HMS Colossus

Monitoring & Investigation

2012

Project Design

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Contents

Project Name

Colossus Monitoring, Survey & Investigation

Summary Description

A small excavation is proposed on the stern section of the designated wreck site of HMS Colossus. There are a number of reasons for this undertaking: investigation of the main gun deck ordnance, recording of a MGD port, and detailed recording of the post-wrecking stratigraphy present on the wreck. In addition to these site specific enquiries, a number of more general aims will be achieved. These include investigation and appraisal of different excavation methods and recording regimes, and the initiation of a long-term reburial trial on the site using real archaeological objects rather than modern tokens. Finally, an opportunity to gain experience in underwater excavation will be offered to two separate 'trainees', who will be able to use their experience towards their NAS part II or III qualifications.

Background

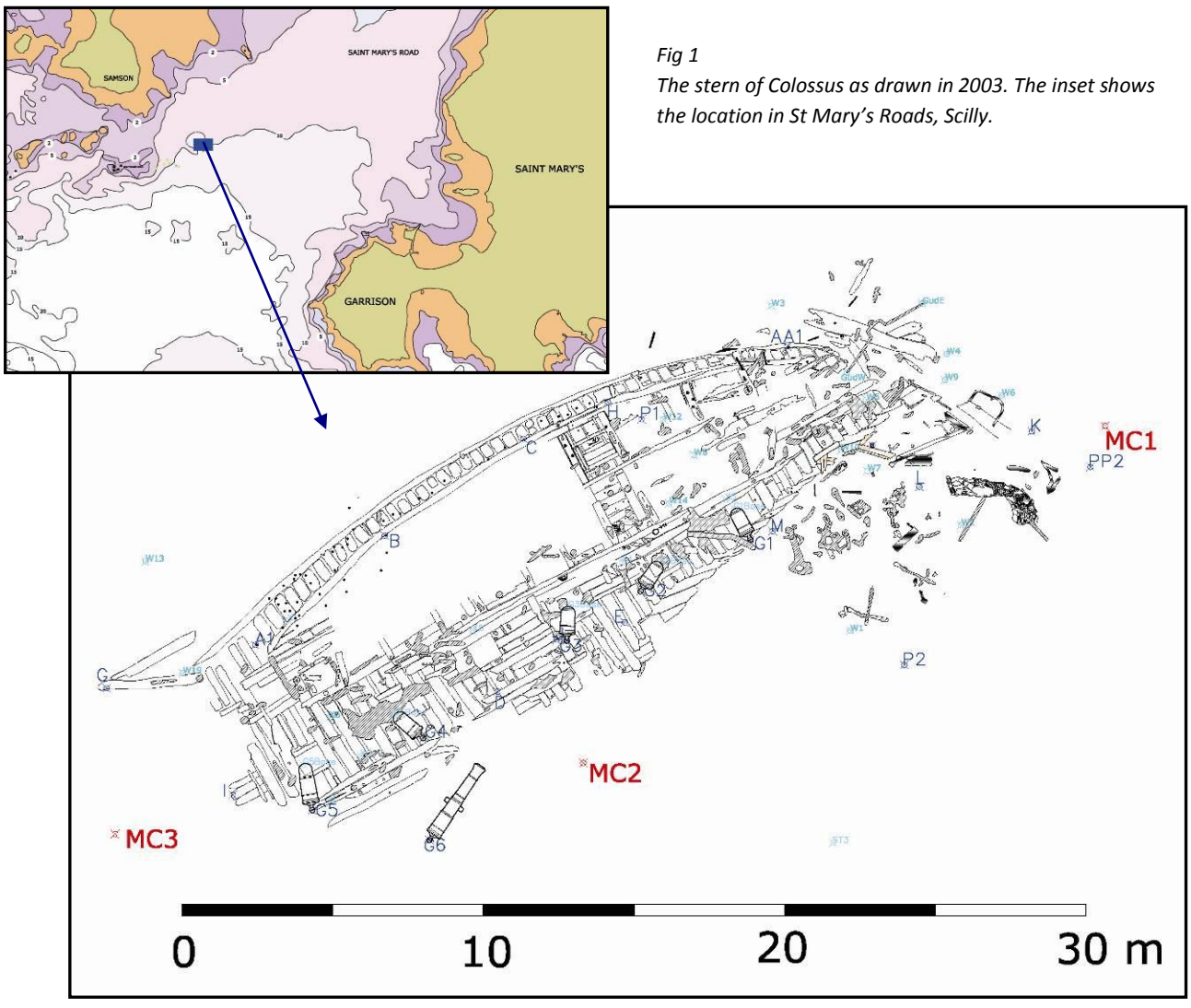

Fig 1
The stern of Colossus as drawn in 2003. The inset shows the location in St Mary's Roads, Scilly.

The Ship

HMS Colossus was a 74 gun warship built in 1787 at Gravesend and wrecked off Samson in the Scillies in 1798. These 74 gun ships were one of the most successful types of the period. They were typically about 51m (170 feet) in length and had a crew of over 600. During her relatively short working life (eleven years) *Colossus* saw action at Toulon, Groix, Cape St Vincent and Cadiz. She also took part in the capture of two enemy ships in 1793: *Le Vanneau*, a French 6-gun ship, and *Vrai Patriot*. She had no less than nine different captains during her relatively short career. She had a complete refit, which took six months, in 1796.

In December 1798 *Colossus* was on her way home to England with wounded from the Battle of the Nile and with cargo including part of Sir William Hamilton's second collection of Greek pottery. She was sheltering from a gale in St Mary's Roads when the anchor cable parted and she was driven aground to the south of Samson. All but one member of the crew were taken off safely before *Colossus* turned onto her beam ends and proceeded to break up.

Vital Statistics

Length (MGD)	172' 3" (52.5m)
Breadth	47' 9" (14.6m)
Tonnage	1703 tons
Draught (hold)	20' 9½" (6.3m)
Standard armament	28 x 32lb main gun deck
	28 x 18lb upper gun deck
	14 x 9lb quarter deck
	4 x 9lb forecastle
Ballast	110 tons of iron ballast and
	250 tons of shingle
Ordered	13th December 1781
Laid down	October 1782
Launched	4th April 1787

The Site

The wreck of HMS *Colossus* lies to the south of Samson in the Isles of Scilly. To date two main areas of wreckage have been identified, the bow and the stern. In 1975 part of the wreck (probably the bow) was designated under the Protection of Wrecks Act. This designation was revoked in 1984. The current site, the stern, was designated in 2001, and is located at Latitude 49˚ 55'.471N, Longitude 006˚ 20'.505W (260154.906E 5535593.077N UTM zone 30, WGS84).

Previous Work

Salvage work took place on *Colossus* from the time of her loss until the early part of last century. Work included Braithwaite and Tonkin 1803-1806, the Dean Brothers in the 1830s and possibly Western Marine Salvage in the early part of last century.

Roland Morris, a marine salver and proprietor of the Penzance Maritime Museum, began searching for the wreck of *Colossus* in 1967 using a small team of divers. In August 1974 they located material relating to *Colossus*. The site was designated in 1975 under the Protection of Wrecks Act 1973. A large quantity of pottery, remains of Hamilton's second collection of pottery, was recovered and deposited in the British Museum – where at least one of these reconstructed pots is now on public display. Once Morris' team had finished their work, the site was de-designated in 1984. The current whereabouts of the other material removed from the site by Morris is for the most part unknown.

Areas of exposed timber and iron guns were discovered by local divers in 2001. This material was some distance to the east of the area worked by Morris and turned out to be part of the stern of *Colossus*. This was designated in July 2001. Late in 2001 the Archaeological Diving Unit (ADU) excavated at the stern of *Colossus* as well as around a piece of carved timber, which turned out to be one of the stern quarter-pieces of the vessel.

In 2002 a quarter-piece, part of the stern decoration of the vessel, was recovered from the site. This was conserved at the Mary Rose Trust, and has now been returned to Scilly for display on Tresco. Later that year a small, limited excavation was undertaken on the site to establish the nature and extent of the structural remains.

In 2003, a two-year site stabilisation trial was commissioned by English Heritage, to determine the most effective method of slowing down the deterioration of the exposed timbers on the seabed. This determined that - on this site - the most effective form of stabilization is a layer of Terram 4000 (Camidge, 2009).

In 2004 and 2005 the Cornwall and Isles of Scilly Maritime Archaeology Society (CISMAS) carried out a survey of the debris field surrounding the wreck of *Colossus*. This demonstrated the presence of large quantities of material from *Colossus* extending beyond the area covered by the current designation.

Between 2002 and 2007 the author carried out monitoring of the sediment levels on the site. This work has demonstrated that the sediment levels around the stern section of *Colossus* have continued to fall throughout this period.

In 2008 a small area at the stern of the wreck was protected with a geotextile covering of Terram 4000. The efficacy of this type of protection on this site was established in the stabilisation trials commissioned by English Heritage (Camidge, 2009). Timber sample blocks were installed beneath the Terram mat and on the seabed. A small seabed sign was also installed to inform visiting divers of the function of the Terram protection. Before the Terram was installed the area to be covered was recorded in detail, along with a control area, so that the long term effects of the stabilisation could be determined. Also in 2008 a diver trail was installed on the site and an underwater guide book produced, copies of which are held by the local dive charter boats for the use of visiting divers. This work was commissioned by English Heritage.

In 2010 a monitoring survey of the small objects exposed on the seabed around the exposed timbers of the wreck was undertaken. The aim of this survey was to allow the amount of object mobility, loss and deterioration to be determined in subsequent monitoring surveys.

Reports relating to work on the Colossus can be downloaded at www.cismas.org.uk

Project Aims and Objectives

The fieldwork will be undertaken in two separate phases. Note that the order of the phases has been reversed from that outlined in the project proposal. This is primarily to allow time for the detailed analysis of the sample reburial objects at the laboratory in York; the objects will then be reburied at the same time as the phase II fieldwork (monitoring and survey).

Phase 1 Fieldwork – Investigation

A small excavation was undertaken on the site in 2002 by the licensee (Mac Mace). The location and extent of this excavation is shown below (fig 2) outlined by a solid green line. This trench was situated in an area previously dug by the licensee prior to the designation. The 2002 excavation report is available on the CISMAS website www.cismas.org.uk (Camidge, 2002)

The investigation will comprise limited excavation over a small part of the site. The intended excavation will be 2.8m wide and 4m long (an area of 11.2 m^2), shown by a dashed red line in fig 2. The total area of sediment contained within the surviving wreck structure is 71m^2; thus the intended excavation would involve 15% of the surviving sediment. Monitoring of the sediment levels on the site since 2002 has demonstrated that the sediment levels have continued to fall throughout this period (Camidge, 2009). The sediment movements on site are complex, but the maximum observed sediment loss (August 2010) was 140mm while the mean of all 14 monitoring points around the wreck was a fall of 44mm. Clearly these deposits are being removed by natural forces. The excavation will allow recording of a sample of these deposits before further loss occurs. The excavation would not disturb any of the *in situ* timbers of the wreck. This part of the project has a number of aims:

Site Specific Aims

Determine whether any main gun-deck guns are present

> None of the main gun-deck 32lb guns appear to be present on the site (three have been found in the debris field). There is a possibility that these could be buried within the sediment as the main gun-deck ports are currently buried – no main gun-deck ports were within the 2002 excavated trench.

Investigation and recording of a main gun-deck port

> The trench would cover one of the main gun-deck ports, allowing recording of this for the first time on this site.

Detailed investigation and recording of the post-wrecking stratigraphy

> The sediments covering the centre section of the hull have all accumulated since the wrecking. It would be useful to have a detailed record to help understand the site formation processes. The trench excavated in 2002 was situated in an area previously excavated by the licensees prior to designation (to minimise new disturbance), but this made a detailed record of the post-wrecking stratigraphy difficult. Where necessary, environmental sampling will be employed to help with understanding the stratigraphy.

General Research Aims

Research into excavation technique

Try, and evaluate, several different methods of underwater excavation during the project.

Evaluation of excavation recording techniques (including the use of contextual recording)

Maritime recording systems in this country are not as 'mature' as those used in terrestrial archaeology, where there is a fairly standard recording system based on (or very similar to) that outlined in the MOLAS Archaeological Site Manual. In maritime archaeology, recording systems - where they exist at all - tend to be driven by artefacts rather than stratigraphy. Site surveys tend to consist of 2D plans of the structural elements of the site, with little or no contextual record. Excavation records tend to record the 3D positions of the artefacts and offer a drawn record of any structural elements exposed. Stratigraphy is rarely recorded in any detail underwater – where its very existence is sometimes questioned. Every underwater excavation I have undertaken has demonstrated multi-layered stratigraphy. Recording of sediments is often very crude when compared to terrestrial excavation recording. Although much of this is driven by what is practical underwater, it may be time to identify and acknowledge what is currently not being recorded. This project will attempt to evaluate different recording techniques, including an appraisal of practicality.

Training in underwater excavation

Very few of us have been lucky enough to take part in underwater excavation in this country. The project would aim to give two individuals experience in underwater excavation which would be carried out to a very high standard.

Detailed trials of reburial of excavated finds

The aim is to make a thorough assessment and record of the recovered artefacts prior to reburial on site. This will allow a proper long-term study of the efficacy of finds reburial.

Phase 2 – Monitoring and Survey

The recorded reburial objects recovered in phase one will be reburied as part of this phase of the fieldwork. This allows sufficient time for the detailed appraisal and recording of the reburial objects.

The surface artefacts recorded in 2010 (EH5943) will be monitored. The aim is to determine any loss or deterioration of the artefacts recorded in July 2010. It will also be useful to see whether any of the objects have been moved, and if so by how much.

At the same time, a survey of the central area of the exposed wreckage will be undertaken. The central area of the wreck is largely blank on the current site plan. This is because when drawn in 2002 this part of the wreck was covered in sand. During the 2010 monitoring project it became clear that timber and iron structures are now exposed in this part of the site. The timber needs to be recorded as soon as possible as we know -exposed material is not recorded soon, the information will be lost.

These tasks (monitoring and survey) will be undertaken at the same time.

Business Case

The management plan for *Colossus* produced by English Heritage (Dunkley, 2007) states:

Policy 1: We will continue to support visitor access to the monument as a mechanism to develop the instrumental value of the Colossus.

This has been implemented by means of a diver trail installed on the site in 2009.

Policy 5: Key gaps in understanding the significance of the monument's component parts should be identified, prioritised and addressed so that these significances can contribute to informing the future conservation management of the place.

One of these gaps is our understanding of the artefacts exposed on the seabed around the wreck. This project seeks to address this by producing a baseline survey of these objects to assess their significance and allow future monitoring of their condition.

Policy 6: We will seek to commission a staged programme of assessment and research to contribute towards a fuller understanding the site in its entirety.

This project would also contribute towards a fuller understanding of the site in its entirety.

English Heritage's Initial Policy for The Management of Maritime Archaeology in England, *Taking to the Water* states

Priorities
12.5 Subject to the provision of adequate resources, English Heritage will undertake a programme of research designed to provide a more robust basis for the understanding and management of the maritime historic environment. In doing so we will place greatest emphasis on work designed to strengthen the national record of maritime sites and landscapes, and work designed to enhance the practical and theoretical basis for site management. The following types of project are seen as a high priority:

- *projects designed to enhance and validate the Maritime Record through field survey, often in partnership with voluntary groups;*
- *studies designed to improve our understanding of marine site environments and to enhance our ability to assess and predict site stability. An understanding of a site's environment is a fundamental requirement for assessing threats and implementing mitigation strategies;*

This project would accord with these priorities. Validation of the Maritime Record through field survey and understanding of the site's environment would be provided by recording artefact mobility on the site. The long term trial of object reburial accords well with the second objective of 12.5 above.

National Heritage Protection Plan

Activity 4H1.

> 4H1 SUBMERGED HERITAGE ASSETS AND LANDSCAPES
> Survey and identification of submerged heritage and inundated prehistoric landscapes (Measure 3) will provide key targets for follow-up assessment. These will comprise specific assets (wrecks, crash sites etc) and wider landscapes (landforms of high potential). Further action will relate only to areas or assets subject to imminent change (aggregates dredging, energy developments, fishing, loss through tidal action/erosion) and will be heavily prioritised.

Project Scope

The project divides into three distinct units

- Investigation: The excavation which includes selection and detailed recording of the objects for the reburial trial. Also includes an appraisal of the excavation techniques and recording used in the project. The excavation will be confined to the area shown outlined with a dashed red line in fig 2 – no excavation will take place outside this area. Excavation will not proceed beyond the hull timbers – the fabric of the vessel will be left undisturbed. All artefacts encountered will be recorded. Those selected for the reburial trial will be subject to further analysis and recording (see Reburial Trial Analysis - page 26) prior to reburial in one of two designated pits as a long term trial of finds reburial. All other artefacts will be reburied in the excavation unless selected by the Isles of Scilly Museum for retention and display.

- Survey and recording of the exposed timber and wreckage in the central part of the site of the site. At the same time the monitoring of the surface artefacts recorded in 2010 will be undertaken. This will be confined to the central area of the wreck, shown outlined with a dashed red line in fig 6.

- Production of the project report. This will be undertaken by Kevin Camidge and Ian Panter.

The project scope does not include any environmental sampling. If this is necessary, it will have to be addressed by a variation to the project.

Permissions

The site is designated under the Protection of Wrecks Act - a licence to excavate will be required from DCMS/EH. A licence will also be required from the Marine Management Organisation under the Marine and Coastal Access Act 2009. This currently costs £158, but the MMO state that this fee could change. They also advise that no separate licence is necessary from the Crown Estate.

The finds handling procedures and a reporting regime have been discussed and agreed with the receiver of wreck (Becky Tye of MCGA).

Interfaces

Colossus Diver trail (EH5682) & Colossus Monitoring EH5943
The monitoring part of this project will facilitate the quantification of any disturbance to exposed objects by visiting divers, which could help to quantify the impact of the diver trail on the site.

Hants IoW Trust for Maritime Archaeology is developing a MoRPHE Project Planning Note (PPN) for marine excavation and post-excavation. An approach has been made to Julie Satchell to ensure that adequate liaison is maintained between that project and the proposed appraisals of excavation and recording aspects of this project.

Communications

The project team will communicate with each other by e-mail and telephone. We will communicate externally with EH through e-mails and highlight reports. Highlight reports will be prepared and circulated on completion of each phase of the project.

Project Review

The project will be reviewed after the fieldwork. This process will be performed by the project manager at the same time as the highlight report is produced. These documents, after any necessary consultation, will be submitted to the EH project assurance officer, Mark James.

Project review & highlight reports		
Product	**Date**	**Destination**
Highlight report	October 2012	Mark James Project team

Health and Safety

Health and safety statement

Work will be conducted in accordance with the manual “Health and Safety in Field Archaeology” (2002) endorsed by the Standing Conference of Archaeological Unit Managers and also the Council for British Archaeology’s Handbook No. 6 “Safety in Archaeological Field Work” (1989).

Prior to carrying out on-site work, a risk assessment will be produced for the project.

The onsite recording will be undertaken by CISMAS. All diving will be undertaken in accordance with the standards, procedures and guidelines laid down by the divers’ qualifying body. No diver will undertake any operation that he/she is not qualified, competent and confident to undertake. All divers will be required to submit a self-certification medical declaration and copies of relevant qualifications to the project director prior to joining the project team. No member of the dive team will receive any financial gain and only reasonable expenses will be paid.

The fieldwork of this project will be run as a recreational volunteer diving project, and thus no diver will be 'at work'. The guidelines in the British Sub Aqua Club (BSAC) publication *Safe Diving* (BSAC, 2010) will form the basis for all diving operations.

The CISMAS team has over six years’ experience in undertaking underwater recording and a well-developed safety regime, and is a team of very experienced divers.

Project Team Structure

The fieldwork for this project will be conducted by the Cornwall and Isles of Scilly Maritime Archaeology Society (CISMAS) under the direction of Kevin Camidge. CISMAS has already carried out work on *Colossus* including a two year survey of the debris field in 2004-5, facilitated by a grant from the Lottery Heritage Initiative. More recently, CISMAS undertook the recording phase of the Stabilisation and Recording Project commissioned by English Heritage and completed in 2007. CISMAS also undertook the *Colossus* monitoring survey (EH5943) in 2010.

CISMAS members have also been involved in detailed recording in Scilly of the wreck of *Firebrand* (1707) for the last four years. Although CISMAS is an organisation of volunteers, the survey standards achieved by its members is of a very high standard.

Phase I - Investigation (Two Weeks) June 2012*				
Post	**Personnel**	**ID**	**Details**	**Day Rate**
Project Manager	Kevin Camidge	KC	Darkwright Archaeology & CISMAS archaeologist	260 per day Volunteer for all CISMAS field work
Conservator	Ian Panter	IP	York Archaeological Trust	250 per day
Environmentalist	Jenneifer Miller	JM	NHEFAU (YAT)	250 per day
Surveyor	Peter Holt	PH	NAS tutor and experienced CISMAS volunteer	Volunteer
Dive safety supervisor	Brendon Rowe	BR	Experienced CISMAS diver	Volunteer
Recorder & Finds assistant	Janet Witheridge	JW	Experienced CISMAS diver	Volunteer
Photographer & recording	Sharon Austin	SA	Experienced CISMAS diver	Volunteer
Excavation & recording	Innes McCartney	IM	Experienced CISMAS diver	Volunteer
Excavation & recording	Jeff Dicker	JD	Experienced CISMAS diver & engineer	Volunteer
Excavation & recording	Peter Menear	PM	Experienced CISMAS diver	Volunteer
Trainee 1	TBC		Trainee for week one	Volunteer
Trainee 2	TBC		Trainee for week two	Volunteer

The trainees will be recruited during the early part of 2012

The environmentalist will only be necessary if environmental samples are taken

Phase II - Monitoring & Survey (One Week) September 2012*				
Post	**Personnel**	**ID**	**Details**	**Day Rate**
Project Manager	Kevin Camidge	KC	Darkwright Archaeology & CISMAS archaeologist	260 per day Volunteer for all CISMAS field work
Surveyor	Peter Holt	PH	NAS tutor and experienced CISMAS volunteer	Volunteer
Dive safety supervisor	Brendon Rowe	BR	Experienced CISMAS diver	Volunteer
Recorder & drawist	Janet Witheridge	JW	Experienced CISMAS diver	Volunteer
Photographer & recording	Sharon Austin	SA	Experienced CISMAS diver	Volunteer
Recording	Jeff Dicker	JD	Experienced CISMAS diver	Volunteer
Recording	Innes McCartney	IM	Experienced CISMAS diver	Volunteer

* Note that these are target dates – the actual dates for the fieldwork will depend on the availability of dive charter vessels and suitable accommodation for volunteers on Scilly. Scilly is a popular holiday destination and availability of charter boats and accommodation is often problematic.

Ian Panter of York Archaeological Trust will be working with the CISMAS team to undertake the conservation aspects of the finds reburial trial. He will analyse the objects used in the reburial trial and will also be on site for the second week of the phase I fieldwork (investigation).

Ian Panter
Graduated in 1980 with an honours degree in archaeological conservation and materials science from the Institute of Archaeology, University of London. Following employment with the Mary Rose Trust and then Portsmouth City Museum & Art Gallery, Ian moved north to taken up an EH funded conservation contract based at York Archaeological Trust. During this time he helped set up the York Archaeological Wood Centre before leaving in 2000 to take up the post of Regional Science Advisor for English Heritage. In 2006 he returned to the York Archaeological Trust to head the conservation department following the retirement of Jim Spriggs. The conservation department continues to undertake commercial work for a wide range of clients, and actively undertakes the conservation of archaeological materials from marine environments. Projects include the conservation of the wrought iron gun from the Studland Bay wreck, artefacts from the Church Rocks wreck and the wooden “merman” from the Swash wreck as well as the Royal Anne Galley environmental assessment.

If any environmental sampling is necessary, this will be undertaken by Jennifer Miller of the Northlight Heritage Environment & Forensics Archaeology Unit which is a part of the York Archaeological Trust Group.

Jennifer Miller
Dr Jennifer J Miller, [BSc(Hons), PhD, FSA Scot, MIfA, MFSSoc] is currently employed as the Director of the Northlight Heritage Environment & Forensics Archaeology Unit which is a part of the York Archaeological Trust Group. Jennifer is a leading authority on palaeo-environmental analysis with particular specialisms in the identification of charcoal and waterlogged macro-plant remains: her PhD was on an archaeobotanical investigation of Oakbank crannog, a prehistoric lake dwelling in Loch Tay, the Scottish Highlands. She has undertaken analysis and published on several hundred palaeo-environmental assemblages from across the UK and internationally. She is currently developing the range of Northlight Heritage environmental services. Jennifer also has expertise in archaeological forensics and provides an important forensics service to police forces across the UK, advising on body recovery, undertaking analysis of remains and appearing as an expert witness at Crown and High Courts. Jennifer is Scotland's representative on the Home Office Forensics Archaeology Standards Committee.

Phase 1 – Investigation

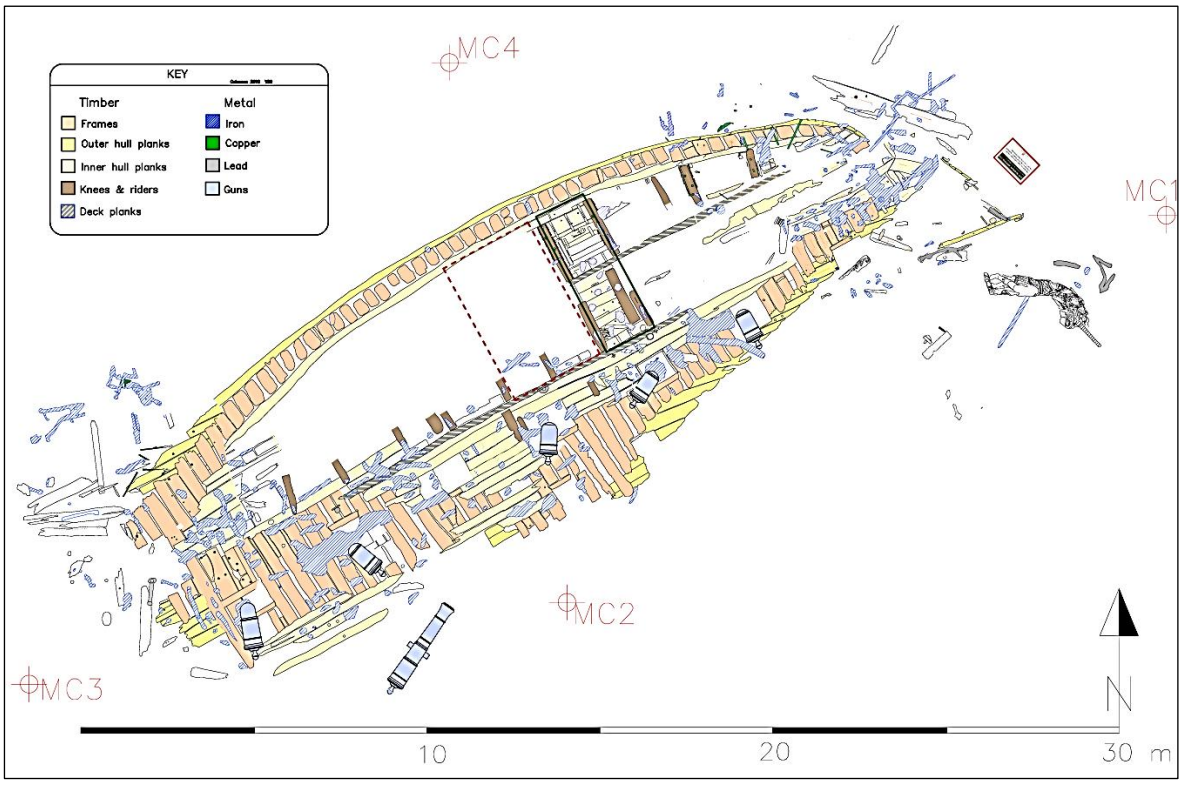

Fig 2
Plan of the exposed wreckage showing the outline of the proposed excavation (dashed red line). The outline of the 2002 trench is shown in green.

Excavation

The intention is to undertake limited excavation over a small part of the site. The excavation will be a maximum of 2.8m wide and 4m long and will not disturb any of the *in situ* timbers of the wreck. The proposed trench is situated so that its long edges will be buttressed by the knees and riders of the wreck, while the short edges will lie on already exposed timber so they will not require any buttressing. If, however, any buttressing of trench edges is required, this will be accomplished using sandbags.

The anticipated depth of stratigraphy is no more than 0.85m to the inside face of the hull (from the adjacent 2002 excavation – see fig 3 below). Sediment will be removed stratigraphically by hand and reaction water-dredge. Only sediment will be removed; all articulated timber will be left *in situ*. All identified contexts will be drawn (in plan and section) and where possible photographed.

Colossus 2002 - Profile T1 - T3

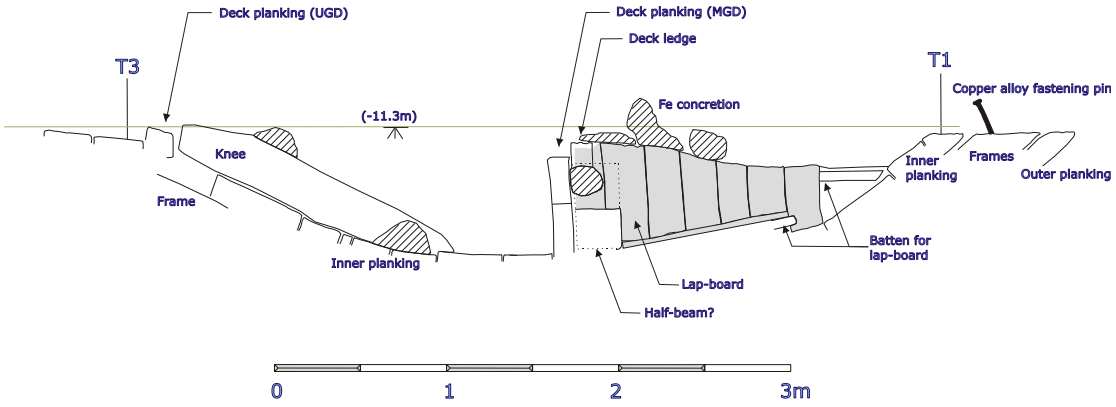

Fig 3
North-south profile through the 2002 exploratory excavation – this demonstrates the maximum likely depth of stratigraphy down to the inner hull planking

Portable finds will be recorded in place (position, depth, context number) and recovered to the surface for detailed recording by finds assistant and conservator.

Stratigraphy

The stratigraphy encountered in the excavation will be recorded in detail; this may allow a better understanding of the post-wrecking events on the site. This was not possible in the previous excavation undertaken in 2002 as that trench was excavated in an area already dug prior to the designation. The stratigraphy on the site has however been recorded during the excavation of the stern carving (now on display on Tresco, Scilly) and during finds reburial on the site in 2002 (Camidge, 2002).

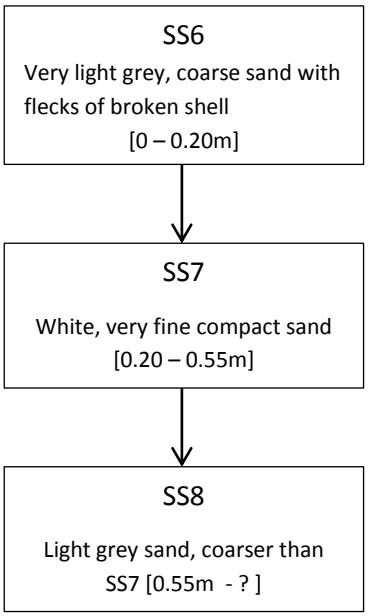

Fig 4
Schematic showing the nature and depth of the stratigraphy encountered on the site in 2002

Each layer will be sampled for geochemical analysis to enable comparison with the environment in the reburial pits (see Reburial Trial Analysis and Recording page 26) thus enabling comparison of the

retrieval and reburial sediments. Environmental sampling will be undertaken if suitable contexts are encountered (food containers or unusual organic remains). Only a single animal bone was recovered from previous excavations on the site. The presence of human bone is very unlikely as the crew of *Colossus* all survived the wreck (with the exception of a single crew member who fell overboard from a small boat while sounding around the grounded vessel some 500m from the present wreck location). Environmental sampling has not been included in the cost of the present project – if required this will need to be dealt with by a variation to the project. Sampling will follow the practice outlined in (Jones(ed), 2002) as far as this is applicable to underwater archaeology.

Backfilling and Consolidation

On completion, the excavation will be backfilled with the sediments removed from the trench. The whole trench will then be covered with a layer of Terram 4000 geotextile, secured in place by sandbags. This method of consolidation worked well on the 2002 excavation without problems (Camidge, 2002). Furthermore the stabilisation trials carried out on this site demonstrated that the use of Terram 4000 produced anoxic conditions within days of being applied and offered complete protection to the timber sample blocks deployed beneath it (Camidge, 2005). It was also noted that Terram mats become colonised within a few months with seaweed, which causes 10-15cm of sediment accumulation over the geotextile within 12 months.

The site is regularly monitored by three different licensees (including the author) so any problems will be quickly noted. In practice Terram 4000 held in place with sandbags has been used so often on this site without any problems that a failure is highly unlikely. The only risk is probably from third party intervention by divers or vessels anchoring on the site illegally.

Training

Two trainee places will be made available during the investigation phase of the project. The aim here is to give underwater excavation experience to two people who would otherwise find it difficult to gain this type of experience. Each trainee place will be for one week; thus during the two week investigation phase one of the trainees will always be in place. The trainee will receive an induction briefing from the safety supervisor and an escorted familiarisation dive around the site. Thereafter the 'trainee' will be paired with an experienced operator in each of the principal tasks being undertaken (excavation, underwater recording and finds recording on the boat). Successful trainees will need suitable diving experience and qualifications (this will be monitored by the diving safety officer, Brendon Rowe).

These trainee places would provide ideal experience for maritime archaeology undergraduates; however, keen avocational archaeologists will also be considered.

Initial discussions with Mark Beattie-Edwards of NAS have suggested that this training may be recognised towards the NAS part II and part III awards. Two of the CISMAS team are NAS tutors. The training places will be advertised in the NAS newsletter and to the wider CISMAS membership; if this fails to bring suitable response the UK university maritime archaeology courses will be circulated.

The intention is that the trainees will have their living and diving expenses covered by the project (although this is dependent on the availability of suitable self-catering accommodation on Scilly). The

volunteers will, however, be responsible for their own travel expenses. Attempts will be made to secure sponsorship to cover the trainee travel expenses.

Finds Recording

Each object will be allocated a unique number when found. The position, depth and context will be recorded on the seabed. The object will then be bagged and recovered to the support vessel inside a pre-numbered minigrip bag. Detailed recording of the object will then be undertaken 'out of water'. The object will be photographed and the following details recorded:

Artefact record	
Field	**Recorded**
No	Pre numbered bags
Position	Underwater
Depth	Underwater
Context	Underwater
Object class	Surface
Object type	Surface
Material	Surface
Description	Surface
Date found	Surface
Dimensions	Surface
Storage medium	Surface
Condition	Surface
Photographs	Surface
Drawn	Only selected objects
Current location	Surface
Recorded by	Surface

Excavation Technique Evaluation

Several different excavation strategies will be tried during the excavation. Excavation will be trialled using hand fanning and a variety of hand tools to excavate with – the reaction dredge will be used to transport spoil away from the excavation. The spoil will be deposited in two areas to the south and north of the wreck, contained by scaffolding mesh until it is used to backfill the excavation (this technique was successfully used in the 2002 excavation). Each of the different excavation techniques will be judged on ease of use, efficacy and speed. Volunteers who undertake excavation will be asked to write an assessment of each of the different excavation techniques used – each technique will be given marks out of ten for each of the assessment criteria. An overall appraisal of the different excavation techniques used will be included in the project report.

Excavation Recording Evaluation

The main and most time-consuming of the recording activities for an underwater excavation is usually the 3D positioning of artefacts. This will be performed using a number of different methods. Offsets and depth measurements will be taken from a fixed baseline at the edge of the excavation.

These will then be converted to eastings, northings and chart datum depths by software; this is the method used in the 2002 excavation. Other methods will also be tried, for example recording the positions on a sheet of Perspex laid over the trench, these will then be converted to eastings and northings on the surface. Direct survey techniques will be tried for fixing artefact positions in order to establish how long this takes. This is unlikely to be a viable technique unless relatively low volumes of artefacts are encountered (due to the time it takes to make four separate measurements to control points). Any necessary improvements will be put into effect for the final week of the fieldwork. The efficacy and economics of the recording system will be evaluated in the project report.

Finds Reburial Trial

In situ preservation of underwater cultural heritage has been highlighted as the preferred option in most recent literature on the subject. 'UNESCO underscores the use of in situ methods in its 2001 convention on the protection of the underwater cultural heritage' and 'If *in situ* methods are to be used as the primary means of preserving underwater cultural heritage they must be explored in depth' (Ortmann, 2009, p.2).

A number of studies have looked at aspects of reburial as a means of preserving underwater material. Burial of modern timber to quantify preservation has been undertaken by a number of projects, in Denmark (Gregory, 1998), in the UK on the protected wreck sites of *Colossus* (Camidge, 2005) and the Swash Channel wreck (Palma, 2009), and the pan European MoSS project (Cederland, 2004). But by far the most comprehensive long term study undertaken to date is the Reburial and Analysis of Archaeological Remains (RAAR) in Marstrand, Sweden (Bergstrand et al., 2005). This project aims to investigate the reburial of archaeological objects over a 50 year period. Organic materials (wood, textile, leather, bone and antler) and inorganic materials (silicates and metals) are being used. Interestingly, with the exception of the silicates (glass and ceramics), modern material or 'tokens' are being used for the reburial rather than archaeological material. The efficacy of packaging, labelling and marking methods is also being investigated. Preliminary results suggest that the reburial environment is an important factor in the preservation of cultural material. The *Colossus* reburial trials will be a useful supplement to this work as we will be using archaeological material rather than 'tokens' in our reburial trials. Marking and labelling of reburial objects in the *Colossus* trials will use the most successful of the methods indicated by the preliminary RAAR results (Godfrey et al., 2009).

All objects located during the excavation will be recorded as detailed in *Finds Recording* above. Towards the end of the excavation the objects to be used in the reburial trial will be selected. For each of the material types, a minimum of two objects (one for each reburial term – 10 and 25 years) up to a maximum of ten objects (five for each reburial term) will be selected. The actual numbers will depend on what is found. The anticipated types - based on the objects encountered in the 2002 excavation on the site - are ceramics, copper alloys, glass, iron, leather and wood. It may however be necessary to modify this list in the light of what is actually encountered in the excavation. If sufficient objects are recovered, a distinction will be made between cast and wrought iron. Similarly, copper and copper alloys may be subdivided if enough are recovered.

Once the reburial objects have been analysed and recorded in the laboratory at York they will be reburied in two separate pits, each approximately one metre square and at least 0.50m deep. One pit will contain the objects to be recovered after 10 years' burial and the other for objects to be

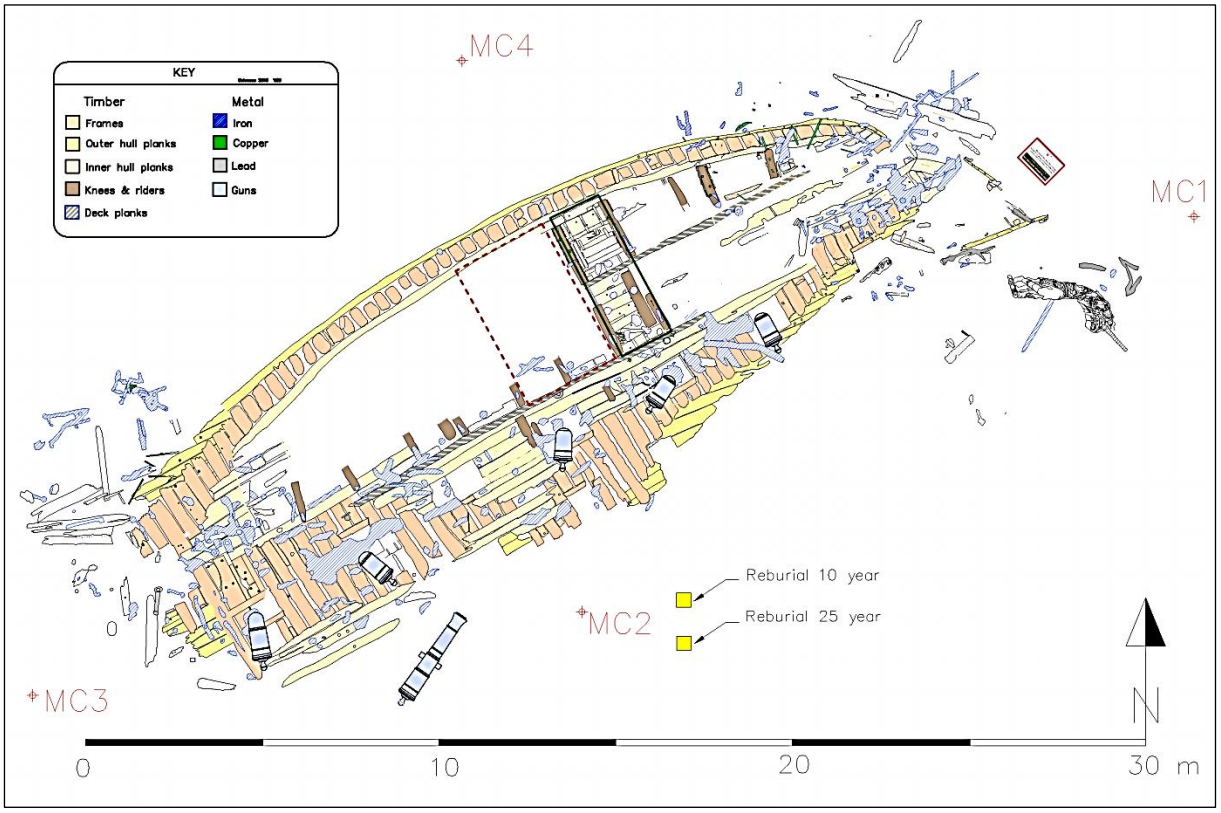

Fig 5
Plan showing the intended location of the two reburial pits to the south of the exposed wreckage

recovered after 25 years' burial. The reburial pits will be approximately 2m apart to ensure a similar burial environment. The actual reburial will take place at the same time as the monitoring and survey fieldwork (phase II) – see below. Objects will be contained in PE minigrip bags, perforated with c. 100 holes of c. 1mm diameter (achieved using a flower display 'pin block'). Each bag will also contain sediment from the context the object was recovered from – this should help to minimise environmental changes. All objects will be arranged in symmetrical patterns in the pit, as far from adjacent objects as possible. All bags will be labelled using two different marking systems. The pit will then be backfilled with the sediment removed to seabed level, covered with a layer of Terram 4000 held in place with sandbags. This technique of stabilising the seabed worked well for the 2002 excavated trench. The sediments in the reburial pit will be sampled as described in Reburial Details below.

The reburial objects will be labelled using permanent felt tip marker pen on the minigrip bags. In addition, a Dymo embossed label and a plastic label marked with felt tip will be included in the bag. Both these techniques have proved effective in the RAAR trials.

Selection of Reburial Objects

Finds for the reburial trial will be selected by the conservator. The Isles of Scilly museum will select any objects they want for display at the end of the excavation – in practice this is likely to involve

only items requiring minimal conservation and Ian Panter will be on site to advise. If the same object is selected for museum display and the reburial trial, this will be resolved by negotiation between the project manager, conservator and museum curator. If a resolution cannot be arrived at then the project manager's decision will be final. All objects will be recorded – including detailed photographs. The remaining objects will be reburied in the excavated trench at the end of the excavation (phase I). They will all be bagged and labelled and placed in a known location so that retrieval will be relatively simple should any of the objects be required. Incidentally, the majority of objects recovered by the ADU in 2001, the objects found while excavating the stern carving in 2002 and those from the excavation in 2002 were all reburied after recording (Camidge, 2002). The recording of these objects did not include photographs and they were not examined by a conservator. However, they should be born in mind as a possible future research resource. To date, no one has expressed any interest in acquiring any of these objects.

Additional Reburial Objects

Angela Karsten of English Heritage Conservation has proposed that additional objects supplied by EH should also be used in the reburial trials. These objects would be from historic shipwrecks other than *Colossus*. These would be subjected to analysis by EH prior to reburial. The proposed analysis includes:

- Fourier-transform infra-red spectroscopy (FTIR) analysis for leather and wood (which can be non-destructive)
- X-ray diffraction (XRD) analysis to identify corrosion products (which requires a small sample)
- Scanning Electron Microscopy (SEM) with energy dispersive spectrometry (EDS) to characterise the composition of glass, metals and ceramics and to quantify the extent of the corrosion (which requires a small sample)

Angela is also looking into supplying a set of 'tokens' (modern materials) to be reburied in this trial to act as a baseline against which the archaeological material can be compared.

This work would be largely self-contained and would only impact on this project to the extent that we would provide space in the reburial pits for the objects supplied by EH. Angela Karsten intends to develop a separate specification document for this work. If for any reason this does not happen, there will be no adverse effect on the present project.

Reburial Trial Analysis and Recording by Ian Panter

Introduction

The aim of this aspect of the project is to assess the long-term preservation potential of the sea-bed sediments using actual artefacts as proxy indicators. Data will be used to inform on decay rates and future management strategies for the designated wreck.

The exercise will broadly follow methodologies developed during the "Reburial and Analysis of Archaeological Remains" project (Godfrey et al., 2009) which is currently evaluating reburial as a method for long-term storage and preservation of waterlogged archaeological remains. The investigations include the reburial of both modern and archaeological materials, as well as examples of packaging and labelling materials widely used on modern excavations. However, our aim is to rebury a diverse range of archaeological artefacts recovered from the wreck, following a thorough examination by conservation staff at the York Archaeological Trust. Two reburial pits will be established with recovery after ten and twenty five years. Rather than a reburial exercise, this project aims to use archaeological artefacts as proxy indicators for the nature of the burial environment

Based upon the results of the 2002 excavation where over 180 artefacts were recovered, it is proposed to rebury the following material classes:

- Ceramics
- Copper alloys
- Wood
- Leather
- Iron
- Glass

Phase II of the RAAR study concluded that neither glass nor iron should be considered for reburial. However their inclusion in the *Colossus* study can be justified as the emphasis here is on long-term preservation potential and the objects will be reburied in broadly similar deposits to those from whence they came. However, iron encrusted concretions will require initial radiography to ensure that iron survives and a visual inspection will be required to ensure that the integrity of the concretion continues to be maintained.

To ensure statistical significance of the data a maximum of ten examples of each material class will be required, with five going into the 10 year pit and five into the 25 year pit. The short-term results from RAAR were inconclusive and it is only now, after about seven years that more meaningful results are coming through.

Tests to characterise the materials will include the following:

- X-radiography for copper alloys and wood
- Photography
- Light –reflected microscopy
- Density assays (for wood)

- Colorimetry
- Scanning Electron Microscopy (if possible, but this will require destructive sampling)

The chemical and physical characteristics of the sediments will be characterised prior to reburial by Jones Environmental Laboratories, a UKAS accredited facility based in Deeside. They have been involved with the analyses of samples from Nantwich, another English Heritage funded programme to assess preservation potential in an urban environment. Six samples, three from each location, will be collected from a minimum depth of 50cm below the seabed. Two samples will be despatched for geochemical analysis whilst the remainder will undergo porosity testing at York using the RAAR procedures. Both porosity and depth are crucial parameters which influence in situ preservation. Previous studies, including the work on the *Royal Anne* Galley (Camidge et al., 2006) (Camidge et al., 2008), indicate that anoxic conditions are created at depths of 50cm and below. However, the RAAR investigations demonstrate the importance of porosity – as a rough rule of thumb, the greater the porosity, the less benign the burial environment.

Methodology

Artefact retrieval
A finds processing facility will be established on the dive platform to ensure that the artefacts are processed and packed as soon after recovery as is possible. Working in collaboration with the project director and finds assistant, Ian Panter (Head of Conservation, YAT) will conduct a visual inspection of each artefact, using pro forma sheets to record the extent and character of deterioration products, physical loss and other pertinent features as well as detailed digital photography and measurement.

Standard recording as employed by the *Colossus* project team will be carried out at this time too, in order to minimise the potential impacts from oxidation and partial desiccation.

Artefacts will then be packed into an oxygen-free environment using the ESCAL^{TM} barrier film system with “RP System” oxygen scavengers and monitor included in each bag. These finds will be stored in cool conditions before onward despatch to York.

Artefact Characterisation
A series of tests will be performed on the artefacts to determine the overall level of preservation and establish the “baseline” condition prior to reburial. Because of the nature of the finds, the tests will be non-destructive. However, destructive tests should not be ruled out at this stage and consideration should be given to using techniques including SEM for sub-samples following discussions once the finds have been assessed.

All artefacts will be photographed using a digital camera before any further tests commence, and each object will be visually inspected using light reflected microscopy to assess surface detail, zones of active corrosion and other relevant features. Partial drying out of the surfaces may be necessary, and this will be achieved using paper towelling to absorb the surface water.

X-radiography will be used to assess metal and wood, using the Faxitron cabinet system at the YAT conservation laboratory, which can take objects up to 24cm by 16cm. The open source system at the Royal Armouries, Leeds, will be used for larger objects, if necessary. For metal objects the degree of mineralisation or extent of survival of a metallic core can be described and quantified. For wood the degree of attack from marine borers will be evaluated using the five point grading system described in British Standard EN 275:1992 (Wood preservatives. Determination of the protective effectiveness against marine borers).

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Density determinations, using the "Archimedes Principal" method will be carried out on the wooden artefacts enabling quantification of the degree of preservation, based on the assumption that loss of wood substance will result in a reduction of the wood density. The use of this technique on other materials including leather, ceramics and glass will be explored further during this stage of the project.

The potential for colour change as a proxy indicator of alteration/decay will be investigated, making use of the in-house Minolta Chromameter. This device has been used during the RAAR project but solely on packaging and labelling materials. Its potential for use on ceramics and possibly glass will be explored further. Readings will be taken using a standard colour recording system, such as the L*a*b* system.

If sub-sampling is permissible the SEM will be used to investigate the microstructure of ceramics and glass and possibly leather and wood, although due consideration to sampling bias will be taken into consideration.

Artefact Reburial

Once recording is complete, each object will be repacked in an oxygen-free environment again and couriered back to the wreck site for reburial.

Each artefact will be placed in a perforated mini grip bag containing sediment from its original environment, and two labels (a Dymo label and one written with a permanent marker such as the Edding 404) included in each bag. The burial pits will be circa 5m south of the excavated trench and material types will be evenly distributed and replicated in each pit. After backfilling, the pits will be covered with Terram 4000 weighted down with sandbags. The possibility of proximity corrosion (between metals not in contact with each other) cannot be ruled out however, the pits will attempt to replicate conditions found at the wreck site, and therefore a wide range of material types need to be replicated in the burial pits.

Sediment characterisation

In total six samples, each approximately 400g, will be collected from the two burial pit locations (e.g. 3 from each)and stored in airtight containers at 5° C prior to despatch. Four samples (two from circa 25cm depth and two from 50cm) will be sent to the YAT laboratory for porosity measurement whilst the other two (from 50cm depth) will go to Jones Environmental for geochemical analysis.

The suite of tests to be performed by Jones will include dissolved oxygen, sulphide, sulphate and total sulphur concentrations, pH, conductivity, particle size analysis, loss on ignition (for organic content) and iron content. These proxy indicators will be used to determine whether the sediments are anoxic and whether there are harmful elements present including reactive iron oxides or sufficient quantities of organic materials that may influence microbial activity.

Porosity tests will be determined by weighing a known volume of sediment and subsequently drying to a constant weight. The porosity will be calculated as the ratio of the volume of the pore space to the total volume of the sediment sample.

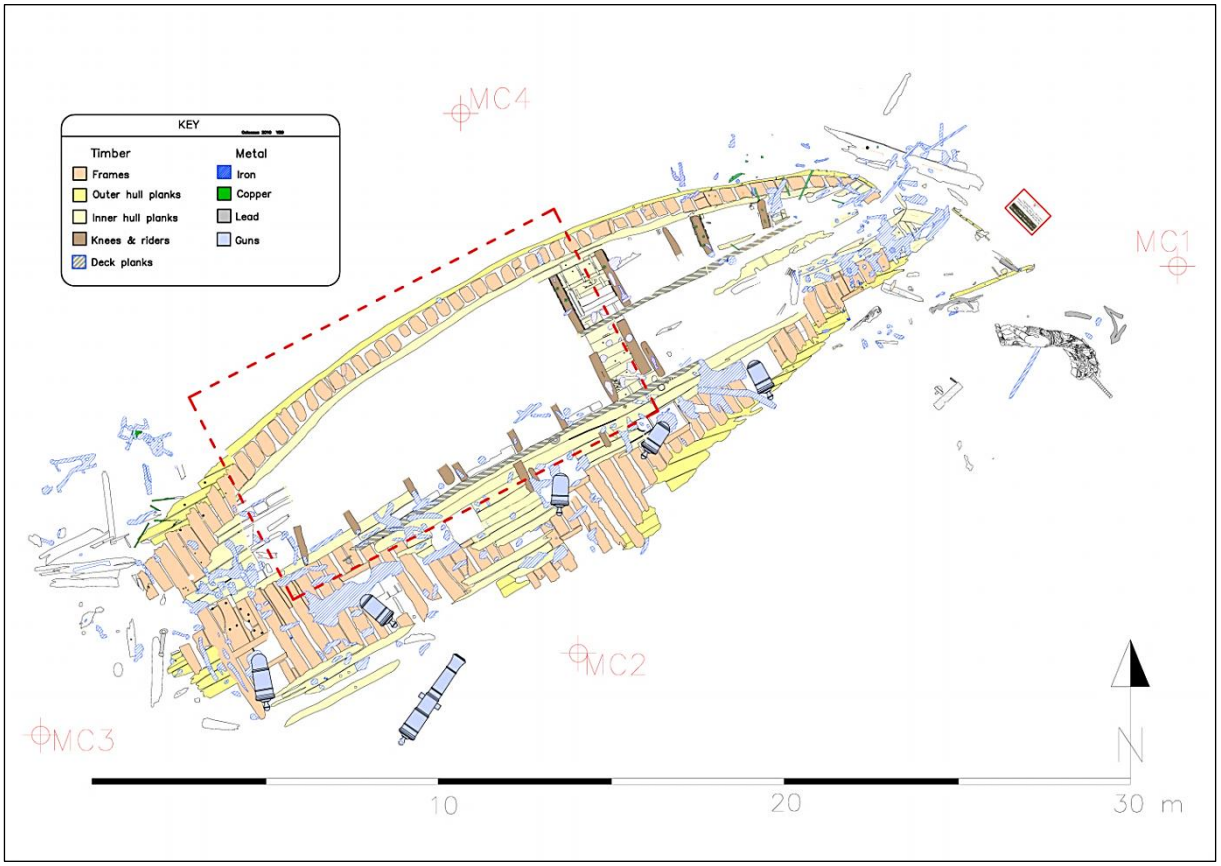

Fig 6
The proposed area for the survey and monitoring outlined with a dashed red line

Survey

The newly-exposed timbers in the centre of the site will be recorded by a planning frame survey and the results added to the existing site plan. The area to be surveyed (see above) is approximately 12m x 6.5m (78 m^2). The planning frame survey will be undertaken using 1 x 1m planning frames positioned along baselines. The baselines will be fixed by reference to the existing control points on the site. This work will also necessitate extra control points being installed and surveyed – these will be referenced to the master control points installed in 2003. The site drawings will then be scanned and imported to AutoCAD.

Monitoring

During the planning frame survey, all objects will be recorded in the same way as they were in the 2010 monitoring survey. This will allow comparison of position (demonstrating any mobility of objects) and comparison of condition and completeness (to document any deterioration since the 2010 monitoring survey). Of the objects recorded in the 2010 monitoring 37 fall within the area of the intended survey/monitoring (fig 5). If time allows, the area will be extended to include more of the objects monitored in 2010 (173 were recorded in total).

- The position of each object will be recorded
- Each exposed object will be photographed in situ
- Each object will be recorded. The following data items will be collected:
    Number
    Position (UTM grid reference)
    Dimensions
    Material
    Object type
    Condition
    Description

Finds Reburial Pits

The actual burial of the objects selected for reburial in phase one will be undertaken at the same time as this phase of the fieldwork. This allows time for the detailed recording of the reburial objects (see Finds reburial trial section above).

Reporting

An entry for the project will be made on the OASIS system.
One final report will be produced. It will describe the results of the fieldwork undertaken, the circumstances and conditions at the time of the work and the results that were obtained.

Final Report (December 2012)
Archive (copies to EH, Cornwall HER, Isles of Scilly Museum)
The report will be posted on the CISMAS website
The final report will be uploaded to OASIS
The report will have the following contents:

Heading	**Contents**
Summary	A summary of the project
Introduction	Background aims and methods
Methods	Description of the methods used, what worked well and what did not.
Results	The survey results
Discussion	Discussion of the project findings
Specialist Reports	Conservation and recording of the reburial objects
Archive	A summary of the archive contents
Illustrations	Photographs and drawings These will be printed in the report as well as supplied electronically on CD ROM. All drawings and survey results will also be held as an AutoCAD file (on CD with the report) including DXF files for easy migration to GIS

Project Archive

All the recording for this project will be in digital form. The only non-digital items will be the original underwater recording sheets (pencil on plastic drafting film), which are scanned and stored as JPEG files at the end of every day's work. All other data collection is made directly on a laptop. The archive will be made available as a DVD ROM. The underwater data collection sheets will be indexed and filed in an A4 wallet file.

The Isles of Scilly Museum have agreed to accept the project archive (paper and digital). They will also inspect the finds and decide what - if anything - they wish to take for display in the IoS Museum.

Stages, Products and Tasks

No	Stage	Proposed date	Output	Personnel
1	Planning	July 2011	Project design	KC & IP
2	Investigation	June 2012*	Context records, plans & sections Sediment samples (chemical and physical) Recording technique appraisal Excavation technique appraisal Selected reburial sample objects	KC, IP, PH, SA, BR, JD, PM, JW, IM Trainees x 2
3	Review	June 2012*	Review recording methods and excavation technique half way through the Investigation phase of the project	All
4	Analysis	July 2012	Analysis of finds and investigation of concordances	KC, JW & IP
5	Investigation post processing	Aug 2012	Digitised survey drawings Enter results onto site GIS/AutoCAD Finds database Synthesized technique results Processed & indexed photographs	KC SA
6	Reburial objects detailed recording – including X Ray	Aug 2012	Object X Rays Detailed reburial object record	IP KC
7	Monitoring and survey	Sept 2012*	Artefact monitoring survey Survey of newly exposed timber Reburial of the sample objects	KC, PH, BR, SA, JW, JD, IM
8	Highlight report	Oct 2012	Highlight report (to Mark James) on completion of phase II of the fieldwork	KC
9	Post-survey processing	Oct 2012	Digitised survey drawings Results onto site GIS/AutoCAD Update finds database Process & index photographs	KC
10	Reporting	Dec 2012	Project report	KC & IP
11	Archive	Jan 2013	Deposit project archive with IoS museum Deposit report with Cornwall and IoS HER	KC

* Target dates

Ownership

Use of all material contained within the project reports is granted to the client.

Risk Log

Risk no	Description	Probability	Impact	Countermeasures	Estimated time and cost	Owner	Updated
1	Boat time might be lost due to bad weather.	**MEDIUM** Previous work on this site has shown that work is possible in all but very severe weather	**HIGH** This would result in lost days' work. Very severe weather tends to last for more than one day	Hard to reschedule as accommodation and boats have to be booked many months in advance. In severe cases the scope of the project may have to be adjusted	This may not happen. But if it does, rescheduling is the only option. Boat hire, accommodation and travel costs would be incurred.	**KC**	
2	Boat breakdown	**LOW**	**MEDIUM**	Not within our control	Charter operator would endeavour to arrange an alternative charter vessel	**KC**	
3	Staff illness	**LOW**	**HIGH**	The critical persons are: Project manager and Conservator alternative project manager or conservator would need to be found Charter boat operators – They would try to find stand-ins.	Unlikely to have cost implications unless stand-ins could not be found.	**KC**	
4	Insufficient objects recovered for reburial trial	**LOW**	**LOW to MEDIUM**	Reference to the finds database from the 2002 excavation shows that minimum numbers of reburial objects were obtained for each of the selected reburial classes – indicating the low risk level. If minimum numbers are not recovered for any reburial class then proxy (modern) material will be used for that material. Use of material from other sites could be considered.	No time or cost implications	**KC & IP**	

Risk no	Description	Probability	Impact	Countermeasures	Estimated time and cost	Owner	Updated
5	Finding human bone	**VERY LOW**	**LOW**	Only a single piece of animal bone was found in the 2002 excavation on the site. All the crew of *Colossus* got ashore safely from the wreck (with the exception of a single individual who fell overboard)	If human bone is found it is likely to be intrusive. If human bone is found a variation would be needed to undertake analysis.	**KC**	

Budget

Phase I Investigation CISMAS Expenses				
Item	**Detail**	**Number**	**Cost**	**Total**
Volunteer travel	PZ-IoS-PZ	10		
Charter boat	Dive charter boat	2		
Volunteer accommodation	Self-catering	10		
Volunteer subsistence	Food	10		
Equipment transport	Container on ferry and Islands transfer	1		
Dive air		9 divers		
Fuel for reaction dredge	Petrol (£1.50 per litre on Scilly)	10 ltrs/day for 12 days		
Insurance				
Equipment and survey supplies	Pump, dredge, containers, Terram, Sand bags and survey consumables			
TOTAL for Phase I CISMAS Expenses				

Phase I Breakdown of conservation costs (Reburial Trial)						
Task	**Who**	**Time**	**Rate**	**Cost**	**Overheads @25%**	**TOTAL**
Site work	I PANTER	5 days				
Condition assessment	I PANTER M FELTER	10 hrs. 30 hrs.				
Travel and Subsistence (assume accommodation provided by project	I PANTER					
Courier to return finds to site	Greenlink					
Geochemical and physical assessment of four sediment samples	Jones laboratory	2 days				
Porosity tests	I PANTER	4 hrs				
Oxygen free storage						
X-ray film/chemicals						
TOTAL (Ex VAT)						
TOTAL (Including VAT @ 20%)						

The above is a breakdown of the conservation costs as supplied by Ian Panter. Costs for carrying out the same work after 10 years could be in the region of £6500 + VAT, based on inflation rate of 5% over this period.

Phase II Monitoring and Survey CISMAS Expenses				
Item	**Detail**	**Number**	**Cost**	**Total**
Volunteer travel	PZ-IoS-PZ	7		
Charter boat	Dive charter boat	1		
Volunteer accommodation	Self-catering	7		
Volunteer subsistence	Food	7		
Equipment transport	Container on ferry and Islands transfer	1		
Dive air		6 divers		
Insurance				
Equipment and survey supplies	Control points, Terram, tags and survey consumables			
TOTAL for Phase II Monitoring and Survey CISMAS Expenses				

Reporting					
Unit Costs	**Name**	**Item**	**Per Day**	**Days**	**Cost**
Project Manager	KC	Post-processing		5	
Project Manager	KC	Other reporting (highlight reports, OASIS and archive)		0.5	
Project Manager	KC	Final report		5	
Conservator	IP	Final report		2	
Total Reporting					

Overheads	
Item	**Cost**
Staff Costs - KC post processing and reporting - 25% of 2730	
Specialist costs - Ian Panter reporting - 10% of 500	
NB YAT have already added overheads to their conservation costs	
Non staff costs – Phase 1 10% of 12,724	
Phase II 10% of 6350	
TOTAL Overheads	

Total Project Cost	
Phase	**Cost**
Phase I Investigation	
Marine Management Organisation License (probable fee)	
Conservation for reburial trial (YAT)	
Phase II Monitoring and survey	
Reporting – Project Reports	
Overheads	
TOTAL	

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