

1.0 Assignment 1: Archaeological Project Assessment

- 1.1.1 A project to inspect, survey, investigate, record, and monitor the Bronze Bell wreck site was undertaken in September 2021 by MSDS Marine (MSDS Marine, 2021). The site consists of the wreckage of an unidentified armed cargo vessel believed to have sunk in 1709, it is protected under the Protection of Wrecks Act 1973. The project was funded by the Climate, Heritage and Environments of Reefs, Islands, and Headlands (CHERISH) project. This site had previously been subject to investigation by a variety of groups and organisations since discovery in 1978, and in 2004, a comprehensive programme of archaeological investigation was undertaken by Wessex Archaeology (Wessex Archaeology 2006). The 2021 investigation was designed to “facilitate comparison with information obtained in wreck dives carried out by Wessex Archaeology” and one of the main aims was to “deliver a public engagement strategy” (MSDS Marine, 2021). Priority tasks of the 2021 fieldwork were, therefore, to create an updated site plan and repeat a series of photographs taken by Wessex Archaeology in 2004 to enable an assessment of change undertake, and also to undertake photogrammetric recording of the site to produce outputs for public engagement. This report will assess the efficacy of the methods employed in the 2021 investigation to achieve these aims.
- 1.1.2 A variety of methods were used to achieve the priority tasks during the 2021 investigation, these were selected according to two key considerations. The first of these was the size of the site, which comprises 120m² of seabed with a large number of archaeological features that required survey. Another consideration was time; fieldwork on site was limited to just five days, and due to air limitations, active diving time could reasonably be up to six hours a day. Further to this, the number of tasks to complete required effective time management. It was concluded that the tasks required methods that could cover the whole site with efficiency. The methods selected were multibeam bathymetry analysis, photogrammetric recording, and diver fieldwork which included diver tracking, verbal reporting, manual feature recording, and photography.
- 1.1.3 Prior to fieldwork taking place, high resolution multibeam bathymetry collected by CHERISH in 2020 across the site and wider area was used to identify seabed features; the resolution was sufficient to observe cargo, armament, and anchors. In some cases, the muzzle, cascabel, and button of guns could be identified which allowed orientation to be accurately determined. A preliminary site plan was produced using the multibeam bathymetry, and this was used to determine where condition photographs taken by Wessex Archaeology in 2004 were taken from. This plan was printed onto dive slates to be used during diving operations. Producing a preliminary site plan prior to fieldwork enabled diving operations to focus on ground truthing the plan and complete the other tasks rather than dedicating time to manually plotting seabed features, thus this can be deemed an effective, efficient method.
- 1.1.4 The site was then surveyed divers who were acoustically tracked using a Micro-Ranger 2 system, an Ultra Short Base Line (USBL) system produced by Sonardyne. Tracking beacons were attached to divers’ buoyancy control devices (BCDs) and activated upon contact with the water. The visualisation software associated with the tracking system, Ranger2, was able to be linked to a QGIS project which enabled the diver tracks to be overlain onto the preliminary site plan and to update in real time. The positional accuracy range was 0.5-1.5m.

- 1.1.5 The topside dive manager was able to guide divers to features on the site using a through-water communications set up, and in return divers were able to relay information about the features including details of orientation and stratigraphy. This set up enabled the preliminary site plan to be updated in real time as information from the divers came through the comms unit in the vessel cabin. This method contributed effectively to achieving the objective; having an accurate tracking system to assist divers navigate the site facilitated safe and efficient dives, as well as enabled the swift collection of archaeological data. The positional accuracy could have been improved upon by calibration of the tracking system and the use of a more accurate GPS unit. Calibration was not undertaken due to the time limitations, and 0.5-1.5m was deemed a sufficiently accurate for the tasks at hand.
- 1.1.6 Divers also undertook manual recording of the archaeological features including taking measurements and condition assessments. This involved systematically targeting groups of features and recording them across several dives. Guns measurements were recorded using a pre-established methodology which involved different letters being assigned to different measurements e.g., A = muzzle to cascabel, B = trunnion to cascabel, C = length of button, etc. The divers were equipped with pre-prepared dive slates which included a diagram of this recording methodology and form for recording. Divers were then directed to specified groups of features using the diver tracking and communication systems. This methodology enabled comprehensive coverage of the site in a controlled, systematic, and efficient manner.
- 1.1.7 The multibeam bathymetry analysis and diving operations produced a comprehensive 2D plan of the site, achieving one of the project's priority tasks. Although site plans had been produced in previous investigation campaigns -the main one being produced in 1981 by Mike Bowyer- the plan generated as part of the 2021 investigation was significantly more accurate. The 2021 investigations identified some discrepancies between the original site plan and the features on the seabed in 2021, with several feature locations, positions, orientations, and relationships requiring revision. Thus, the new accurate site plan with exact position and orientation of features was developed. The improvement in accuracy can be attributed in part to advances in geophysical and diver tracking technology in recent years. New archaeological features were identified during diving operations including linear objects, and a feature consisting of a concretion of at least four rings each approximately 23cm in diameter. The accurate recording of archaeological features on this nationally important site contributes to its archaeological record.
- 1.1.8 The data collected as part of the site plan contributes to the archaeological understanding of the site. The orientation and position of the cannon on the site were recorded during the 2021 campaign. This data can help to provide evidence as to whether the guns were being carried as armament or whether they were being stored as cargo/ballast. The exact nature of the wrecking event, including the orientation of the vessel and sinking process are unknown. The position of cannon and anchors on the site has been used as evidence in a number of theories surrounding the identity of the vessel and its wrecking. One such theory proposes the Bronze Bell ship lies atop another wreck two centuries older based on the stratigraphy of cannon; older swivel guns were purportedly beneath the later iron guns and marble blocks (Bennett, 2018). The site plan created in 2021 refutes this theory; the stratigraphy of the site based on the multibeam bathymetry, tracked diver survey, and photogrammetry indicates that the

remaining swivel guns actually lie on top of the newer iron guns, and no guns are visible beneath the marble blocks. The new data collected in 2021 influences the interpretation of the site.

- 1.1.9 The diving operations also included underwater photography. The report for the 2004 investigation by Wessex Archaeology included 21 photographs of features within the site, and one of the priority tasks for the 2021 investigation was to recreate these photographs in order to identify any changes to the features. In order to do this, the original photographs were printed onto dive slates along with the preliminary site plan labelled with the original photograph positions. The underwater photographer was able to be guided around the site using the diver tracking and communications set up. The diver then staged scale bars and took photographs from the same position as the original versions. This was a fairly effective method of completing this task; however, it could have been improved. The light conditions and level of marine growth of the 2021 photography campaign were considerably different to those in 2004, as such it was difficult to identify the replica photographs in a small number of cases. This could have been remedied by the diver noting the relevant photograph number from their camera on their dive slate as each photograph was taken. Regardless, new data regarding the condition of select features were collected, and this data can be used to comment on changes to the features since the last survey in 2004.
- 1.1.10 Photogrammetric recording was also undertaken over the majority of the site. High quality photogrammetric models are composed of large numbers of photographs and collecting these is time-consuming. Therefore, due to fieldwork time restraints, it was decided photogrammetry was only going to be undertaken on areas with features, rather than over all of the seabed within the site limits. The photogrammetry involved systematic photography of features from all available angles. Time lapse mode was used on the underwater camera which allowed the operator to swim around the site pointing the camera at the features to capture images without having to use the camera trigger. This method negatively impacts the quality of the output as it does not allow for camera setting adjustment while time lapse mode is active; however, it was deemed the most appropriate method as it enabled coverage of all of the target areas within the time available. In order to produce higher quality outputs, manual photography could have been used which would have enabled appropriate adjustment of camera settings to take better photographs. However, it is unlikely that full coverage of the target areas would have been achieved using this method as it is time consuming.
- 1.1.11 The priority tasks were completed effectively using the above methods. However, a small number of cannons were unable to be measured due to time constraints as the final day of planned fieldwork was cancelled due to adverse weather. Despite this, the methods used were appropriate for the tasks and resulted in a meaningful and useful outputs.
- 1.1.12 The work undertaken during the 2021 investigation of the Bronze Bell wreck site has produced research outcomes with significant impact, specifically benefitting the Royal Commission on Ancient and Historical Monuments of Wales (RCAHMW), who manage the site. The outcomes of the project, including site plan, photogrammetry and comparison photographs will be used to influence management decisions. One such aspect of this management is protection; illegal salvage is an issue for protected wreck sites; although they are protected under law, there is limited physical protection that heritage management agencies can put in place. Thus, diving sites without the appropriate licences and the illegal removal of archaeological features is a

significant threat to protected wreck sites. The site plan produced as part of the 2021 investigation can be used as a baseline for the presence of archaeological features, and any future change to these can be swiftly identified and action can be taken to recover stolen artefacts.

- 1.1.13 The condition photographs and photogrammetry collected during the 2021 investigation are useful to the CHERISH project which has a strong focus on the effects of climate change on heritage and engagement with the public. The photographs can be compared with those taken in 2004, and with future photographs, and can be used to assess changes to the condition of archaeological features and whether climate change is impacting the site. The photogrammetric outputs are excellent opportunities for outreach as they allow the public to engage with a fairly inaccessible site more easily.
- 1.1.14 The research outcomes also have a significant impact on the recreational diving community who may dive the site. The Malvern Archaeological Diving Unit (MADU) have proposed a route for an underwater dive trail for the site (MADU, 2018). The original proposal was based on the site plan from 1981 (digitised by Wessex Archaeology in 2004), which the 2021 investigation proved to be slightly inaccurate. Divers frequently use compass bearings to navigate dive trails, and also use site features as visual prompts for navigation, thus an inaccurate plan can undermine the effectiveness of a dive trail. The 2021 site plan will enable the introduction of an effective and usable dive plan that can be enjoyed by the recreational diving community.
- 1.1.15 In summary, this assessment of the archaeological research methods utilised during the 2021 investigation of the Bronze Bell wreck indicates that the methods employed were appropriate and effective for achieving the specified project tasks. The methods produced new, meaningful data that benefits the site managers, project commissioners, and site users.

2.0 References

Bennett T (2018) Tŷ Gwyn & the Bronze Bell Wreck. Independently Published.

Malvern Archaeological Diving Unit (2018) Recommendations for the management and administration of a diver trail for the Bronze Bell (Tal-y-Bont) shipwreck site. Report for Nautical Archaeology Society, on behalf of Cadw.

MSDS Marine (2021) CHERISH Archaeological Dive Contract 2021: Written Scheme of Investigation. Report for CHERISH.

Wessex Archaeology (2006) Tal-Y-Bont, Cardigan Bay, Wales Designated Site Assessment: Full Report. Report for Cadw Available at: https://coflein.gov.uk/media/37/148/aent17_02.pdf. Accessed 21.10.2021.

CHERISH Archaeological Dive Contract



BRONZE BELL WRECK

WRITTEN SCHEME OF INVESTIGATION



MSDS
Marine

MSDS Marine

CHERISH Archaeological Dive Contract 2021

Written Scheme of Investigation

Project Name	CHERISH Archaeological Dive Contract 2021	
Client	CHERISH	
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MSDS Marine Project Number	MSDS21172	
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1.0 Statement Of Competencies and Accreditations

- 1.0.1 MSDS Marine are a specialist marine and coastal contractor based in Derbyshire, UK with extensive experience in offering bespoke archaeological solutions for our clients. MSDS Marine offer a full range of archaeological services including, but not limited to consultancy, research, desk-based services, remote sensing, conservation, ground-truthing, and diving services. Our team includes individuals who are specialists in the support of development projects, diving, historic vessels, heritage management, historic and archival research, assessments and management of significance, surveying, conservation, and stakeholder engagement.
- 1.0.2 Our high standards are recognised in our ISO 9001 : 2015 and ISO 45001 : 2018 certifications. We operate an effective and robust ISO 9001 : 2015 Quality Management System that enables our clients to have confidence in our work and ensures that our management systems are constantly assessed and approved. MSDS Marine are committed to creating an environment which is safe, healthy and secure for all our employees. We operate a certified ISO 45001 : 2018 Occupational Health and Safety Management System that fulfils the objectives of maintaining the excellent record of MSDS Marine in relation to health and safety and to ensure all our legal requirements as an employer are met.
- 1.0.3 MSDS Marine are a member of the Association of Diving Contractors UK and Ireland (ADC) and a member of the Scientific Diving Supervisory Committee (SDSC) which demonstrates our commitment to safe and professional standards in relation to our diving activities. Green thinking is a key part of our culture and we identify opportunities to reduce our environmental impact wherever possible. MSDS Marine are a founding member of the Climate Heritage Network (CHN)¹ and our environmental champion Phoebe Ronn is actively participating in CHN working groups.
- 1.0.4 Professionally we work to the high standards established by the Chartered Institute for Archaeologists (CIfA) and MSDS Marine achieved Registered Organisation status in 2020². All our archaeological staff are corporate members of CIfA, most of which are at the highest MCIfA grade. MSDS Marine are a member of the Federation of Archaeological Managers and Employers Ltd (FAME). Our wealth of experience and range of services allow us to help and provide expert advice on all areas of archaeological work.
- 1.0.5 MSDS Marine's approach to contract management is to ensure that the most appropriate members of staff are assigned to the project from start to finish. This approach ensures the consistency of all deliverables and an informed view of the project as a whole to ensure that any advice given takes into consideration all available information and includes previous, current and future works.

¹ <https://msdsmarine.com/climate-heritage-network/>, accessed 21st June 2021

² <https://www.archaeologists.net/civicism-contact-distance-search/38555>, accessed 21st June 2021

2.0 Introduction

2.1 Non-Technical Summary

- 2.1.1 MSDS Marine have been appointed by CHERISH to undertake inspection, survey, investigation, recording and monitoring of the Bronze Bell wreck³, a previously monitored and designated wreck site in Welsh waters.
- 2.1.2 A five-day diving project will be undertaken in September 2021.

2.2 Site Location

- 2.2.1 The site is located approximately 450m off Benar Beach near Tal-y-Bont, Ceredigion, Wales (see Figure 1).
- 2.2.2 The wreck lies in c.10m of water. The position of the wreck site is given as Latitude 52.7791526, Longitude -4.1266942 (WGS 84).
- 2.2.3 The wreck is designated under the Protection of Wrecks Act 1973 and there is a 300m radius circular designated area around the wreck.

³ Coflein (2012) Tal-y-Bont Wreck; Bronze Bell Wreck Available at: <https://coflein.gov.uk/en/site/1015>. Accessed 18.06.2021

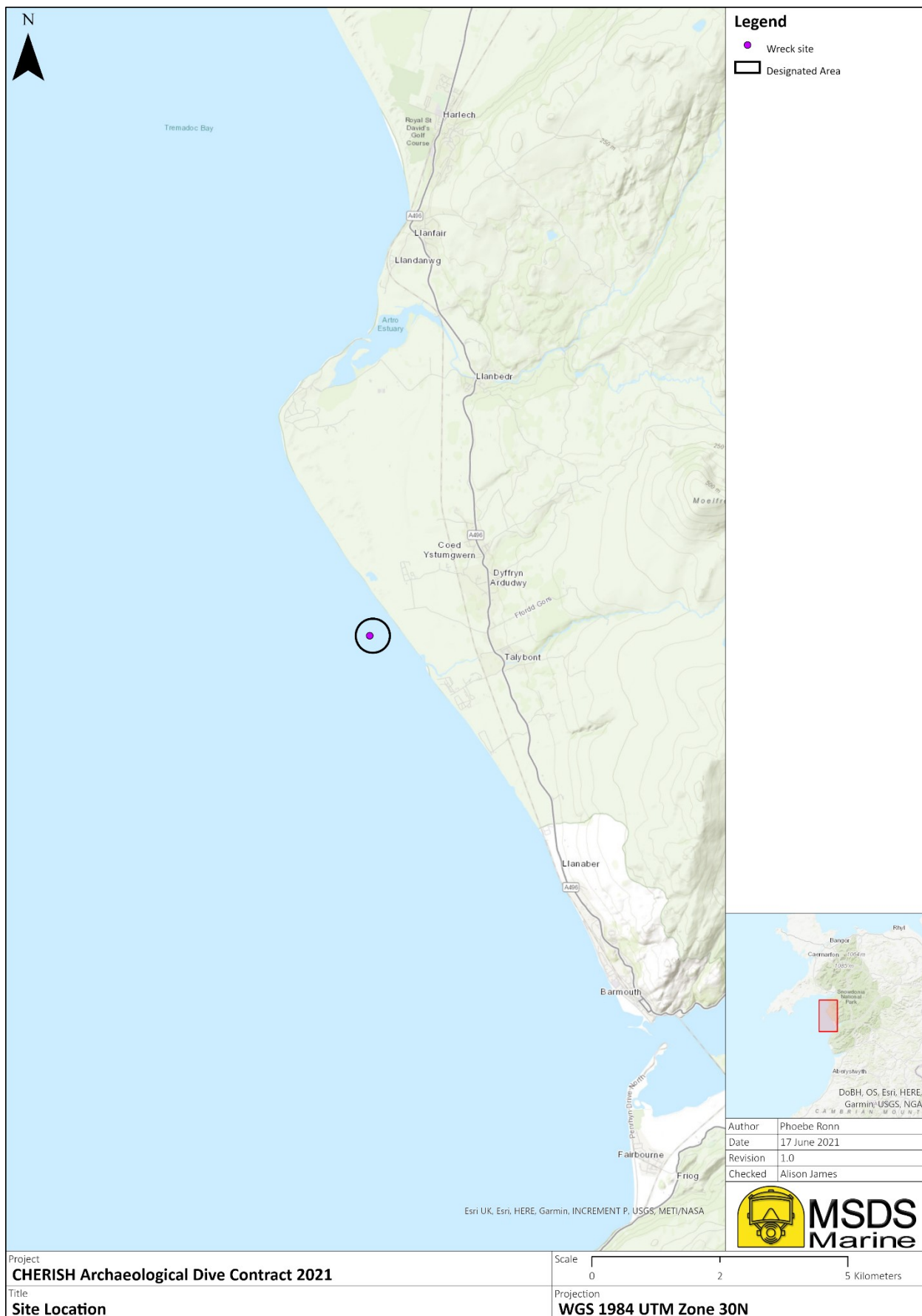


Figure 1: Site Location

2.3 Project Context

- 2.3.1 On behalf of the CHERISH project, MSDS Marine is undertaking inspection, survey, investigation, recording and monitoring of the Bronze Bell wreck, a previously monitored wreck site in Welsh waters. The works focus on the effects of climate change on the site and will align with previous surveys and investigations in order to generate comparable data.
- 2.3.2 The project will also involve a programme of public engagement and outreach provided in both Welsh and English in order to promote the project and the work of the CHERISH project.

3.0 Aims and Project Plan

3.0.1 The Request for Tenders (RfT) for this project identified three key aims:

- To undertake a survey and recording expedition to undertake a condition survey designed to facilitate comparison with information obtained in wreck dives carried out by Wessex Archaeology in 2006. The work will require a survey to uncover any evidence of change, with a particular focus on change caused by climatic changes such as increased storminess.
- To contact previous licensees and organisations who have worked on the site to discuss previous work undertaken and liaise with CHERISH partner Geological Survey Ireland who currently hold the consent to carry out surveys.
- To deliver a public engagement and outreach strategy which should be provided bilingually (Welsh and English). The strategy should include a programme of bilingual social media posts and a dive diary to promote the work of the CHERISH project and the dive to be shared on the CHERISH social media channels. This aim also includes delivery an on-line presentation of the work carried out.

3.0.2 This project will support the CHERISH overarching objectives:

- A stimulus for encouraging local tourism and growth in the Blue Economy. CHERISH will provide new coastal heritage information and innovative products, enabling enhanced cultural tourism for the study sites and raised awareness of the historic environment in selected communities.

This project will have bespoke public engagement and outreach strategy to ensure all opportunities to meet this objective are met. The Dive Diaries will highlight the local area and the innovative photogrammetry models will enable enhanced cultural tourism.

- Improved evidence base for statutory protection, decision-making and adaptation strategies, informing protection for historic environment assets from climate change at all levels, from local communities through to Government.

The condition survey will provide an improved and updated evidence base to enable ongoing management and appropriate management responses to be developed to ensure the Bronze Bell wreck is protected into the future and the threats of climate change to the site are better understood.

- Increased knowledge and awareness of heritage assets on the previously understudied and remote reefs, islands and headlands across the Irish Sea, evidenced through newly created and enhanced Historic Environment Records, field intervention with scientific dating and analysis, programmes of citizen science and outreach activities (including walks, talks, training days, workshops and excavation, innovative online crowd-sourced initiatives to skill local communities) online and hardcopy resources, interpretation and dissemination.

The project will provide increased knowledge of a nationally significant site and ensure that outreach provision is embedded within all elements of work.

- Innovative data capture, modelling and visualisation products, to raise knowledge and awareness of the historic environment and climate change to include integration of project data within open access shared spatial data infrastructure (SDI) to enable full reuse of all

datasets across and beyond the operation across Europe including via the EU Climate-ADAPT Platform.

MSDS Marine are highly skilled in data capture, modelling and visualisation and will ensure that products produced as part of this project will raise knowledge and awareness of the historic environment and climate change as well as meeting the principles of FAIR data to ensure datasets can be fully reused across Europe.

3.0.3 The project has the potential to contribute to the Research Framework for the Archaeology of Wales: Early Post Medieval Wales and Maritime and Coastal Wales. The 2017 review identifies the Bronze Bell wreck as a significant site⁴ and this has the potential to contribute to the aims of the Research Framework and especially to the following themes identified in the Maritime and Coastal Wales section:

- Theme 2: Seafaring and Seascapes
- Theme 3: Marine Transport
- Theme 4: Challenges for Conservation Management
- Theme 6: Material Culture and Preservation by Record

3.0.4 As recommended in the 2017 review the project will strongly support and encourage community engagement throughout⁵.

⁴ Rees, S et al. 2017. A Research Framework for the Archaeology of Wales Version 03: Final Refresh Document February 2017: Maritime and Coastal Wales Appendix 1. Available at:

<https://www.archaeoleg.org.uk/pdf/review2017/maritimekeyvesselsites2017.pdf>

⁵ Bezant, J and Bailey, J. 2017. A Research Framework for the Archaeology of Wales Version 03: Final Refresh Document February 2017: Earlier Post Medieval 1539 to 1750. Available at:

<https://www.archaeoleg.org.uk/pdf/review2017/postmedreview2017.pdf>

4.0 Guidance

- 4.0.1 MSDS Marine are a Registered Organisation (RO) of the Chartered Institute for Archaeologists (CIfA) and abide by the regulations, standards and guidelines implemented by our professional bodies in the UK, including CIfA and the Institute of Conservation (ICON). The CIfA is the leading professional body representing archaeologists working in the UK and overseas. It represents the interests of archaeology and archaeologists to government, policy makers and industry, sets standards and issues guidelines. ICON is the professional body for the conservation of our cultural heritage.
- 4.0.2 All MSDS Marine's archaeological staff are corporate members of the CIfA (or currently waiting for their applications to go before the validation committee), or other professional bodies as dictated by their roles. Corporate membership is obtained only through a peer reviewed process of selection ensuring competency. All members are bound to adhere to the regulations, standards and guidelines issued by the CIfA.
- 4.0.3 Our staff are actively encouraged to participate in the activities of our professional bodies, CIfA and ICON, through conference attendance and presenting papers at their conferences. In addition, Alison James is a current member of the CIfA Maritime Affairs Special Interest Group committee.
- 4.0.4 In order to maintain an active dialogue with all the diving sectors the UK Health and Safety Executive (HSE), who are charged with implementing the regulations, recognise one professional body that is representative of each diving sector. The Scientific Diving Supervisory Committee (SDSC) is the recognised representative body for the Scientific and Archaeological sector. The SDSC is funded by and reports to the Natural Environment Research Council. Mark James represents MSDS Marine on the Scientific Diving and Supervisory Committee.
- 4.0.5 All work is governed by the Health and Safety at Work Act 1974 and within Wales diving at work is governed by the Diving at Work Regulations 1997.
- 4.0.6 MSDS Marine are a registered UK diving contractor and have an in-depth knowledge and comply with the UK regulations.

5.0 Baseline

5.1 Geological And Topographical Background

- 5.1.1 The area around the site is fairly flat and includes a small reef. The seabed material consists predominantly of sand, shell, and gravel overlain by scattered cobbles and boulders. Previous excavation of the site recorded a layer of very compacted grey silty clay with small stones and shells below the seabed surface⁶. Below this was a light grey sandy and silty layer.
- 5.1.2 Geological features in the wider area include Sarn Badrig, a smooth-topped ridge at the seabed that extends approximately 15km seaward from an area south of the Mochras peninsula. Sarn Badrig is one of three such ridges in the area. The nature of their formation is debated; however, it has been suggested that they are remnants of late-glacial sandur⁷.

5.2 Archaeological Background

- 5.2.1 A description of the site and an interpretation of the vessel is derived from the entry for the site in Coflein⁸. The site lies in 10m of water and is represented by the cargo and other finds, no timbers are believed to be present. The cargo consists of 42 blocks of Carrera marble totalling c.65 tonnes. The blocks range in size from 80cm cubes to larger blocks up to 2.8 x 1.0 x 0.8m. The blocks sit amidships and appear to remain in the positions that they were originally loaded. The vessel was heavily armed when it sank, evidenced by the 25 cast-iron guns and one wrought iron breech loading gun still present on the site. A number of guns have also been reportedly removed from the site.
- 5.2.2 The eponymous bronze bell, stamped with the date 1677, was discovered in 1978. Further finds include coins from 10 different countries that indicate a wrecking date of post-1702, and pewter plates, one of which bore a maker's mark dating it to 1700.
- 5.2.3 The archaeological evidence suggests that the vessel was not particularly large despite the heavy armament. The cargo and finds suggest it was a French trader transporting Italian marble via Genoa or Leghorn. No timber remains have been identified in any investigation, however, local historical information suggests that timbers were recovered and reused in a building at the nearby Cors y Gedol Hall, and other recovered artefacts were also used there. The Llanendwyn Parish Register records the death of Juan Benedictus in 1730 who may have been a survivor of the wrecking event.
- 5.2.4 Since discovery, the site has been subject to a series of investigations, both on and off the site, from various organisations and individuals. These are outlined in Table 1.

⁶ Wessex Archaeology (2006) Tal-y-Bont, Cardigan Bay, Wales Designated Site Assessment: Full Report

⁷ Tappin DR, Chadwick RA, Jackson AA, Wingfield RTR, and Smith NJP (1994) United Kingdom Offshore Regional Report: The geology of Cardigan Bay and the Bristol Channel. London: HMSO for the British Geological Survey.

⁸ Coflein (2012) Tal-y-Bont Wreck; Bronze Bell Wreck Available at: <https://coflein.gov.uk/en/site/1015>. Accessed 18.06.2021

Year	Activity	Organisation/Individuals
1966*	Magnetometer Survey	Unknown
1978	Recreational Diving	Cae Nest Group
1979	Survey and investigation	Sidney Wignall, John Illsley and Robin Livens
1980-86	Survey and excavation	Cae Nest Group
1982	Research into marble blocks	John Illsley
1987	Excavation	Angus Konstam
Post 1987	Monitoring work	Mike Bowyer
1998	Survey and recording	Malvern Archaeological Diving Unit and Tewkesbury Underwater Group
2003	TV Documentary 'Wreck Detectives'	Channel 4
2004	Survey and excavation	Wessex Archaeology
2010	Geophysical survey	Wessex Archaeology
2014	Multibeam survey	Cotswold Archaeology
2017	Research and assessment	Malvern Archaeological Diving Unit

*It has been previously noted that this report may be unreliable⁹

Table 1: Previous work at the site

⁹ Wessex Archaeology (2006) Tal-y-Bont, Cardigan Bay, Wales Designated Site Assessment: Full Report
MSDS21171 CHERISH Archaeological Dive Contract 2021
Written Scheme of Investigation – 2021/MSDS21172/1

6.0 Methodologies

6.1 Pre-Fieldwork

Planning Meeting to Discuss the Approach and Agree Timescales

- 6.1.1 At the outset of the project Alison James (Project Executive) and Mark James (Project Manager) met with the CHERISH project manager Clare Lancaster and other members of the CHERISH project team to discuss approach and to agree timescales.
- 6.1.2 The meeting provided an opportunity to discuss the public engagement and outreach strategy and communications plan which is provided as a separate document. This is discussed further below, but it should be clarified that the public engagement strategy will all be agreed prior to any fieldwork taking place.
- 6.1.3 MSDS Marine will be the Licensee for the project. This WSI is intended to support an application to Cadw for a survey licence under the Protection of Wrecks Act 1973¹⁰. It should be noted that no recovery of material is planned, nor would be allowed under the terms of a survey licence.

6.2 Fieldwork

- 6.2.1 Fieldwork is planned for Monday 13th September – Friday 17th September 2021.
- 6.2.2 The project will undertake a five-day tracked diver survey to assess condition and to record and position key features and artefacts on the Bronze Bell wreck. The condition survey will have a particular focus on change to the wreck caused by climatic changes such as increased storminess. In line with other work MSDS Marine undertake, pH samples will be taken on the site as standard.
- 6.2.3 The work will be undertaken by staff with extensive experience of underwater survey and recording skills honed on work on other UK wreck sites, including underwater planning, record taking, surveying, illustration, photography, videography and underwater metal detection survey.
- 6.2.4 All fieldwork will follow the processes and forms set out in the MSDS Marine Archaeological Manual and follow the standard and guidance set out by the Chartered Institute for Archaeologists.
- 6.2.5 In advance of the project, MSDS Marine have undertaken bespoke training from Andrew Viduka at Gathering Information via Recreational and Technical (GIRT) Scientific Divers¹¹. Andrew's GIRT methodology has been developed to enable better understanding of the condition of wreck sites and the climate change factors driving their preservation or deterioration. It also aims to encourage interested people to have an active and positive public archaeology role.
- 6.2.6 MSDS Marine and the Nautical Archaeology Society are currently in discussions with Andrew about rolling out the GIRT methodology in the UK. The GIRT methodology for collecting information relating to climate change will be employed on the Bronze Bell wreck as a test case for understanding climate change on wrecks in UK waters. The Bronze Bell wreck will be

¹⁰ <https://www.gov.uk/protected-wreck-site-licences>

¹¹ <https://www.girtsd.org/>

adopted as a GIRT site. During fieldwork the team will identify ten locations to undertake detailed conditions photography that can be monitored in future years. An initial audit of species on the site that can be monitored as climate change indicators will be undertaken. A GIRT recording form will be completed and subsequently uploaded to the GIRT register and included as an Annex to the final site report.

- 6.2.7 All work will be designed to be repeatable and will be clearly outlined in the final report to enable continued monitoring in future years. Andrew has indicated he is willing to be consulted as an advisor to the project during fieldwork if required.
- 6.2.8 Diving will be undertaken using SCUBA equipment owned by MSDS Marine. MSDS Marine will be the Diving Contractor and provide a full dive team for the project.
- 6.2.9 MADU co-founders Ian Cundy and Bill Turner will be advisors to the team. Ian and Bill have extensive knowledge relating to the site and embedding them as team members ensures that MADU are engaged and their important knowledge is passed on to the current project.
- 6.2.10 The RCAHMS have put MSDS Marine in touch with the finder of the site, Geraint Jones. Geraint will be contacted in advance of fieldwork and invited to add his knowledge of the site to the project.
- 6.2.11 In addition, underwater photographer and videographer Michael Pitts, will accompany the core dive team. Michael Pitts has worked extensively with MSDS Marine on other protected wreck sites and has consistently demonstrated his ability to capture underwater footage in difficult conditions. The footage will help increase knowledge of the site and be able to be used by all stakeholders to educate and engage people with the site. The footage can also be used to monitor change to the sites and as a baseline for future survey work.
- 6.2.12 Diving will be undertaken on SCUBA with a six-person dive team which will comprise of a supervisor, surface recovery, and four divers. If the risk assessment allows, and it is anticipated from prior site experience that it will, it may be possible to have two waves of two divers in the water during some slack water periods. Where possible two slack water periods will be dived per day with divers working up to ten-hour days on the diving support vessel. On the short slack water, it is anticipated a single pair of divers will be deployed, and on the longer slack water four divers in two -pairs will be deployed dependant on conditions.
- 6.2.13 Diving will be undertaken from the diving support vessel *Seekat C* operated by Jon Shaw¹². *Seekat C* is an MCA Category 2 workboat licensed to carry 12 personnel up to 60nm from a safe haven. The vessel has a large wheelhouse at deck level with a large deck area. The vessel is equipped with a galley, toilet and heating throughout. The vessel operator has considerable experience of using *Seekat C* for a number of commercial diving applications included archaeological work. The vessel has a dive ladder, space for a compressor, a store area for diving equipment and a large indoor area for diving control. *Seekat C* has been used by MSDS Marine on a number of occasions for both survey and diving work in Welsh waters, including the multibeam echo-sounder survey of the Bronze Bell wreck.
- 6.2.14 Diving operations will take place out of Pwllheli. Hafan Pwllheli has over 44 fully serviced pontoon berths and is fully accessible at all states of the tide.

¹² <http://www.seekatcharters.co.uk/>

- 6.2.15 To enable effective acoustic tracking the vessel will be anchored on a two-point mooring to enable a fixed position over the site to be achieved. The vessel crew have experience in mooring in this configuration on archaeological projects, including with MSDS Marine.
- 6.2.16 All members of the proposed diving team will be qualified to HSE SCUBA or equivalent and will have a valid and in-date HSE medical certificate. Supervisors will be appointed in writing by MSDS Marine. Provision will be made for CHERISH and RCAHMW employees and, where requested, other stakeholders including heritage specialists to dive as part of the dive team or as part of the dive operation, subject to possession of a valid medical and all of the requirements of applicable regulations and ACoPs being met.
- 6.2.17 SCUBA diving operations will be conducted using OTS Guardian full face masks with a 15-litre cylinder and a 3 litre (300 bar) bail out, or other suitable equipment as deemed appropriate for the depth, duration and environment. Communications with the surface will be via either through-water comms or hard-wired comms. High quality communications are essential to archaeological diving operations, not just for diver safety, but to ensure that information during the dive can be passed to the vessel for recording. Unfortunately, communications are also generally the least reliable item of equipment. To this end MSDS Marine solely use the OTS-2010 diver transceivers and STX-101 topside unit which we have used extensively and have found to be the most reliable.
- 6.2.18 Each dive will be recorded digitally using GoPro cameras capable of recording HD footage or Paralenz HD video cameras with communications recorded through the STX-101 topside unit.
- 6.2.19 The use of a four-person SCUBA team typically allows only one pair of divers to enter the water per slack water period, although there are exceptions on sites with longer slack water periods. For this project MSDS Marine will field a six-person SCUBA team which allows two pairs of divers to enter the water in succession on each slack water period significantly increasing overall productivity, where tasks such as diver tracking are being undertaken an additional person will be required to enable the equipment to be operated independently of the core dive team. The increase in diving productivity is achievable through ensuring that a minimum of four full sets of equipment (plus spares) are available on each project.
- 6.2.20 Acoustic tracking will be used throughout diving fieldwork activities. The application of acoustic tracking technology for the accurate recording and positioning of marine archaeological sites has become more common in its use and has revolutionised the survey and positioning of underwater sites. During its development for archaeology, the use of tracking as a tool to ‘draw’ a site has frequently been envisaged. While this is not possible without considerable investment in equipment above that used in archaeology, the technology remains an extremely valuable component of underwater archaeological recording enabling:
- The location of targets in low visibility in-water conditions;
 - Navigation around sites;
 - The interrogation and geo-referencing of existing site plans and geophysical data;
 - High levels of accuracy for the positions, and extent, of sites and search areas;
 - The creation of fast accurate site ‘sketch’ plans, including the location of the main elements of the site;

- 6.2.21 MSDS Marine will use an Ultra Short Base Line (USBL) system to track in-water diver movements. This will be a Sonardyne Micro-Ranger 2 system, which has superseded the well-known SCOUT system. The system requires the mounting of a vessel-based transceiver which tracks a transponder attached to the divers. In addition, fixed beacons can be mounted to features to enable higher levels of accuracy to be obtained by the mobile tracking devices mounted to divers.
- 6.2.22 The USBL system works by calculating the range and bearing of the diver-mounted transponder to the transceiver. The transceiver will be mounted to the vessel below the water line on a side-mounted survey pole, which ensures repeatable accuracy in its location. The system will be coupled to a Vector Heading Sensor DGPS receiver ensuring a high level of positional accuracy. The system chosen will be capable of tracking up to four divers at a range of up to 500m. To ensure further positional accuracy the tracking system will be used alongside a programme that will provide an average position and smooth errors.
- 6.2.23 The diving will require a licence from the Department for Digital, Culture, Media and Sport (DCMS) issued on the recommendation of Cadw under the Protection of Wrecks Act, 1973. This WSI is intended to act as a basis for a licence application by MSDS Marine.

Drawn Survey

- 6.2.24 Dependant on the specification of the task, the location of the site and the position of drawings in relation to the site will be achieved by acoustic tracking whilst underwater.
- 6.2.25 An updated site plan will be a priority of the fieldwork programme. Prior to fieldwork commencing a digital site plan will be created from the most recent Multibeam bathymetry for the site. This will be ground truthed and refined by the team during the course of fieldwork. Sections across the site can be prepared from the Multibeam data and are considerably more accurate on a site such as the Bronze Bell wreck than hand drawn diver sections. Key features such as the marble blocks and cannon will be drawn in greater detail once on site as well as being tied into the updated site plan using the diver tracking.
- 6.2.26 Location and archaeological plans will be prepared at an appropriate scale (typically 1:200 or larger) showing all investigation areas and their relation to topographical features and data sources such as geophysical images, track lines, aerial photographs, maps and charts. Each archaeological plan will show all features and contexts recorded.
- 6.2.27 Plans, sections and elevations of archaeological features and deposits will be drawn as necessary at 1:10, 1:20 and 1:50 as appropriate. Drawings will be made in pencil on permanent drafting film (permatrace) and will be transferred into digital format for incorporation into the project GIS workspace. The spot height of selected features and levels will be calculated in metres relative to Chart Datum.

Metal Detector Survey

- 6.2.28 MSDS Marine have extensive experience in the planning and execution of systematic underwater searches using metal detectors and have used the technique on wreck sites including the *Kennemerland* and *Wrangels Palais* (Out Skerries, Shetland) to determine the extents of the site to allow for rapid identification of wreck remains and efficient monitoring.
- 6.2.29 We have also employed the technique to systematically search areas for wreck remains including the Langdon Bay wreck, as part of a contract to assess the site for de-designation.

- 6.2.30 MSDS Marine own a number of underwater metal detectors and diver held magnetometers that will be used during fieldwork. Divers will swim parallel lines over the site sweeping the metal detector in an arc in front of them ensuring a minimum of 100% coverage of the seabed. The position of identified targets will be recorded using the diver tracking, or on a site plan and then investigated as required. It is not planned that any disturbance of the seabed should occur and buried contacts will not be exposed.

Photogrammetric Recording

- 6.2.31 The core MSDS Marine dive team includes individuals who are specialists in photogrammetry. The specialists are able to process the datasets and produce visualisations that form both an accurate record of the wreck site on the seabed and visualisations for public engagement and outreach.
- 6.2.32 All work will be undertaken following the best practice outlined by Historic England in Photogrammetric Applications for Cultural Heritage: Guidance for Good Practice (2017) and 3D Recording and Interpretation for Maritime Archaeology by John McCarthy, Jonathan Benjamin, Trevor Windon and Wendy van Duivenvoorde (2019).
- 6.2.33 The following methodology is based upon that developed by Dr Rodrigo Ortiz during his PhD. MSDS Marine, Rodrigo and Felix are highly skilled in archaeological photogrammetric survey for the purposes of measurable point cloud dataset creation and bring considerable experience to the project.
- 6.2.34 Underwater photography has to take into account water optics, which changes depending on the location of the water body, depth and the changes during day/night, cloud cover, spring or neap tides as well as seasonal cycles. The two main factors that affect underwater photography are light absorption and light scattering. Even though determining light absorption on a specific site is a complicated matter, in general terms, there is a gradual loss of colours with depth increment.
- 6.2.35 The importance of appropriately timing an underwater photography survey is essential to guarantee the best results. Underwater visibility is a crucial factor in obtaining high-definition photographs, and the quality will heavily depend on the camera operator. Tides, currents, weather, storminess, winds and swell affect visibility, especially within shallow water submerged shipwrecks. Predicting good visibility is difficult, but being on site on a daily basis allows selecting the best conditions to carry out the survey.
- 6.2.36 In high-energy environments, including those found on many shipwreck sites, it is crucial to do the survey as close as possible to slack water, this will allow the diver to keep a systematic survey following a grid as well as allowing less movement of loose seaweed or other flora on the wreck that can cause issues with overlapping images. In the case of extensive surveys, where a large area is covered by sand, it is essential to have some structure to allow the software to recognise a pattern from one image to the next. For pre-disturbance surveys, in sand patches, the use of markers or scale bars is an essential aid to address these difficulties. Photographs captured for photogrammetric surveys require correction. There are two types of corrections for underwater photography, a physical correction and a software correction that is applied during data collection and in the post-processing. Higher ISO settings are required in darker conditions, however increasing the ISO sensitivity will lead to adjusting the f-stop (aperture) determining a depth of field on the image. The correct settings on the camera will

determine whether the picture is sharp, or if it has noise (grain). Some of the features can be enhanced during the postprocessing, providing better detail. For this purpose, it is recommended to take pictures in RAW format, and later converted to .jpg, .tiff or .png for further processing.

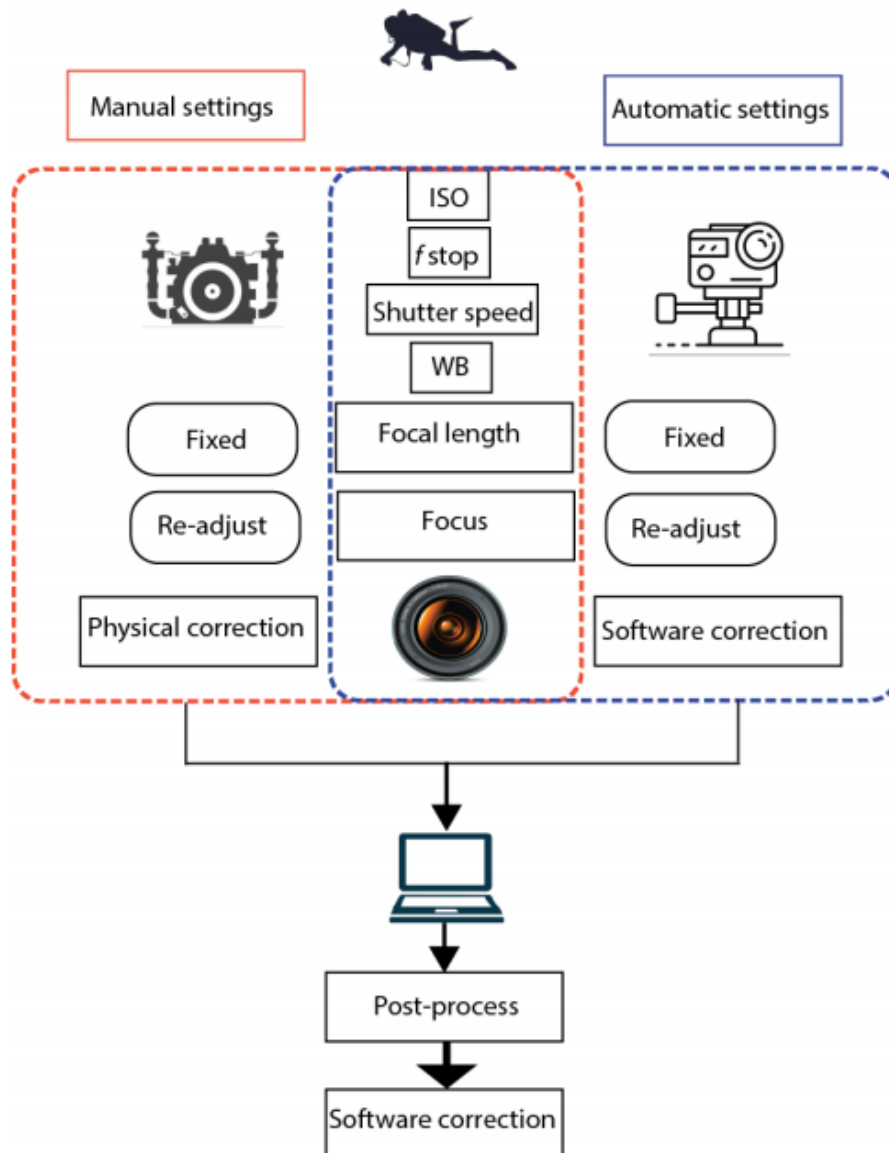


Figure 2: Photograph settings with physical and software correction. Illustration by Dr Rodrigo Ortiz.

- 6.2.37 As light absorption is a significant factor in losing the original colour, with depth, using an artificial light source or strobes (flash or flood lights), allows counteracting this phenomenon. However, this brings another problem with light scattering depending on the total suspended matter in the water column, which causes backscatter on each picture. Mineral and organic detritus will absorb yellow light and scatter light efficiently. Phytoplankton and zooplankton will influence the optical properties of the water column (bio-optical properties) by absorbing the light with spectral selectivity and creating backscatter. Another major factor is the distortion caused by light travelling through water, captured with a camera sensor passing through the lenses, and the underwater housing. To counteract the distortion effects, it is essential to choose the correct equipment, and/or calibrate for better results.

6.2.38 The use of a time-lapse mode to capture photographs guarantees better overlap from image to image, but also it makes it easier for the camera operator to swim around the site, without having to use a trigger. A time-lapse will have a direct impact on quality, as it is impossible to control and change the cameras' settings manually during each cycle. All the adjustments are done automatically by the camera and software.

Broadcast Quality Underwater Videography and Photography

6.2.39 MSDS Marine provide high quality videography and photography as standard, however, for this project Michael Pitts will be imbedded into the dive team to ensure the collection of very high-quality professional photography and broadcast quality video. Michael has extensive experience of underwater and terrestrial videography on shipwrecks and archaeological sites and is one of the country's leading underwater cameraman. He has worked for, amongst others, the BBC and National Geographic for a number of years. Michael is able to undertake underwater photography and videography and capture images for photogrammetry if required.

6.2.40 Copyright and ownership of all photographs or photogrammetric work and associated data produced as part of any contract shall remain with the CHERISH Project. Photographs, photogrammetric work or the results of a project shall not be published, reproduced or released on the internet, websites or social media, or to TV, Radio, or Print media outlets without prior written permission from CHERISH project; the CHERISH project retains the right to refuse such permission.

6.2.41 MSDS Marine and Michael Pitts have an established working relationship. Michael has worked with MSDS Marine extensively and is committed to complying with archaeological standards and best practice. He follows the steps outlined in the MSDS Marine field manual (available on request) to ensure his photographic record is maintained correctly.

6.2.42 Michael has over thirty years proven experience in underwater photography and is regarded as one of Britain's foremost underwater cameramen. However, he is equally happy shooting on the surface or from the air. Amongst his many awards he has received Emmys for cinematography on two BBC landmark series: David Attenborough's 'Private Life of Plants' and 'Blue Planet'.

6.2.43 Michael is a highly qualified commercial diver and has considerable experience working on commercial diving projects and archaeological projects. He has nearly forty-years' experience of working on archaeological projects.

6.2.44 Michael has worked with the Directors of MSDS Marine since before MSDS Marine was formed on a variety of archaeological projects. In 2010 Michael shot, edited and presented *Shipwrecks of the Western Solent* on behalf of the New Forest National Park Authority¹³. Michael explored five different shipwreck sites within the challenging marine environment of the Western Solent Channel. Current Project Manager Mark James was the Project Manager for that project.

6.2.45 Michael has wide ranging experience working on archaeological sites. He is able to adapt to become an integral part of the dive team and understands the challenges of working in the marine environment on archaeological sites.

¹³ <http://www.michaelpitts.co.uk/movies.php?m=8>, accessed 23rd January 2020

- 6.2.46 He has worked with MSDS Marine on a range of sites notably including on the *Rooswijk* project where he was embedded alongside the core team. He has worked on many other archaeological sites notably the shipwrecks of *Invincible*, *Colossus* and the *Pomone* and the submerged landscape of Bouldnor Cliff.
- 6.2.47 His images have been used in many archaeological publications, notably on the cover of various Historic England guidance documents.

6.3 Post-Fieldwork

Post-fieldwork photogrammetric data processing

- 6.3.1 Following the collection of photographs for 3D modelling, photos will be post-processed, colour corrected for better results on the final model as well as converted to a format that Agisoft Metashape Pro[®] can work with. Colour correction can be done in RawTherapee[®] or Adobe Lightroom[®]. The preferred method of MSDS Marine is to convert from RAW format to 16bit-PNG files and then import them into Agisoft Metashape Pro[®]. This maintains photo quality that provides the best results, with more tie-points and higher density point clouds. Data file storage needs to be taken into account for the archival purpose, as multiple years of data are going to be stored for several wrecks. Also, this allows reprocessing previously captured data with newly available software in the future, or with the updated that have considerably improved Agisoft Metashape Pro[®].
- 6.3.2 Positioning accuracy of the 3D photogrammetric model and its sub-products point cloud, mesh, DEM, and orthophoto, relies on having a control point's network (CPN). The CPN was measured with direct survey measurement (DSM) that was created by Rule (Rule 1989), and later on, incorporated into a GIS platform such as Site Recorder, QGIS or ArcMap[®].
- 6.3.3 Agisoft Metashape Pro[®] has a series of individually numbered targets that are automatically detected on a model. These targets allow the software to have a unique reference point, for common tie-points between images and also used as control points so they can be used to scale a model. As the target has to remain on site for several months without moving, MSDS Marine have created targets printed on composite panel, Dibond[®]102. Additionally, these targets are printed on a matt surface, to avoid light reflecting during the recording stage, especially when using the artificial light source.
- 6.3.4 Georeferencing, changes the model from local coordinates to a projected coordinate system, in this case, WGS84/UTM 30N. This way it is possible to take points from an MBES survey that are recognisable on the model and match them either on ArcMap[®] or Cloud Compare[®]. The points come from MBES data sets, where X, Y and Z values are reliable, and they have been calibrated previously.
- 6.3.5 Agisoft Metashape Pro[®] allows to calculate: easting (m), northing (M), altitude (M), accuracy (M), error (M), yaw (°), pitch (°), roll (°), accuracy (°), error (°), projections (num), and error (pix)104. To guarantee the spatial accuracy of our models we have selected a series of additional Ground Control Points (GCP) based on the MBES surveys, and recognisable with photogrammetry. This is the best way to guarantee global positioning with several correcting methods RTK, POSPac[®]105 and depth based on the tidal correction. Therefore, these points are set as markers with two primary objectives: To scale the model and to geo-reference and give a real z value, or depth.

- 6.3.6 An orthophoto is a geometrical rectified composite image, from which it is possible to measure. The difference between an orthophoto and a conventional perspective aerial photograph is that the latter contains image displacements caused by the tilting of the camera (yaw, pitch and roll) and differences in the terrain relief. The effects of camera tilt and the underwater bathymetry are removed from the ortho creating a uniform scale photograph.

Report Preparation

- 6.3.7 The culmination of fieldwork will result in the dissemination of results through the production of an archaeological report. The report will be authored by the Project Manager with input as required from other team members and specialists as required. The report will draw upon all available information gained through desk-based research and fieldwork. Where previous works have been undertaken, either by archaeological contractors, divers, third parties or survey companies this too will be analysed, assessed, and included where appropriate.
- 6.3.8 Where external sources, including the results of previous works, have been used in the production of reports, permissions will be sought as required and full credit and acknowledge made.
- 6.3.9 MSDS Marine recognise that some fieldwork, or research, may result in information that is pertinent to ongoing management but that CHERISH may wish to remain confidential due to its sensitivity. Should information believed to be sensitive arise this will be discussed in a phone call with the CHERISH project manager and further guidance sought. If required, this could be appended to the reports as a separate Annex that can be excluded from public circulation.
- 6.3.10 The draft report will be provided to the CHERISH project manager within six weeks of the completion of diving.

Publication and Dissemination Proposals

- 6.3.11 MSDS Marine will respond to and address comments on the report from CHERISH and RCAHWW in a finalised report no later than six months post dive. A finalised report including any specialist reports and up to grey literature archival standard will be delivered in PDF-A format.

Copyright

- 6.3.12 Copyright and ownership of all photographs or photogrammetric models, outputs and associated artwork produced as part of any contract shall remain with the CHERISH project. The results of a project shall not be published, reproduced or released on the internet, websites, social media, or to TV, Radio, or Print media outlets without prior written permission from the CHERISH project; who retains the right to refuse such permission.
- 6.3.13 The data and reports created by MSDS Marine under this contract will be CHERISH Project Copyright. Copyright on all reports submitted will reside with the CHERISH Project however a third-party in-perpetuity licence will automatically be given for reproduction of the works by the originator, subject to agreement in writing from the CHERISH Project.
- 6.3.14 The MSDS Marine team shall abide by a confidentiality agreement under which terms sensitive information shall not be released without written permission to do so. MSDS Marine shall be prepared to be advised by the CHERISH project in this regard. We understand that the CHERISH project also reserves the right to publish any aspect of a project undertaken as part of a contract awarded under the terms of this framework agreement.

- 6.3.15 Wherever external images, or material are obtained for reports or for the purposes of dissemination appropriate copyright permissions will be obtained. It is noted that reports may be reproduced online and copyright permissions for this purpose will be obtained. Where restrictions may apply, the CHERISH Project will be made aware of these and alternatives suggested.

Archiving all paper, graphic and digital materials

- 6.3.16 MSDS Marine have established systems for archiving and data management. A company wide data management plan will be implemented for the project.
- 6.3.17 MSDS Marine will follow the systems implemented by CHERISH for the wider CHERISH project in relation to archiving.

6.4 Public Engagement

- 6.4.1 Dissemination will take many forms in the course of this project and prior to the commencement of the project and any dissemination, a communications plan will be developed and agreed with CHERISH.
- 6.4.2 MSDS Marine will identify all opportunities for dissemination throughout the course of the project. Methods will include but are not limited to:
- Phone calls, email and meetings with stakeholders including Volunteers, Dive Groups, Owners and other interest groups
 - Social media posts on Facebook, Instagram, Twitter and Linked in through MSDS Marine accounts
 - Social media content provided to CHERISH for distribution through CHERISH social media accounts
 - Blogs hosted on the MSDS Marine website
 - Blogs written for CHERISH social media channels
 - Talks for local stakeholders to be given where the fieldwork schedule allows
 - Papers presented at archaeological and scientific diving conferences
 - Data presented in a way designed for public viewing e.g. Photogrammetry models presented on Sketchfab
 - Opportunities for wider media engagement identified throughout the course of the project

Dive Diary

- 6.4.3 During fieldwork we will be joined by award winning underwater photographer and videographer Michael Pitts. Michael will be creating daily dive diary videos that can be hosted on the CHERISH website and shared through social media. Prior to diving he will undertake a visit to the Tŷ Gwyn Museum to film material from the wreck site that can be used in the videos. It is hoped the dive diaries will include interviews with the fieldwork team, Gewaint Jones (one of the original finders of the site) and Ian Cundy and Bill Turner from MADU as well as representatives from CHERISH. The diaries will include underwater footage of the wreck as well as topside footage.
- 6.4.4 The Dive Diaries will primarily be recorded in English, although accompanying social media posts will be bilingual. Simon Adey Davis, a member of the dive team, is a native Welsh speaker and fluent in both reading and writing which will ensure translation can be undertaken daily.

- 6.4.5 As stated above, MSDS Marine are mindful that some elements of some sites can be sensitive, for example if high value or human remains are exposed on site. It is our policy not to share images of human remains online. If sensitive material is encountered this will not be shared online prior to sign off from the CHERISH project manager.

Provision of content for social media on behalf of CHERISH

- 6.4.6 Prior to, during and post fieldwork MSDS Marine will provide social media content directly to CHERISH for distribution through their accounts. This will take the form of text, images and video footage. Following the initial project meeting it is anticipated that CHERISH will provide MSDS Marine with direct access to their social media accounts for the duration of fieldwork to post content directly.

Delivery of online presentation

- 6.4.7 A member of the MSDS Marine project team will design and deliver an online presentation about the project. It is anticipated that this will take place as part of a series of talks led by RCAHMW in the Autumn.
- 6.4.8 In addition to the online presentation, local museums close to the Bronze Bell wreck will be contacted to update them on the planned fieldwork. Subject to agreement from CHERISH, and the fieldwork schedule, a talk about the fieldwork will be offered through a local Museum during the project at no additional cost to CHERISH provided it fits within the agreed fieldwork schedule. Local Museums include the Tŷ Gwyn Museum (part of Barmouth Sailors' Institute) who holds finds from the wreck including the bronze bell and Porthmadog Maritime Museum.

Working with Volunteers

- 6.4.9 It is anticipated that CHERISH may wish to provide contact details of volunteers as appropriate. Other individuals may, on occasion, wish to engage in the field assessment. In this instance, CHERISH will provide contact details as appropriate. MSDS Marine frequently receive enquiries from people willing to volunteer their time to a maritime archaeology project and where possible we facilitate their requests through our current fieldwork programme. Project Executive, Alison James, has considerable experience of working with volunteers, as well as a Level 3 qualification in the Management of Volunteers from the Institute of Leadership and Management. As such, Alison is able to expertly manage volunteers to ensure the best long-term relationship with them for CHERISH.
- 6.4.10 MSDS Marine undertake all of our work with volunteers in compliance with the ClfA policy statement on the use of volunteers and students on archaeological projects (ClfA, 2018)¹⁴. Volunteer opportunities will not be provided at the expense of professional standards or risk to the limited archaeological resource.
- 6.4.11 Suitable opportunities for volunteers to become involved with fieldwork will be fully considered at every possible opportunity at all stages of the project including in research, fieldwork, and post excavation phases. MSDS Marine have extensive experience of running high quality volunteer projects both on intertidal sites and underwater and are extremely well placed to work with volunteers to ensure added public value is achieved for the project.

¹⁴ <https://www.archaeologists.net/sites/default/files/Policy%20statements%20revised%20Aug%202018.pdf>, accessed 22nd April 2021

- 6.4.12 Working with volunteers underwater faces a Diving Contractor with a unique set of challenges that can be addressed in a number of ways. Where a volunteer diver holds a suitable diving qualification and meets the medical requirements they can be included as a member of the professional diving team (SCUBA and SSDE). MSDS Marine have experience of providing Full Face Mask Training to volunteers to enable them to dive as part of the core professional team.
- 6.4.13 In addition, during SCUBA operations, at the clients request and where safe and practical, other divers can be given the opportunity to undertake diving activities alongside the professional dive team. Other divers will be deemed not 'at work' as per the Diving at Work Regulations 1997 and as such will not be paid for any time they spend diving. Other divers can include volunteers and students. For the purposes of this document other divers will be referred to as volunteer divers.
- 6.4.14 Volunteer divers will be qualified to a minimum of CMAS 2* or equivalent, be medically fit to dive as per the requirements of their qualifying body, and be deemed competent by the diving supervisor. Copies of qualifications and medical certificates will be kept on file.
- 6.4.15 Where a volunteer diver holds a suitable diving qualification and meets the medical requirements they can be included as a member of the professional diving team (SCUBA and SSDE). If this is a requirement of the project, the Diving Project Plan will be updated to include the mechanisms for this work.

7.0 Resources

7.1 Timetable

7.1.1 Key project dates are as follows in Table 2:

Stage	Commencement Date	Completion Date
Pre Dive	May 2021	June 2021
Delivery of Monitoring Dive	June 2021	September 2021
Public Engagement	May 2021	December 2021
Post Dive	October 2021	February 2021

Table 2: Estimated Timescale

7.1.2 Table 3 is an indicative timetable for the completion of the main tasks within each stage based on the project starting in May 2021. It should be noted that a lot of flexibility has been built into the timetable to allow for the easing of covid restrictions and a good weather window.

	May	June	July	August	September	October	November	December	January	February
Project Management and Co-ordination										
Quality Assurance										
Pre Dive										
Planning Meeting										
Agreement of Written Scheme of Investigation to follow ClfA standards										
Additional planning meeting prior to fieldwork										
Delivery of Monitoring Dive										
Review of diving project plan										
Preparation, planning and bookings										
Mobilisation										
Five days tracked diver condition survey including photogrammetry										
Demobilisation										
Public Engagement										
Public engagement and outreach strategy, including comms plan										
Dive Diary										
Provision of content for social media on behalf of CHERISH										
Creation and delivery of online presentation										
Post Dive										
Photogrammetry Processing and modelling										

Completion of draft report and summary of main findings to include specialist reports up to grey literature archival standard										
Delivery of final report and to include specialist reports up to grey literature archival standard										
Submission to Archive										

Table 3: Timetable

7.2 Staffing

- 7.2.1 The Project Executive will be Alison James, one of the Directors of MSDS Marine. Alison is a full time, permanent member of staff based at the company's registered address. Alison has extensive experience in project management, and managed a similar contract through her previous role at Historic England. Alison's experience and technical expertise is wide-ranging allowing for the effective fulfilment of the Project Executive role and the effective delegation of works to the Project Manager. Alison provides quality assurance for the project.
- 7.2.2 The project will be managed by Mark James. Mark is one of the Directors of MSDS Marine, a full time, permanent member of staff and based at the company's registered address. Mark has been managing large scale marine archaeological projects and fieldwork for the last ten years, including the management of the New Forest National Park Authority Coastal Heritage Project, large-scale offshore development works and the excavation of the *Rooswijk* and *London* designated wreck sites.
- 7.2.3 Mark will be the main point of contact between CHERISH and MSDS Marine.
- 7.2.4 Alison and Mark can each fulfil each other's roles in the event of illness or a change in circumstances and both will be kept updated with the project progress.
- 7.2.5 Our project team includes expertise in all areas of maritime archaeology, including:
- Desk based research and assessment
 - Archaeological diving, recording and survey
 - Photogrammetry
 - Remote sensing for archaeology
 - Intertidal survey
 - Stakeholder engagement
 - Reporting
 - Archiving
 - Volunteer management, outreach and education
- 7.2.6 The Project Manager will monitor the need for any additional expertise. Should any of the field assessments undertaken as part of this contract lead to a need for further detailed specialist advice this will be obtained using our considerable external key contacts within the conservation, heritage management, and historic vessel communities. These contacts have been built up via our involvement in a wide variety of projects, including the excavation and

conservation of historic wrecks such as the *Rooswijk* and *London*, and the management of specialist teams for this purpose, in addition to our staff experience working in heritage management and research roles. If the need for any further detailed specialist advice is identified and this is not available in-house, any additional costs, over our standard rates will be borne by MSDS Marine.

- 7.2.7 The dive team will be completed by members of the MSDS Marine core staff including Jenny Kent and Tom Harrison. The core team will be complimented by photogrammetry specialists Dr Rodrigo Ortis and Felix Pedrotti, underwater cameraman Michael Pitts and native Welsh speaker Simon Adey-Davis.
- 7.2.8 All MSDS Marine staff are members of ClfA.

8.0 Health, Safety, and Environment

8.1 Health and Safety Considerations

- 8.1.1 MSDS Marine are committed to creating an environment which is safe, healthy and secure for all our employees. We operate a certified ISO 45001 : 2018 Occupational Health and Safety Management System that fulfils the objectives of maintaining the excellent record of MSDS Marine in relation to health and safety and to ensure all our legal requirements as an employer are met. MSDS Marine have a dedicated member of the team with responsibility for Health and Safety. MSDS Marine have responsibilities for the health and safety of our employees and any visitors to our premises such as clients, suppliers and the general public. In addition to these duties, there are regulations to deal with particular hazards and for industries where hazards are particularly high. Our Health and Safety lead regularly reviews relevant Health and Safety legislation and is registered to receive updates from the HSE to ensure MSDS Marine Safety Policies and Risk Assessments are up to date with legislation, approved codes of practice and guidance. They are able to provide competent advice through their training and experience.
- 8.1.2 The MSDS Marine Health and Safety policy describes how we manage health and safety issues and which members of staff are responsible for delivering the policy. Regularly reviewed risk assessments ensure that we comply with health and safety legislation and regulations including the provision of welfare facilities. Training and information provided to employees ensure everyone who works for MSDS Marine know how to work safely and without a risk to health. We provide a suitable and safe workplace environment both in our office and on site with access to toilets ventilation, lighting, seating and work stations. We have first aid arrangements in place with a suitably stocked first aid box and a designated person who takes charge of first aid arrangements and information. We display a Health and Safety Law poster where our employees can easily read it and health and safety forms a standing agenda item on the quarterly management and full team meetings.
- 8.1.3 Risk assessments are undertaken by senior members of staff with appropriate training and experience in the activity. For example, diving risk assessments are undertaken by the diving supervisor. Where required a risk assessment review will be undertaken, alongside, for example, the vessel master or any external contractors. Appropriate training is always provided to staff to reduce the risk of incidents from hazards identified during the risk assessment process. Most fieldwork is undertaken in environments where formal qualifications are required, this includes medicals for activities such as diving. All qualifications are reviewed prior to the commencement of any works.
- 8.1.4 All sub-contractors working with MSDS Marine are required to comply with our health and safety arrangements.
- 8.1.5 Health and safety forms a standing item on the quarterly management review meeting and our ISO 45001 : 2018 management system provides a process for annual audits and monitoring. Legislation, regulations, industry good practice, MSDS Marine systems, accidents and reporting procedures are all reviewed to ensure they are up to date and appropriate. MSDS Marine have an exemplary health and safety record with no reportable incidents since our formation.
- 8.1.6 A copy of our Health and Safety Policy is available on request

8.2 Environmental Protection Considerations

- 8.2.1 MSDS Marine understand that we have a responsibility to manage our activities in a way that promotes environmental best practice. We operate a robust environmental policy to help fulfil this responsibility. A copy of our Environmental Policy is available on request
- 8.2.2 In addition, MSDS Marine are a founding member of the Climate Heritage Network and have appointed an environmental champion, Phoebe Ronn, to champion environmental issues internally at MSDS Marine.

8.3 Monitoring Procedures

- 8.3.1 MSDS Marine operate an ISO 9001 :2015 certified Quality Management System. The Management System demonstrates MSDS Marine's;
- Ability to consistently provide products and services that meet customer and applicable statutory and regulatory requirements
 - Ability to determine both the external and internal contexts in which it operates and shall monitor and review the issues which arise
 - Aims to identify the needs and expectations of interested parties
 - Aims to enhance customer satisfaction through the effective application of the Quality Management System, including processes for improvement of the System and the assurance of conformity to customer and applicable statutory and regulatory requirements.
 - Achievement of Quality Objectives
- 8.3.2 MSDS Marine maintain an Internal Audit Programme as part of our Quality Management System ensuring that the Management System is verified in accordance to the defined Audit Programme. The Audit Programme takes into consideration the importance of the process, with those areas considered critical being audited more frequently.
- 8.3.3 In addition, MSDS Marine are audited by an external auditor annually as part of our continual improvement process.
- 8.3.4 Any activities not meeting the requirements of the Quality Management System are recorded on the Issues Log, along with any corrective actions. An investigation is undertaken to determine the cause of each incident or non-conformance. The corrective actions taken to prevent recurrence of non-conformances, and those records and reports generated, are regularly reviewed at quarterly Management Review meetings in order to identify any trends and to determine the effectiveness of preventive measures taken. Revised procedures are developed and implemented as considered appropriate and are reviewed accordingly. New significant risks or opportunities may be identified as a result of the non-conformance process. These are fed back into our SWOT analysis which is updated quarterly.
- 8.3.5 The effectiveness of the Management System is continually reviewed and improved through the Management Review process and the associated Management Review Agenda.
- 8.3.6 A copy of the Quality Management System Policy is available on request.