried but intact feature, or it may be all that remains of a feature as a result of past impacts from, for example, dredging or fishing.

Marine Magnetometer

3.3.22 The magnetometer data were processed using Geometrics MagPick software in order to identify any discrete magnetic contacts which could represent buried metallic debris or structures. The software enables both the visualisation of individual lines of data and gridding of data to produce a magnetic anomaly map (**Figure 3**).

3.3.23 Prior to assessment the magnetometer data were reduced so that the files just included data from when the vessel was steady sub-surface (not diving or climbing). The data were then loaded into MagPick. The data were then smoothed, a trend fitted to the results, and then the trend values subtracted from the smoothed values. This was carried out in an attempt to remove natural variations in the data (such as diurnal variation in magnetic field strength and changes in geology). The processed data were then gridded to produce a map of magnetic anomalies, and individual anomalies tagged and images taken in a similar process to that undertaken for the sidescan sonar data.

3.3.24 The form and size of a magnetic anomaly is a guide to its potential to be an anthropogenic feature. Generally single magnetic amplitudes of over 5nT identified along a short distance are interpreted to be of anthropogenic origin.

Multibeam Bathymetry

3.3.25 The multibeam bathymetry data acquired with the AUV were fully analysed to identify any unusual structures of the vessel or other anthropogenic debris. The data were gridded to a cell size of 0.75m and analysed using IVS Fledermaus software, which enables 3-D visualisation of the acquired data and geo-picking of seabed anomalies. Due to the nature of the dataset the data from individual lines were processed and interpreted separately.

3.3.26 The 2007 CHP multibeam bathymetry data were fully analysed. The data were gridded to a cell size of 0.3m and fully analysed using IVS Fledermaus software.

Anomaly Grouping and Discrimination

3.3.27 The previous section describes the initial interpretation of all available geophysical data sets. This inevitably leads to the possibility of any one object being the cause of numerous anomalies in different data sets and apparently overstating the number of archaeological features around the wreck site.

3.3.28 To address this fact, the anomalies were grouped together, allowing one ID number to be assigned to a single object for which there may be, for example, a magnetic response and multiple sidescan sonar anomalies.

3.3.29 Once all the geophysical anomalies have been grouped, a discrimination flag is added to the record in order to discriminate against those which are not thought to be of an archaeological concern. These flags are ascribed as follows:

Table 2: Criteria for discriminating archaeological importance of features

Non-Archaeological	U1	Not of anthropogenic origin
	U2	Known non-archaeological feature
	U3	Non-archaeological hazard
Archaeological	A1	Anthropogenic origin of archaeological interest
	A2	Uncertain origin of possible archaeological interest
	A3	Historic record of possible archaeological interest with no corresponding geophysical anomaly

3.3.30 All the anomalies that have been identified from around the wreck sites are presented in **Appendix I** and discussed in this report.

3.3.31 The grouping and discrimination of information at this stage is based on all available information and is not definitive. It allows for all features of potential archaeological interest to be highlighted, whilst retaining all the information produced during the course of the geophysical interpretation for further evaluation should more information become available.

3.4 Diving Survey

3.4.1 No diving activities were undertaken as part of this assessment.

4 RESULTS

4.1 Summary of Progress against Objectives

4.1.1 **Table 2** shows the progress that has been made against the fieldwork objectives presented in **Section 2**.

Table 3: Summary table

Objective	Progress
Data Audit including documentary research	Achieved. See Section 3.2.
Contact Receiver of Wreck and Historic England	Achieved
Establish links with local divers and skippers	Somewhat achieved as per revised plan.
Geophysical Survey	Achieved by AUV. See generally below.
Undertake a diver survey	Not achieved, as per revised plan.
Locate additional archaeological material	Somewhat achieved based on geophysical data.
Produce a structured record and archive	Achieved.

4.2 Site Position

4.2.1 The wreck site is located in the English Channel, approximately 2km north-west of the South Varne buoy, and 11km south-east of Folkestone (**Figure 1**).

4.2.2 The location of the wreck site is as follows, based on the geophysical data:

Table 4: Site co-ordinates

WGS84 Lat/Long (DDM)		WGS84 UTM 31N	
Longitude	E 01 15.383	**Easting**	377481
Latitude	N 50 56.032	**Northing**	5643919

4.3 Seabed Features Assessment

4.3.1 A total of 31 sidescan sonar, four multibeam bathymetry and nine magnetic anomalies were identified within the geophysical data. Following the grouping and discrimination procedure outlined above, these were grouped to produce a list of six sites of potential archaeological interest within the survey area (**Figure 4**), which were characterised as follows:

Table 5: Sites of potential archaeological interest within the survey area

Archaeological Discrimination	Number of Sites	Interpretation
A1	1	Anthropogenic origin of archaeological interest
A2	5	Uncertain origin of possible archaeological interest
Total	**6**	

4.3.2 These six sites have been designated the following classifications:

Table 6: Classification of sites with archaeological potential

Classification	Number of Sites
Wreck	1
Debris	1
Dark Reflector	3
Bright Reflector	1
Total	**6**

4.3.3 Anomaly **WA7000** has been classified as A1 – Anthropogenic origin of archaeological interest. This anomaly has been interpreted as the wreck of the U8 and is located in approximately 32.5m Lowest Astronomical Tide (LAT) at the UKHO recorded position (**Figure 5**) orientated approximately north-east/south-west and has dimensions of 57.3m x 6.2m x 6.7m. These dimensions correspond with those of the U8 (Young and Armstrong 2006: 308). The conning tower is visible in both multibeam bathymetry datasets, with the presence of a mast and radio antennae also inferred by the shadows cast in the sidescan sonar data only. A maximum height of 6.7m has been recorded for this structure. The main body of the wreck has a recorded height of 4m above the seabed, appearing upright and relatively intact in the sidescan sonar and both multibeam bathymetry datasets, although possibly slightly broken up at the south-west end. A possible cavity in the centre port side of the structure can also be observed in the sidescan sonar data. The portside hydroplane is evident in the multibeam bathymetry which also shows a slightly raised section forward of the conning tower that might be the collapsible engine exhaust columns. The multibeam bathymetry data suggests that there is a build-up of sediment along the west edge of the wreck which could bury further debris. A very large magnetic anomaly of 2063nT is associated with the wreck, which may mask smaller anomalies that may be present caused by such buried debris.

4.3.4 The remaining five anomalies have been classified as A2 – Uncertain origin of possible archaeological interest.

4.3.5 Anomaly **WA7005** is situated 13m to the north-west of the central wreck position. It has been interpreted as a piece of debris measuring 7.5m x 3.5m x 0.5m and it is possible that this is debris in the form of superstructure that has fallen away from the main body of the wreck. However this may prove to be a natural build-up of sediment or intrusive material such as fishing gear. It was visible only in the 2015 multibeam bathymetry data. Any associated magnetic value would be obscured by the very large magnetic anomaly of the wreck.

4.3.6 A small dark reflector (**WA7001**) was identified in the sidescan sonar data approximately 16m north-west from the southern end of the wreck, measuring 3.1m x 1.0m x 0.2m. The feature was observed as a small curvilinear object with a total measured length of 10.5m and a recorded width of approximately 0.3m. Any associated magnetic value would be obscured by the very large magnetic anomaly of the wreck.

4.3.7 Anomaly **WA7002** has been identified approximately 75m to the north-west of the centre of the wreck and was interpreted as small dark reflector in the side scan sonar data measuring 1.9m x 0.4m x 0.2m. This object was not identified within either multibeam bathymetry data set and there is no associated magnetic value for this anomaly. This could be due to the non-ferrous nature of the anomaly or that it is outside the detection limits from the nearest magnetometer survey line.

4.3.8 Anomaly **WA7003** has been identified approximately 88m north-west of the central wreck position. It was interpreted as a small dark reflector visible in the sidescan data and a small

mound in the 2007 bathymetry data. The anomaly measures approximately 2.6m x 1.7m x 0.2m. There is no associated magnetic value for this anomaly. This could be due to the non-ferrous nature of the anomaly or that it is outside the detection limits from the nearest magnetometer survey line.

4.3.9 The final anomaly (**WA7004**) has been interpreted as a bright reflector located approximately 28m from the southern end of the wreck. This anomaly was also identified in the sidescan sonar data only, measuring 3m x 0.7m; any associated magnetic value at this location would be obscured by the proximity to the very large magnetic anomaly of the wreck.

4.3.10 A comparison can be drawn between the two multibeam bathymetry sets despite the difference in resolution (**Figure 6**).

4.3.11 It can be seen from looking at the two different datasets that the background of the site has not significantly changed between 2007 and 2015. The ridge along the south-east of the wreck has not moved and the scour patterning is very similar between the two datasets. The dimensions of the wreck in the 2007 CHP data are observed as 56m x 6m x 3.7m. In the 2015 dataset they are observed as 54m x 8.5m x 3.4m. The sediment build-up at the north end of the wreck seems to have shifted southwards slightly which would account for the difference of 2m in length and the build-up of sediment on the west side of the wreck is visible in both datasets and has increased slightly since 2007, which would explain the apparent widening of the wreck structure and the loss of height.

4.4 Site Description

Seabed and Ecology

4.4.1 From previous non-Wessex Archaeology diving operations it is known that the seabed is sand and shell (Cotswold 2014: 79; Young and Armstrong 2006: 313) with some silt that can reduce visibility when disturbed[4].

4.4.2 Video footage from Brian Robinson shows that U8 is covered by a short, dense marine turf with a concentration of white sponges on the bow and a more dispersed covering on the remainder of the vessel. There is also a considerable amount of fish life inhabiting the U8 environment.

5 DISCUSSION

5.1 Site Identification

5.1.1 Analysis of the geophysical data from the AUV survey and comparison with U-boat plans along with diver photographs proves that this wreck is SM U8. The wreck appears to be quite intact with only one possible small section separated from the hull. However, it is still possible that other debris may lie buried in the seabed.

5.1.2 Due to the historical information about the U8's sinking location, the many witnesses to this event and the strong correlation between the wreck remains and the known U8 design, and the recovery and repatriation of one of the propellers, it is unlikely that this wreck is anything other than U8.

5.2 Site Characterisation

5.2.1 The overall characterisation of the exposed material on the seabed can be summarised as follows, using the Build/Use/Loss/Survival/Investigation (BULSI) method for 'shipwreck

[4] http://www.canterburydivers.org.uk/wrecks.html#u_8 Accessed 03/11/2015

biography' as presented within the Aggregate Levy Sustainability Fund (ALSF) project *On the Importance of Shipwrecks* (Wessex Archaeology 2006). The site characterisation of U8 is as follows:

Build

5.2.2 The intact steel hull on the seabed has been measured by geophysical survey and is of similar dimensions to those recorded when U8 was constructed, to the type-U5 specification, in 1908-11 which was 57.3m long, 5.6m beam, 3.6m draught and maximum conning tower height of 7.3m. The sidescan sonar and bathymetry both show an image of a submarine shape on the seabed with a protruding conning tower of 3.6m fore and aft dimensions. The submarine extends forward of the conning tower for 27.1m and aft of the conning tower for 26.6m which corresponds to the U8 dimensions (**Figure 7**). U8 had a steel double hull and two bronze propellers, however the propellers are no longer on the seabed. Other features to substantiate the identification of U8 are the upper and lower rudders, both of which are extant. U8 was also known to have three periscopes, two of which are extant on the conning tower and one forward. The anchor is also still stowed on the starboard bow of the wreck (**Plate 7**).

5.2.3 U8 was one of four 500-ton, gasoline powered coastal torpedo attack U-boats that was designed for speed and fire power. At the time of construction it was the most advanced and powerful submarine design in the world, although it was quickly surpassed with the improvement in designs necessitated by the outbreak of the First World War.

Use

5.2.4 It is known that U8 was a coastal torpedo U-boat with a capacity of six torpedoes and a retrofitted 105mm deck cannon. At the time of loss, U8 was on a mission to sink as many enemy ships as possible so would have been armed with maximum munitions. There is no record of U8 firing a torpedo or using the deck cannon on its last mission and therefore it is likely to still retain all its munitions.

Loss

5.2.5 Multiple historical accounts from both sides of the conflict record the events that led to the loss of U8. Whilst these accounts have slightly conflicting timings of the events, they all follow the general pattern that U8 was chased by the Dover patrol for four hours before an explosive sweep caused critical damage to the U-boat forcing it to surface. The crew evacuated the vessel and were taken prisoner, but not before scuttling U8.

Survival

5.2.6 The majority of the U-boat hull survives intact with the conning tower and three periscopes still extant. However there is some damage to the casing around the conning tower as a result of the explosive sweep and two hits to the conning tower from destroyer attack. Both propellers have been illegally salvaged and some other smaller artefacts that may have come from the U8 have been raised and reported to the Receiver of Wreck. There is also the possibility that a larger section of the hull (**WA7005**) has fallen away onto the seabed and other smaller sections of the U-boat may also have become detached and been buried.

Investigation

5.2.7 Prior to the current investigation, the U8 has been visited by Innes McCartney on several occasions since 2003 as part of his larger project to research U-boats in the English Channel. U8 has also featured on a *Time Team* special which investigated the submarines of the First World War (FWW). Cotswold Archaeology included the U8 in their desk-based assessment of submarines in 2014. Wessex Archaeology has completed the current 2015 investigation using the data acquired by AUV.

6 RISK ASSESSMENT

6.1.1 Using available information, the site has been risk assessed for the purposes of site management using Historic England's *Protected Wreck Sites at Risk: A Risk Management Handbook* (2008). The results are set out in **Appendix 1**.

6.1.2 Risk is assessed as Low. The principal vulnerability is the risk of a resumption of finds recoveries without adequate archaeological controls, however this may be viewed as relatively minor.

7 ASSESSMENT AGAINST NON-STATUTORY CRITERIA FOR DESIGNATION

7.1 Assessment Scale

7.1.1 For each criterion, one of the following grades has been selected. This has been done in order to help assess the relative importance of the criteria as they apply to the site. The 'scoring' system is as follows:

- *Uncertain – insufficient evidence to comment;*
- *Variable – the importance of the wreck may change, subject to the context in which it is viewed;*
- *Not Valuable – this category does not give the site any special importance;*
- *Moderately Valuable – this category makes the site more important than the average wreck site;*
- *Highly Valuable – this category gives the site a high degree of importance. A site that is designated is likely to have at least two criteria graded as highly valuable;*
- *Extremely Valuable – this category makes the site exceptionally important. The site could be designated on the grounds of this category alone.*

7.2 Non-Statutory Criteria Assessment

7.2.1 The U8 site has been assessed using the scale presented below against the criteria required for designation under the Protection of Wrecks Act 1973 as presented in Historic England's *Ships and Boats: Prehistory to Present* (2012: 9-11). If further evidence be found relating to the site, this assessment should be updated appropriately.

Period

7.2.2 **Extremely Valuable.** This site has been conclusively identified and closely dated as U8, a pre-First World War (FWW) U-boat that was the most advanced submarine design in the world at the time of its construction. This wreck is physical evidence of the exponential technological advancements in the first ten years of German U-boat construction. Another factor in determining U8's historical significance is the fact that it was the first U-boat to be lost in the Dover Strait during this conflict.

Rarity

7.2.3 **Extremely Valuable.** U8 is the only known remaining U-boat of its type (U5). U8 was one of four coastal torpedo attack U-boats constructed in 1908 by Germaniawerft. U6 and U7 were both sunk by torpedoes in 1915 and have never been located. U5 was mined but then raised and toured internationally to raise funds post-FWW and then broken up. In the broader sense, U8 is also the only extant representative of the 14 U-boats powered by Korting heavy-oil type engines and sunk in English waters. U11 is the other example and it has not been conclusively located on the seabed. One final feature to contribute to U8's

rarity is that it is the only U-boat known to have been sunk as a result of effective use of an explosive sweep.

Documentation

7.2.4 **Highly Valuable.** There is a considerable level of documentation available related to U8 including design plans and English and German accounts of the loss. It is highly unusual to have both sides of events preserved in the historical record. It is also the first captured U-boat to be photographed during the FWW with many different images being taken as the crew were evacuated from the sinking vessel. The photographing of the sinking U8 demonstrates a marked change in the way in which war events were reported.This documentation contributes to the significance of this vessel in providing a more detailed understanding of this early U-boat.

Group Value

7.2.5 **Highly Valuable.** U8 is the earliest representative of the 20-22 U-boats sunk by the Dover Patrol during the FWW. Not all loss reports have been confirmed as wrecks to date. This group of wrecks demonstrates the effectiveness of the Dover Patrol that used minefields, destroyers and drifters to block the Strait to enemy vessels. U8 is also one of a large number of wrecks located in the Channel that make up an extensive landscape of FWW wrecks, including both hunters and the hunted.

Survival/Condition

7.2.6 **Highly Valuable.** Based on diver reports and geophysical investigations, the U8 is preserved on the seabed in a relatively intact condition. The hull is comparatively complete and upright on the seabed with the conning tower and periscopes still *in situ*. Minimal damage was caused to the hull by the explosive sweep as the vessel was still capable of rising to the surface and it was probably the crew that scuttled it. The propellers have been salvaged along with some other fixtures and fittings and there is the possibility that a section of hull is buried in the seabed nearby. Damage was caused to the internal fittings of U8 during the wrecking process including: burst pressure hull seams, fire in the starboard switch panel and flooded electric motors and batteries. As the conning tower hatch was left open it is probable that the U-boat has, at least partially, filled with sediment. Confirmation of the internal conditions would need to be confirmed by diving investigation and the current condition of the internal features of U8 cannot be ascertained with the information available.

Potential

7.2.7 **Highly Valuable.** U8 has great potential for illustrating many aspects of history. It was the first U-boat to be sunk in the Dover Strait and demonstrates the effectiveness of the Dover Patrol. The protracted chase by multiple destroyers for four hours, followed by the crew surrendering was widely reported in print and photographs across the world, even as far away as New Zealand.[5] It reflects a time early in the war when the enemy was still treated with a degree of respect. Although the crew were initially to be tried for piracy (McCartney 2015: 43) they were well treated and the officers were invited to dinner on-board the submarine depot ship HMS *Arrogant* the day they were captured (Young and Armstrong 2006). It is Wessex Archaeology's view that the wreck is the focus of a thought-proving story with a relatively happy ending that has potential for future public interpretation. More recently, the U8 wreck has become an interesting dive site, helped support the strong prosecution of illegal salvage of artefacts and positive relations between former enemies with the repatriation of the salvaged propeller to the German Navy.

[5] See: http://paperspast.natlib.govt.nz/cgi-bin/paperspast?a=d&d=AS19150306.1.5&e=-------10--1----0-- Accessed 04/12/2015.

Fragility/Vulnerability

7.2.8 **Highly Valuable.** As the hull is relatively intact. The most significant threat to the structural integrity of the site is the inevitable corrosion and erosion caused by environmental conditions. There is still the possibility of further damage caused by unethical diving practices, fishing activities or shipping incidents, however as long as the hull retains its integrity the wreck should remain relatively stable.

Diversity

7.2.9 **Highly Valuable.** U8 adds to the diversity of wrecks in English waters as being the only example of a pre-FWW U-boat in good condition suitable for relatively easy underwater interpretation and with strong connections to historical events.

7.3 Summary

7.3.1 It has been demonstrated that U8 is either extremely or highly valuable in all the categories above due to its unique construction, sinking event, level of preservation and connection to wider historical themes. This significance has also been recognised by both Cotswold Archaeology and McCartney's submarine studies (Cotswold Archaeology 2014: 79; McCartney 2003: 148; McCartney 2014: 43). The evidence provided demonstrates that U8 meets the non-statutory criteria for designation under Protection of Wrecks Act 1973.

8 CONCLUSION AND RECOMMENDATIONS

8.1.1 The archaeological and geophysical survey of this site concludes that this is the wreck of coastal torpedo attack U-boat U8 wrecked in March 1915. Based on the assessment of the physical seabed features, the wreck is in relatively good condition and will continue to remain so unless any remarkable human or environmental activity intervenes. The wreck is in a busy shipping lane which does act as a slight deterrent to diving and fishing vessels and therefore there is lower than average risk to the wreck in these respects. However, due to the significance of U8 as outlined above, it is recommended that this wreck is designated to further protect the remains. This will also serve to promote the significance of the wreck, encourage responsible diving and add an extra layer of protection by deterring any removal of artefacts from the U8.

8.1.2 In conjunction with designation, it is recommended that custodianship of the U8 is encouraged in the local dive clubs that have already visited the site. This would assist Historic England with monitoring the wreck for both illegal activity and adverse environmental effects.

8.1.3 The character of the site is summarised in the following table, which focuses on seven topics for evaluating underwater wreck sites (Watson and Gale 1990, 183).

Table 7: Summary of site character, based on Watson and Gale 1990

Area and distribution of surviving ship structure	Main submarine body 57.3m by 6.2m
Character of the ship structure	Mostly intact
Depth and character of stratigraphy	Less than one metre of hull buried
Volume and quality of artefactual evidence	Submarine body relatively intact with possible sections fallen off on the seabed.

Apparent date of the ship's construction and/or loss	Launched in1911 and sunk in 1915
Apparent function	Attack submarine
Apparent origin	Germany

8.1.4 It is recommended that local dive club custodianship is encouraged to assist with the long term monitoring of U8.

9 ARCHIVE

9.1.1 The project archive consists of a hard copy file and computer records and is currently stored at Wessex Archaeology under project code 108280. The project archive will be transferred to an accredited repository that is yet to be agreed.

9.1.2 Shapefiles generated for the project comply with Marine Environment Data and Information Network (MEDIN) standards for metadata (Seeley *et al.* 2014).

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11 APPENDICES

11.1 Appendix 1: Site Risk Assessment

Wreck/Site Name	**SM U8**		
HRHE / UKHO No.	EH Region	Restricted Area	Principal Land Use
	South East		Marine
Latitude (WGS84)	N 50 56.032		
Longitude (WGS84)	E 01 15.383		
Class Listing	Period	Status	
U-boat (Type U5)	Pre-FWW	Non-designated wreck site	
Licensee	Nominated Archaeologist	Principal Ownership Category	
Nil	Nil	Ministry of Defence/German Government	
Seabed Owner	Navigational Administrative Responsibility		
Crown Estate			
Environmental Designations			
None			
Seabed Sediment	Energy		
sZ Sandy silt			
Survival			
Very good			
Overall Condition	Condition Trend	Principal Vulnerability	
B: Generally satisfactory. No management action is required provided it does not greatly exceed is current extent.	C: Stable: the monument shows no sign of active deterioration either recent or midterm.	Socio-economic activity, ACC Authorise Access	
Amenity Value: visibility			
A: substantial above bed structural remains that are highly visible and 'legible' without further information.			
Amenity Value: physical accessibility	Amenity Value: intellectual accessibility		
A: Full: no restrictions on access and no impediments to appreciation of the wreck.	C: no interpretation		
Management Action	D: action to be identified		
Management Prescription	A: a formal management agreement		
Notes:			
Risk is assessed as:	**Low**		
Data Source	**CON**	**Date & Initials**	**05/11/2015 WA**

11.2 Appendix 2: Anomalies of Archaeological Potential

WA ID	Classification	Easting	Northing	Latitude (WGS 84 DDM)	Longitude (WGS 84 DDM)	Archaeological Discrimination	Length (m)	Width (m)	Height (m)	Magnetic Amplitude	Description	External References
7000	Wreck	377481	5643919	N 50 56.032	E 01 15.383	A1	57.3	6.2	6.7	2063	Long thin outline of a wreck - from shape of shadow has been interpreted as an upright submarine as conning tower and radio masts visible in the SSS shadow. Measuring 57.3m x 5.6m with highest point measured at 6.70m at this point, rest of the vessel approximately 4m. Some structure is visible within the main outline and to one side as dark reflectors, some with slight shadow. Appears it is possibly broken up at one end. Mag value given as largest recorded however, mag data not recorded directly above the wreck position. Position taken from the central position observed in the bathymetry data. Dimensions in this dataset 57mx6.2mx3.8m with highest point recorded as 5.5m, thought to be the conning tower. Some other structure visible on the top and to the sides.	UKHO 21102
7001	Dark Reflector	377451	5643910	N 50 56.027	E 01 15.357	A2	3.1	1	0.2	-	Curvilinear object that may be associated with the wreck lying just to one side. Curled in an area measuring 3.1m x1m but full measurements recorded as 10.5m x 0.3m x 0.2m. Located on one side of a geological feature but not visible within the bathymetry data. Any associated magnetic value would be obscured by the very large magnetic anomaly of the wreck.	

WA ID	Classification	Easting	Northing	Latitude (WGS 84 DDM)	Longitude (WGS 84 DDM)	Archaeological Discrimination	Length (m)	Width (m)	Height (m)	Magnetic Amplitude	Description	External References
7002	Dark Reflector	377417	5643960	N 50 56.054	E 01 15.327	A2	1.9	0.4	0.2	-	Small slightly concave object with slight scouring in front and slight shadow indicating height. Possibly a small object associated with the wreck. Not visible within the bathymetry data. No associated magnetic value for this anomaly - unclear if would be covered by gridded magnetometer data.	
7003	Dark Reflector	377398	5643948	N 50 56.047	E 01 15.311	A2	2.6	1.7	0.2	-	Indistinct straight object with rounded bright shadow. Possible debris associated with the wreck. Visible within the bathymetry data as a small mound measuring 1.8mx1.7mx0.1m. Location not covered by magnetic data.	
7004	Bright Reflector	377484	5643881	N 50 56.012	E 01 15.386	A2	3	0.7	-	-	Small curvilinear bright reflector approx. 28m SE of South West end of wreck. No dark edge visible - could be due to image quality or object could be made of synthetic material. Not visible within the bathymetry data. No associated magnetic anomaly but size of wreck anomaly masks the whole area.	
7005	Debris	377468	5643923	N 50 56.034	E 01 15.372	A2	7.5	3.5	0.5	-	Indistinct irregular object just to the north side of the vessel. Could be fallen away superstructure. Only seen in the 2015 multibeam bathymetry data.	

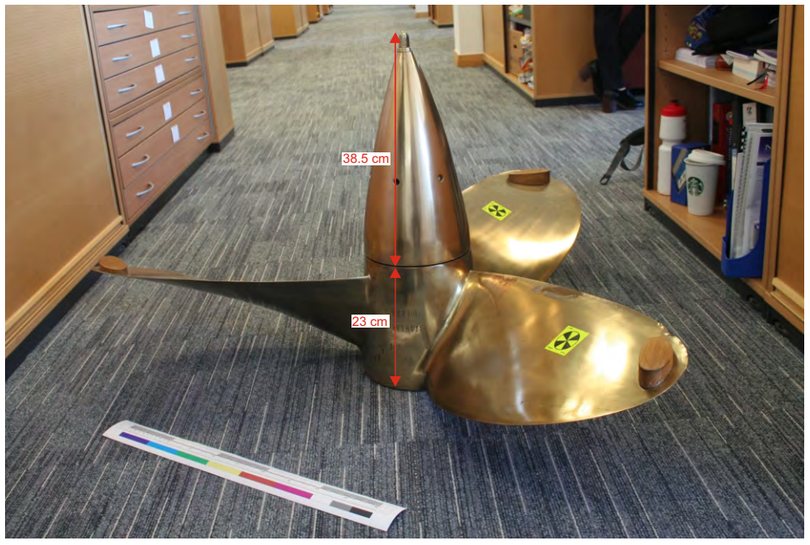
Notes

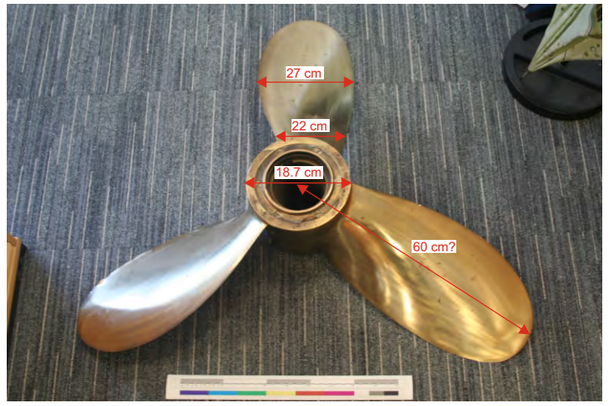
1. Co-ordinates are in WGS84 UTM 31
2. Positional accuracy estimated ±10m

11.3 Appendix 3: Recording of U8 propeller

U8 propeller

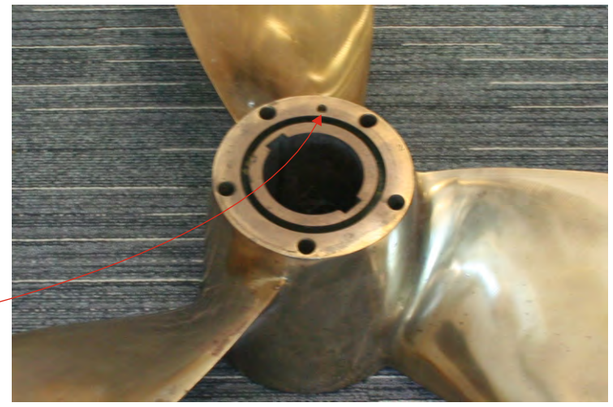
Description	The bronze three bladed propeller consists of two parts, the inner rotating hub and the central boss. The central boss is 38.5cm high with a maximum diameter of 18.7cm. The bronze hub has a hollow central rotating shaft of 18.7cm diameter with three radiating angled blades. Each of the blades has a minimum width of 22cm, a maximum width of 27cm and extends for 60cm from the centre of the hub. The height of the central hub is 23cm. On the underside of the hub the central hollow has an inner raised lip bounded by an outside recessed circular channel with six screws embedded. On the outer side of the bronze hub there are five regularly spaced medium sized holes and one small hole. The second part of the propeller is the central boss, also constructed of bronze and conical in shape. Half way down the conical boss, there are six regularly spaced holes, one of which is larger than the others. The bottom third of the boss is hollow and has an inner screw thread. Surrounding the hollow, on the base face, there is a raised circular ridge surrounded by a ring of 11 semi-regularly spaced holes and one pin. This one pin fits into the small receiving hole on the bronze hub.
Damage	One of the blades has a small series of chips on the outer edge of the blade. Wooden blocks were attached to the three blades to re-use the propeller as a coffee table. These have since been removed.

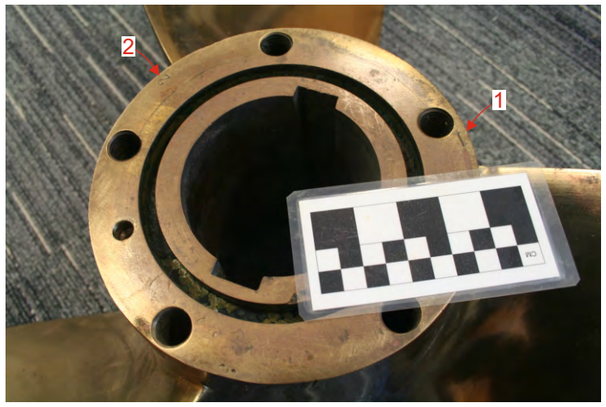




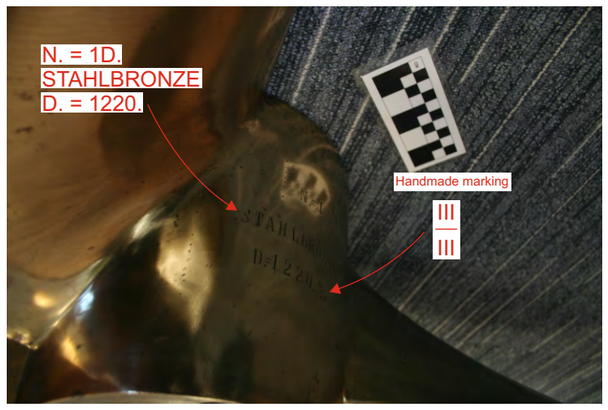
Hub showing under side view


Hub under side


Hub outer side



Number engravings on outer hub



Between two blades on the hub


Handmade ‘X’ marking on hub

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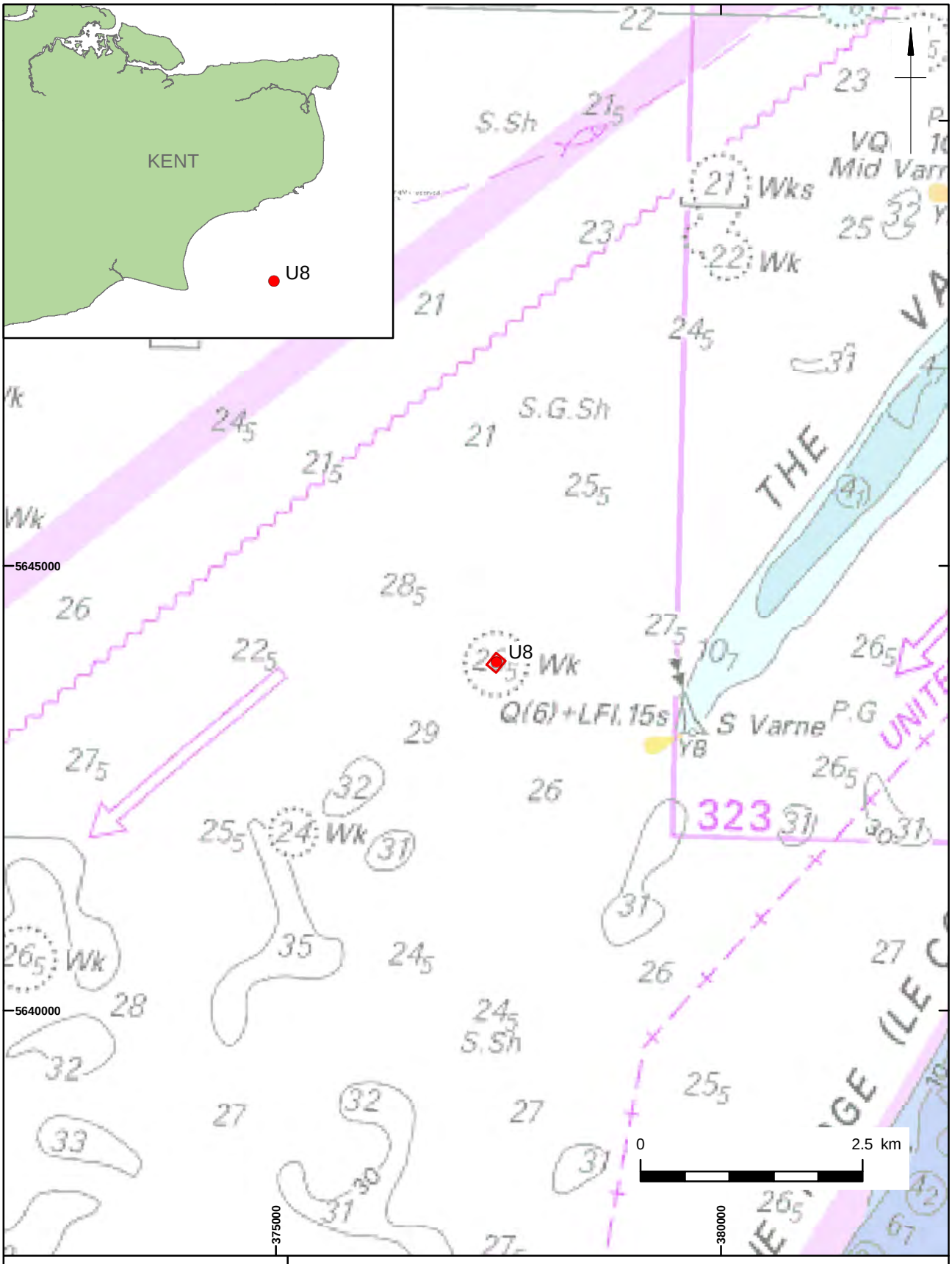

Target location

Study Area

Drawing projection: UTM WGS84 z31N
Admiralty chart no. 1610

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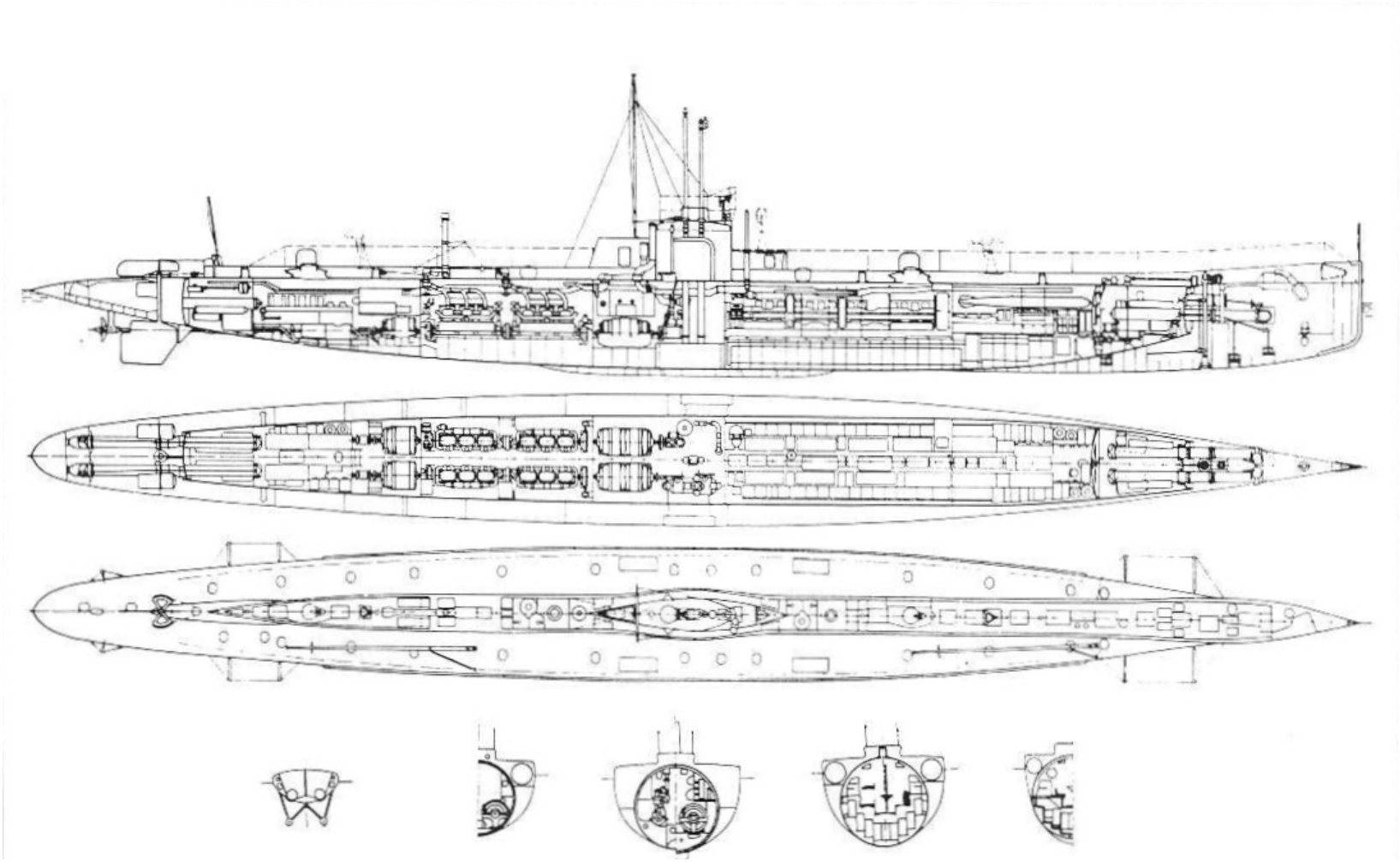
Site location

Figure 1



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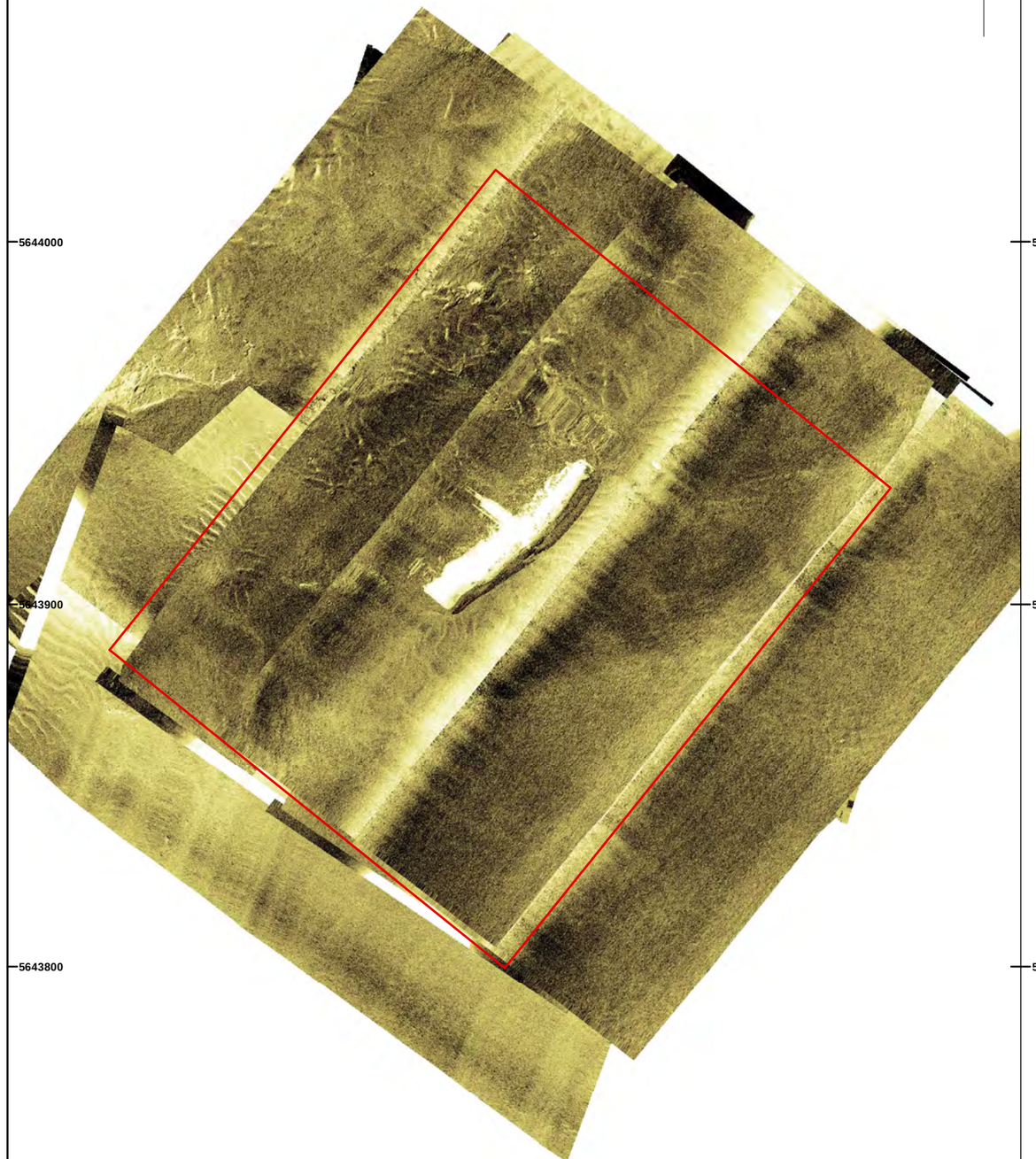
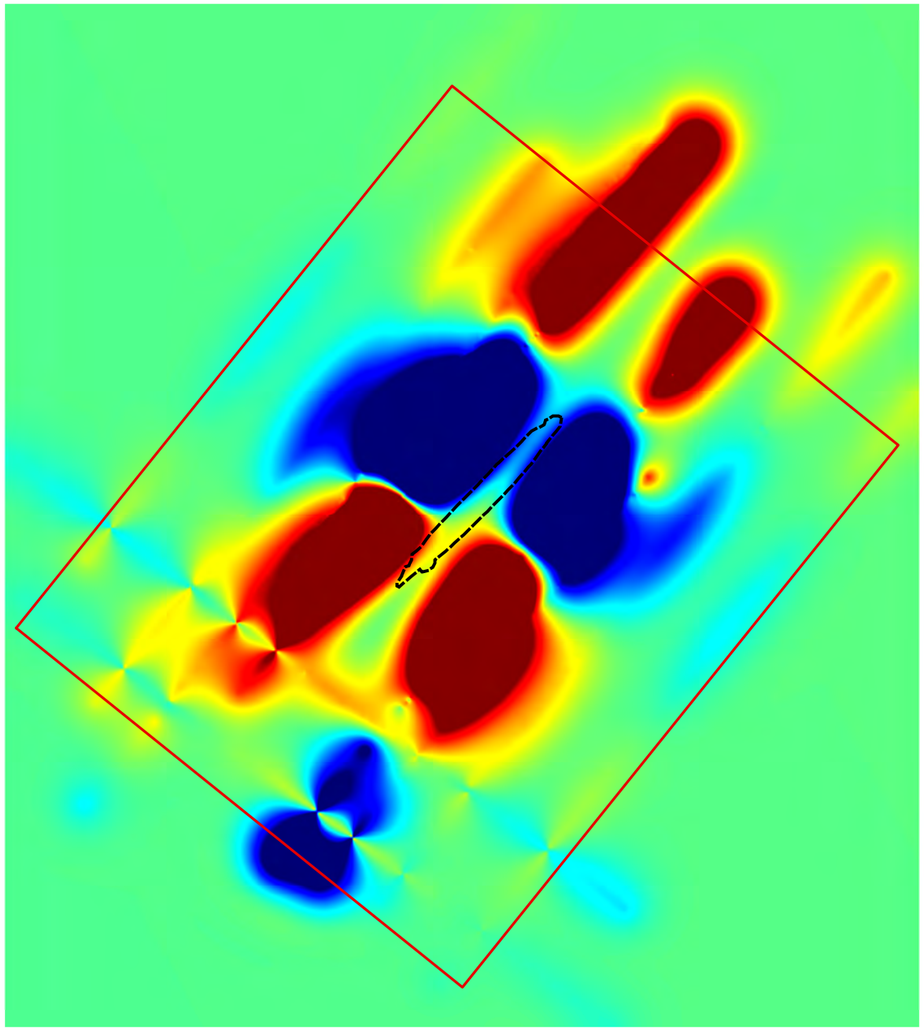
Plan of U5-U8 taken from Rossler 2001 © Bundesarchiv-Militararchiv, Potsdam

Figure 2

A. Sidescan sonar mosaic

B. Gridded magnetometer data (+/- 100nT)





5644000
5643900
5643800
377400
377500
377600

Study Area
Wreck Boundary
0 50 m

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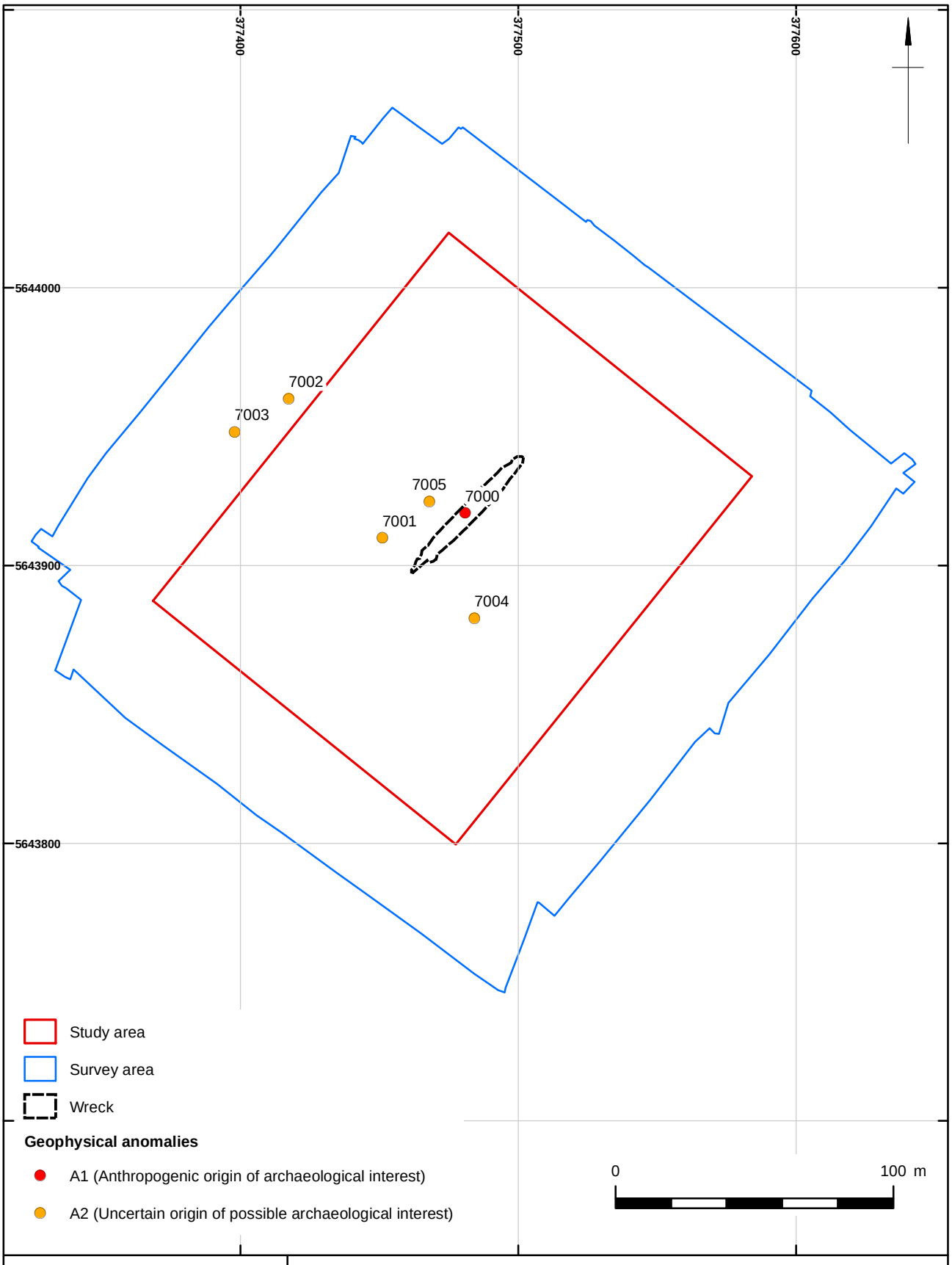
Sidescan sonar mosaic, gridded magnetometer data

Figure 3



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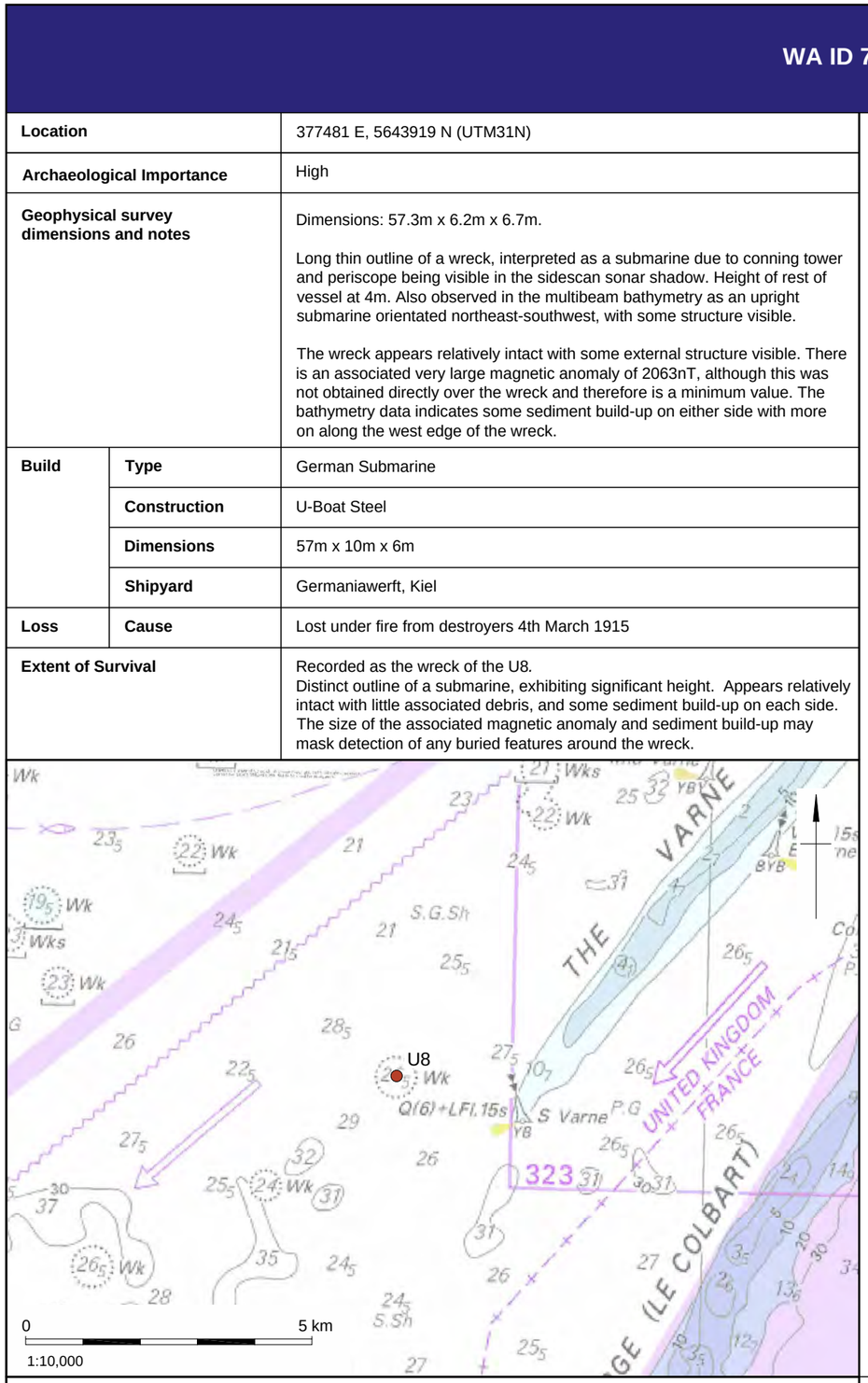
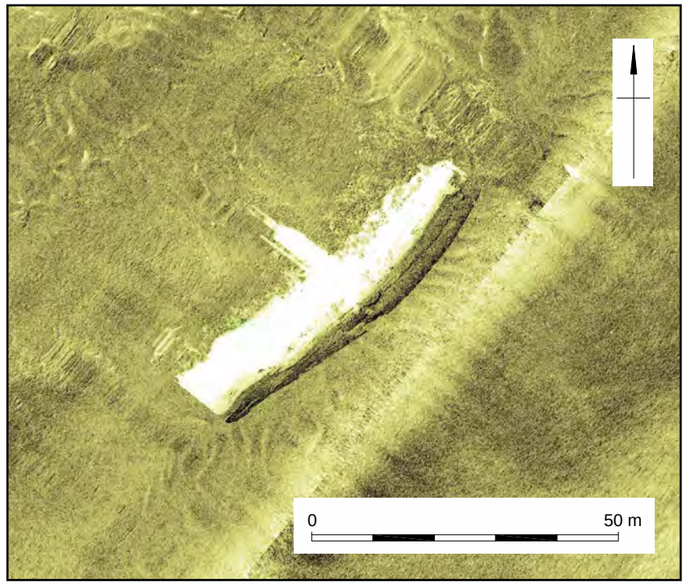
Anomalies of potential archaeological interest

Figure 4

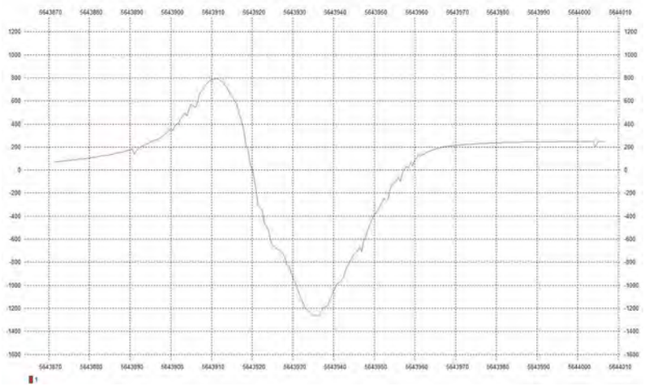
WA ID 7000 U8 UKHO 21102

Location		377481 E, 5643919 N (UTM31N)
Archaeological Importance		High
Geophysical survey dimensions and notes		Dimensions: 57.3m x 6.2m x 6.7m. Long thin outline of a wreck, interpreted as a submarine due to conning tower and periscope being visible in the sidescan sonar shadow. Height of rest of vessel at 4m. Also observed in the multibeam bathymetry as an upright submarine orientated northeast-southwest, with some structure visible. The wreck appears relatively intact with some external structure visible. There is an associated very large magnetic anomaly of 2063nT, although this was not obtained directly over the wreck and therefore is a minimum value. The bathymetry data indicates some sediment build-up on either side with more on along the west edge of the wreck.
Build	**Type**	German Submarine
	Construction	U-Boat Steel
	Dimensions	57m x 10m x 6m
	Shipyard	Germaniawerft, Kiel
Loss	**Cause**	Lost under fire from destroyers 4th March 1915
Extent of Survival		Recorded as the wreck of the U8. Distinct outline of a submarine, exhibiting significant height. Appears relatively intact with little associated debris, and some sediment build-up on each side. The size of the associated magnetic anomaly and sediment build-up may mask detection of any buried features around the wreck.

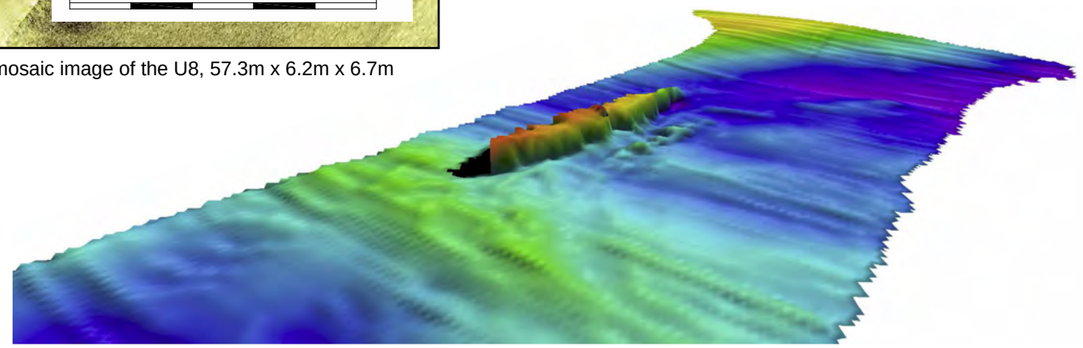




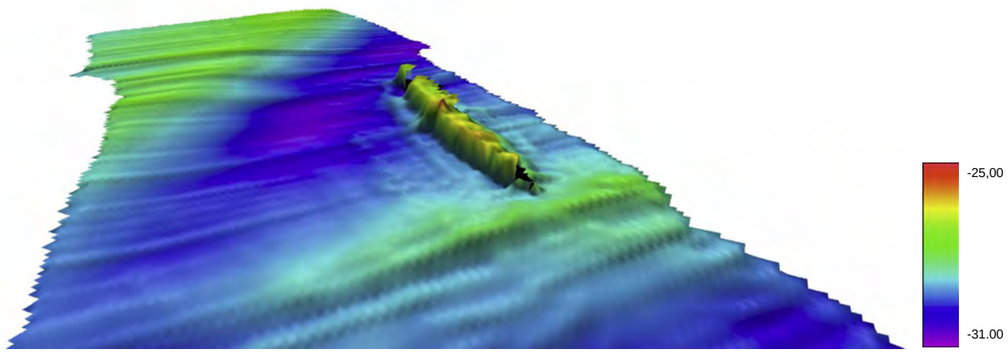
A pseudo-sidescan sonar mosaic image of the U8, 57.3m x 6.2m x 6.7m



Magnetometer profile alongside the U8, 2063nT



A 2015 multibeam bathymetry image of the U8, facing south, 1x vertical exaggeration



A 2015 multibeam bathymetry image of the U8, facing southwest, 1x Vertical exaggeration

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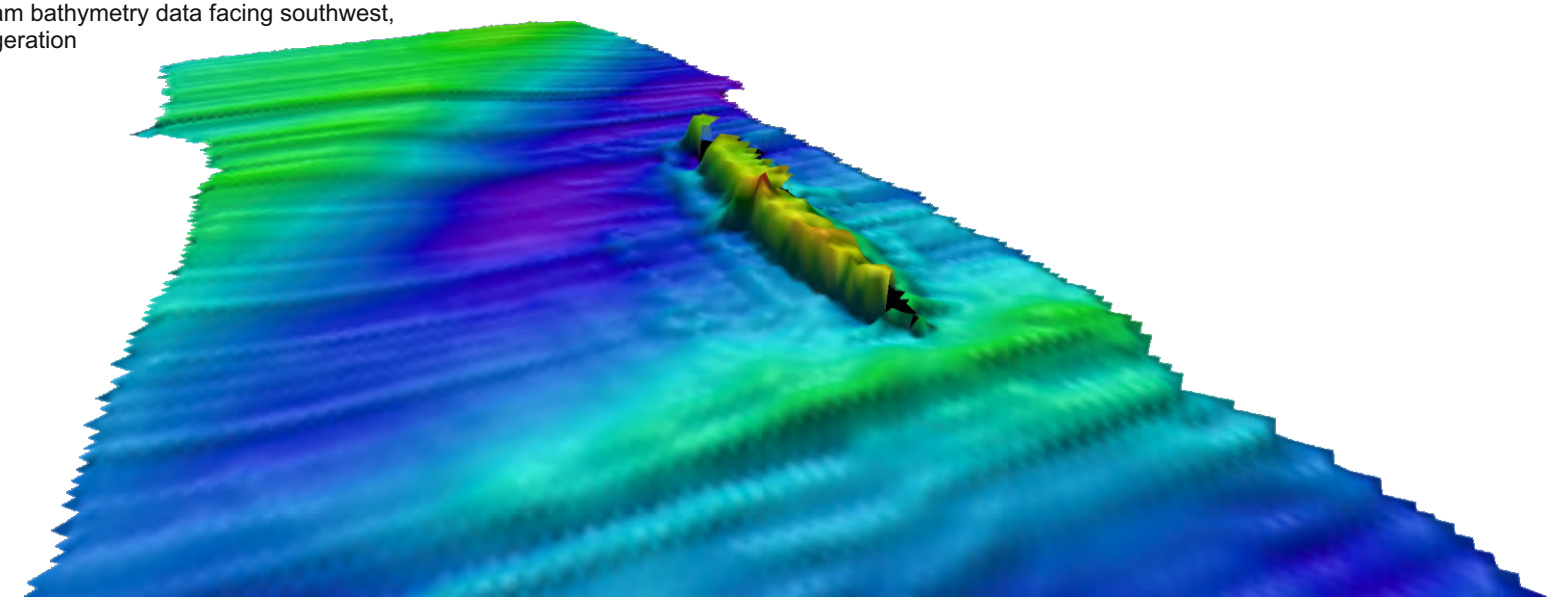
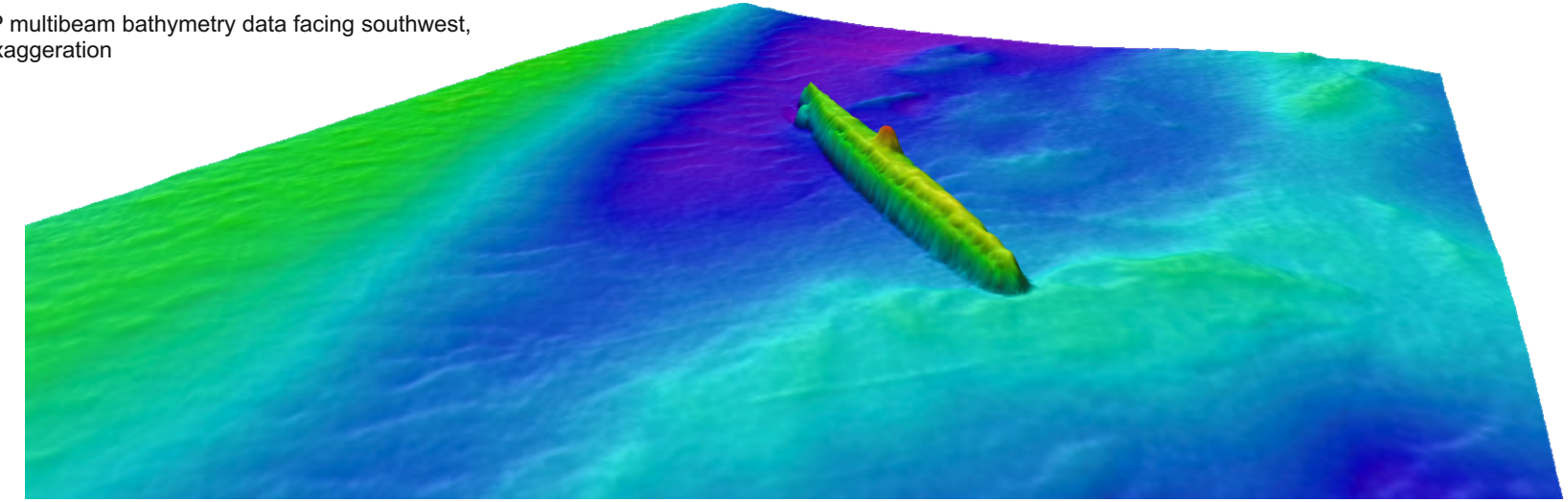
Figure 5

A. 2015 multibeam bathymetry data facing southwest, 1x vertical exaggeration



B. 2007 CHP multibeam bathymetry data facing southwest, 1x vertical exaggeration



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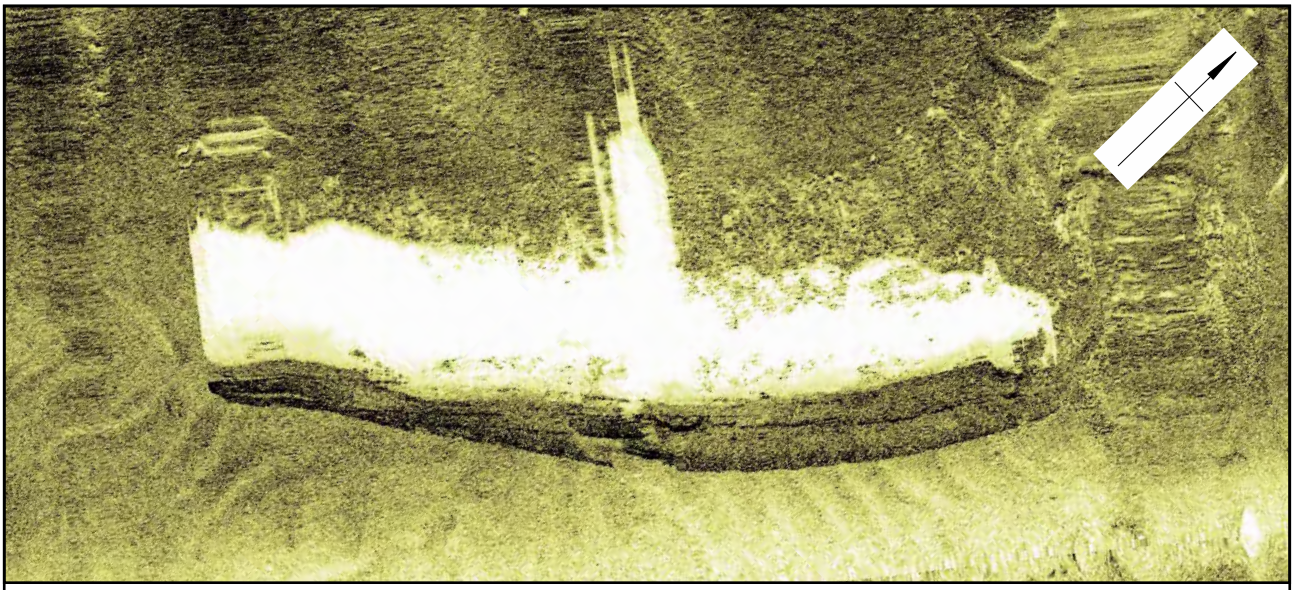
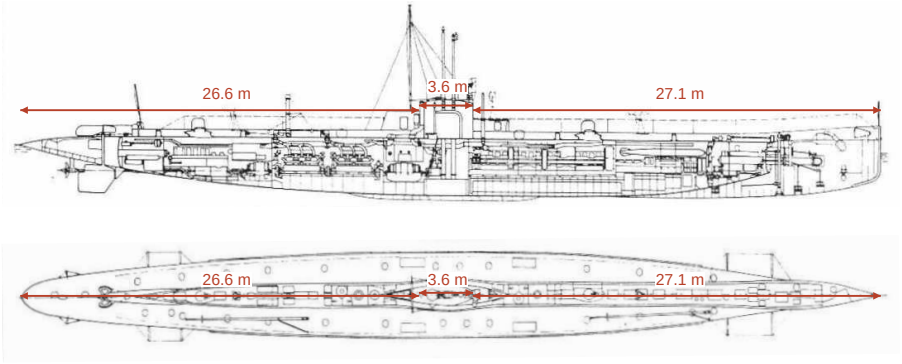
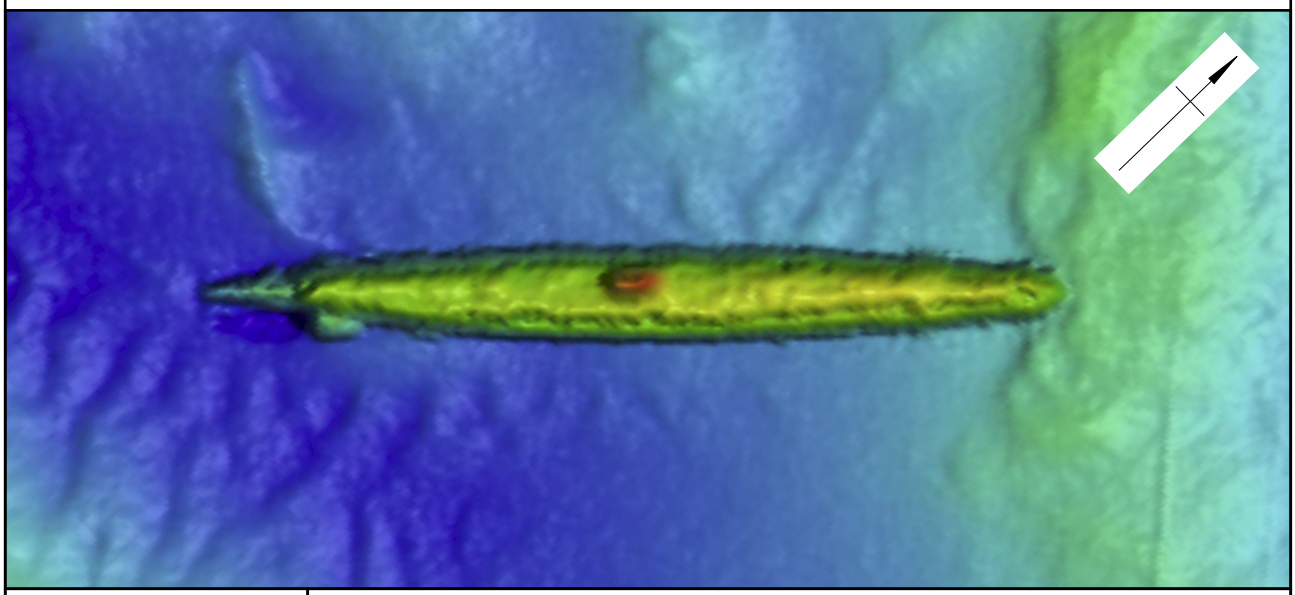
Comparison of multibeam bathymetry data

Figure 6







0 10 m

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Comparison of measurements from U8 wreck site SSS and Bathymetry and U8 Plan Figure 7

Plate 1: First German submarine to be sunk during the war by the Dover Patrol. U8 from Surgeon Parkes Collection of Ships Portraits SP1240 © Crown Copyright. IWM.

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Plate 2: Upper rudder

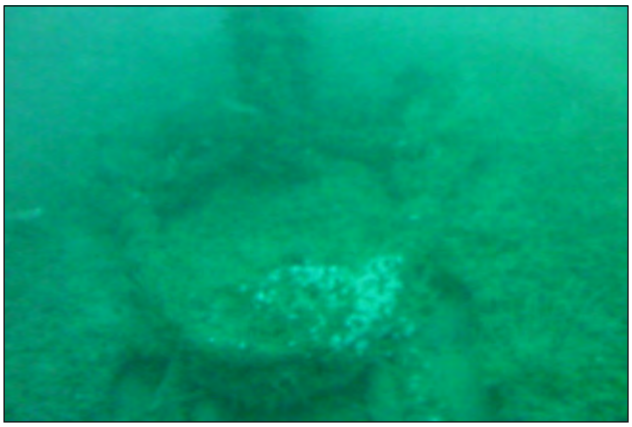

Plate 3: Upper rudder with steering gear

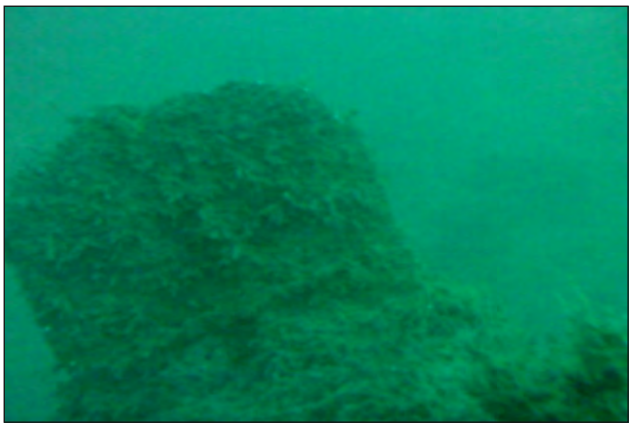

Plate 4: Torpedo hatch

Plate 5: Conning tower periscopes

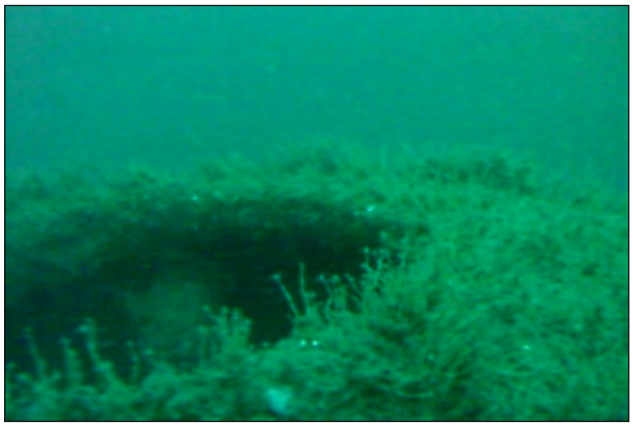

Plate 6: Conning tower hatch

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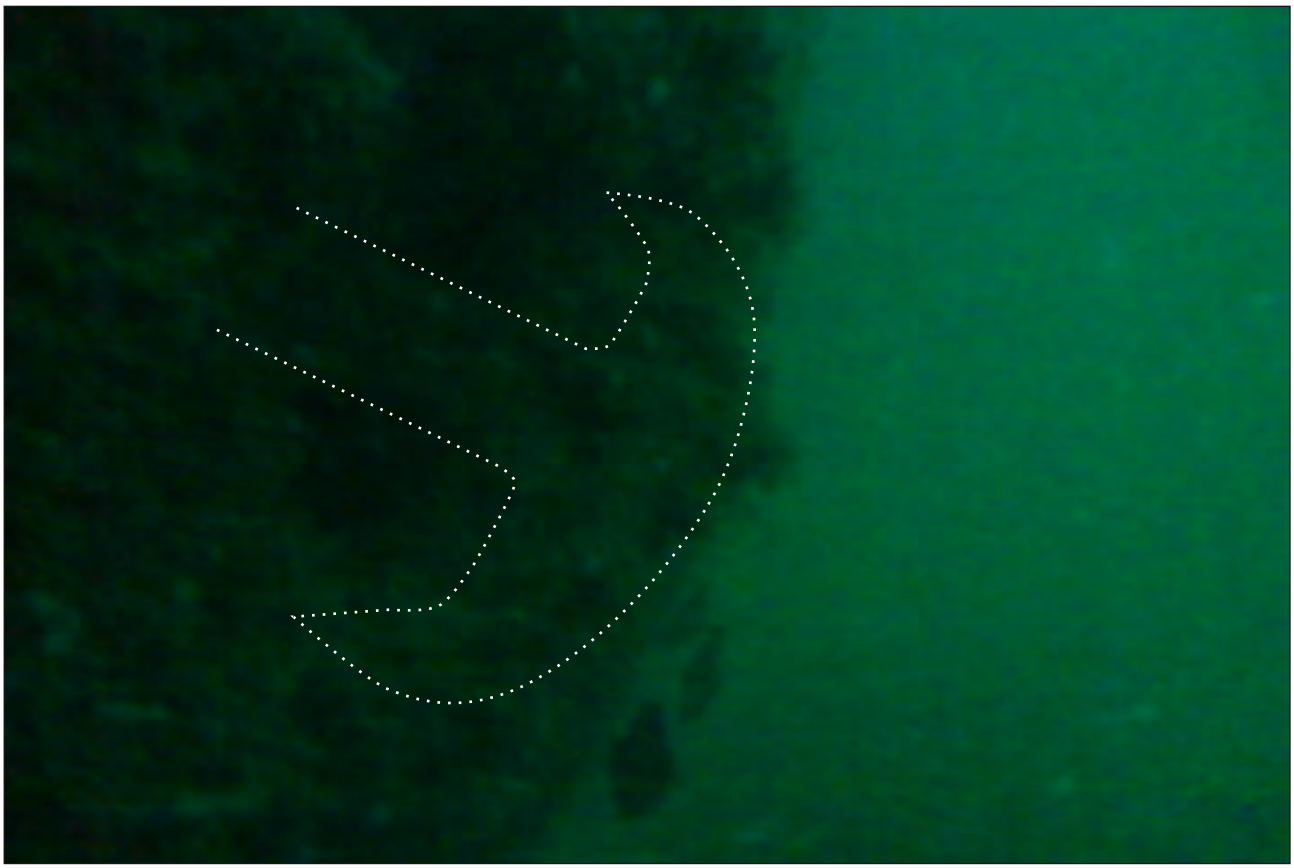
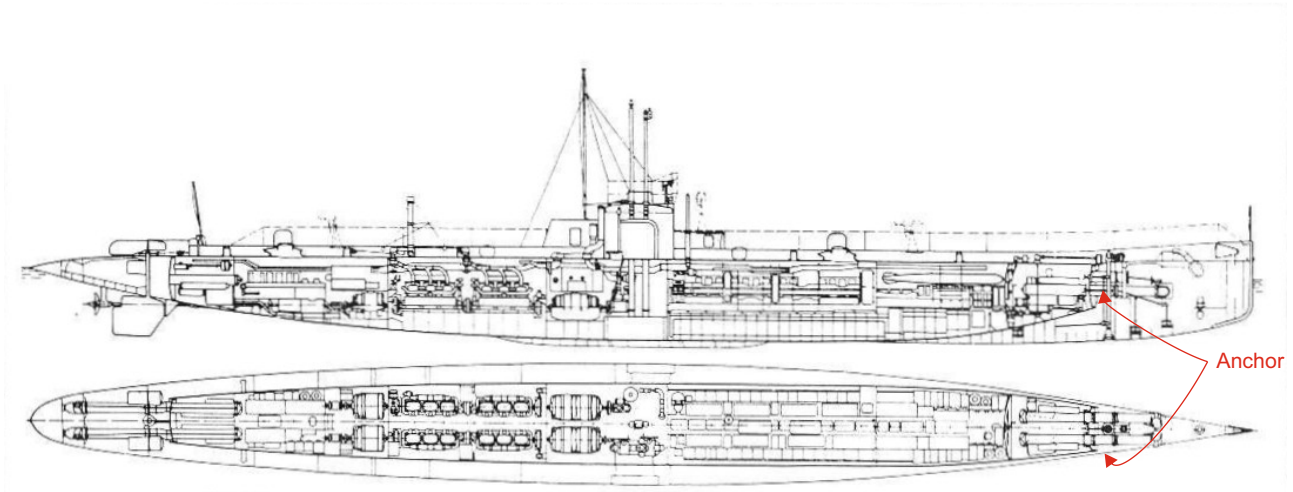


Plate 7: Stowed anchor © Brian Robinson (still from video)



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Wessex Archaeology Ltd registered office Portway House, Old Sarum Park, Salisbury, Wiltshire SP4 6EB
Tel: 01722 326867 Fax: 01722 337562 info@wessexarch.co.uk www.wessexarch.co.uk