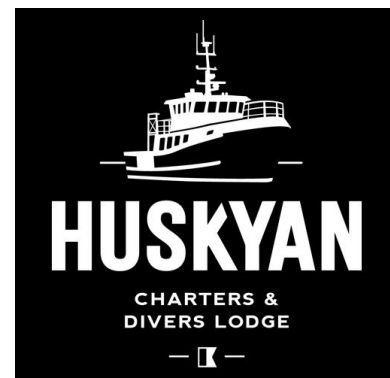




HMS Vanguard

Geophysical, ROV and Diver Survey

April 2016



seatronics

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1 Project Description

1.1 Summary

HMS *Vanguard* remains a frequently overlooked war grave within Scapa Flow, especially in comparison to HMS *Royal Oak* and HMS *Hampshire*. This project, undertaken by ORCA (Orkney Research Centre for Archaeology) Marine, Seatronics and Huskyn Marine will provide archival research, marine geophysical survey, remote archaeological evaluation, and diver survey. This will establish the extent, survival and character of the remains of HMS *Vanguard* in Scapa Flow, Orkney. It is planned that this will coincide with the centenary commemorations of World War One and the forthcoming centenary of her destruction at her moorings by a series of explosions before midnight on Monday, 9 July 1917 with the reported loss of 843 out of the 845 onboard.

The marine geophysical survey will be undertaken by side scan sonar, multibeam echosounder survey and BlueView BV5000 3D Scanner, alongside an archaeological survey undertaken by Remotely Operated Vehicle (ROV) and a diver survey conducted by Huskyn Marine; the remains of HMS *Vanguard* will not be physically disturbed by any aspect of the proposed survey. The archival research and archaeological remote evaluation surveys will lead to an enhanced display and memorial of loss alongside the *Royal Oak* memorial at Scapa, Orkney and on Flotta.

1.2 Existing Knowledge

The third ship of the St Vincent class HMS *Vanguard* was part of the naval estimates of 1907 to 1908 and was ordered on the 6th February 1908. She was built by Vickers at Barrow-in-Furness, who also constructed her engines. Laid down on the 2nd April of the same year, she was launched on the 22nd February 1909 and was commissioned into the Royal Navy at Devonport on the 1st March 1910 as the 8th ship to bear the name of HMS *Vanguard* in the Royal Navy.

The St Vincent class were similar to the HMS *Dreadnought* with a few, minor alterations. This allowed for rapid rebuilding of the battle fleet with dreadnoughts allowing the Royal Navy to keep ahead in the naval arms race. Just like the Bellerophon class she carried a secondary armament of sixteen 4 inch guns instead of Dreadnought's 12 pounders and her foremast was ahead of her forward funnel making it habitable. However, the mainmast was still too close to the rear funnel and could be unbearable due to the smoke and heat from the rear funnel.

She served in the 1st Battle Squadron in 1914 and (with the older ships of the Grand Fleet) in the 4th Battle Squadron at the Battle of Jutland. She was a part of the action from beginning to end, but did not suffer any damage or casualties.

HMS *Vanguard* was destroyed at her mooring by a series of explosions before midnight on Monday, 9 July 1917 with the reported loss of 843 out of the 845 people on board (<http://www.scapaflowwrecks.com/wrecks/vanguard/history.php>). The Court of Inquiry attributed the loss to the ignition of cordite 'from an "avoidable cause", or the deterioration of perhaps unstable cordite' (Schleihau 2000: 77) probably in P or Q magazine (just abaft the foremast). The wreck lies to the south of the Barrel of Butter and to the west of Calf of Flotta in approximately 28m of water and within the installation area of the loading buoys for the Flotta oil terminal. The bodies of 22 dead (Stell 2010: 205) were recovered and buried in Lyness Cemetery, where there is a memorial to the loss.

A number of salvage activities were undertaken on HMS *Vanguard* following her loss, however a definitive list of these activities has not been compiled and the exact details of items recovered from the wreck remains unknown. Various artefacts from the wreckage are currently on display in the Furness Dock Museum, in Barrow and in the Stromness and Lyness Museum in Orkney. On 12 September 1975, a detailed investigation was carried out by the Royal Navy's Command Clearance Diving Team who confirmed that the original series of explosions destroyed virtually all the explosive ordnance on board and blew the wreck apart. The 1975 investigation noted that the stern section of the wreck containing the after torpedo compartment was largely undamaged. It is presumed that this section contains a number of 18 inch torpedoes and live warheads for the torpedoes. It is not known how many torpedoes and live warheads remain in this section. It was stated that the torpedo warheads in the stern section posed a potential threat to the Occidental pipeline, and that it was considered unwise to disturb them in view of probable deterioration. A light scattering of loose cordite sticks was found lying on the seabed and were determined to be of no threat and were subsequently left in situ. One 12 inch shell was reportedly removed from the wreckage for disposal from during the period of 15-19 September 1975 (Report cited on Canmore (ID # 103004), accessed January 2015).

In 2002 HMS *Vanguard* was designated a Controlled Site under the Protection of Military Remains Act of 1986 prohibiting diving within a 200 metre exclusion zone of the wreck site. She is marked by a buoy which carries a notice that the wreck is a war grave.

2 Project Scope

2.1 Rationale

HMS *Vanguard* remains a frequently overlooked war grave within Scapa Flow, especially in comparison to HMS *Royal Oak* and HMS *Hampshire*. Even in her scattered and damaged state, her remains are a rare example of an early dreadnought battleship. The centenary of World War One provides a timely opportunity to undertake geophysical and ROV surveys to assess her remains with a view to providing a baseline dataset for long term monitoring. Assessment of the remains could be used as a means to commemorate the impact of her loss on Orkney and wider communities, combining archaeological assessment with historical data collection to investigate the service life of HMS *Vanguard* and her crew before her untimely destruction.

2.2 Project Aims

The project will build on information gained from previous surveys by addressing the following aims:

- Conduct archival and community based research into the history of HMS *Vanguard*;
- Undertake Side Scan Sonar & Multibeam Echosounder surveys to gain a detailed overview of the standing debris;
- Undertake 3D modelling of the wreck site using a BlueView BV5000 3D scanner;
- Ground truth the remains using an ROV to provide information on the extent, survival and condition of HMS *Vanguard*;
- The diver survey will aim to take extensive high resolution, detailed photographs and film footage to build on the footage taken in the ROV survey;
- To assess the current condition of any exposed munitions on the wreck site of HMS *Vanguard* and any possible danger that they may pose;
- And provide content, imagery and recommendations for updated memorial displays, crew casualty list and further information. These could be presented at the nearest viewing point on Flotta and the Silent Cabin and alongside the HMS *Royal Oak* memorial at Scapa, Orkney. It is planned that these would be made available to coincide with the centenary anniversary of the sinking.

The project will be conducted in liaison with Orkney Marine Services, Orkney Marine Skippers, and relevant authorities/ marine users, ensuring appropriate permissions are obtained before the work begins. The data and project archive will be deposited with Historic Environment Scotland in accordance with the standards established by the Marine Environmental Data Information Network (MEDIN).

2.3 Research Questions

There are a number of research questions that should be asked concerning HMS *Vanguard*:

- Where was *Vanguard* moored at the time of her loss?

According to Schleihau (2000) the logs of the Grand Fleet ships indicate that *Vanguard* was moored at B5. However, *Chart 3729: Scapa Flow and Approaches (Northern Sheet)* July 1923 clearly show the prohibited area for the wreck site of *Vanguard* at mooring B4. This location matches the location of the remains of *Vanguard* surveyed by Multi Beam Echosounder (MBES) during the ScapaMAP (<http://www.scapamap.org>) project in 2000 (ScapaMap 2000-2002: 21-22). This discrepancy could have a bearing on the witness reports of the explosion and the dispersal pattern of any debris.

- What caused the loss of HMS *Vanguard*?

Interrogation of available sources, witness reports, the Court of Inquiry and local accounts may still shed some light on the nature of the explosions that destroyed the battleship and what may have caused them. The side scan survey, BlueView 3D scanning, ROV survey and diver survey should ascertain the location of any surviving main armament, magazines and ammunition stocks. Their survival, location and, in the case, of shells and cordite stocks, numbers could indicate which magazine or magazines exploded and elucidate a possible chain of events that resulted in HMS *Vanguard*'s destruction.

- How many were lost on *Vanguard* and the stories behind their lives?

The casualty figures for the losses on *Vanguard* and the number of bodies recovered and buried vary. Archival research and collection of oral histories will aim to confirm the number, name and identities of the casualties, collecting personal narratives about their lives prior to and during their service on HMS *Vanguard*.

- What salvage activities were undertaken on the reported surface debris created by the explosion of HMS *Vanguard*?

A more thorough investigation and a historical analysis of the number, nature and subsequent initial clean-up of debris created by the explosion should be undertaken. One prime example is the account of a complete 12 inch gun turret that is reported to have landed on Flotta along with other burning debris. Although commonly repeated in historical accounts the details remain sparse. If this account is accurate what records exist of this event? Furthermore, it is unclear where the gun turret and its associated debris landed and what eventually happened to them. Are there any other reports of debris on Flotta or elsewhere and what happened to these remains?

- What was the nature and extent of salvage activities on the wrecksite of HMS *Vanguard* after World War One?

Records of the salvage activities on HMS *Vanguard* are incomplete and inconsistent between sources. Although salvage rights are reported as existing up to the end of 31st December 1982 (Canmore 103004) the 1975 Royal Navy-led investigation was to the best of our knowledge the last, recorded salvage activity conducted on HMS *Vanguard*. The nature of the activities is also inconsistent. For example, the main gun turrets were reported to have been removed prior to Nundy Marine Metals activities (Schleihauf 2000: 80) in 1957 when the 12 inch guns were reportedly salvaged (ScapaMap 2000-2002: 104). Frank Lilleker (ScapaMap, 2000-2002: 102), who was part of the Nundy Marine Metal's salvage activities from 1958-59 gives an account that seems to contradict Schleihauf (2000), at least in regard to the details. Gunhouse roofs were reported to have odd shaped holes cut in them and this indicates that part of the turrets were still present on the wreck at the time. Items like a propeller and a 12 inch gun barrel were recorded as being recovered during this phase. More items, including further 12 inch guns were recovered. However, Lilleker's accounts are vague as to the exact number of items salvaged. The research should determine the exact history of the salvage activities conducted on HMS *Vanguard* seeing to confirm or correct the various accounts. The side scan sonar, multibeam and ROV survey will determine what is currently present on the site and it may be possible to identify previous salvage activities with the ROV Survey. The ROV footage will be reviewed alongside Dougall Campbell who previously owned the salvage rights to HMS *Vanguard*, and who will be brought in as a non-diving Advisor as part of the project team.

3 Methodology

The project will be carried out in 3 phases

Phase 1: Remote Surveys

- Stage 1 Archival, Community and Desk-Based Research;
- Stage 2 Side Scan Sonar & Multibeam echosounder Survey;
- Stage 3 Predator II ROV Survey; and
- Stage 4 Teledyne-BlueView 3D scanner.

Phase 2 – Diver Surveys

- Stage 1 Initial survey and assessment of main wreck site;
- Stage 2 Capture extensive still and video footage of main wreck site;
- Stage 3 Diver survey of significant targets in the debris field; and
- Stage 4 Capture still and video footage of these targets.

Phase 3: Assessment and Commemoration

- Stage 1 Assessment and Analysis;
- Stage 2 Preparation of Deliverables and Dissemination; and
- Stage 3 Recommendations for creation of expanded war memorial displays.

3.1 Inception

An inception meeting between MoD, ORCA Marine, Seatronics and Huskyn Marine will take place using VC close to the start of the project to discuss the project aims and finalise any methodological queries. Any Review Point meeting dates will be arranged.

3.2 Archival, Community and Desk-Based Research

The following data sources will be interrogated as part of archival and desk based research in order to achieve the proposed outputs:

- Any existing marine surveys of the HMS *Vanguard* and surrounding areas including geophysical and MoD/Salvage diver surveys;
- Local publications;
- Academic journals;

- Local communities and stakeholder knowledge;
- Sites and Monuments Records;
- Kirkwall and Stromness Museum and other identified collections holding relevant artefacts;
- Orkney County Archives;
- Royal Navy and MoD; and
- Grey literature reports.

Archival research will be undertaken to ascertain and gather historical information with regard to HMS *Vanguard*. Such research could prove vital with regard to the loss of HMS *Vanguard* and any debris or items that landed on Flotta and any subsequent salvage activities on land.

Further secondary data sources such as historical books on Scapa Flow including Geoffrey Stell's *Orkney at War: Defending Scapa Flow, Vol 1, World War I* (2010) would also be consulted. Where required additional data sources identified by the project team would be procured. Safe copies of these would be included in the project archive.

A MEDIN-compliant ArcGIS Project will be created during this phase, WGS1984 UTM Zone 30N will be the preferred geodetic datum for use. Acquired data will be entered into ArcGIS and added to the results of the fieldwork. ESRI's ArcGIS software has been chosen as the most suitable program for use on this project due to its advanced tools, database connections and graphical output capabilities. A shapefile will be created within an ArcGIS *.mxd project, ensuring compatibility with other datasets. Each defined aspect of HMS *Vanguard* in the GIS will be assigned a Unique ID number. This will allow easy spatial querying of the GIS enabling the auditing and assessment of the sites and anomalies.

3.3 Side Scan Sonar and Multibeam Echosounder Survey

Side scan sonar and multibeam echosounder survey has been selected as these techniques provide a suitable level of detail to characterise the structure and extent of the site. Surveys completed using both systems are capable of resolving objects 0.5m and larger distributed across the survey area.

The benefits of multibeam echo sounders are that they map the seafloor by a fan of narrow acoustic beams, thus providing 100% coverage of the bottom. The resulting seabed maps are produced faster, reducing your ship survey time.

The side scan sonar surveys will be completed using a towed C-MAX Sonar CM2 Digital Towfish. Data will be collected in real time using MaxView software – ensuring the best possible images of the site are recorded. The multibeam echosounder survey will be completed using an overside mounted Reson T50-P. Data will be collected in real time using software – ensuring the best possible images of the site are recorded.

The data will be post processed using SonarWiz 5 and Teledyne PDS2000 following guidance in the 2013 *Marine Geophysics Data Acquisition, Processing and Interpretation: Guidance Notes* (English Heritage 2013: 34-36). This will be used to produce a mosaic of several survey transects achieving the best possible images of the sites. SonarWiz 5 and Teledyne PDS2000 are highly flexible pieces of software which allows other data such as basemap in ESRI shapefile format to be viewed alongside the side scan and multibeam data.

Geo-referenced images for each aspect of the site will be generated for assessment prior to the BlueView BV5000 3D scan and the ground truthing phase.

The side-scan sonar and multibeam echosounder surveys will produce an incredibly detailed picture of the wreck site, surpassing any previous recordings of the site. It will document the wreck one hundred years after its sinking, mapping the extent of the wrecksite and its current condition. The images will be used to identify key areas of the wreckage that should be examined in more detail during the ROV reconnaissance.

3.4 Predator II ROV Survey

The Predator II inspection class ROV will be used to undertake the ground truthing survey. In this first instance, the ROV will undertake an overall survey of the site. This will be followed by a targeted survey of key elements around the wreckage identified by the geophysical surveys. Ideally the ROV survey will be timed for weather conditions that will allow for the greatest visibility on the site. ROV surveys will not be undertaken after stormy weather as sediment will have been disturbed resulting in greater suspension within the water column restricting visibility on the ROV's underwater cameras. Throughout the surveys care will be taken to avoid disturbing the wreckage. Enclosed areas of wreckage will be avoided to minimise potential for entanglement. The ROV will capture video and stills footage, and a marine archaeologist will be on board to assess the images in real time – directing the survey in response to features identified.

This data will be used to further ground-truth the existing surveys and feed into the overall assessment and analysis of the *Vanguard* wreck site.

3.5 BlueView BV5000 3D Scanner

The BlueView BV5000 is an acoustic imaging device, it bounces sound waves off the ocean floor and wreck site and turns them into rapidly updated streaming digital images. The BlueView 3D is a combination of a multibeam profiler sonar with a pan and tilt to scan areas of interest generating 3D point clouds, it creates a fully interactive 3D model from which accurate geometries and range measurements can be taken. The interactive model contains millions of measureable points, creating a visual model of the target structure and surrounding area with centimetre level accuracy. The BlueView BV5000 carries out full 360° scans, enabling immediate visual assessment of the data for quality assurance. creating an instant visual check.

The BlueView BV5000 will create an interactive model of the wrecksite of the *Vanguard*, It will allow measurements to be taken of the wreckage material within 1centimeter accuracy.

3.6 Diver Survey

Huskyan Marine, owned and operated by Emily Turton and Ben Wade, will conduct a diver survey of the wreck site and debris field. The diving is to take place over the winter of 2016/2017 as weather permits. While the winter months' risk worse surface weather conditions and shorter daylight hours it is by far the best time of year to guarantee better under water visibility and therefore better images. It is anticipated that 30 days of diving will be required to cover the entire site. This is in part due to the size of the wreck herself and the unknown extent of the debris field. We envisage that a single 30-day period would be insufficient time due to potential adverse diving conditions so we would need the option to spread the 30 days out over the winter period.

The diving project was first discussed in an informal conversation with Andy Liddell when in Orkney in April 2013 for the corrosion study of the German Fleet. We feel that the current collaboration with ORCA in the lead up to the centenary of her sinking provides an excellent opportunity for such a project. By combining their archaeological and remote survey skillset with our wealth of experience and knowledge of diving warships of this era and in the conditions experienced in Scapa Flow will provide the ideal partnership.

3.7 Diving Project Plan

Main Wreck Site – Conduct an extensive diver survey of the main body of the wreck. The primary function is to map the wreck in detail and to identify all key features within the main body of the wreck.

Debris Field – The extent of the debris field will be identified in the remote survey portion of the project. Analysis of this data will identify targets to include in the diver survey.

Detailed ships plans for the Vanguard survive and are available from the archive at Greenwich. Prior to the commencing the diver survey the plans will be consulted in detail to help understand the original layout of the ship. This technique has proved invaluable in understanding the current condition of the heavily salvaged areas of the WWI German shipwrecks in Scapa Flow. The diver survey will include extensive use of high-resolution videography and still photography to detail and document the wreck and debris field in her current condition.

3.7.1 Dive Team

Vessel: MV Huskylan is a purpose built dive vessel licensed to carry 12 passengers and 3 crew. Designed to operate in Scottish water she is the ideal platform for the expedition.

The dive team will be made up as follows:

1. **Ben Wade:** Owner of Huskylan Marine. Technical wreck diver and diving instructor with 20 years experience diving WWI battleships both externally and internally.
2. **Emily Turton:** Commercial Skipper. Owner of Huskylan Marine. Technical wreck diver and WWI wreck researcher with 12 years experience diving the WWI wrecks in Scapa Flow
3. **Rod Macdonald:** Technical diver and author of many shipwreck diving books such as Dive Scapa Flow.
4. **Paul Haynes:** Dive Supervisor. Technical diver, commercial diver and ex Royal Marine/SBS.
5. **Marjo Tynkkynen:** Photographer and photo editor. Technical wreck diver & under water photographer

6 - 12 Additional dive team members will be made up of suitably qualified people as necessary each bringing a specific and important skillset to the project.

Non Diving Advisor

Dougall Campbell will act as a non diving advisor to the project. Dougall owned the salvage rights to the Vanguard. He is the last commercial operator to salvage anything from the wreck and he assisted with the 1975 MOD survey of the wreck. His wealth of knowledge of the wreck is invaluable as are his anecdotes in telling the story of the Vanguard.

3.8 Assessment and Analysis

Once all of the data has been compiled into the GIS project the data will be examined for its quality, accuracy and coverage of the site and for the following key considerations:

- Identification
- Location character
- Area and distribution of surviving structure
- Condition
- And character of structures

The data would be evaluated in light of the research questions posited in Section 2.3.

3.9 Production of Final Illustrated Project Report

An illustrated project report would be prepared documenting the entire process of the work undertaken, outlining evidence in relation to the research questions proposed and detailing how the work has met the aims of the project.

It is proposed that the report will be laid out as following:

- Executive Summary
- Acknowledgements
- Introduction and Project Background
- Aims and Objectives

- Methodology
- Results:
 - Location;
 - Site Conditions and Environment
 - Investigation: Survey history and results of previous work
 - Results in relation to archaeological and historical datasets:
 - Site layout and extent
 - Identification of component pieces
 - Character and condition of the remains
 - Evidence of fittings, machinery, cargo and other artefacts
 - Analysis:
 - Assessment of data in relation to research questions
 - Conclusions
 - Recommendations for updated memorial displays
 - References and Abbreviations
 - Appendices

4 Project Deliverables and Dissemination

Four hard copies and a digital pdf copy of the full illustrated project report, copies on CD will be submitted to MoD, HES (Historic Environment Scotland), OIC and the Orkney Library and Archives. A digital copy of the report with illustrations at online quality will be submitted to Historic Environment Scotland for publication online. A talk on the work will be given to the Orkney Marine Archaeological Forum (OMAF) and the Orkney Archaeology Society (OAS).

A digital archive will be created from the ArcGIS project with the data saved in appropriate, stable formats such as shapefiles, TIFFS, JPEGs and JGWs, TFWs and ASCII. All figures produced during the project will be saved as PDFs. The project archive will include:

- The Project Brief
- The Project Design
- The Project Report
- The GIS and digital data such as shapefiles, ArcGIS projects, geo-referenced images and their respective worldfiles
- Raw survey data
- Text or mapped data produced or copied unless restricted by copyright

The archive will be deposited with MoD, HES, OIC and a submission to the Online Access to the Index of Archaeological Investigations (OASIS) will be made. ORCA Marine will liaise with the relevant bodies regarding applicable standards for accepting, using and archiving digital data, which will be MEDIN compliant. A safe copy of any data produced either by the survey or acquired from additional sources will be kept as a back-up in its original format at ORCA Marine.

4.1 Recommendations for Display Boards and Updated Memorials

The information acquired over the course of the project will be used to create updated memorial displays at Scapa Beach alongside the *Royal Oak* memorial garden and a display at the Silent Cabin on Flotta. The project team will liaise with OIC to provide recommendations on the content and presentation of the updated memorial displays.

5 Copyright and Ownership

Reports, all associated documentation, records, research material and GIS shapefiles/projects will be the in the ownership of MoD, although it is assumed that a third-party in-perpetuity licence will automatically for given for reproduction of the works by the originators (ORCA Marine, Seatronics & Huskyn Marine), subject to agreement in writing from MoD. Where data (e.g. photographs and charts) have been supplied by another party, permission for use will have been sought and gained before reproduction, though all rights may be reserved by the owner. Copyright ownership of still photographs and videography captured in the diver survey will remain with the owner.

6 References

Vanguard site record on Canmore (Canmore ID 103004),

<http://canmore.rcahms.gov.uk/en/site/103004/details/hms+vanguard+scapa+flow+orkney>
Accessed 15/01/2015

English Heritage (2013) Marine Geophysics Data Acquisition, Processing and Interpretation: Guidance Notes

Report taken from a signal from FOSNI to the MOD Navy, Queen's Harbour Master Rosyth, and the Commander in Chief of the fleet. On Canmore, ID 103004,
<http://canmore.rcahms.gov.uk/en/site/103004/details/hms+vanguard+scapa+flow+orkney>
Accessed 15/01/2015

ScapaMap 2000-2002 Report Compiled for Historic Scotland on the Mapping and Management of the Submerged Archaeological Resource in Scapa Flow, Orkney
<http://www.scapamap.org/reports.php>

Schleihauf, W (July 2000) Disaster in Harbour: The Loss of HMS *Vanguard*, *The Northern Mariner* 10 (No. 3): 57-89

Stell, G. (2010) Orkney at War: Defending Scapa Flow Volume 1 World War 1. The Orcadian, Kirkwall

UKHO (July 1923), Chart 3729: Scapa Flow and Approaches (Northern Sheet)

7 Abbreviations

CIFA	Chartered Institute for Archaeologist
DBA	Desk Based Assessment
GIS	Geographical Information System
HER	Historic Environment Record
HES	Historic Environment Scotland
HSC	Historic Seascapes Characterisation
HSE	Health and Safety Executive
MAG	Maritime Affairs Group
MBES	Multi Beam EchoSounder
MCA	Maritime and Coastguard Agency
MEDIN	Marine Environmental Data Information Network
MoD	Ministry of Defence
NAS	Nautical Archaeology Society
OAS	Orkney Archaeology Society
OASIS	Online Access to the Index of Archaeological Investigations
OIC	Orkney Islands Council
OMAF	Orkney Marine Archaeology Forum
ORCA	Orkney Research Centre for Archaeology
PD	Project Design
QA	Quality Assurance

RCAHMS	Royal Commission on the Ancient and Historical Monuments of Scotland
ROV	Remotely Operated Vehicle
SAMS	Scottish Association of Marine Sciences
SDSC	Scientific Diving Supervisory Committee
SMR	Sites and Monuments Record
UHI	University of the Highlands and Islands
UKHO	United Kingdom Hydrographic Office