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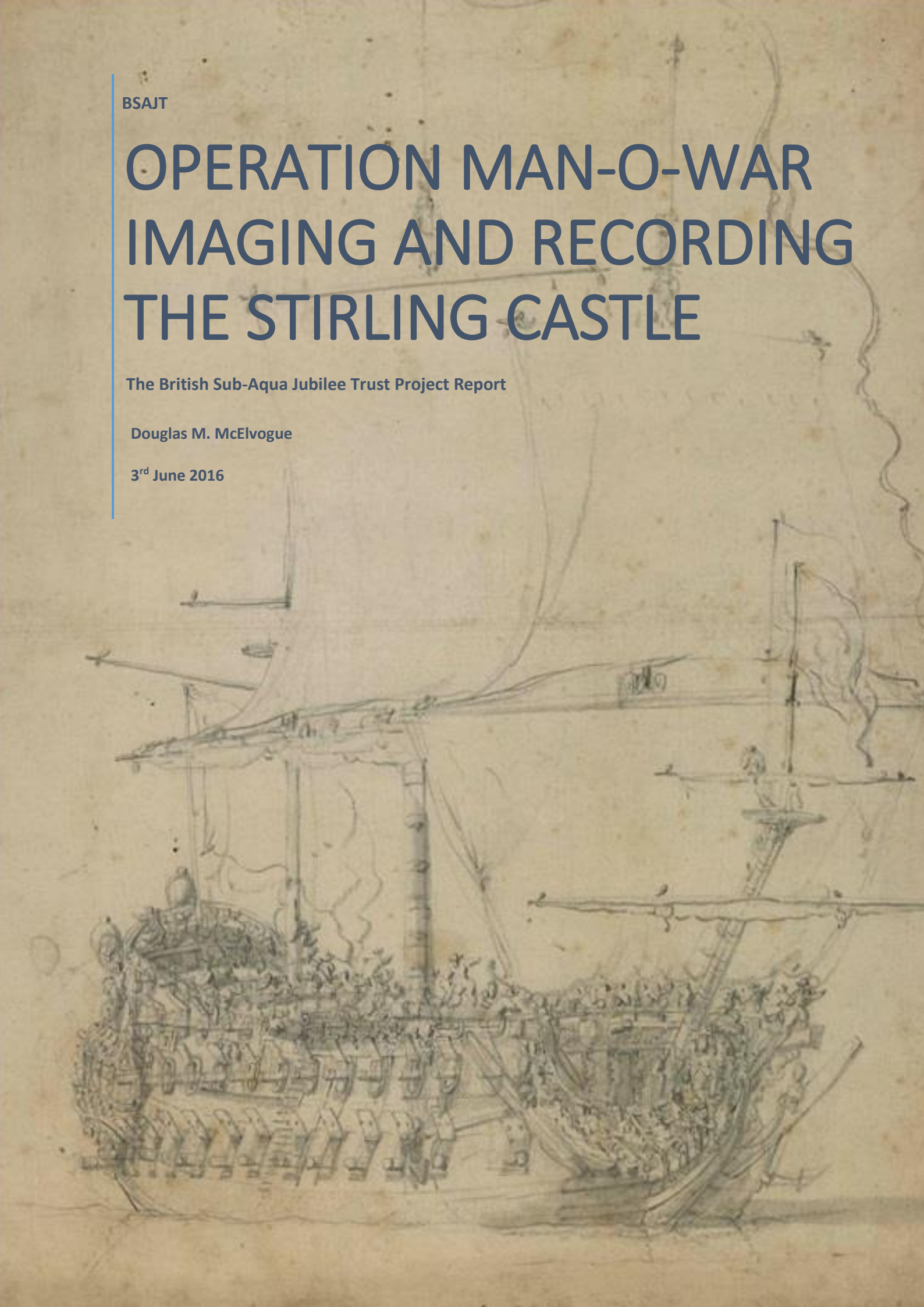
OPERATION MAN-O-WAR IMAGING AND RECORDING THE STIRLING CASTLE

The British Sub-Aqua Jubilee Trust Project Report

Douglas M. McElvogue

3rd June 2016



OPERATION MAN-O-WAR
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PROJECT REPORT

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1 Acknowledgements

1.1.1 The author gratefully acknowledges the funding received from the British Sub-Aqua Jubilee Trust (BSAJT). The author also acknowledges the assistance of the following:

- Financial assistance from Historic England for the High Resolution Multi Beam Echo Sounder survey.
- Robert Peacock of SeaDive Organisation for assistance with surveying, on site operations, interpretation of the site surveys and accommodation.
- Mark Coucher, owner and skipper of *Christabell*.
- Mark James of MSDS Marine for GIS and 3D modelling.
- James Williams for assistance with multi-beam echo sounder survey interpretation.
- Divers of SeaDive Organisation for their time and assistance.

1.1.2 This report has been written by Douglas McElvogue. All illustrations have been prepared by Douglas McElvogue and underwater photographers were Douglas McElvogue and Robert Peacock.

2 Copyright Statement

3 PROJECT SUMMARY

3.1.1 This project surveyed the Protected Wreck *Stirling Castle* with a High Resolution Multi-Beam system which was then ground trothed by diving the site. The survey data was collected and then cleaned to produce a point cloud and a 3D “as is” surface model of the *Stirling Castle*. This “as is” surface model defines the current state of the remains of the Protected Wreck Site *Stirling Castle*. The multi-beam survey was commissioned by English Heritage for the site of the *Stirling Castle*. However this only gave a surface impression of the site and had to be interpreted. BSAC volunteer divers from SeaDive Organisation have dived the site and identified the archaeological features seen in the multi-beam image. Digital stills and video with scales and direct measurements accompany the multi beam survey allowing the production of a base line site plan of the *Stirling Castle*.

4 INTRODUCTION

4.1 PROJECT BACKGROUND

4.1.1 The *Stirling Castle* is one of the most infamous of England's Protected Wrecks (referred to throughout this report as the *Stirling Castle*). This is due to its initial state of preservation when found, being nearly the whole ship (Cates, M., and Chamberlain D., 1998) and then its subsequent decay into a wreck mound with little perceived intervention from heritage bodies. The site has been continuously exposed for over 10 years. In this time it has gone from a coherent and recognisable ship with guns on its deck, sticking out of gun ports (Cates and Chamberlain, 1998) to a wreck mound, not fully recognisable to the unfamiliar (Peacock, 2013).

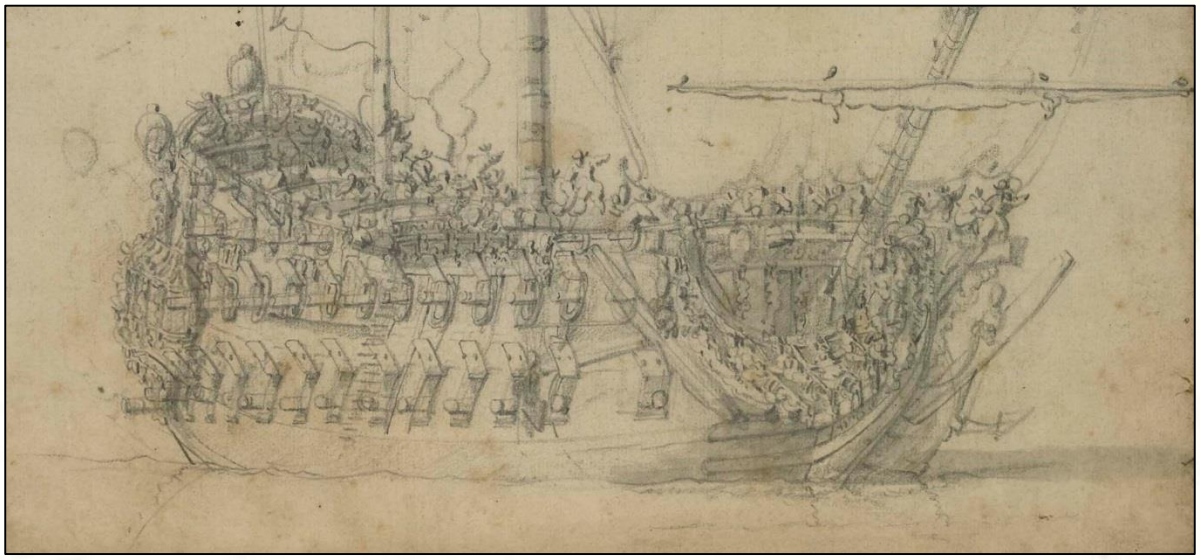

Figure 1 Stirling Castle under full sail (with kind Permission of the Trustees of the British Museum)

4.1.2 It is recognised that the *Stirling Castle* reached a point of near equilibrium. The upper structure of the vessel has both collapsed and then been buried in the surrounding seabed sediments, or it has decayed through biological or sediment erosion (McElvogue, 2015). Recent years have seen no dramatic changes in the site's physical burial environment, with only localised accretion and secretion of sediments. This is recognised by the *Stirling Castle* being taken off the Historic England "At Risk Register", and it being considered robust enough for licences to be given to non-archaeological divers to now visit the site.

4.1.3 It was therefore considered an opportune time to produce a baseline survey of the *Stirling Castle* and its local environment. The baseline survey was produced using a high resolution multi-beam echo sounder. This has been supplemented with digital stills and video of the site.

4.2 SITE LOCATION

4.2.1 The site of the Protected Wreck *Stirling Castle* lies within the northern part of the Goodwin Sands (see Figure 1). This area is commonly known as "the North Goodwin" or historically as "the North Sands". The site lies in Historic England's South East Region. The restricted area is a circle with a radius of 300m. The position of the centre of the circle is as follows (WGS84).

Table 1 Position of the Stirling Castle

STIRLING CASTLE	
Latitude:	**51º 16.4561' N**
Longitude:	**01º 30.4121' E**

4.3 SITE DESIGNATIONS

4.3.1 The wreck is designated under the 1973 Protection of Wrecks Act and is listed in the National Heritage List for England (NHLE) as 1000056. The Statutory Instrument orders are no.1980/645, no.1980/1306 and no.2004/2395. The *Stirling Castle* is attributed the National Record of the Historic Environment (NRHE) number 1082115.

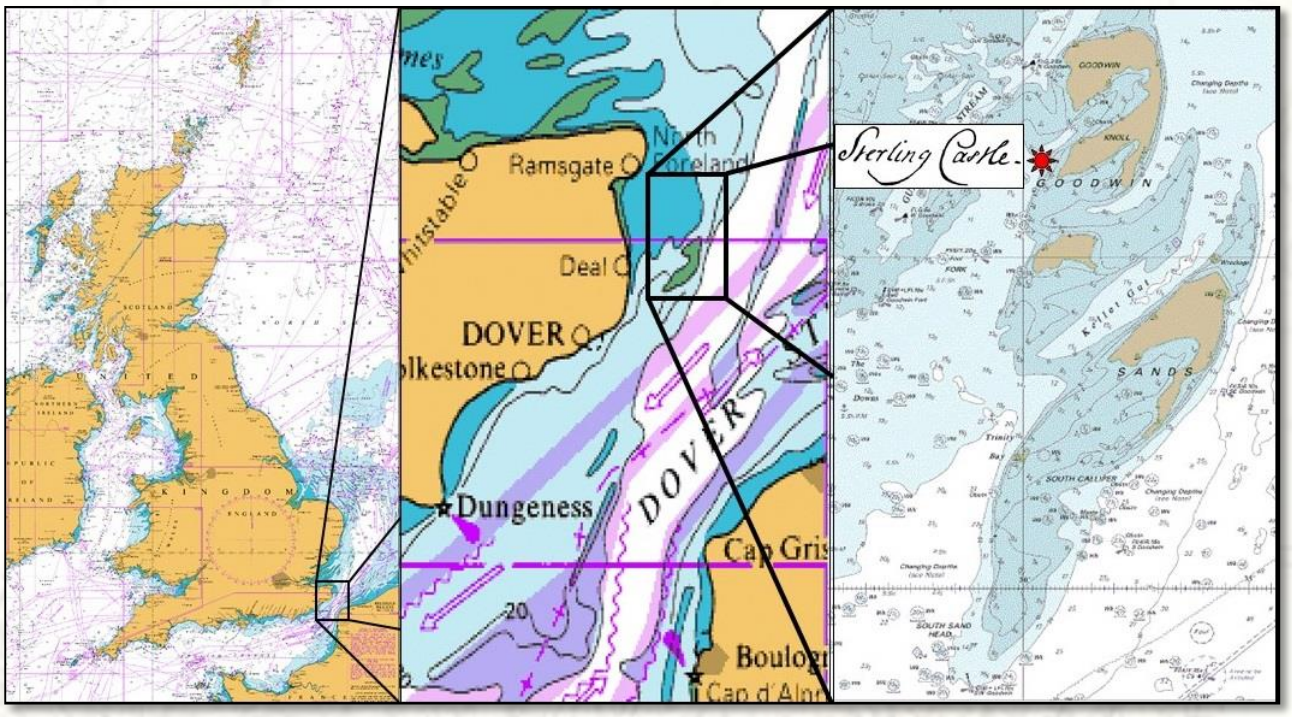

Figure 2 Location map for the Stirling Castle.

4.4 HISTORICAL BACKGROUND

4.4.1 The *Stirling Castle* was one of 30 great ships of the line built as part of Samuel Pepys 1677 shipbuilding programme. The programme consisted of 1 first rate,

9 second rates and 20 third rates (Fox 1980:154). The new ships initial design was found lacking. The cost of the alterations to the vessels was met by the King himself, Charles II. To simplify maintenance the King insisted the masts, spars, rigging and fittings of each rate be standardised, whilst Pepys ensured the ordnance was also standardised. This marked the first steps in the control of naval architecture by the naval administration. The *Stirling Castle* was built by John Shish and completed in two years, being launched at Deptford on the south bank of the river Thames in 1679.

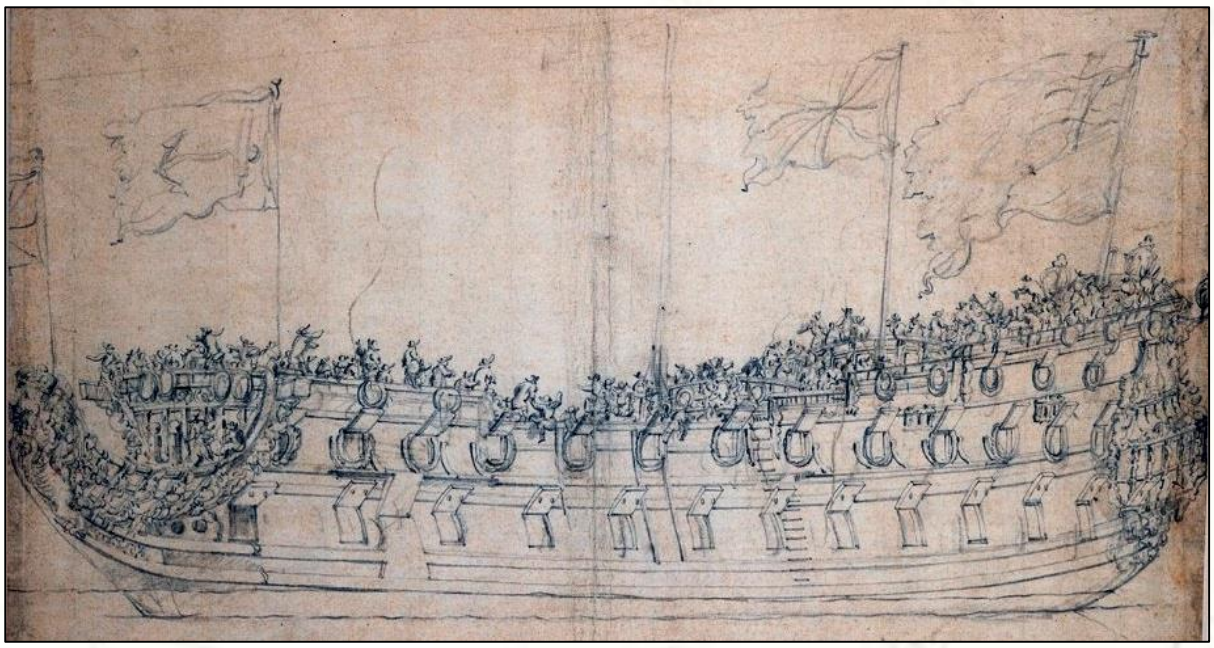

Figure 3 Launching of the Stirling Castle at Deptford

4.4.2 The *Stirling Castle* was amongst the third rates listed in the Revolution Fleet of 1688, then went on to fight as part of the Red Squadron at the battle of Beachy head (1690), and part of the Blue Squadron at the Barfleur in 1692. During 1699 the *Stirling Castle* was rebuilt, and in 1701 was refitted. In 1702 the *Stirling Castle* was part of an Anglo-Danish fleet of 50 ships of the line sent on an expedition to Cadiz. Before returning home and wrecking on the Goodwin Sands in the Great Storm of 1703, the *Stirling Castle* was assigned to the Mediterranean.

4.4.3 The *Stirling Castle* became a total wreck and was lost with 4 fifths of its crew in the early hours of 27th November 1703. It remained hidden until dived upon by the local Ramsgate Dive Club in 1979. A pewter plate with the initials “JJ” was recovered and identified as belonging to John Johnson, the Captain of the *Stirling Castle* when it was lost. For the first time in over 250 years the *Stirling Castle* had been found and positively identified. The ship gave up its secrets for just over two years until the sands shifted again and reclaimed the vessel and all its artefacts. It would not be until the summer of 1998 that the Goodwin’s would reveal the *Stirling Castle* for another time.

4.4.4 This time under the direction of Bob Peacock, a local diver and business man the *Stirling Castle* was investigated and recorded under the auspices of "Operation Man-O-War" (OMOW). As the site fell apart it was surveyed and significant structural features recorded and finds recovered and displayed. The site has been continuously exposed for over 10 years. In this time it has gone from a coherent and recognisable ship with guns on its deck, sticking out gun ports (Cates, M., and Chamberlain D., 1998) to a wreck mound, not fully recognisable to the unfamiliar (Peacock, 2013).

4.4.5 The *Stirling Castle* has now reached a point of near equilibrium. The stern structure has both collapsed and then been buried in the surrounding seabed sediments, or it has decayed through biological or sediment erosion. The recent years have seen no dramatic changes in the overall physical burial environment, with only localised accretion and secretion of sediments and archaeology. Therefore an ongoing programme of monitoring dives and surveying has been initiated to monitor the site. To do so efficiently the production of a base line site plan of the *Stirling Castle* was required. This was the aim of this project which has now been completed.

5 PROJECT AIMS AND OBJECTIVES

5.1.1 The project aim as set out in the BSAJT grant application was to produce a baseline survey of the *Stirling Castle* wreck. The objectives were to:

- record any exposed surface archaeology on the site of the *Stirling Castle*,
- record any flora and fauna seen on the site of the *Stirling Castle*,
- and to produce a baseline site plan and report on the archaeology and flora and fauna of the *Stirling Castle*.

5.1.2 These project aims and objectives have been reached and are reported on below.

6 SURVEY METHODOLOGY

6.1 Survey/Dive Platform

6.1.1 The local vessel (Christabel) was suitable for all survey operations and is Maritime and Coastguard Agency (MCA) coded to the appropriate level (12 passengers up to 12 miles off shore). Christabel is based in Ramsgate harbour, and all operations were from there. Christabel is a Lochin 366 Harbour Pilot. It has a large cockpit environment that offered a comfortable interior. The Lochin's proven sea going qualities were key to ensuring that any weather window that would allow surveying off shore could be taken advantage of, without entailing any undue risk when returning back inshore if the weather turned.

Figure 4 Christabel alongside her berth.

Table 2 Christabel Specifications

LOCHIN L333 SPECIFICATION	
Length overall	10.05m (34.45')
Beam	3.72m (12.2')
Draft	0.75-1.1m (2.5'- 3.6')
Displacement	7.500-9000kg (7.5 - 9 Tonnes)
Fuel range	900 Litres (198 Gallons)
Speed	Up to 27 Knots
Standards	Cat. B (Offshore)

6.2 High Resolution Multi-Beam Survey

6.2.1 The project success was reliant on the successful production of a High Resolution Multi-Beam Echo Sounder Survey (HRMBES). This was funded by English heritage and completed in June 2015.

6.3 Survey Equipment

6.3.1 An R2SONIC 2022 Multi-Beam Echo-Sounder (MBES) with Integrated Inertial Navigation Sensor (I2NS) was installed on the vessel using a Universal over the Side Mount (UOSM). The use of the universal mount minimised the offsets between the sensors and meant measurements could be taken more accurately. This and the mounting of the sensors within a rigid frame meant that the inherent inaccuracies of mobilising a vessel of opportunity were significantly reduced.

Figure 5 Mobilising Christabel at Ramsgate harbour.

6.3.2 The I2NS uses data from an Inertial Measurement Unit (IMU) and dual Global Navigation Satellite System (GNSS) antennas to produce a positional solution for the MBES data. Real Time Kinetic (RTK) corrections were obtained using a 3g cellular dongle to increase height and positional accuracy. All data inputs (MBES and I2NS) and survey application commands were relayed via the Sonar Interface Module (SIM). Sound velocity was continuously monitored at the MBES head with a Valeport MiniSVS and at intervals through the water column with a Valeport MiniSVP. The particulars of the survey system are outlined in appendix 1.

6.4 Software Applications

6.4.1 HYPACK SURVEY 2015 is an integrated hydrographic survey management and navigation software database package. HYPACK was used to acquire and post process all survey data.

6.4.2 The HYPACK Survey software was loaded onto the survey computer which was connected to the Integrated Inertial Navigation Sensor (I2NS) allowing HYPACK to receive data from;

- Global Positioning System (GPS) antenna
- 3G cellular Real Time Kinetic (RTK) dongle
- Integrated Inertial Navigation Sensor (I2NS)
- R2SONIC Sonic 2022 Multi-Beam Echo-Sounder (MBES)

6.4.3 HYPACK allows the real time visualisation of survey data, including the application of RTK tidal corrections. The real time visualisation of data ensures 100% coverage but also assists the surveyor with the collection of

data at various angles when insonifying elements of the wreck.

6.4.4 Cloud Compare version 2.6.2 was used for the final cleaning of the data, visualisation and the matching up of the historical survey data. Cloud Compare is a 3D point cloud and mesh processing software. Fledermaus (Version 7.0) was used when further analysis and visualisation was required.

6.5 MBES Survey Area

6.5.1 To ensure that all upstanding archaeology was captured for the diver survey, a minimum survey area was delineated for the HRMBES. This consisted of a square oriented North/South which encompassed the designated area. This area was surveyed in ultra-high resolution at 700 kHz. The study area is presented in Universal Transverse Mercator (UTM) zone 31N Easting and Northings (m).

Table 3 Study area

STUDY AREA (UTM Zone 31N)	
X Range (Eastings)	395793.72 - 395879.22
Y Range (Northings)	5681365.82 - 5681441.32

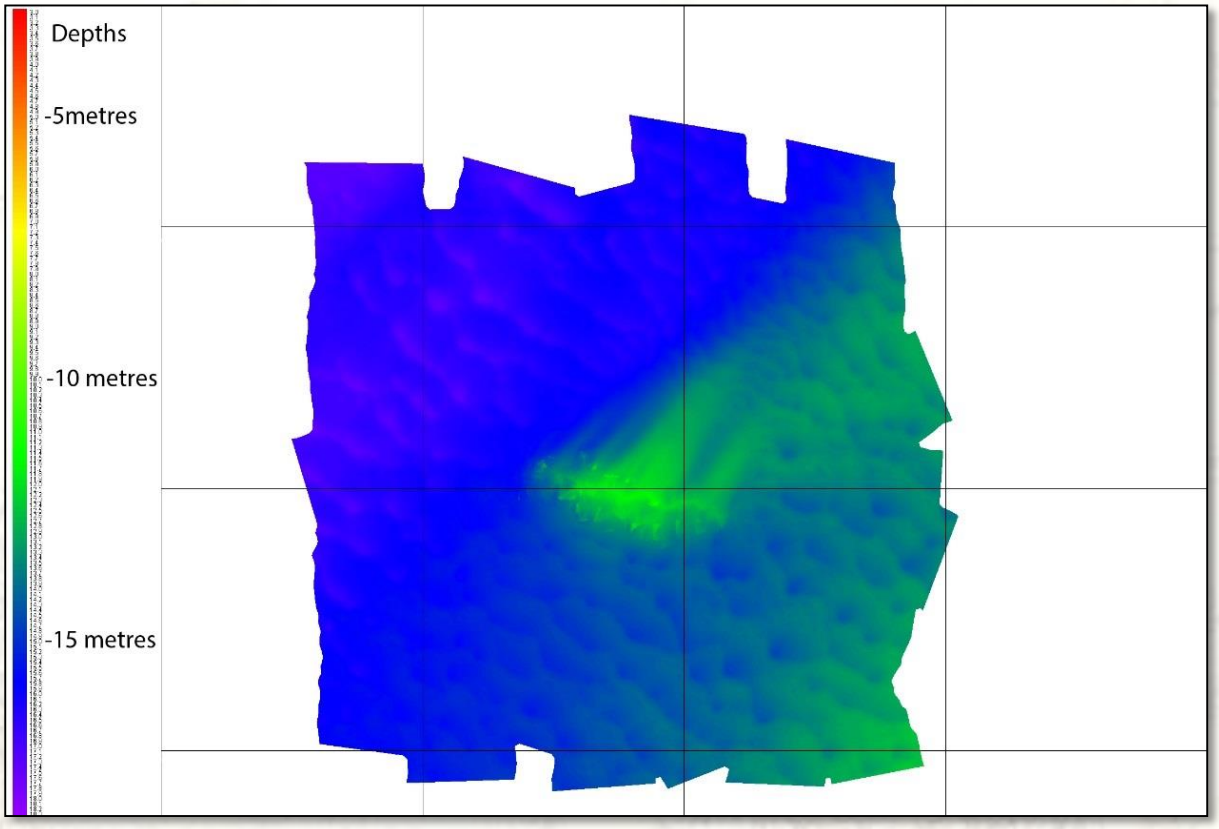

Figure 6 Stirling Castle survey overview at 700 kHz UHR.

6.6 MBES Survey Resolution

6.6.1 Survey resolution is an important criterion for analysing the site. A high resolution was required due to the nature of the upstanding archaeology on site and ability to resolve sand waves sufficiently. To see the archaeology in the survey or to differentiate between sand waves a resolution greater than 0.5m is required in the MBES survey.

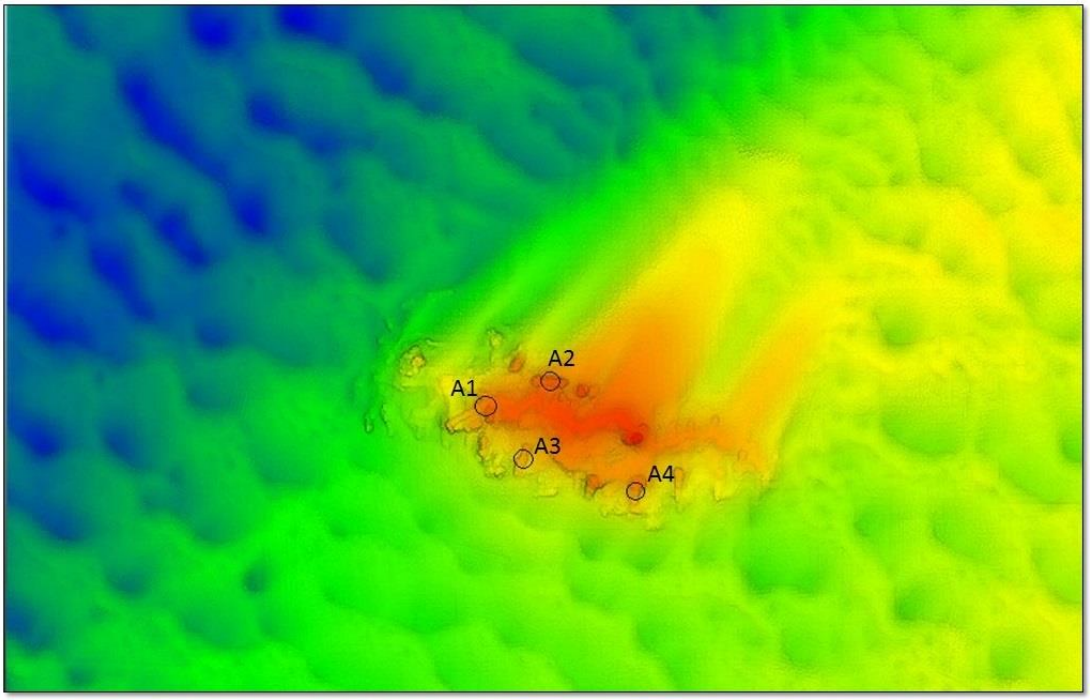

Figure 7 MBES of the Stirling Castle with known datum points highlighted on it. Red is shallow and blue deep.

6.6.2 The resolution of the survey is dependent on the size of the individual cells that make up the grid. The cell size is determined by the density of the data across the whole survey area, thus the minimum cell size will be determined by where the data is sparsest. For example, in the below figures (Figure ??) it can be seen that whilst it might be desirable to have 5cm resolution this will not be attainable as some of the cells do not contain a sounding (Figure 15a). Therefore a 10cm cell size was required (Figure 15b). The 2015 MBES survey has used a 10 cm cell sized grid.

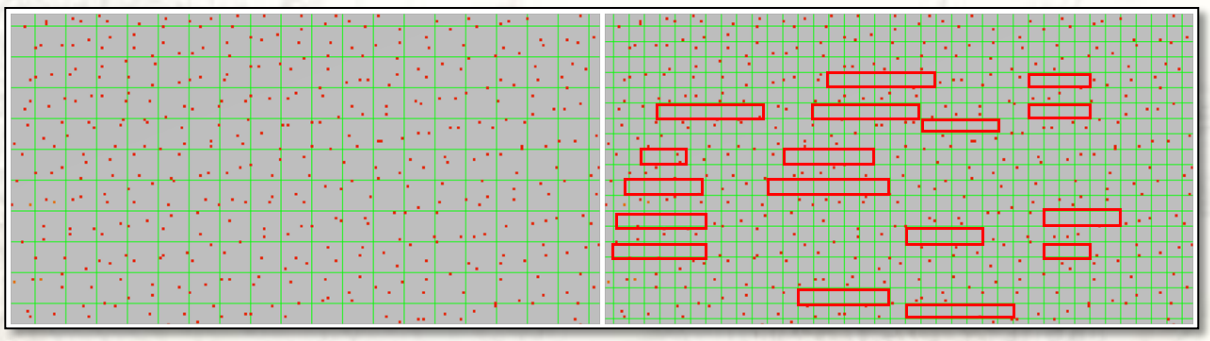

Figure 8 The left hand side (a) is a 10cm cell size and the right (b) a 5cm cell size. The red boxes show cells that are empty in the 5cm grid but where they have at least one sounding in the 10cm grid.

6.7 Diving Methodology

6.8 Tidal Conditions

6.8.1 The site of the *Stirling Castle* is swept by strong tidal currents during spring and neap tides. The tide runs in a general south to north direction over the site which lies east to west. The tide backs off for just over 1 hour's slack water diving time either side of slack on neaps. Diving times are scheduled only for neap tides due to neaps giving longer diving times and shallower maximum depths. The site lies between 18 and 22 metres depth of water.

6.9 Seabed Typography

6.9.1 The general seabed typography consists of a chalk seabed covered by flints and gravel overlain by course sand with clay sediments. Sand waves up to 1 meter in height are normal around the wreck site of the *Stirling Castle* but larger sand waves up to 2 metres in height are known to track across the site from south to north.

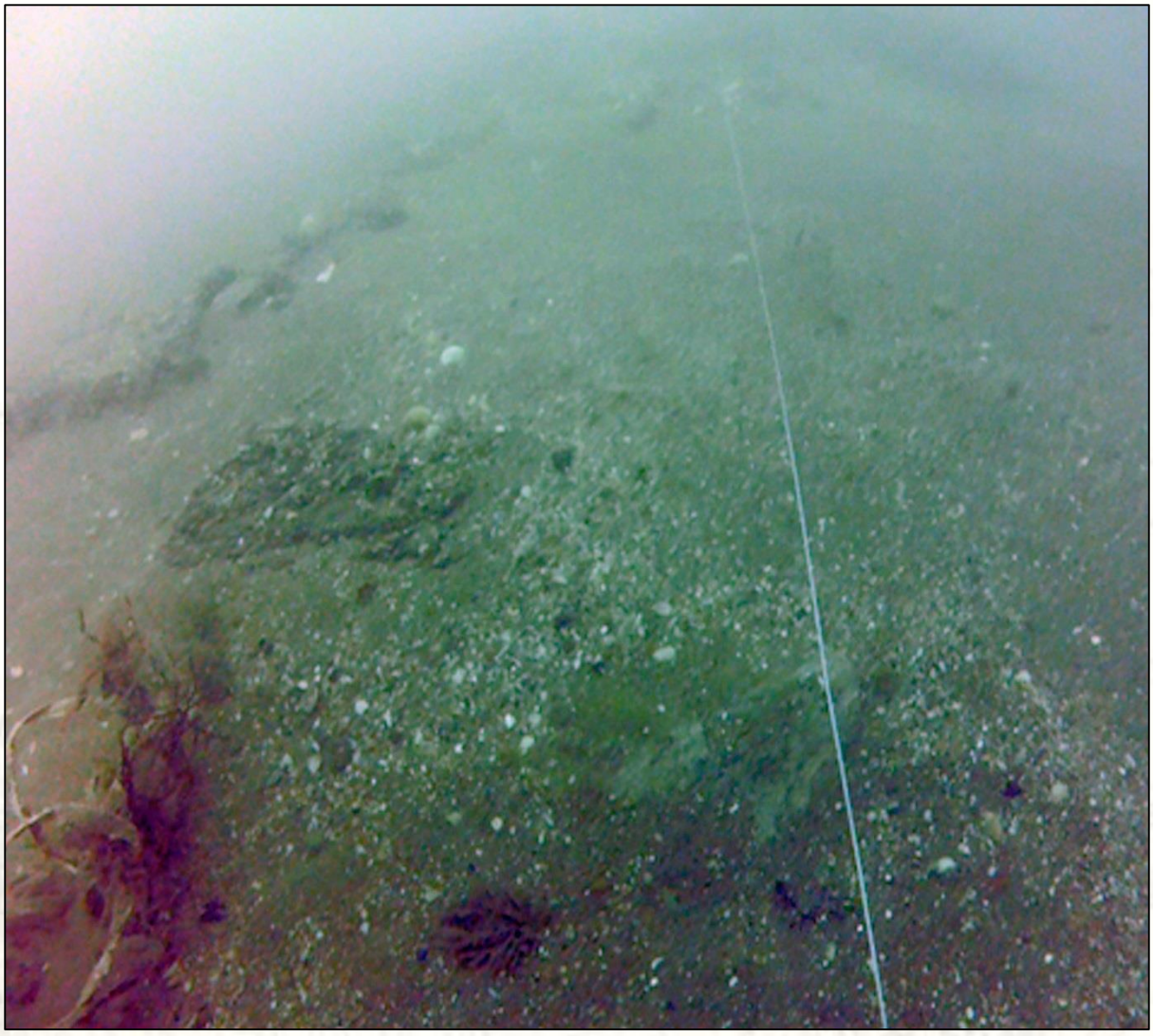

Figure 9 Seabed sediments with white ground line, looking north from the south of the site. Modern detritus can be seen in the left hand corner.

6.10 Diving Management

6.10.1 Prior to commencement of any diving operations all divers are required to produce proof of;

- their diving qualifications,
- medical fitness to dive,
- cylinders in date and regulators working,
- evidence of third party insurance.

6.10.2 All diving was undertaken using open circuit scuba equipment. The rules and regulations of their certifying organisations were followed by all divers. Prior to leaving Ramsgate harbour the local coastguard were informed of the diving operations. Prior to each dive the project team were briefed on:

- the dive plan,
- current and forecast weather conditions,
- current and forecast tidal conditions,
- boat and diving procedures (entering and exiting water),
- survey and recording methods,
- boat and diving procedures (entering and exiting water),
- survey and recording methods,
- individual recording tasks,
- any health and safety issues.

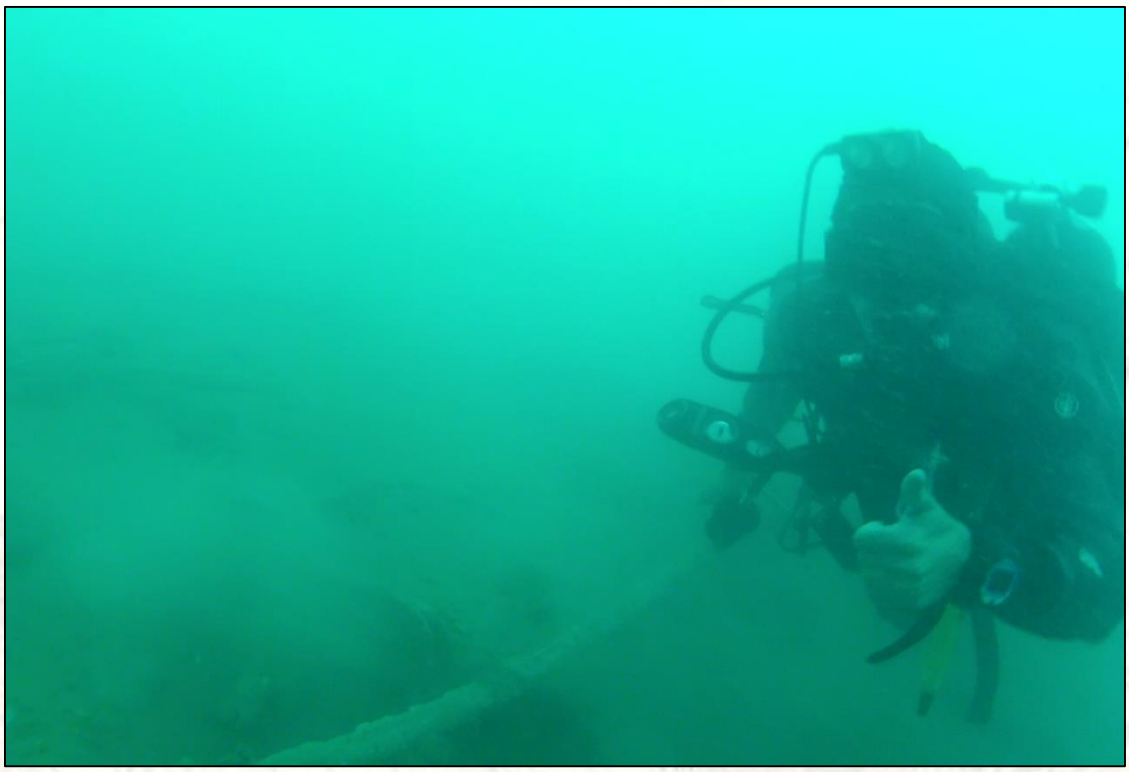

Figure 10 Diver on the site of the Stirling Castle

6.10.3 Once at the site a buoyed shot was deployed just off the site for the divers to descend. Prior to the commencement of diving operations the international code flag Alpha was deployed. Once slack water is encountered then the divers can commence their dive. When the divers reached bottom they clipped onto

the bottom of the shot and reeled out their ground line during the swim over. This method ensured that divers could always return safely to the shot, then to the surface to be picked up by the dive vessel.

Figure 11 Diver being recovered to the dive boat.

6.11 Diver Survey

6.11.1 Divers filled in an archaeological or biological record sheets where required which provided details of their specific work undertaken. The survey record sheets reference any numbers utilized e.g context numbers, feature numbers, species type and number seen. In summary the principal record sheet system includes:

- Dive log sheet
- Archaeological or Biological record sheet
- Context log
- Drawing index
- Photo index
- Video index

6.12 Archaeology

6.12.1 The archaeological survey methodology was carried out in accordance with the IFA Standard and Guidance for Nautical Archaeological Recording and

Reconstruction (IFA 2008). The methodological approach to carrying out archaeological work underwater followed the procedures and guidelines set out in Underwater Archaeology: The NAS Guide to Principles and Practice (Bowen 2008).

6.12.2 The divers carried out a swim over of the site and recorded any upstanding features. All hull structure, anthropological features and artefacts were photographed or videoed in-situ and/or identified on the multi-beam echo sounder site plan. The photographs and video allowed for the correct interpretation of the MBES survey. This allowed for the correct interpretation of the features seen in the MBES, be they the anchor, cannons, deck beams, barrels, area of fishing nets or other modern anthropological features, as listed below.

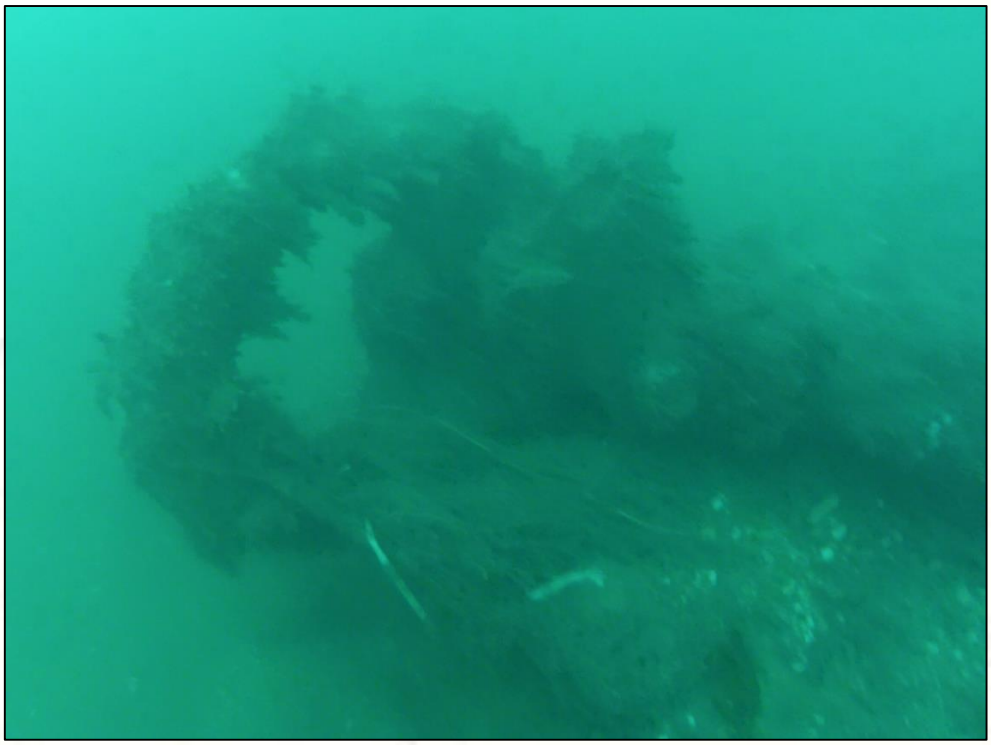

Figure 12 The anchor ring of the main anchor on site.

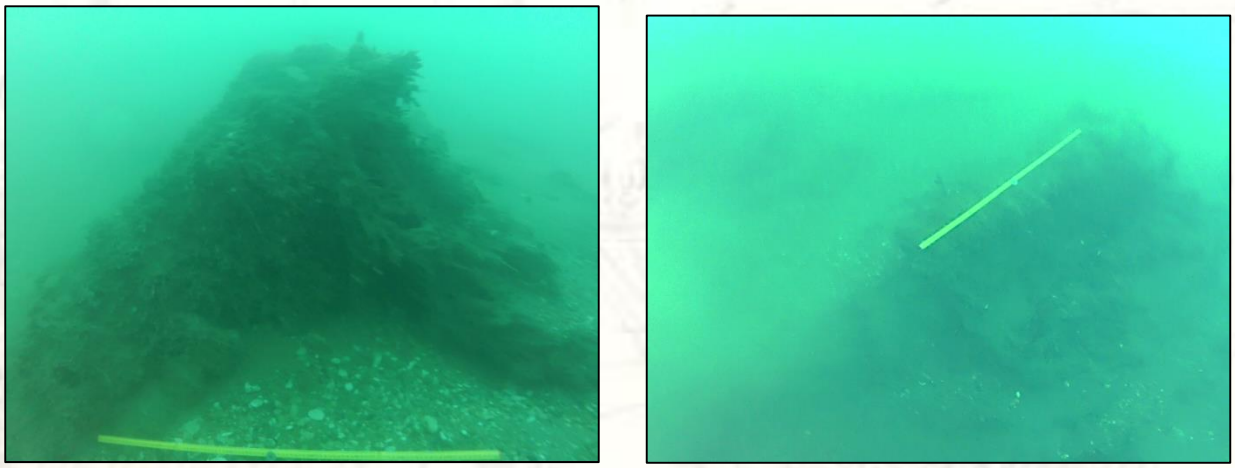

Figure 13 A cannon with the remains of its carriage lying to port and faced down the south side of the site.

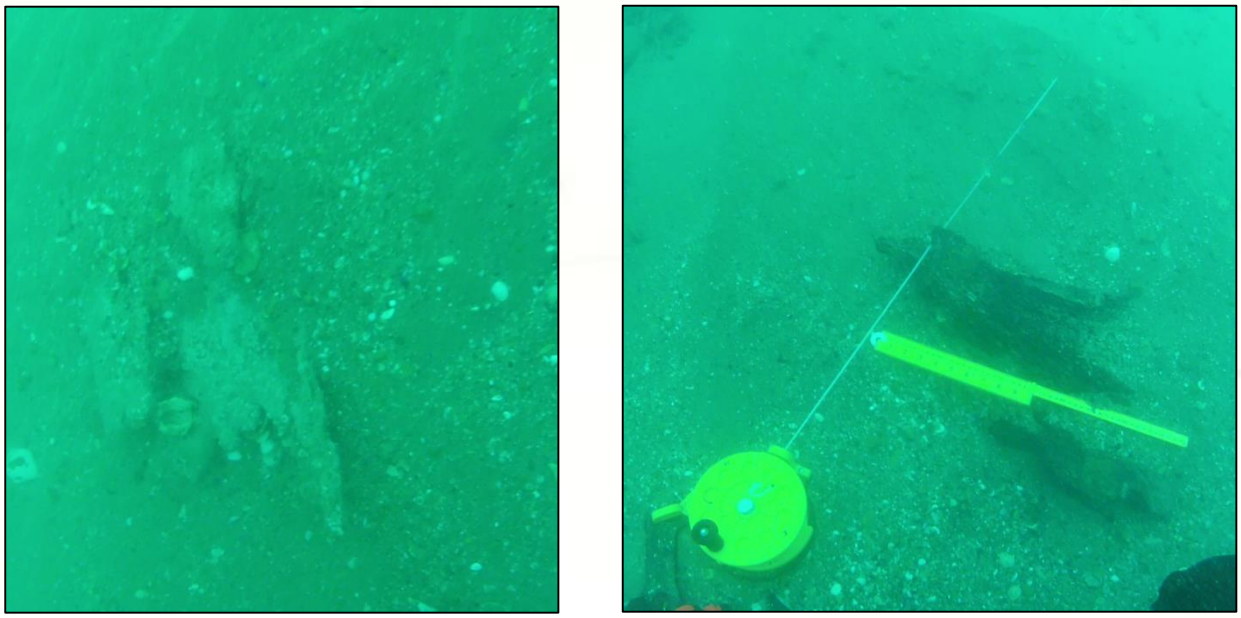

Figure 14 Left - Partial remains of a deck beam sticking out the side of the sand bank on the south side of the site. Right - Deck beam being exposed form the side of the south bank of the wreck site.

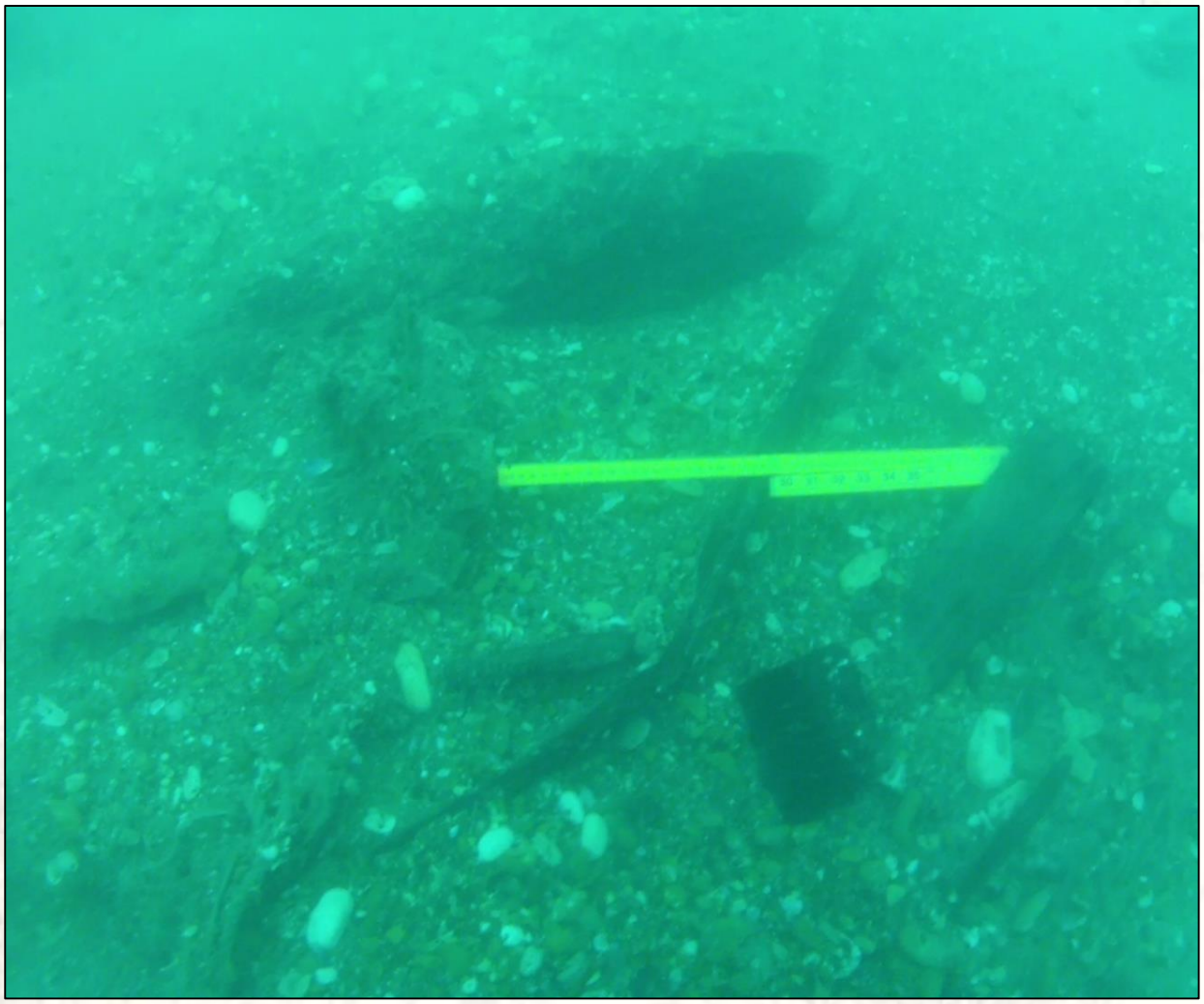

Figure 15 Area of barrels being exposed within the central area of the site.

Figure 16 More barrels being exposed in the middle of the site. The remains of the main deck beam can be seen in the top left of the photo.

Figure 17 Area of fishing nets with common star fish on top. This could easily be misinterpreted for an archaeological feature in the multi beam echo sounder survey if not ground trothed by divers.

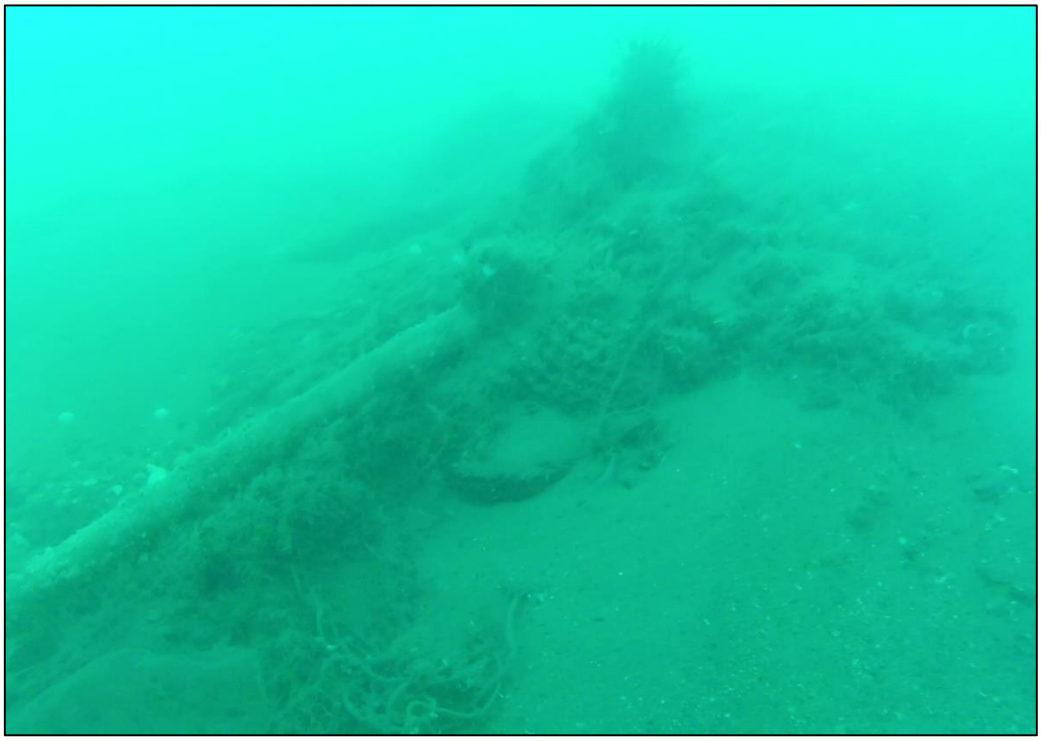

Figure 18 Modern detritus, fishing nets and telephone cabling, caught on part of the wreck.

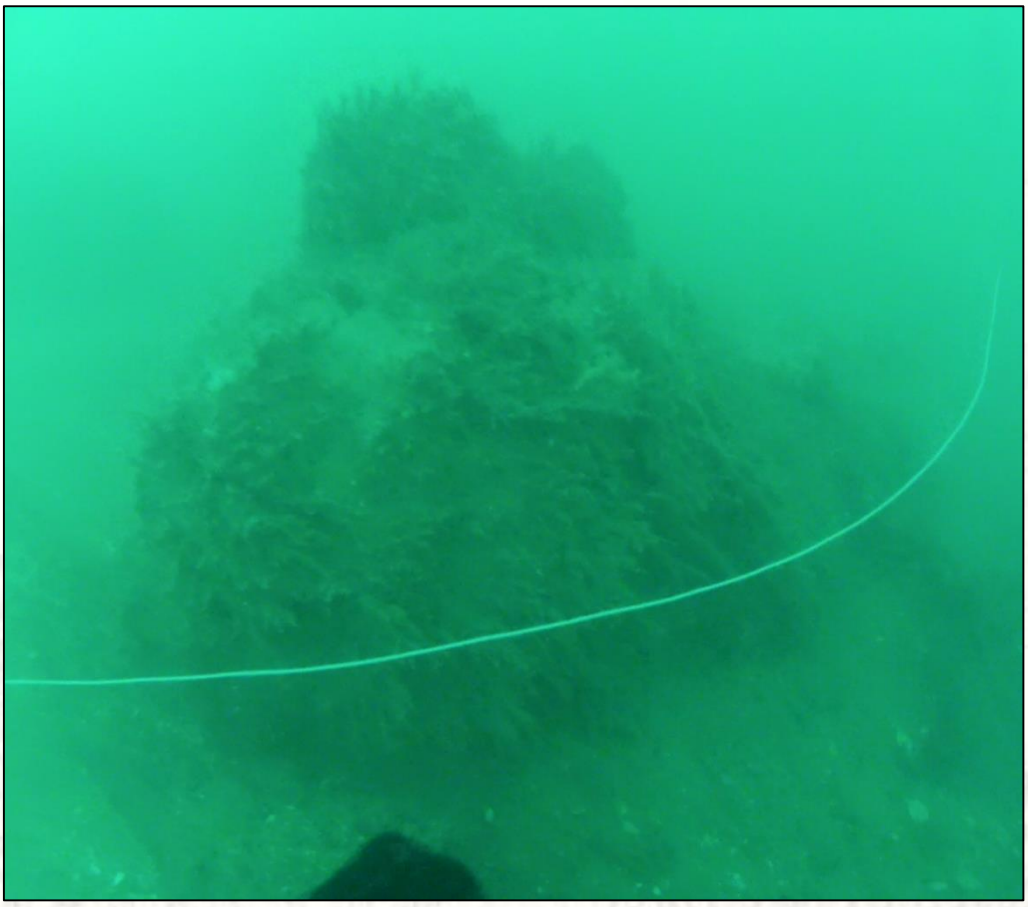

Figure 19 Stem post and bow area showing heavy weed growth, possibly due to fishing gear snag.

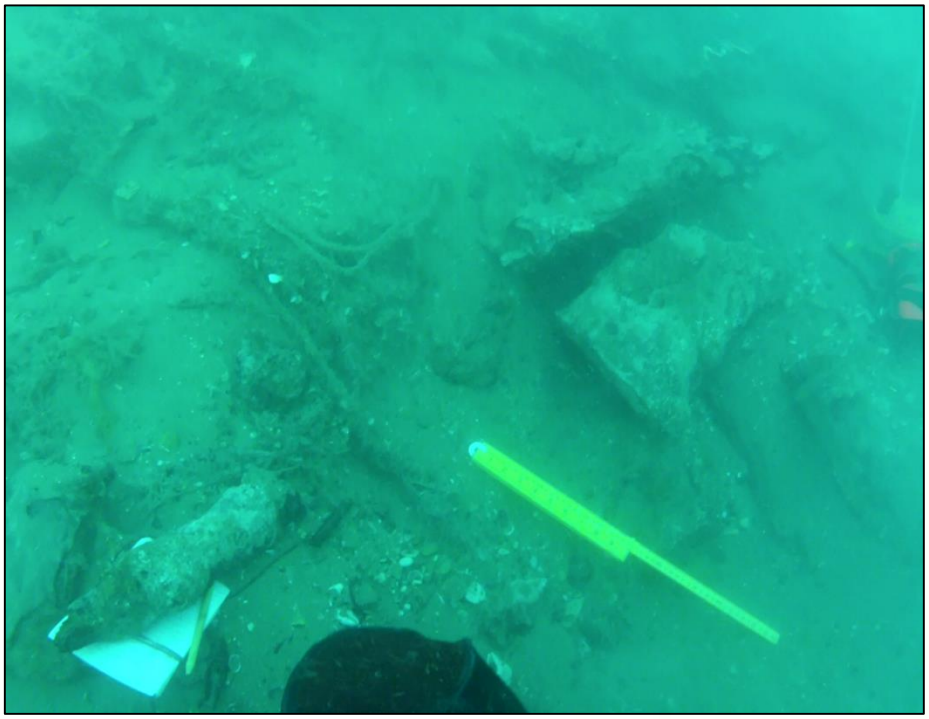

Figure 20 Area of artefacts including pieces of personal chest lying the scour at the bow.

6.13 Biological

6.13.1 All biological surveys were recorded following the guideline outlined in the Seasearch Observation Form Guidance Notes and the Seasearch Survey Form Guidance Notes (http://www.seasearch.co.uk/recording.htm). The Seasearch proforma sheets were utilized for all biological surveys. Each diver recorded their observations and where possible photographs or video of the sea life. This record was then used to identify the species from a guide to sea and shore life (Gibson et.al., 2001). The correct species is then transferred to the Seasearch proforma sheets and then posted to Seasearch for inclusion in their database.

6.13.2 Species seen and identified were:

- gooseberry sea squirts,
- white and red plum anemones
- yellow sponges
- edible brown crabs
- common brown prawns.
- velvet crabs
- hermit crabs
- dog Fish (including their eggs)
- pollock
- bib or pout
- common star fish

6.13.3 The flora and fauna colonizing the wreck site of the *Stirling Castle* proved it to be an oasis in a barren seascape. The above surface structure of the *Stirling Castle* was covered in an abundance of sea life and a hard encrustation, most probably due to barnacles and molasses. This surface layer collects light silt

and has layers of common mussels in clumps throughout. Velvet crabs graze over this layer during slack waters, whilst Hermit crabs scurry around the seabed, and young Pout and Pollock dart around in small shoals.

6.13.4 The surrounding seabed of the wreck site of the *Stirling Castle* is barren of any flora and fauna. The exposed bedrock is chalk. This is overlain with heavy gravel interspersed with large flint nodules. No recognisable flora or fauna was seen any distance for the wreck site.

7 RESULTS

7.1.1 This project has produced a baseline archaeological and biological survey of the protected wreck *Stirling Castle*. These surveys allow for an understanding of the sites current state of preservation the final results of which are an archaeologically interpreted 3D “as is” surface model. This “surface model” along with the diver interpretation of features seen in the model has allowed divers, the general public and heritage agencies to be able to interpret the current state of the wreck site *Stirling Castle*.

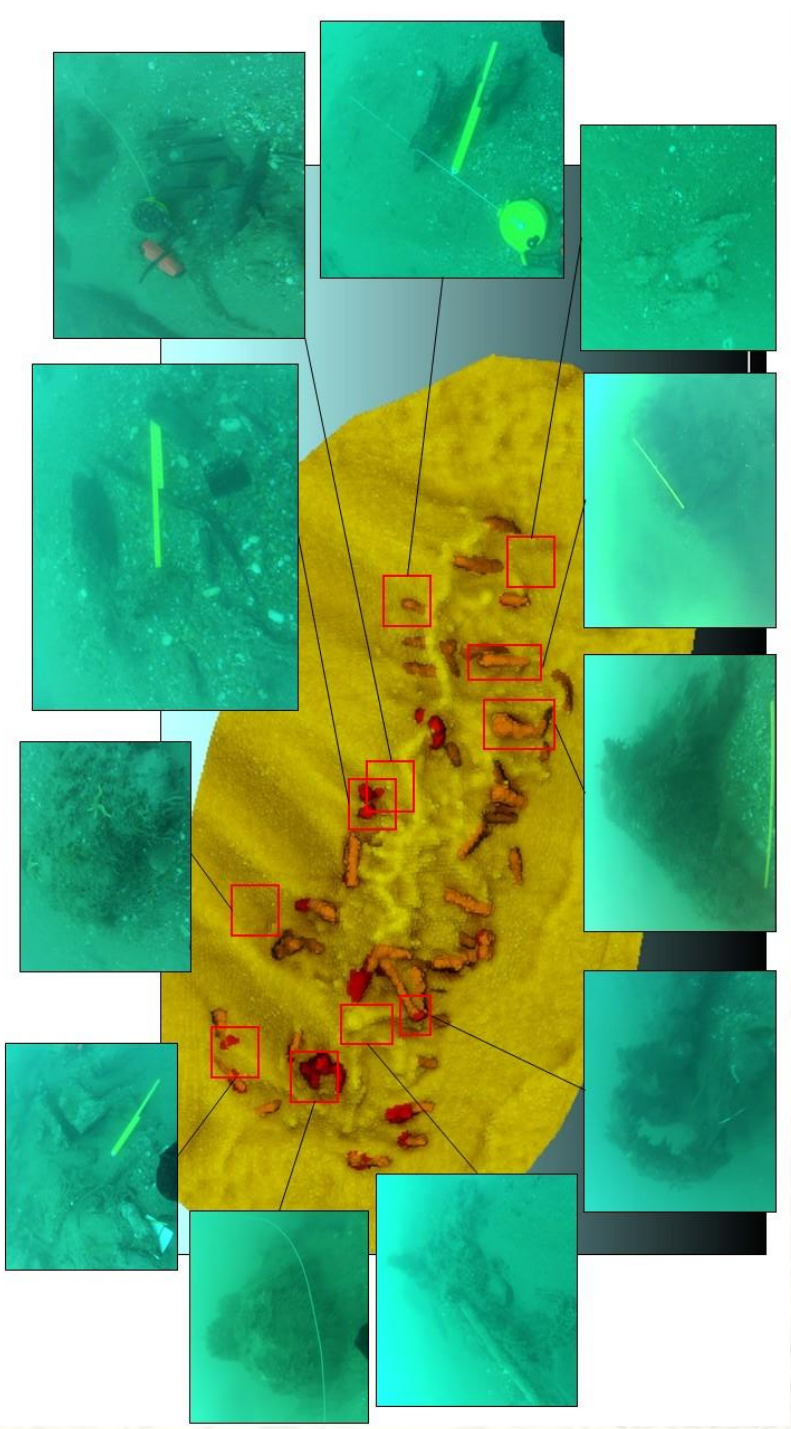

Figure 21 The interpreted site plan with photographs superimposed to show relative locations.

8 INTERPRETATION

8.1 Site Plan

8.1.1 The 2015 multi beam echo sounder survey produced a high resolution “as is” 3D model of the site (Figure 22). This model is derived from an “all points” cleaned but not gridded point cloud. This produces the most accurate representation of the site with an all point’s resolution of less than 10 mm. The anomalies and features seen in the 3D model have to be ground trothed/interpreted so that natural features are not represented as anthropological features. This ground truthing is based on diver observations which also produced a traditional site plan.

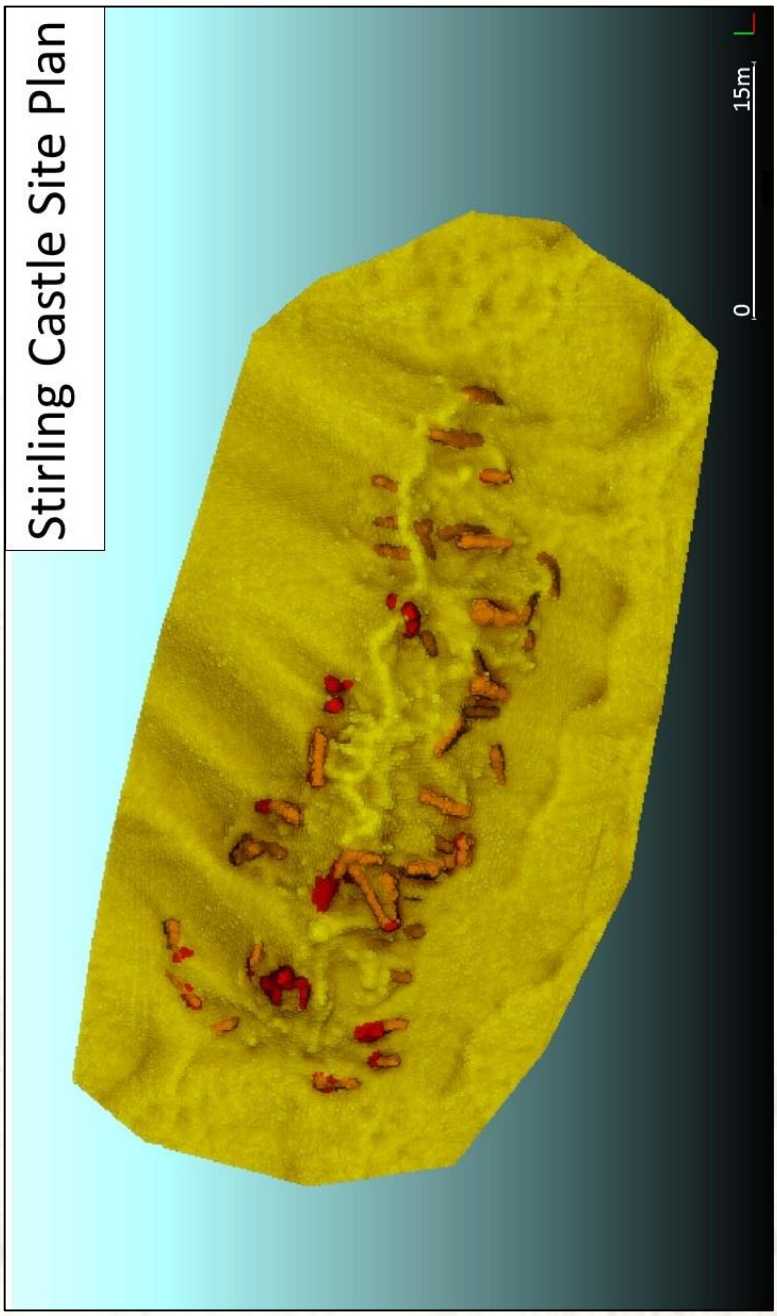

Figure 22 Stirling Castlediver interpreted site plan where orange is iron (anchors and cannon), and red is bricks or other archaeology and brown represents wooden structure.

8.1.2 The site plan is based on an orthographic vertical projection of the 3D model. It is this that is used to fill out an “as is” site survey of the *Stirling Castle* wreck. The model can also be viewed from other angles, as shown in figures 23 and 24.

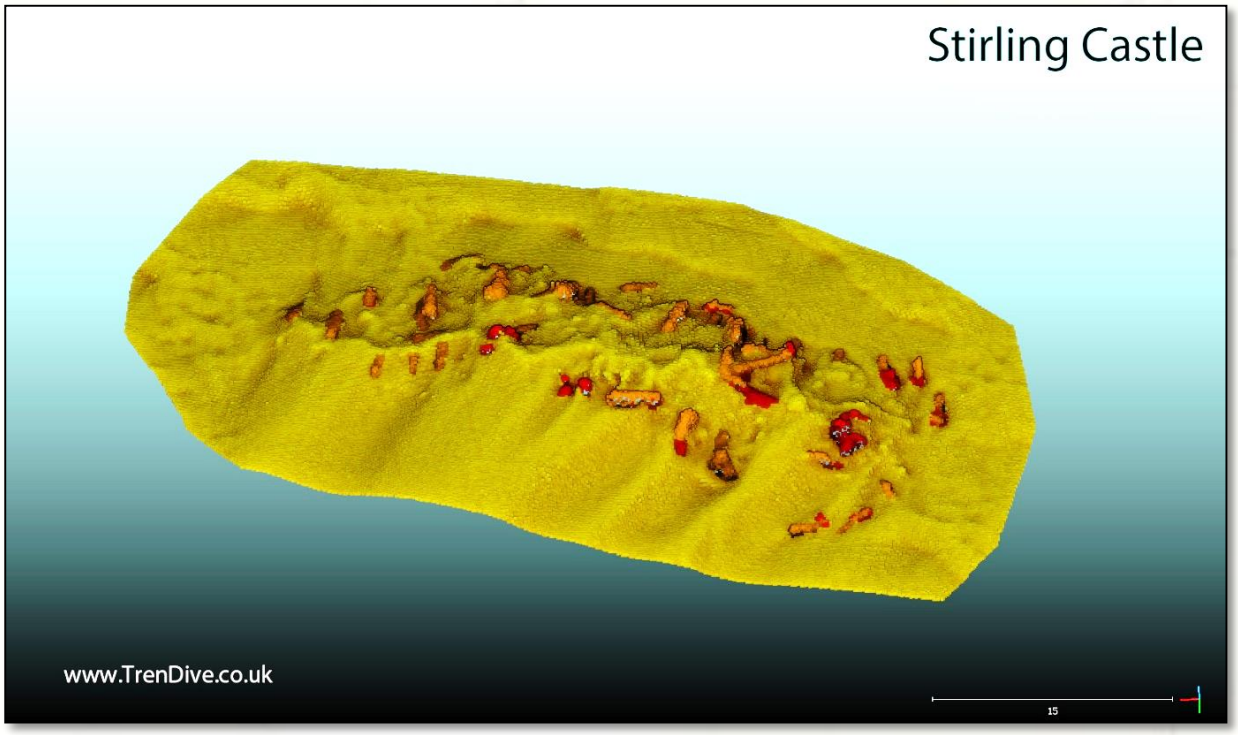

Figure 23 Stirling Castle MBES derived site model (2015) looking north to south over the site.

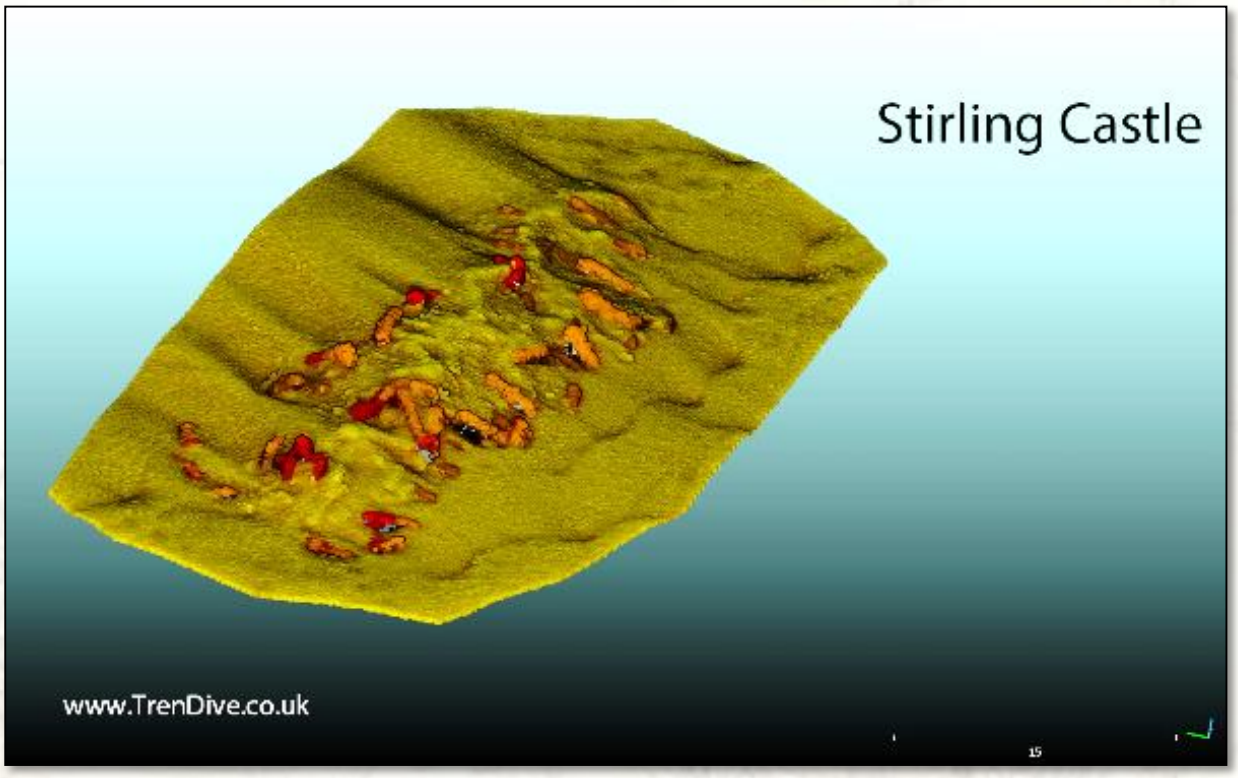

Figure 24 Stirling Castle MBES derived site model (2015) looking east to west over the site.

9 FUTURE RESEARCH POSIBILITIES

9.1.1 The British Sub Aqua Jubilee Trust grant has allowed the site of the *Stirling Castle* to be recorded, interpreted and the results presented in a format accessible to the diver and the public. The BSAJT grant has inspired a new team of BSAC divers in their local underwater heritage and to become custodians for this heritage. These divers' future tasks will be further:

- archaeological and biological survey training
- training in 3d photogrammetry
- training in archaeological illustration
- further site surveys of archaeological significant wrecks in and around the East Kent coast.

9.1.2 The grant aid form the BSAJT has acted as an enabler for the continued survey of the Stirling Castle. This will hopefully progress with further recording of the site and its features as well as a 3d photogrammetric survey of the site.

10 REFERENCES

Cates, M., and Chamberlain D., 1998, The *Stirling Castle*1703. in Bound M., Excavating Ships of War Vol. 2. Oswestry.

Peacock, R., 2013, Licensees report.