Wessex Archaeology

Aggregate Levy Sustainability Fund

Marine Aggregates and the Historic Environment

Wrecks on the Seabed R2
Assessment, Evaluation and Recording

Year 2 Report

Ref: 57454.03

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AGGREGATE LEVY SUSTAINABILITY FUND
MARINE AGGREGATES AND THE HISTORIC ENVIRONMENT

WRECKS ON THE SEABED R2:
ASSESSMENT, EVALUATION AND RECORDING

YEAR 2 REPORT

Prepared for:

English Heritage

By:

Wessex Archaeology
Portway House
Old Sarum Park
Salisbury
SP4 6EB

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The fieldwork was undertaken by Jens Auer and Labhaoise McKenna. This report was compiled by Jens Auer and edited by John Gribble. John Gribble managed this project for Wessex Archaeology. Head of Coastal and Marine, Antony Firth initiated the research proposal. The illustrations were prepared by Karen Nichols.

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1 INTRODUCTION

1.1 PROJECT BACKGROUND

1.1.1 Wessex Archaeology was commissioned by English Heritage to undertake a second round of the project 'Wrecks on the Seabed': Assessing, Evaluating and Recording', based on a project design (Wessex Archaeology 2005), submitted in February 2005. The project is supported by the Aggregate Levy Sustainability Fund (ALSF), distributed by English Heritage.

1.1.2 In Round 1 of the project, which was carried out by Wessex Archaeology between 2001 and 2004, a number of methodologies for the rapid assessment, evaluation and recording of wreck sites were successfully developed and tested.

1.1.3 Round 1 also included the development of a series of structured Recording Levels for wreck investigations. The recording scheme developed by Wessex Archaeology provides five levels of recording, each with different objectives corresponding to the levels of investigation. It is envisaged that these recording levels will be used by regulators, curators and industry, providing a common basis for briefs, specifications, project designs and method statements. A table showing the Recording Level scheme can be found in **Appendix A**.

1.1.4 Round 1 commenced with the interrogation of UKHO and other information sources to identify sites suitable for survey, using pre-determined selection criteria. A range of these sites were then subject to geophysical survey to produce baseline site data, using techniques including sidescan sonar, multibeam sonar, magnetometer, and sub bottom profiler. Altogether 17 targets between the Solent and Eastbourne were geophysically surveyed.

1.1.5 Nine of these sites were subsequently dived during Round 1, using an integrated acoustic tracking and purpose designed recording system. Three sites were recorded in detail to Level 2a/3a (Wessex Archaeology, 2003 and 2004).

1.1.6 Round 2 of 'Wrecks on the Seabed' commenced in 2005 and consisted of a geophysical section and a diving and remotely operated vehicle (ROV) section. During Year 1 of Round 2 aspects of geophysical surveys on deep water sites and area survey methods and the geophysical identification of ephemeral sites were examined (Wessex Archaeology, 2006a). Also during Round 2, Year 1 the diving and ROV section of the project dealt with the infrastructure of diving projects as well as the application of ROV survey methods on shallow wreck sites (Wessex Archaeology, 2006b).

1.1.7 These deep water geophysical surveys and the ROV work conducted on shallow sites served as the basis for the deep water ROV wreck surveys conducted in Round 2, Year 2 covered in this report

1.1.8 The deep water ROV surveys developed out of feedback received from the aggregate industry during Round 1 of the project in which the question of the applicability of the tested methods to sites in up to 60m of water was raised due to the possibility of the aggregate industry expanding its activities into deeper water in the future.

1.1.9 To assess whether the ROV survey methodologies developed during R2, Year 1 of the project could be applied to a deepwater environment, three unknown wreck sites in water depths between 50m and 60m were surveyed with multibeam sonar, sidescan sonar and magnetometer in Round 2, Year 1 as part of the geophysical section of the project (Wessex Archaeology 2006a). The acquired geophysical data was used as the basis for the ROV survey, and all three sites were subject to an ROV survey during Round 2, Year 2 aimed at achieving Level 2 or 3 site recordings.

1.1.10 This report is divided into a methodological section which discusses the individual deep ROV project objectives and a baseline section which outlines the archaeological results of the fieldwork. The archaeological results of the fieldwork are contained in **Appendix C**.

1.2 PROJECT AIMS AND OBJECTIVES

Project Aim

1.2.1 The aim of the 'Wrecks on the Seabed' project is to provide industry, regulators and contractors with a framework for the incremental, decision-oriented investigation of wreck sites and with guidance on their archaeological assessment, evaluation and recording.

1.2.2 Such a framework is particularly relevant when considering the cost and time implications for marine archaeological investigations. It is also important for developing effective communication between industry, regulators and contractors.

Project Objectives

1.2.3 The objectives of Round 2, Year 2 are:

- O5 Develop and refine methodologies for assessing, evaluating and recording sites in deeper water.
- O7 Assess the effectiveness of undertaking archaeological recording (to Levels 2 and 3) using ROV and geophysical techniques only.
- O8 Assess environmental issues (e.g. depth, distance from port, fetch) in respect of working on sites in deeper water.
- O9 Assess infrastructure issues (e.g. anchoring, tow cable handling, umbilical handling) in respect of working on sites in deeper water.

Study Area

1.2.4 The study area is located ca. 30km offshore in an area between St Catherine's Point on the Isle of Wight in the west and Shoreham in the east (**Figure 1**). The ports of Shoreham and Cowes on the Isle of Wight were used as supply bases and for shelter in bad weather.

1.2.5 The seabed in the study area is made up of a thin layer of mobile sediment overlying tertiary clay and sand (Hamblin et al. 1992).

1.2.6 In the west of the study area the mobile sediment on the wreck sites consisted mainly of gravel and shells underlain by chalk. In the East of the study area, sand and silty sand prevailed.

1.2.7 The water depths measured on the sites varied between 50m and 60m.

Study Sites

1.2.8 Three deepwater sites that were subject of geophysical survey in Year 1 of Round 2 were chosen as study sites for the 2006 ROV survey (**Figure 1**). These were:

WA ID	**Wreck Name**	**Position WGS84**	**Depth m CD**	**Type**
1001	Unknown	50° 23.389 N 00° 54.838 W	58	Identified by ROV fieldwork as B-24 bomber (WA 2006)
1002	Unknown	50° 36.286 N 00° 18.958 W	60	Vessel, iron or steel
1003	Unknown,	50° 26.628 N 00° 33.954 W	53	Identified by ROV fieldwork as U-86 (WA 2006)

1.2.9 All three study sites were listed as unknown wrecks in the UK Hydrographic Office (UKHO) wreck database. Wreck **WA 1001** was described as a small and possibly intact wooden wreck, **WA 1002** was listed as a vessel on its starboard side with two masts alongside on the seabed and **WA 1003** was described as a largely intact wreck with two possible masts.

1.2.10 On the basis of the UKHO records, basic documentary research and the geophysical survey results of Round 2, Year 1 a preliminary identification of the sites was attempted. This is outlined in **section 4.3** of the geophysical fieldwork report (Wessex Archaeology 2006a).

2 FIELDWORK OVERVIEW

2.1.1 The deepwater ROV survey took place between the 11 May 2006 and the 23 May 2006. The survey was carried out from the diving support vessel *Sara*

Maatje XV. Two WA employees acted as archaeological supervisor and recording system operator. The ROV operator was provided by Subsea Vision Ltd.

2.2 WORK SUPPORT VESSEL

2.2.1 The *Sara Maatje XV* is a survey, supply and support ship operated by Van Stee Survey and Supply bv of Harlingen in the Netherlands. The vessel has a length overall of 36m, a beam of 7m and a 1m draft. The general layout of the vessel can be seen in **Figure 2**.

2.2.2 *Sara Maatje XV* is equipped with two 300hp main engines, one 500hp Schottel (directional propeller) and a 120hp bowthruster, which provide excellent manoeuvrability.

2.2.3 The vessel has a 136m² wood covered working deck equipped with a hydraulic double drum winch for anchoring and a 80t/mtr deck crane.

2.2.4 It provided accommodation for 10 people in five cabins and was equipped with heads, showers, a large messroom and a galley. Water for approximately ten days could be stored in a $13m^3$ fresh water tank. Three different generators provided 450V AC, 240V AC, 24V DC and 12V DC power supply on board.

2.2.5 The WA ROV equipment was set up in the large survey office in the wheelhouse.

2.3 MOORING SYSTEM

2.3.1 Throughout the ROV session *Sara Maatje XV* was moored on a three point mooring above the wrecks to be surveyed.

2.3.2 Generally one of the vessel's bow anchors was deployed in conjunction with two 500kg anchors at the stern. The large freefall winch on deck was used for handling the two stern anchors.

2.3.3 For the mooring procedure, the wreck position was input in the vessel's navigation software. On arrival on site the position was confirmed with the echosounder, before the mooring started.

2.4 ROV DIVING OPERATIONS

2.4.1 The ROV and ROV operator were supplied by Subsea Vision Ltd. A Seaeye Falcon ROV was used throughout the project.

2.4.2 The Seaeye Falcon measures 1m x 0.5m x 0.6m and weighs 50kg. Four vectored vertical thrusters and a single horizontal thruster provide a maximum forward speed of more than 3 knots (**Figure 3, Plate 1**).

2.4.3 The ROV was fitted with a Tritech Typhoon Zoom video camera, a Tritech Tornado Low Light Monochrome video camera and three 75 watt lights.

2.4.4 In addition, a Kongsberg oe14-208 underwater digital stills camera (a Canon Powershot G5 in a Kongsberg housing) with oe11-202 flashgun and a Tritech ISS scaling camera were mounted on an under-slung module for some dives.

2.4.5 The digital stills camera could be operated through a Graphical User Interface (GUI) on a surface computer which gave full control of all camera settings. The captured images were temporarily stored in the on-board memory of the camera and were then downloaded on the surface.

2.4.6 The Tritech Image Scaling System (ISS) consists of a PAL colour zoom video camera with six lasers. Four of these lasers provide parallel beams, while two lasers are mounted at predefined angles to provide reference points. To measure an object, a video screen capture has to be taken with the lasers pointed at the object. The screen capture is then imported into the ISS-SOFT package after the dive, where the image can be analysed and measurements can be taken (**Figure 5**). Depending on the image quality and camera angle, millimetric accuracy can be achieved.

2.4.7 The ROV was equipped with forward scanning Tritech Mini King sonar for navigation, a built in fluxgate compass and a digital depth gauge. Information from these instruments could be displayed over the video output.

2.4.8 The surface controls consisted of the main ROV surface unit, a hand controller with joystick, a screen, two PCs for sonar display and digital stills camera control and a Sony digital video capture unit (**Figure 3, Plate 2**). Video was recorded on miniDV tapes.

2.4.9 The ROV surface unit was installed in the survey office in the wheelhouse. A communication system allowed direct communication between ROV pilot in the wheelhouse and umbilical tender on deck. The ROV was launched and tendered by the crew of *Sara Maatje XV* (**Figure 6**).

2.5 THE ACOUSTIC TRACKING SYSTEM

2.5.1 As in the Round 2, Year 1 fieldwork session, the Ultra Short Baseline (USBL) SCOUT acoustic tracking system from Sonardyne was used to track the ROV.

2.5.2 The SCOUT system consists of three main components: the vessel mounted acoustic transceiver, one or more ROV or diver mounted transponders and the surface command module running the control software.

2.5.3 In a USBL system, the position of subsea targets is calculated by measuring range and bearing from the vessel mounted transceiver to the submerged transponder, which emits acoustic signals.

2.5.4 In a short baseline system, only one transducer (transponder on the seabed) transmits sound, but many transducers on the surface receive signals. In a USBL system such as SCOUT this array of transducers is built into a single transceiver assembly. The baselines between the individual transducers are very (ultra) short, usually in the range of centimetres.

2.5.5 The waterproof and portable surface command module running the SCOUT USBL software was installed in the wheelhouse **(Figure 4, Plate 1)**. The SCOUT USBL transceiver was mounted on a custom-made pole over the port side of *Sara Maatje XV*. In order to provide maximum stability for the transceiver the pole had a diameter of 8cm and was attached to a bracket welded onto the rail and supported by another bracket further down the ship's side. In addition the pole was supported by lines fore and aft. The pole could be retracted when *Sara Maatje XV* was in passage **(Figure 4, Plate 2)**.

2.5.6 SCOUT's very light and rugged Type 7815 HF transponders could easily be attached to the ROV **(Figure 4, Plate 3)**.

2.5.7 The transponder worked on frequencies between 35 and 55kHz. The stated operating range for the system was 500m and the acoustic coverage was ± 90 degrees below the transceiver.

2.5.8 Even when moored, a vessel yaws, pitches and rolls. As the calculated diver or ROV position is based on the transceiver position, this movement introduces inaccuracies into the positioning and has to be compensated for. The SCOUT system allows tracking in two modes: either the internal heading and attitude sensor within the transceiver can be used for compensation; or an external Motion Reference Unit (MRU) and a gyrocompass can be used to compensate for vessel movements.

2.5.9 Using the system on internal sensors is easier, as no external instruments have to be configured, but this decreases the stated accuracy of the system from ± 0.5% of the slant range to ± 2.75% of the slant range.

2.5.10 To obtain maximum accuracy, an external gyrocompass and an external MRU were installed on *Sara Maatje XV*.

2.5.11 The TSS HRP-10 MRU was fitted forward below in the vessel. X, Y and Z offset values to the transceiver were entered in the SCOUT software.

2.5.12 The SG Brown Meridian Surveyor gyrocompass was installed in the wheelhouse and positioned exactly parallel to the vessel's lubber line.

2.5.13 Positioning was provided by a Trimble Pro XR dGPS unit. The GPS antenna was installed on top of the wheelhouse and the offsets to the transceiver were entered into the SCOUT command module.

2.6 THE RECORDING SYSTEM

2.6.1 Since 2002 Wessex Archaeology has been refining a Microsoft Access based diver recording system known as 'DIVA' which it developed to manage and record archaeological diving operations. DIVA can be used for real time recording of three-dimensional positions and information in conjunction with ESRI ArcGIS 9.0, and consists of a Microsoft Access database which stores the information, and a GIS interface for graphic display. The system has been used throughout the 'Wrecks on the Seabed' project.

2.6.2 The position of the ROV or diver being tracked is output from the Sonardyne SCOUT surface command module in real world co-ordinates and can consequently be displayed in real time on top of geophysical survey data in ArcGIS 9. The vehicle or diver track can also be displayed and saved separately.

2.6.3 To allow seamless integration with the previously acquired geophysical survey data, Universal Transverse Mercator (UTM) coordinates, based on the WGS84 datum and the WGS84 ellipsoid were used for display and recording. The targeted wrecks were located in UTM zone 30.

2.6.4 A laptop running DIVA and ArcGIS was set up in the wheelhouse, so that the recording system operator could see the screens showing the underwater footage being collected by the ROV.

2.6.5 Observations recorded from the ROV video feed were entered into the database by the recorder. These observations, stored in the DIVA database, included the three-dimensional position, comments typed in by the recorder, and mapping labels for display in the GIS system.

2.6.6 Observations were taken as quick, but less accurate spot fixes, or as average fixes. Average fixes obtain a number of positions over a short period of time and calculate an average position for the diver or tracked vehicle using a software application developed by WA and known as Accu-fix. The more accurate average fixes were generally used for recording datum points and important features on the wrecks.

2.6.7 Observations can be displayed as different layers in ArcGIS grouped, for example, by mapping labels, observation type, etc.

2.6.8 A summary form allows the archaeological supervisor to summarise individual dives, whole events and monuments. The recorder can also enter archaeological, environmental and operational summaries. Paper records such as drawings can be referenced to individual observations.

2.6.9 A general log allows the archaeological supervisor to keep track of daily events, working hours, weather forecast and tidal predictions.

2.6.10 With the exception of a few bug fixes and minor alterations, the DIVA recording system remained unchanged from Round 2, Year 1.

2.7 FIELDWORK SUMMARY

2.7.1 *Sara Maatje XV* was mobilised on 10 May 2006 in Shoreham. The acoustic tracking system was installed and secondary instruments such as GPS and gyrocompass measured in. After loading and setting up the ROV equipment, the USBL system was tested in Shoreham harbour.

2.7.2 Work on the first site commenced on 11 May 2006.

2.7.3 Altogether 12 ROV dives were conducted on three different sites in 13 days, although seven days were down days due to strong winds (above force 6).

The total bottom time for the 12 conducted dives is 652 minutes, or 10.86 hours. The table below provides further details of the sites dived and recorded:

WA ID	Wreck Name	Dive Days	Down Days	No of Dives	Bottom Time/min
1001	*Unknown B-24 bomber*	1	-	2	99
1002	*Unknown steamship*	2	-	5	262
1003	*U-86*	3	-	5	291

3 METHODOLOGY

3.1 O5: DEVELOP AND REFINE METHODOLOGIES FOR ASSESSING, EVALUATING AND RECORDING WRECK SITES IN DEEPER WATER.

3.1.1 Building on the experiences with ROV surveys made in Year 1 of Round 2 of the project, the same basic methods were employed for the deepwater ROV survey (Wessex Archaeology 2006b). The Seaeye Falcon ROV was bigger and slightly more powerful than the Seaeye 600 used the previous year, but proved to be very similar in terms of handling and the ability to cope with current.

3.1.2 It was found that dives could be conducted in currents of up to one knot, which limited the working time to slack-water periods. The ROV was tracked using the SCOUT system, which generally performed well and reliably. However, as described in the Year 1 report (Wessex Archaeology 2006b), due to a lack of seabed references the achieved accuracy is hard to quantify.

3.1.3 A combination of Wessex Archaeology's DIVA recording database and the ESRI ArcGIS 9.0 GIS package was used for recording observations. The ROV position established by the tracking system was displayed over geo-referenced geophysical data acquired in Round 2, Year 1 of the project. Observation points generated by the recording system operator were saved with a label and description in the DIVA database. Points could be generated either as less accurate simple fixes for general observations or as averaged co-ordinates for important features.

3.1.4 All dives were recorded on miniDV tapes from start to end. In addition to the standard low light and colour camera, the ROV was also equipped with a digital stills camera with flashgun and with a Tritech laser scaling camera. These cameras were used to overcome two of the main problems encountered during the shallow ROV survey in Year 1 of the project: the inability to obtain high resolution stills images; and to measure features on the seabed.

3.1.5 As in Year 1 of the project, the aim was to record sites to Level 2, the general objective being to establish the extent, character, date and importance of each site. In addition, the fieldwork also aimed to investigate the potential for achieving limited Level 3 recording using an ROV (**Table 1**).

3.1.6 As the quality of the geophysical background data was insufficient for survey planning due to the depth of the wreck sites (Wessex Archaeology 2006a), the first dive was spent locating the site, obtaining a general overview and establishing the type of site.

3.1.7 The subsequent dives were conducted to confirm the wreck extents by following the outer edges of the wreck site. Debris and artefact scatters were mapped and marked, either with observation points in the GIS or on sketch plans of the sites.

3.1.8 With the wreck outline defined, a thorough flyover survey was used to gather information about the character and condition of the site. The positions of diagnostic features were marked with observation points in DIVA and on a sketch plan.

3.1.9 The next recording stage was designed to take the acquired record from a Level 2 evaluation to Level 3 *in situ* recording. This was achieved by selecting diagnostic features that could be used to extract information on site date, character or importance, and recording them in as much detail as possible using the scaling camera and the underwater stills camera on the ROV.

3.1.10 Using the same techniques as in Round 2, Year 1 of the project, the video footage was reviewed after the completion of diving on each site. Important scenes were captured and catalogued as iMovie projects in iMovie software on a Power Mac G5. During the process of video reviewing, site sketches and descriptions could be corrected and then finalised. Short movies showing the key elements of each site were compiled in the field (**Appendix B**).

3.1.11 The information gathered during each dive was recorded in the DIVA diving summary. Once diving on a site was completed this information was also summarised on an event and monument basis, suitable for inclusion in the National Monuments Record.

3.1.12 The following table sets out the operational steps of the survey methodology described above:

Step	Activity
1	Review geophysical data
2	Review available documentary data
3	Locate site, obtain general overview and establish site type
4	Establish site extents. Map debris and artefact scatters
5	Flyover to establish character and condition, and to locate and map diagnostic features
6	Detailed recording of diagnostic features

7	Review video/stills. Revise site sketches and descriptions
8	Summarise data
9	Output revised monument and event records

3.1.13 The relationship of these operational steps to the recording levels can be expressed as follows:

Level 1	Level 2	Level 3
Objective: A record sufficient to establish the presence, position and type of site	**Objective: A record that provides sufficient data to establish the extent, character, date and importance of the site**	**Objective: A record that enables an archaeologist who has not seen the site to comprehend its components, layout and sequences**
Step 1 - Review geophysical data	Step 1 - Review geophysical data	Step 1 - Review geophysical data
Step 2 - Review available documentary data	Step 2 - Review available documentary data	Step 2 - Review available documentary data
Step 3 - Locate site, obtain general overview and establish site type	Step 3 - Locate site, obtain general overview and establish site type	Step 3 - Locate site, obtain general overview and establish site type
	Step 4 - Establish site extents. Map debris and artefact scatters	Step 4 - Establish site extents. Map debris and artefact scatters
	Step 5 - Flyover to establish character and condition, and to locate and map diagnostic features	Step 5 - Flyover to establish character and condition, and to locate and map diagnostic features
		Step 6 - Detailed recording of diagnostic features
Step 7 - Review video/stills. Revise site sketches and descriptions	Step 7 - Review video/stills. Revise site sketches and descriptions	Step 7 - Review video/stills. Revise site sketches and descriptions
Step 8 - Summarise data	Step 8 - Summarise data	Step 8 - Summarise data
Step 9 - Output revised monument and event records	Step 9 - Output revised monument and event records	Step 9 - Output revised monument and event records

3.1.14 This survey approach was used for all three study sites. However, with generally very low visibility and strong tidal currents on the sites, a high degree of flexibility proved to be necessary. Rather than strictly following the outlined survey process, video flyovers had to be conducted whenever the visibility was good, while detailed recording of individual features and the confirmation of the site extents could also take place in low visibility conditions. In many instances, tidal currents restricted ROV work to one side of a wreck or to a specific area on the site. In many cases planned survey tasks had to be altered once the ROV reached the seabed and the conditions on site became apparent. It is important therefore to remain flexible and be able to adapt the survey methodology to the varying environmental conditions and physical constraints of the site under investigation.

3.2 O7: ASSESS THE EFFECTIVENESS OF UNDERTAKING ARCHAEOLOGICAL RECORDING (TO LEVELS 2 AND 3) USING ROV AND GEOPHYSICAL TECHNIQUES ONLY.

3.2.1 When assessing the effectiveness of archaeological recording using geophysical techniques and ROV only, the levels of recording provide a useful reference system (**Appendix A**).

3.2.2 Using only the sidescan, multibeam and magnetometer data acquired on the three study sites in Year 1 of Round 2 of 'Wrecks on the Seabed', partial Level 1b recording can be achieved. The presence, position and the basic dimensions of each site were apparent from the data, but the available information was not sufficient to establish the type of site, e.g. wooden shipwreck, metal shipwreck, aircraft, etc.

3.2.3 The results presented in the geophysical report for Round 2, Year 1 (Wessex Archaeology 2006a), also demonstrated that even in conjunction with basic documentary research, the geophysical data did not provide enough evidence to attempt an identification of the study sites.

3.2.4 One of the conclusions of the diving and ROV fieldwork report of Round 2, Year 1 was that it proved to be generally possible to achieve Level 2 recording of shallow wreck sites using a combination of geophysical survey and ROV diving, provided there was an acceptable level of underwater visibility (Wessex Archaeology 2006b). A Level 2 record provides sufficient data to establish the extent, character, date and importance of a site.

3.2.5 Applying the methodology outlined in the previous chapter to this year's fieldwork has proved that this also holds true for deep wreck sites.

3.2.6 During Year 1 of the project a Level 3 record of the study sites could not be achieved using the ROV and additional diving work became necessary. A number of limiting factors that prevented partial or full Level 3 recording were outlined in the Year 1 fieldwork report (Wessex Archaeology 2006b). These included the inability to take high resolution underwater pictures and the absence of any means of scaling objects on the seabed.

3.2.7 Both of these points were addressed during the current fieldwork session. The Kongsberg oe14-208 underwater stills camera with flashgun mounted on the ROV allowed taking high resolution digital pictures of objects on the seabed. While the effective use of the camera was limited to close-up and macro shots because of the limited visibility on the three deep sites (**Figure 5, Plate 1**), this solution would be ideal in good underwater visibility.

3.2.8 The Tritech ISS scaling camera allowed accurate measurements to be taken of objects on the seabed, as long as the five laser beams could be pointed straight at the feature to be measured. Although the absolute accuracy of this system is hard to quantify, comparisons with contemporary ship plans on site **WA 1003** showed that the achieved accuracy was at least centimetric. The scaling camera worked well, even in low visibility conditions (**Figure 5, Plate 2**).

3.2.9 Using the above technologies, at least partial Level 3 recording could be achieved under the prevailing conditions.

3.2.10 Other problems and limiting factors identified during Year 1 also affected the deepwater survey. These include visibility, tidal current, access and marine growth.

3.2.11 Visibility proved to be the single biggest limiting factor when carrying out archaeological recording with an ROV only. The general underwater visibility on the study sites varied between 0.5m and 2m. Rather than being related to the water depth the visibility was related to prevailing weather and sea conditions, and according to local divers it was not typical for the time of the year the survey was undertaken.

3.2.12 The limited visibility made orientation on site as well as video flyovers very difficult and in some cases almost impossible. Tasks that would normally have taken a single ROV dive, like establishing the extents of a site, required up to three dives.

3.2.13 The size of the ROV made it necessary to mount the underwater stills camera and the flash very close to each other. Due to the amount of suspended particles in the water, this created problems with backscatter when taking pictures from any distance (**Figure 5, Plate 1**). Unless macro pictures were taken, the quality of the digital stills proved to be insufficient for recording purposes and the digital stills camera was eventually taken off the ROV. Even the use of the standard PAL colour camera became problematic, and very often the low-light B&W camera had to be used for orientation and flyovers.

3.2.14 However, while diving had to be aborted in underwater visibility of less than 2m on site **WA 5006** in Round 2, Year 1 of the project, all three sites could be dived in the 2006 fieldwork session regardless of visibility. The reason for this was primarily the skill of the ROV pilot and his experience with shipwreck surveys.

3.2.15 Strong tidal currents were encountered on all study sites. On site **WA 1001**, the tide never slackened at all and just turned. Even though the anchoring above each site was very precise (see **Section 3.4**), fairly extensive lengths of umbilical were required for the ROV to reach the sites in 60m of water. The umbilical was heavily affected by the tide, and it became difficult to control the ROV and keep it stable. This meant that certain areas on a site could not be reached on every dive and a high degree of flexibility was necessary as survey plans had to be adapted to the underwater conditions encountered on each dive.

3.2.16 As noted in the Round 2, Year 1 fieldwork report, it can be very difficult to get access to confined or overhead environments on wreck sites using the ROV. This was particularly apparent on site **WA 1002**, a coherent iron or steel vessel lying on its side. The angle of the wreck made access to the inside and upper deck difficult, so that the propulsion of the vessel could not be determined during the survey.

3.2.17 **WA 1002** was also covered in dense marine growth. As the ROV lacks the capability to remove such growth, this had an impact on identifying and distinguishing features on the site.

3.2.18 Despite the issues described above, this project has proven that partial Level 3 recording of shipwrecks is possible in 50-60 metres of water, using a small survey class ROV such as the Seaeye Falcon equipped with a scaling camera and a digital stills camera. However, the environmental conditions on the study sites can have a great impact on the survey efficiency and time. A degree of underwater visibility, acceptable tidal currents, a relatively low level of marine growth on the wreck and unrestricted access to all areas of interest on the site are necessary for a fast and efficient ROV survey.

3.2.19 Even under the prevailing conditions in the study area at the time, it was possible to carry out recording to Level 2, and in some cases even Level 3, in a relatively short period of time. **WA 1003** was surveyed to a partial Level 3, although more time on site would have been desirable. Sites **WA 1001** and **WA 1002** were surveyed to a partial Level 2. Limitations on fully attaining the desired recording levels were the bad visibility, the high level of marine growth and the restricted access on site **WA 1002** and the limited survey time due to weather on site **WA 1001**.

3.3 O8: ASSESS ENVIRONMENTAL ISSUES (E.G. DEPTH, DISTANCE FROM PORT, FETCH) IN RESPECT OF WORKING ON SITES IN DEEPER WATER.

3.3.1 In terms of environmental issues, the deepwater study area proved to be very similar to the shallower study area in Round 2, Year 1 of the project. The distance from port necessitated the use of a larger working vessel with live-aboard accommodation. The general exposure and weather and sea conditions were very similar to those experienced in Year 1. With the ship moored several hours away from the next safe port, the weather had to be monitored constantly to allow enough time to reach a port in case of sudden weather changes.

3.3.2 The environmental underwater conditions experienced on the study sites were not typical for the area or depth of water, but were the result of the unusual gales experienced in late May throughout the UK and the English Channel. According to local divers, the underwater visibility around the Isle of Wight is generally very good in May.

3.3.3 One noticeable difference on the deepwater study sites was the absence of lobster and whelk pots as well as local fishing vessels, sport fishing boats and sport divers. During Round 2, Year 1 of the project, fishing gear caused a number of problems when attempting to anchor over some of the shallow study sites.

3.3.4 Two of the study sites, **WA 1001** and **WA 1003**, were located in the deepwater shipping channel. As anchoring on these sites on a three point mooring was potentially dangerous, especially in conditions of low visibility, a Notice to Mariners was put out before the fieldwork commenced. In addition the *Sara Maatje XV* broadcast a Securité message every hour while moored on site. At night the vessel moved to a safer position just outside the shipping channel.

3.3.5 Despite these measures, a number of individual ships had to be asked to give a wider berth. On one occasion thick sea-fog made anchoring in the channel too dangerous and diving had to be delayed until the fog lifted.

3.3.6 These environmental issues were related to the location of the sites in a shipping channel rather than to the depth of water and would also apply to sites in a similar location in shallow water.

3.4 O9: Assess infrastructure issues (e.g. Anchoring, ROV Umbilical handling) in respect of working on sites in deeper water.

3.4.1 When assessing infrastructural issues in respect of working on sites in deeper water, anchoring and umbilical handling suggested themselves as two potentially important factors to consider. Establishing position above the shallow study sites with *MV Flatholm* in Year 1 proved to be a lengthy and difficult procedure which damaged the sites in a number of cases (Wessex Archaeology 2006b). The problems encountered could be attributed to three main factors:

- Unsuitable winches on the support vessel
- Unsuitable anchors
- Inexperienced crew

3.4.2 In contrast, the anchoring in the Round 2, Year 2 fieldwork session proved to be very straightforward despite the much greater water depth. Using a single bow anchor and two 500kg stern anchors, the vessel was generally secured exactly above the wreck within 30 minutes to an hour. On only one occasion did *Sara Maatje XV* have to be re-anchored several times as the chalk seabed caused the anchors to drag. However, no slack tides were lost to anchoring and the vessel was always securely moored in time for diving.

3.4.3 This can be ascribed to a number of different factors. With the Schottel and bow thruster, *Sara Maatje XV* was far more manoeuvrable than *Flatholm*. In addition, the twin drum stern winch on *Sara Maatje XV* was designed for anchoring and had freefall capabilities, so that the stern anchors could be dropped rather than lowered to the seabed. Perhaps most importantly, however, the skipper and crew of *Sara Maatje XV* were very experienced and acted with a high degree of professional skill.

3.4.4 According to the crew of *Sara Maatje XV*, the depth of water on the study sites was not an issue and made no big difference in terms of anchoring.

3.4.5 In the Round 2, Year 1 fieldwork session, the ROV was tendered by WA personnel. This interrupted the recording procedure as constant attention to the umbilical was necessary. The ROV pilot in Year 1 suggested a Tether Management System (TMS) as a possible solution to this problem.

3.4.6 When asked during the tendering process, Subsea Vision Ltd. stated that a TMS could be employed, but would be unnecessary for the type of survey planned. With this in mind it was decided to hire the Seaeye Falcon ROV with a conventional umbilical rather than a TMS.

3.4.7 During this year's fieldwork session, umbilical handling as well as ROV launch and recovery were undertaken by the crew of *Sara Maatje XV*. A direct intercom link between ROV pilot and tender on deck allowed effective communication and the WA personnel were free to concentrate on the recording tasks (**Figure 6, Plate 1**).

3.4.8 In operational terms the umbilical handling and ROV launch and recovery procedures were very similar. The ROV was launched and recovered with the deck crane and tendered manually (**Figure 6, Plate 2**).

3.4.9 As with the anchoring the most noticeable difference was the general helpfulness and efficiency of the crew of *Sara Maatje XV*.

4 CONCLUSIONS

4.1.1 Following on from Year 1 of Round 2 of 'Wrecks on the Seabed', Year 2 aimed at further developing and testing methodologies for the rapid assessment, evaluation and recording of wreck sites, specifically through the ROV survey of sites in deep water.

4.1.2 The Year 2 fieldwork consisted of a 15 day ROV session. Three study sites were visited all of which had been subject to geophysical survey in Round 2, Year 1 of the project.

4.1.3 The intention was to record each of these sites to Level 2a or 3, with the aim of developing methodologies for the use of ROVs on deep water sites and to assess the effectiveness of archaeological recording using ROV and geophysical techniques only. In addition, infrastructural and environmental issues related to working on sites in deeper water were to be assessed.

4.1.4 When looking at the methodologies for assessing, evaluating and recording wreck sites in deeper water, it was found that the general approach to the ROV survey did not differ very much from the approach taken on the shallow sites. However a few alterations to the survey plan had to be made:

- The fairly low quality of the geophysical background data required that additional dives were necessary to obtain a general overview of the site and establish the type of site.

- The use of a digital stills camera and the Tritech ISS scaling camera increased the scope for raising the recording from Level 2 to Level 3. This was successfully accomplished on one site.

- Generally, the adverse underwater conditions on site necessitated a high degree of flexibility in the survey procedures.

4.1.5 Objective 7 dealt with assessing the effectiveness of undertaking archaeological recording using ROV and geophysical techniques only. It became apparent that using the geophysical data only, partial Level 1 recording was possible. While presence and position of the sites could be established, the available information was not sufficient to determine the type of site.

4.1.6 Applying the methodology outlined in **section 3.1**, all deep wreck sites could be recorded to Level 2. The use of a scaling camera and a digital stills camera on the ROV allowed partial Level 3 recording, even in the low visibility conditions and strong currents experienced on the study sites.

4.1.7 However, it was found that the four main factors limiting survey efficiency that were identified during the shallow water ROV survey in Year 1 also affected the deepwater survey. These were:

- visibility,
- tidal current,
- access and
- marine growth.

4.1.8 The poor visibility experienced on all of the deep wreck sites made underwater orientation and video recording very difficult. It also limited the use of the underwater stills camera due to the backscatter effect. Most importantly, the planned timescales for all recording tasks had to be changed as even simple tasks took substantially longer. Despite of this, it proved to be possible to carry out the required recording, to a large extent due to the skill and experience of the ROV pilot.

4.1.9 The strong tidal currents experienced on all sites limited diving to the slack-water periods and made it difficult to control the ROV. Again the survey efficiency depended mainly on the skill and experience of the ROV operator and on a high degree of flexibility in the survey planning. The problems of access to enclosed areas on coherent wrecks and dense marine growth preventing the identification and recording of features are indicative for ROV surveys in all environments and have to be accepted as general limitations.

4.1.10 No environmental issues relating specifically to the location of the sites in deeper water could be identified, as the conditions experienced were related to the time of year and the unusual general weather conditions rather than to the location of the sites in deeper water.

4.1.11 When assessing issues related to infrastructure, the choice of support vessel was found to be a critical factor. Using *Sara Maatje XV*, none of the problems identified during the Year 1 survey were encountered. The vessel was equipped for establishing three- or four point moorings and the crew was very skilled and experienced. The mooring procedure on each wreck site took an average of 30 minutes and the vessel was generally secured directly above the wreck. ROV umbilical handling was carried out by the crew and did not pose any additional problems.

4.1.12 Altogether the project has improved the knowledge necessary for specifying and conducting rapid and efficient deepwater ROV wreck surveys in areas with conditions similar to the English Channel.

4.1.13 All the wrecks investigated in the course of this project are described in detail in **Appendix C**.

5 PROJECT SUMMARY: ROUND 2, YEARS 1 AND 2

5.1.1 The non-geophysical objectives of Round 2 of the 'Wrecks on the Seabed' project related to the following categories:

- Infrastructure
- ROVs in Archaeology
- Intrasite Survey

Infrastructure

5.1.2 The infrastructure aspect of the project was intended primarily to establish the ideal vessel size for rapid and cost-efficient archaeological diving and ROV surveys. To do this, a large workboat with live-aboard facilities was used as the diving support vessel for the ROV and diving work during Round 2. While some of the shallow wreck sites in Round 2, Year 1, could potentially have been dived from a smaller vessel, this was not an option for the deeper, more remote and exposed study sites in Year 2.

5.1.3 The use of a larger vessel during Round 2 was found to have several advantages over the small vessel used in Round 1:

- It proved possible to access all study sites, even those that could not be worked on from a smaller vessel in Round 1 of the project due to weather or ground conditions. Anchored on a four-point mooring, the vessel could hold position over a site even in unfavourable weather conditions.
- The more stable platform allowed more accurate acoustic diver tracking and sensitive equipment could be set up and stored more safely.
- The average bottom time for divers could be increased substantially, ROV dive times could be maximised, and weather and travel downtime could be greatly reduced.

5.1.4 Establishing a secure four point mooring over a wreck without interfering with the site was however found extremely difficult and time-consuming with the support vessel used in Year 1 of Round 2. The difficulties were partly related to the vessel type but also to the experience of the vessel crew.

5.1.5 This became clear in Year 2 of Round 2 when a different large support vessel was used to conduct the ROV survey on deep wreck sites. Even though the sites were more exposed, much deeper and the holding ground was difficult, the anchoring was fast and straightforward and wreck sites were not impacted. The main reasons for this were the type of gear the vessel was equipped with and the extremely experienced and efficient crew.

5.1.6 In choosing a support vessel therefore it is essential to make sure that the vessel is equipped for multi-point moorings and that the crew is experienced in establishing moorings and holding positions without interfering with sensitive sites on the seabed.

5.1.7 The greater water depth over the study sites in Year 2 did not present any problems in terms of the chosen infrastructure.

ROVs in Archaeology

5.1.8 In the ROV-related portions of Round 2 the methodologies for the use of ROV's for wreck site assessment, evaluation and recording were developed. In addition, ROV- and diver-based methods for rapid wreck surveys were compared. In Year 2 the application of the methods developed in Year 1 to deeper wreck sites was assessed.

5.1.9 Using the ROV in conjunction with a Sonardyne Scout USBL tracking system and WA's DIVA recording system the following methodological approach for archaeological wreck surveys was developed:

- Making us of the available geophysical base data, the first ROV dives were spent locating the site and confirming the extents by moving around its outer edges. In this stage artefact scatters and debris fields can also be located.

- The wreck extents are either mapped digitally with observation points or sketched over prints of sidescan or bathymetric data.

- The next step is a thorough flyover survey of the wreck to get an impression of site character and condition and identify diagnostic features.

- During the final recording stage selected diagnostic features are recorded in detail using the video camera and if available a digital stills camera for detailed close-up photographs and a scaling camera to obtain dimensions.

5.1.10 This basic methodological approach allows at least partial Level 3 recording based on a combination of geophysical survey data and ROV survey.

5.1.11 When assessing the use of ROV instead of diver-based methods, it was found that the ROV was an efficient mechanism for the rapid survey of large wreck sites.

5.1.12 However, four factors were found to severely limit ROV survey efficiency: tidal currents, visibility, access and marine growth. Of these, only tidal currents limit divers to the same extent as ROVs.

5.1.13 Strong tidal currents affect the ROV's ability to perform underwater. However, this project has found that survey efficiency in tidal currents can also depend to a large extent on the individual skill and experience of the ROV pilot or diver.

5.1.14 Low visibility makes underwater orientation and video recording very difficult and limits the use of an ROV mounted digital stills camera. While divers can use their sense of touch to navigate around sites, the ROV lacks this capability. However, in Year 2 of the project underwater recording on the deep wreck sites proved to be possible despite very low visibility, mainly because of the skill and experience of the ROV operator.

5.1.15 While access to enclosed areas of sites and the removal of marine growth are possible for divers, they have to be accepted as a general limitation for ROV surveys.

5.1.16 Altogether, the results of Round 2 demonstrate that while partial Level 3 recording is possible with the ROV as a stand-alone tool, an idealised scenario would be the combined use of ROV and divers. The time consuming task of obtaining an overview of a wreck and defining its extents is most efficiently carried out by the ROV, allowing divers to concentrate on the detailed recording of selected elements which are not as effectively recorded using the ROV.

5.1.17 The greater water depth of the Year 2 study sites did not present new problems and no changes to the general ROV survey approach were necessary. Given the water depth, diver-based approaches, as an alternative or supplement to the ROV would not have been possible except through a very large increase in infrastructure and costs.

Intrasite Survey

5.1.18 As part of the intrasite survey aspect of the project, the Sonardyne Scout USBL shallow water acoustic tracking system was used to track divers and the ROV. The system was found to have a low repeatability from dive to dive, but achieved sufficient accuracy for Level 2a surveys during single dives. Recent use of the system in conjunction with an RTK GPS rather than a DGPS showed that repeatability as well as accuracy are mainly GPS related.

5.1.19 The integration of the acoustic tracking with the WA recording system DIVA and the ESRI ArcGIS 9.0 GIS package greatly reduced post-processing times and facilitated decision making in the field.

5.1.20 Video and still photographic methods were developed further and experiments with different camera and lighting systems helped to find the best camera and strobe settings for the shallow study sites.

5.1.21 Using the information collected during Round 2 of 'Wrecks on the Seabed', the WA Levels of Recording were refined during Year 1. No further revision has been considered necessary as a result of Year 2. The current Recording Levels can be found in **Appendix A**.

6 THE APPLICATION OF 'WRECKS ON THE SEABED' TO THE AGGREGATE DREDGING INDUSTRY

6.1.1 'Wrecks on the Seabed' set out to provide industry and regulators with a framework for the incremental, decision oriented investigation of wreck sites and with guidance methodologies for their rapid archaeological assessment, evaluation and recording.

6.1.2 Using the idea of a staged approach to shipwreck assessment, evaluation and recording, the project addressed every level of this process, from initial desk-based assessment to geophysical survey and diver/ROV survey.

6.1.3 The first stage of the application process for obtaining or renewing a dredging licence for an aggregate extraction area includes a desk-based archaeological assessment.

6.1.4 In general the assessment of maritime sites in an aggregate extraction area was mainly based on data available from the National Monuments Record (NMR) and the UKHO shipwreck database. These sources generally contain little detailed information on individual wrecks, which makes the assessment of site character, date and importance a difficult task.

6.1.5 The 'Wrecks on the Seabed' project has shown the importance of extended documentary research for the assessment of shipwrecks. In a number of cases (e.g. site 5004, the *Concha*) an evaluation of readily available additional documentary sources has helped to accurately assess the significance of wreck sites. It has also been possible to identify wreck sites on the basis of geophysical surveys and documentary information (**Appendix C** and Wessex Archaeology 2006b).

6.1.6 The geophysical aspects of 'Wrecks on the Seabed' have helped to develop guidelines and specifications relating to wide area geophysical surveys such as are generally carried out in advance of marine aggregate extraction, and to deep geophysical surveys. The project has attempted to develop survey specifications that are commercially viable but which will produce data that is detailed enough for archaeological purposes (Wessex Archaeology 2006a).

6.1.7 Finally, the diving and ROV section of the project has shown how a more detailed wreck survey (to Level 2a/3a) can help to establish the character, date and extents of a site (**Appendix C**).

6.1.8 An attempt has been made to demonstrate the applicability of the results of 'Wrecks on the Seabed' to the marine aggregate extraction industry in the section of **Appendix C** entitled 'Significance of Effects and Mitigation'. This section is based on the format of an archaeological assessment and assumes that each of the three deep study sites was found in an aggregate extraction area. The significance of likely effects, importance of each wreck and proposed mitigation are outlined.

6.1.9 Without the extensive geophysical and archaeological fieldwork and the documentary research carried out on each of the three previously unknown Year 2 study sites, it would have been impossible to accurately assess the wrecks and propose mitigation strategies that are both archaeologically sound and economically viable.

7 DISSEMINATION AND OUTREACH

7.1 DIVER INFORMATION PACKS

7.1.1 Public lectures to dive clubs held after Round 1 of the project generated considerable interest in the geophysical, diver survey and documentary results for wrecks that are subject to recreational diving. Although sport divers were familiar with the sites in general, the character and history of the sites, revealed by the Round 1 investigations, was a source of positive comment.

7.1.2 Wessex Archaeology therefore decided to build on this interest in the results of the project by developing Diver Information Packs for these sites. It is hoped that these packs will serve as a means of disseminating archaeological information about the sites to the diving and non-diving public alike.

7.1.3 The diver information packs consist of a brochure on the history of the site in question, a report form, a waterproof site plan and a multimedia CD.

7.1.4 The Diver Report form consists of an annotated orientation site plan of each wreck and a site recording form. The site plan will serve as a guide for divers when visiting the site, whilst the recording form is aimed at encouraging divers to record further information about the site and making this publicly available.

7.1.5 This recording may take the form of a detailed survey of a particular area of the site; the recording of previously unsurveyed areas of the site or notes about changes in the condition of the site between visits. All additional information will contribute to the generation of a comprehensive site record, and enhance the experience of visiting the site. Diver information can also be passed on to relevant authorities such as the National Monuments Record (NMR) and the United Kingdom Hydrographic Office (UKHO).

7.1.6 The CD contains the Diver Information Pack as a .pdf file, the ‘Wrecks on the Seabed’ web page, video footage, images of the wreck site and downloadable wallpapers created from images of the site.

7.1.7 Diver packs for sites **5004**, **5009** and **5013** have been prepared and will be send out to dive clubs, dive operators and dive shops along the South Coast for comments.

7.1.8 After tests with laminated orientation site plans for underwater use proved unsuccessful, site plans have been printed on waterproof film for further testing by recreational divers. The site plans can be revised after feedback and comments have been received.

7.1.9 In addition to the paper report form, we have investigated the feasibility of an interactive web-based form for dive reports similar in nature to the BMAPA/EH web based reporting system. This would allow divers to report their observations via a form on the Wessex Archaeology webpage.

7.1.10 Although the creation of a report system is possible, Wessex Archaeology currently lacks the in-house capability to develop such a system.

7.1.11 Due to the depth and sensitive nature of the 2006 deep wreck sites, no diver packs will be prepared for these sites.

7.2 PRESENTATIONS

Seminar Presentation and Participation

7.2.1 Since the beginning of 2006 the ‘Wrecks on the Seabed’ project was presented at five conferences:

- 10th March 2006 Southampton University Student Seminar Day, Wessex Archaeology, *Wrecks on the Seabed: Assessment, Evaluation and Recording of Shipwrecks in the context of the Aggregate Industry*, Jens Auer
- 12th May 2006 EH Outreach Workshop, London, *Wrecks on the Seabed: Diver Information*, John Gribble
- 7th October 2006 AKUWA, Annency: *The ALSF projects*, Dietlind Paddenberg
- 27th - 30th November 2006 III Jornadas Arqueología Subacuática Universidad de Huelva: *Wrecks on the Seabed*, Jens Auer
- 19th December 2006 Environmental and Industrial Geophysics Group (EIGG) meeting on recent work in archaeological geophysics: *Wrecks on the Seabed*, Paul Baggaley

7.2.2 WA staff also participated in the Hurst Castle Maritime Archaeology and Wildlife Weekend on the 19th/ 20th August 2006 with a poster display relating to Wrecks on the Seabed.

Public Lectures

7.2.3 A wide range of groups, including archaeological societies and dive clubs were contacted regarding lectures on ‘Wrecks on the Seabed’, but WA received a limited response. To date two public lectures were held:

- 4th December 2006 Yapton Ford Historical Society
- 13th December 2006 Sussex University Archaeological Society

7.2.4 Further lectures are being pursued for early 2007 in relation to the dissemination of the Diver Information Packs.

7.3 PUBLICATIONS

7.3.1 A number of popular articles and newsworthy items have been published or submitted for publication:

- *Wrecks on the Seabed: Gone but not forgotten* published in Dredging and Port Construction March 2006;
- *Wrecks on the Seabed* in International Society of Archaeological Prospection, published in 9th Newsletter issued October 2006;
- *Wrecks on the Seabed Year 2* submitted for publication to Dredging and Port Construction;
- *Wrecks on the Seabed: New methodologies for rapid diver and ROV based wreck surveys* submitted for publication to the Association of Diving Contractors Newsletter.
- *The discovery of U-86* submitted for publication online to http://uboat.net/
- Old Glory (a magazine for steam engine enthusiasts) - an article on the well-preserved steam engines which survive on a number of wrecks surveyed as part of the project;

7.3.2 The two scholarly articles (M9, M13) for the Hydrographic Journal and the International Journal of Nautical Archaeology respectively have been drafted and are undergoing QA before being submitted for publication.

7.4 WEB PAGES

7.4.1 The web pages for Round 2, Year Two (Deep ROV) and pages relating to the geophysical section of Round 1 (Area and Ephemeral Sites) and Round 2, Year One (Deep Wrecks) are online.

8 THE FUTURE OF 'WRECKS ON THE SEABED'

8.1 DIVING AND ROV SECTION

8.1.1 Rounds 1 and 2 of the project concentrated on the development of methodologies for the rapid assessment and evaluation of wreck sites to Levels 1 and 2. The aspect of intrasite recording (Level 3) was only partly explored in Round 2, Year 1 with the so-called 'Bottle Wreck' (**5013**) recorded by divers using traditional offset drawing methods.

8.1.2 One avenue for taking the project to the next level and developing methodologies for rapid intrasite recording of shipwrecks would be to apply a range of different intrasite recording methods to a single study site. The unknown wreck site identified in the area survey (Wessex Archaeology 2006a) or site 5013 would represent good study sites, as they are accessible and relatively small. The use of a single study site would allow direct comparison of the efficiency of individual recording methods. Such a comparison would be beneficial to determine the best way to rapidly record a shipwreck encountered in a development-led context to a higher recording level (level 3 or higher).

8.1.3 Recording methods that could be explored include: photogrammetry and acoustic recording systems (e.g. the Aquametre).

- Aquametre:

  The use of an accurate acoustic survey system such as Aquametre could greatly speed up the recording of sites to level 3a and higher. In 2005, wreck 5013 was recorded to level 3b using traditional diver-based methods such as trilateration and offset measurements acquired with tape measures. This site could provide a basis upon which the performance, accuracy and efficiency of an acoustic survey system such as Aquametre could be evaluated and compared with traditional site survey methods.

- Photogrammetry:

  Another intra-site survey method proposed in the original project design was photogrammetry. The application of photogrammetric methodologies to wreck 5013 could serve to assess the efficiency and accuracy of this system when applied to wreck recording, and would also provide a comparison with the ROV and diver-based photographic recording of the site undertaken during 2005.

8.1.4 The project could also serve to compare different acoustic systems (e.g. Sonardyne ROV-Trak and SCOUT and Aquametre) in terms of accuracy and repeatability. The results of such a comparison could also be used to improve methodologies for Level 1 and 2 recording.

8.2 GEOPHYSICAL SECTION

8.2.1 Although several aspects relating to the geophysical survey of shipwrecks were tested in Rounds 1 and 2 of the project, there is still considerable potential for the improvement of existing survey methods.

8.2.2 Improved geophysical survey methods would aid the detection and subsequent interpretation of anomalies in the course of surveys which are conducted as part of the overall environmental assessment for a development.

Magnetics

8.2.3 The benefits of magnetic gradiometer systems for the detection of metal objects on and below the seabed could be tested by conducting gradiometer surveys of study sites that have already been surveyed with a single magnetometer during Rounds 1 and 2 of the project.

8.2.4 In addition the difference between a vertical and horizontal gradiometer system could be tested, as could the response of the system to the orientation of survey lines. Eventually trials could be expanded to using a full gradiometer system with four magnetometers.

8.2.5 It is anticipated that a magnetic gradiometer system would give a higher resolution dataset compared to using a single magnetometer.

Sidescan Sonar

8.2.6 Although modern sidescan sonars have fluxgate compasses built into the towfish, the positioning/heading of the sidescan sonar fish still poses a problem in post processing as a number of assumptions have to be made regarding the position of the sidescan sonar towfish.

8.2.7 The use of a USBL system like SCOUT for tracking the sidescan towfish could be explored. Accurate tracking of the towfish would also allow an assessment of the error range produced in positioning anomalies when traditional methods are used (i.e. when a simple layback and heading due to course made good are applied).

8.2.8 More accurate positioning of sidescan anomalies will aid the establishment of exclusion zones and the detection of said anomalies on the seabed by divers or ROVs.

Multibeam

8.2.9 Due to the depth of water on the deep study sites, the multibeam data obtained in Round 2 of the project is of relatively low resolution. In the geophysical fieldwork report (Wessex Archaeology 2006a) it was concluded that the resolution could only be improved by getting the multibeam head closer to the site to be surveyed.

8.2.10 The most common, but also very cost-intensive way to do this is mounting the multibeam on an ROV. Another, considerably cheaper option to achieve this could be tested in a future round of the project. The multibeam could be mounted either on an ROV, or on a survey sledge which is trailed by the survey vessel.

Sub-bottom

8.2.11 In Round 1 of 'Wrecks on the Seabed' a number of study sites were surveyed with a boomer with limited success. The data collected showed the overall geological context of the wreck sites, but an interpretation of the extent of buried material on the sites, in many cases essential for the definition of wreck exclusion zones, proved impossible.

8.2.12 It would be beneficial to repeat this on selected scattered wreck sites with a high degree of burial using either a Chirp or a parametric sonar. The chirp system has already proved useful in the 'Seabed Prehistory' project at identifying paleaogeographic features buried within the top meter of sediment.

8.2.13 The parametric sonar is not used by the aggregate industry at the moment, but acts as a single beam echosounder which it could replace, in addition to giving high resolution sub-bottom data within the first few metres of the seafloor.

8.3 OTHER

8.3.1 As a result of the site assessments conducted during 'Wrecks on the Seabed' and other seabed work Wessex Archaeology has become increasingly aware that there may be merit in developing a clearer understanding of the relationships between archaeological sites underwater and the flora and fauna that inhabit them. There are four particular questions that spring to mind:

- Do (archaeological) wreck sites have nature conservation value in terms of species/habitats?
- Do protected wreck sites act as refuges for species/habitats, which might assist with recolonisation of adjacent areas?
- Can the presence or character of species/habitats be used as a proxy for gauging wreck site condition and stability?
- Is there any scope for (or value in) integrating archaeological and ecological surveys of wreck sites?

8.3.2 Wessex Archaeology has started a dialogue with marine nature conservation professionals to ascertain whether information gathered during archaeological site assessments would be useful to them, and also to explore what might be done to incorporate biological recording into archaeological survey work.

8.3.3 Initial indications are that photographic images and video footage obtained by 'Wrecks on the Seabed' can provide useful biological evidence such as the presence of species, including key species that are currently 'moving' as a result of climate change or are otherwise significant. From an archaeological perspective there is the potential for using this information to more accurately describe the biological condition of wrecks, including the variability across wreck sites, with a view also to commenting on environmental processes indicated by different species.

8.3.4 If these initial informal exchanges prove fruitful there may be scope for, and merit in developing these ideas further within the context of any Round 3 to the ALSF.

REFERENCES

Hamblin, R. J. O., Crosby, A. and Balson, P. S. a., 1992, *The geology of the English Channel,* United Kingdom Offshore Regional Report London.

Wessex Archaeology, 2003, *Wrecks on the Seabed: Assessment, Evaluation and Recording. Round 1, Year One Report*, Unpublished Report, 51536.02

Wessex Archaeology, 2004, *Wrecks on the Seabed: Assessment, Evaluation and Recording. Round 1, Year Two Report*, Unpublished Report, 51536.04

Wessex Archaeology, 2005, *Wrecks on the Seabed R2: Assessment, Evaluation and Recording. Project Design*, Unpublished Report, 57450.04.

Wessex Archaeology, 2006a, '*Wrecks on the Seabed R2: Assessment, Evaluation and Recording. Geophysical Report*', Unpublished Report, 57452.01.

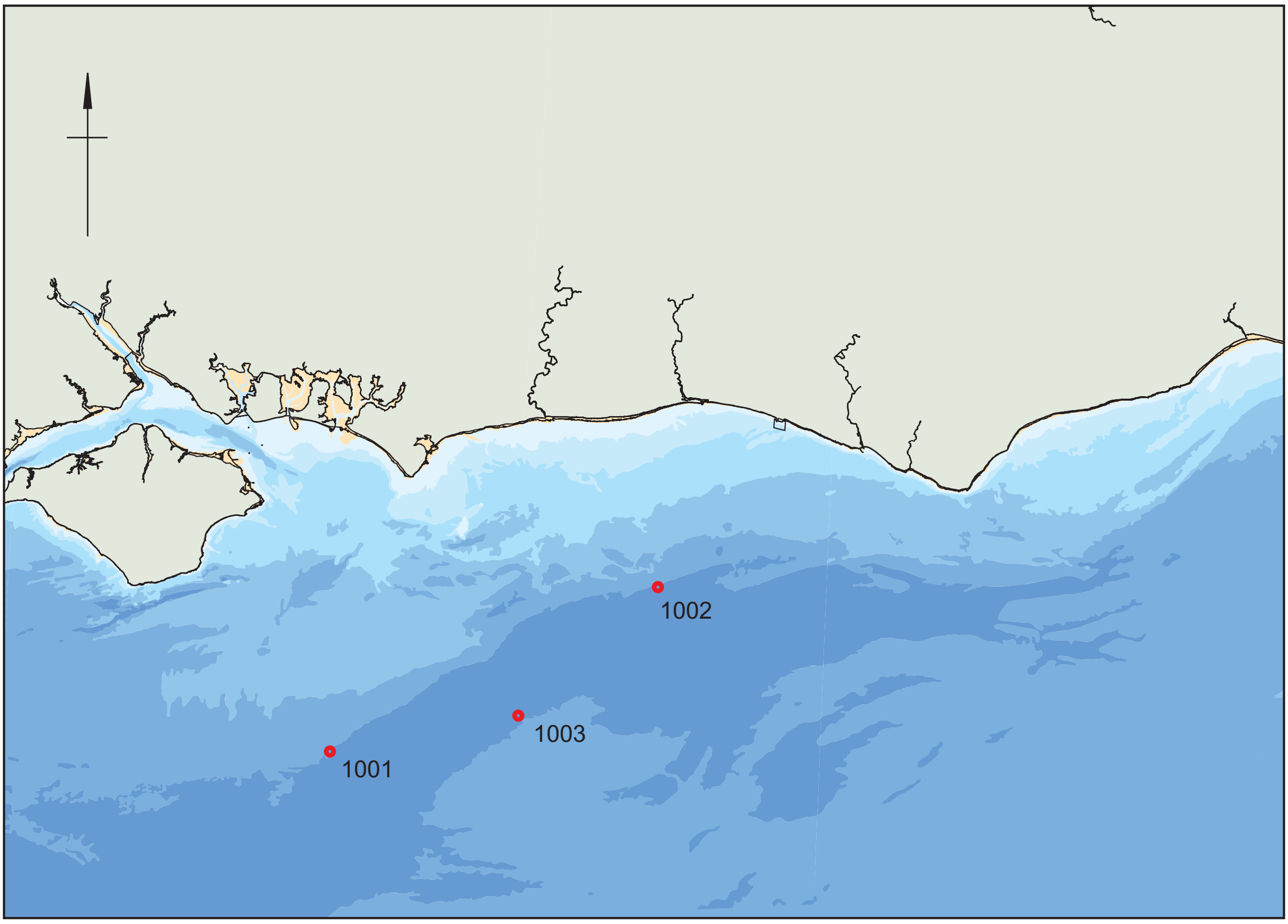
Wessex Archaeology, 2006b, '*Wrecks on the Seabed R2: Assessment, Evaluation and Recording. Year 1 Report*', Unpublished Report, 57453.02.

APPENDIX A: LEVELS OF RECORDING

Level	Type	Objective	Sub-level	Character	Scope	Recording Tasks	Recording Focus
1	Assessment	A record sufficient to establish the presence, position and type of site.	1a	Indirect (desk-based)	From documentary, cartographic or graphic sources, including photographic (incl. AP), geotechnical and geophysical surveys commissioned for purposes other than archaeology.		
			1b	Direct (field)	From geophysical, diving inspection etc., including surveys commissioned specifically for archaeological purposes.		
2	Evaluation	A record that provides sufficient data to establish the extent, character, date and importance of the site.	2a	Non-intrusive	To include light cleaning, probing and spot sampling, but without bulk removal of plant growth, soil, debris etc. and basic recording	**Extent:** -Acoustic tracking around site with ROV or diver **or** -Tape measurements of site extents based on geophysical data **or** -Sketch of extents based on video footage and geophysical data **Character & Date** - Written description **and** - Sketch record **and** - Photographic record **or** - Video record	**Extent:** Focus on establishing the full site extent, including possible buried sections and debris fields. **Character & Date:** Focus on: <u>Build:</u> - Construction (material, fastenings, methods) - Propulsion (sail, steam, diesel or a combination) - Diagnostic features (machinery, fittings, armament) <u>Use</u> - Artefacts/Cargo (dating objects) <u>Survival:</u> General survival of site <u>Invesigation:</u> - Traces of any previous work on the site (salvage, excavation, etc.
			2b	Intrusive	To include vigorous cleaning, test pits and/or trenches. May also include recovery (following recording) of elements at immediate risk, or disturbed by investigation.		
3	In situ Recording	A record that enables an archaeologist who has not seen the site to comprehend its components, layout and sequences.	3a	Diagnostic	A detailed record of selected elements of the site.	**Detailed Record:** - Written description **and** - Measured drawings or detailed measured sketches **and** - Photographs (stand-off and close-ups) **and** - Detailed video survey **or** - Photo mosaic for visualisation purposes	**Selection of elements to be recorded should be based on Level 2 survey. In general decision based on:** - Diagnostic quality of elements - Representative quality of elements (are elements typical for period?) - Rarity (are elements rare and unusual for period?)- Accessibility of elements - State of preservation of elements
			3b	Unexcavated	A detailed record of all elements of the site visible without excavation.	As above but for whole site	All exposed elements
			3c	Excavated	A detailed record of all elements of the site exposed by open excavation of part or whole of the site.	As above but for whole site after excavation	All elements after exposure
4	Removal	A record sufficient to enable analytical reconstruction and/or reinterpretation of the site, its components and its matrix.			A complete record of all elements of the site in the course of dismantling and/or excavation.		
5	Inter-site Analysis	A record that places the site in the context of its cultural environment and other comparable sites.			A complete record and analysis of all elements of the site, including comparisons with other sites.		

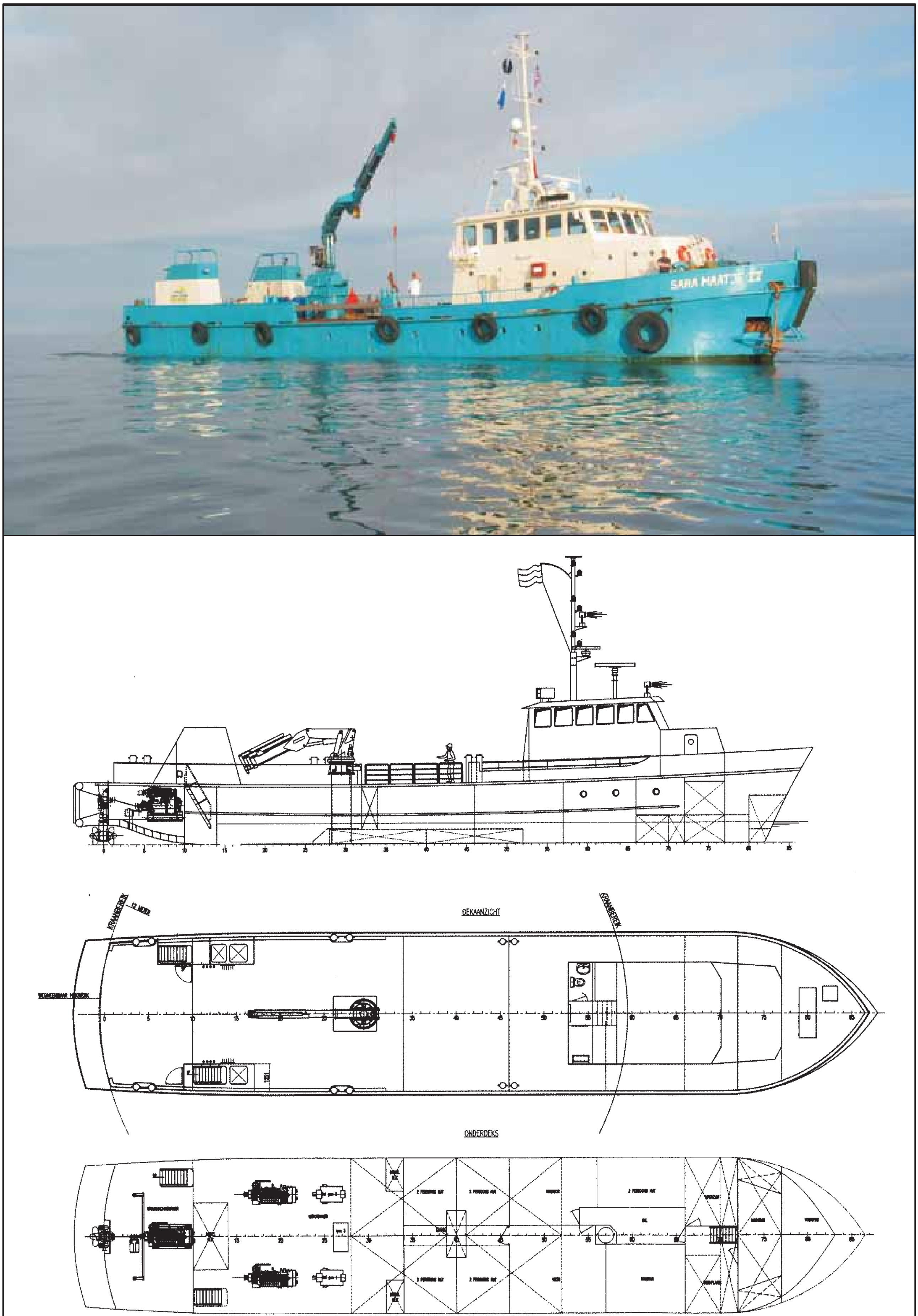
APPENDIX B: ROV FOOTAGE

APPENDIX C: ARCHAEOLOGICAL RESULTS, SEPERATELY BOUND



Wessex Archaeology	Projection WGS84 UTM Zone 31 N Seazone Licence Number 102003.005 NOT TO BE USED FOR NAVIGATION Digital data reproduced from Ordnance Survey data © Crown Copyright 2005. All rights reserved. Reference Number: 100020449. This material is for client report only © Wessex Archaeology. No unauthorised reproduction.			
	Date:	04_08_06	Revision Number:	0
	Scale:	1:100,000	Illustrator:	KMN
	Path:	S:\Wrecks_on_the _Seabed\57452 wrecks\DO\RepFigs\Fieldwork report Vol_1		

The study area showing the sites surveyed in 2006. Figure 1



Wessex Archaeology				
	Date:	04/08/06	Illustrator:	KMN
	Path:	S:\Wrecks_on_the _Seabed\57454E\Drawing Office\Report Figures\Fieldwork report Vol_1\06_08_04		

Sara Maatje XV at sea and layout (© Van Stee Surey & Supply bv). Figure 2

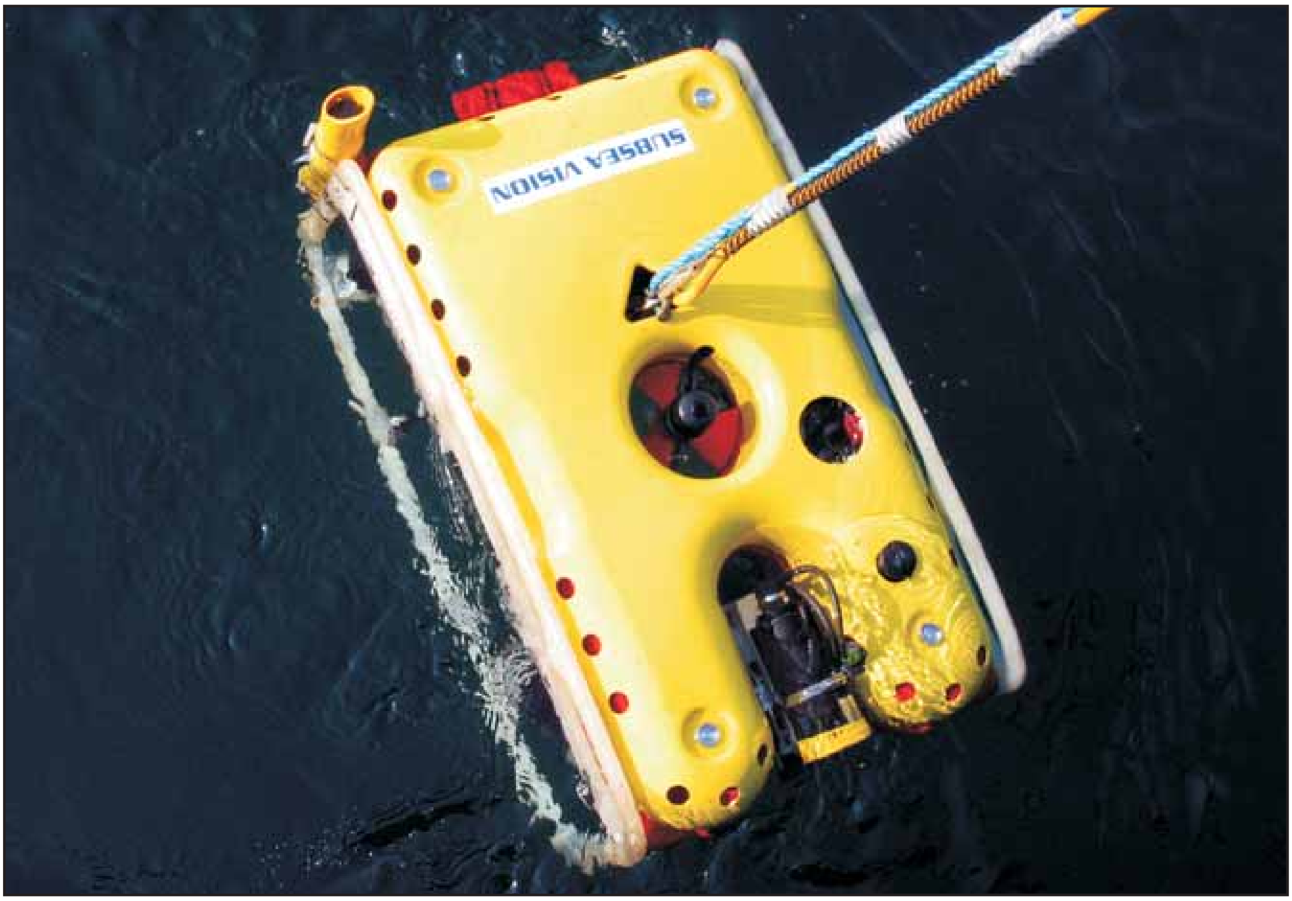


Plate 1: Seaeye Falcon ROV.


Plate 2: ROV control system set up in the wheelhouse of *Sara Maatje XV.*

Wessex Archaeology	Date:	04/08/06	Illustrator:	KMN
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Figure 3

Plate 1: SCOUT surface command module.

Plate 2: SCOUT transceiver on pole.

Plate 3: SCOUT transponder mounted on the ROV.

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Figure 4

Plate 1: Still camera shot of fastening taken on site WA 1002 in low visibility.

Plate 2: Scaling camera shot of the same fastening.

Wessex Archaeology	Date:	04/08/06	Illustrator:	KMN
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Figure 5

Plate 1: ROV tender with intercom link to ROV pilot.


Plate 2: ROV recovery with the crane.

Wessex Archaeology	Date:	04/08/06	Illustrator:	KMN
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Figure 6

WESSEX ARCHAEOLOGY LIMITED.
Head Office: Portway House, Old Sarum Park, Salisbury, Wiltshire SP4 6EB.
Tel: 01722 326867 Fax: 01722 337562 info@wessexarch.co.uk www.wessexarch.co.uk
London Office: Unit 113, The Chandlery, 50 Westminster Bridge Road, London SE1 7QY.
Tel: 020 7953 7494 Fax: 020 7953 7499 london-info@wessexarch.co.uk www.wessexarch.co.uk

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