# The Wrecks of the Banc du Cardonnet

A Southsea Sub-Aqua Club diving expedition to learn more about just some of the many wrecks lost during the Allied Forces Normandy Campaign in June 1944.

Project Plan

Martin Davies
Diving Officer and Project Leader

## 1. INTRODUCTION

Based in Portsmouth, England, the home of the Royal Navy, the members of Southsea Sub-Aqua Club (SSAC) have been exploring the wrecks of the south coast and beyond since 1954. Indeed it was SSAC members that discovered the wreck of the historic Tudor warship 'Mary Rose' which was later raised from the Solent and, after years of careful conservation is now located in a world class museum in the historic Dockyard.

In recent years members from SSAC have undertaken a number of award winning diving projects associated with wrecks of Operation Neptune, the Naval assault phase of Operation Overlord, and the largest ever maritime invasion. Following two years of meticulous planning Portsmouth and other harbours and towns along the south coast of England prepared for the invasion fleet of 7,000 ships, vessels and craft. Hundreds of thousands of Allied troops and their equipment finally set sail on 5th June to cross the English Channel and in the early hours of D Day on the 6th June 1944, the first soldiers finally landed on the French beaches code named Utah, Omaha, Gold, Juno, and Sword. So began one of the most daring and ambitious campaigns of WW2 which ultimately led to the liberation of France and the end of WW2.

Following our successful projects, Tanks and Bulldozers, Neptune Wrecks, Kedge Hook and Mulberry 70, and a successful joint expedition to dive wrecks in Normandy with members of the French Federation group 'Scuba Ninjas' in September 2014, members of SSAC are planning to return to Normandy to discover more about the WW2 wrecks of Operation Neptune.

Using the skills we have developed we hope to record and photograph the wrecks of the Banc du Cardonnet located at the western end of the Baie de Seine on the approaches to Utah beach. We also plan to create where practicable photogrammetry or 3D models of the wrecks which can be used to inform identification and improve the wider knowledge, understanding and appreciation of these wrecks as part of our shared cultural heritage. In recording and documenting

the condition of these wrecks we will also complete this record with details of the marine life present on these artificial reefs.

Building on data gathered by side scan sonar surveys by the US and UKHO and working closely with subject matter expert Chris Howlett, our project centres on the wrecks of two US Tank Landing Craft (LCT(5) 458 and LCT(6) 593) which were lost near the Banc du Cardonnet and the armoured fighting vehicles that were part of their cargo. In addition we would hope to dive a number of wrecks of barges and armoured vehicles in the area to assist in their identification.

The members of SSAC are extremely aware of the ultimate sacrifice made by many in the Normandy campaign and throughout WW2. We are always respectful of the fact that many of these wrecks are the last resting place of brave soldiers and sailors from the Allied forces. Coming from a naval city we are always sensitive to the fact that we are visiting a special place, one that few people are able to visit. We take the greatest care not to disturb or interfere with any wreck or artefacts. Indeed many of the project team have either served in or with the British Armed Forces and have family members who also have served.

## 2. THE WRECK SITES

### US LCT(5) 458

US LCT(5) 458 was built by the New York Shipbuilding Corp in 1942. She was constructed of steel and had a displacement of 286 tonnes and had a length of 35.8m and beam of 9.8m. LCT (5) 458 had 3 Grey marine diesel engines which delivered 675 horsepower to each of her 3 shafts. Her maximum speed was 10 knots. She was armed with a 20mm Anti-Aircraft gun and 2 0.5 calibre machine guns. LCT(5) 458 had a complement of 13 and embarked at Dartmouth as part of the US 'U' force.

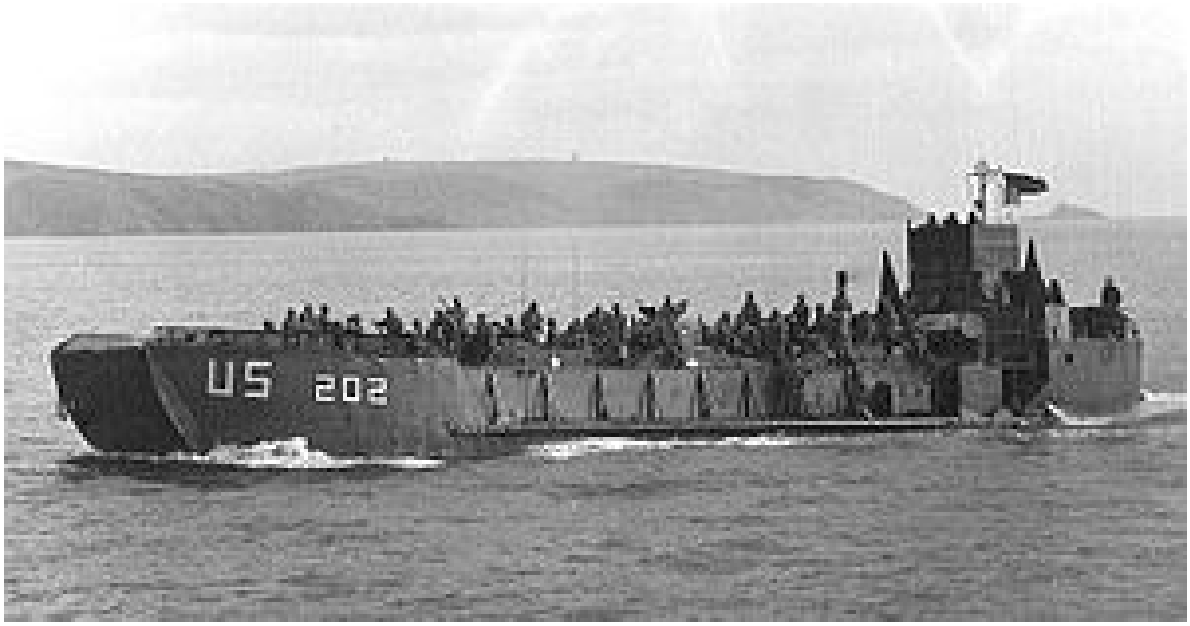


*Figure 1US LCT Mark 5 off the English coast 1944*

LCT (5) 458 sank on 7th June 1944 after hitting a mine while running into the beach. She was carrying 4 x M-7 Priests and supporting vehicles of B Battery, 29th Field Artillery. All vehicles and many men were lost. Three of the M-7s were are recorded by UKHO multi-beam survey. The remaining M-7 Priest is unrecorded as a target but is likely to be to one of the anomalies nearby.

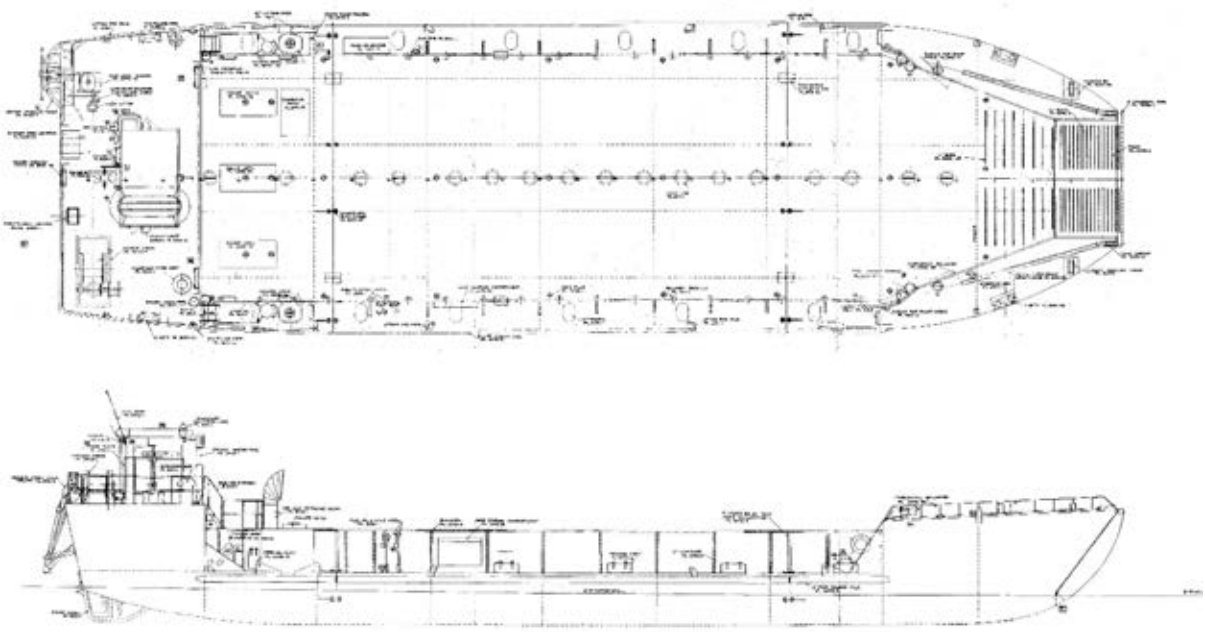

*Figure 2 The general layout of a US LCT Mark 5*

The loading documentation for LCT 458 indicates 4 M-7s two with an M-10 trailer, 2 2.5 ton trucks with an M-10 trailer each, 3 Jeeps and 2 ¾ ton weapons carriers. Photos taken by the divers show 3 M-7s and several sets of wheels and possibly engine blocks.

One of the aims of the project will be to confirm that the LCT wreckage is from a Mk 5 and that the unrecorded object is the 4th M-7. Also we hope to determine the other debris remains by examining the wheels.

**US LCT (6) 593**

LCT (6) 593 was built by Pidgeon-Thomas Iron Co in Memphis. She was constructed of steel and had a displacement of 16o tonnes. Her propulsion was from 3 Grey Marine Diesel engines delivering 225 shp to each of her 3 shafts. Her length was 36.7m and she had a beam of 9.8m. LCT (6) 593 was armed with two 20mm Anti-Aircraft guns and four .50 calibre machine guns. Her construction was very different to the Mark 5 LCT in that the loading was a roll-on: roll-off style with doors at both bow and stern of the vessel.

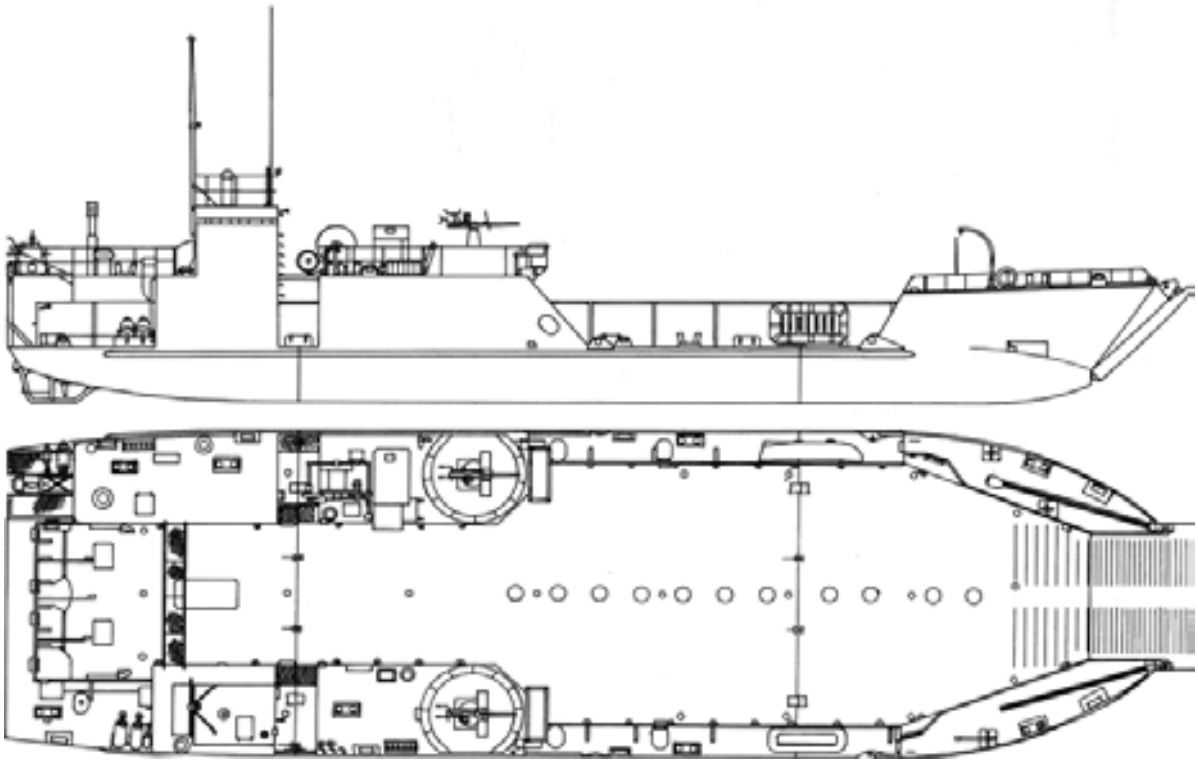

*Figure 3 the general layout of a US LCT Mark 6*

Shortly before dawn on 6th June 1944 eight US Navy LCTs carrying the 70th Battalion's DD tanks approached Utah beach. As LCT (6) 593, with four of A Company's DD Sherman tanks aboard, passed over the shallow Banc du Cardonnet it detonated an enormous German mine. LCT (6) 593 was instantly broken in two and power from the massive explosion propelled her men, vehicles and equipment into the air. Many lives were lost.

Our task under this project will be to confirm the remaining parts of the wreck and associated Sherman DD tanks plus equipment that were dispersed as a result of the enormous explosion. As the wreck was broken into at least two parts this may be a difficult exercise.

Again we will hope to create 3D images of the wreck and her cargo as well as record marine life present.

**Other wrecks of the Banc du Cardonnet.**

Time and weather permitting we will also attempt to dive and record several other unidentified wrecks in the vicinity of the Banc du Cardonnet including those believed to be of two LBVs (Landing Barge Vehicle), Sherman DD tanks.

A full list of potential wreck targets for investigation is at Annex A.

## 3. PERMISSION AND RECORDING THE WRECKS

We have consulted with the French Cultural authorities in order to secure permission to dive and document the wreck sites and share the results of our investigations. Our sincere thanks go to Mme Celcile Sauvage of the Département des Recherches Archéologiques Subaquatiques et Sous-Marines (French: Submarine and Undersea Archelogic Research Department) (DRASSM) for her patience, understanding and support of our project in recent months. With her guidance we have applied for permission to record and document the site. In the event that we are not able to secure this permission it may be possible to dive the wrecks but we will not be able to document our findings.

A condition of the permission is that all divers register with the Institut National de Plongee Proffessionelle as Level 1B commercial divers. This requires CMAS 3*** BS EN 14153-3 equivalence as a minimum and certification by a hyperbaric doctor of fitness to dive. We are grateful for the help and assistance from our French team member Alain Demaire in submitting our applications.

Using unobtrusive methods such as photography and video we hope to record the wrecks in detail so as to aid identification and to establish a baseline for their condition. In addition, using a technique known as photogrammetry, we hope to create 3D images which can be used to share the knowledge and experience of visiting the wreck using Virtual Reality technology. Even without this technology anyone with access to the internet using Google Chrome will be able to view the image from all angles.

We also plan to record the marine life present and to photograph in more detail any artefacts that may be seen, particularly where these assist in the identification of the wreck.

This data and the images created will then be compared with historical records with the aim of adding to the public record regarding the loss of these vessels, vehicles and men in the Battle for Normandy June 1944.

## 4. EXPEDITION PLAN AND LOGISTICS

Travelling from Portsmouth via ferry on the morning of 2nd June, we plan to arrive at Grandcamp-Maisy in the afternoon of 2nd June. We will bring our well-equipped boat ‘Southsea Explorer’ as well as all our diving equipment and portable air compressor.

*Figure 4 The harbour and marina at Grandcamp-Maisy*

We will be staying at a lovely house on the eastern side of the fishing harbour at Grandcamp-Maisy and will launch and operate our boat from the marina in the harbour just a short distance from the house. The harbour is tidal and access is restricted to approx. 2 hours either side of high water. This has been taken into account when planning the diving.

*Figure 5 The house where we will be staying at Grandcamp-Maisy, overlooks the sea.*

Grandcamp-Maisy has all we need in terms of shops, goods and services and will provide an excellent base to explore the area where there are many points of interest particularly those connected with D Day and the Battle of Normandy. Nestling on the coast between the landing beaches of Utah and Omaha we will have the opportunity to visit some of the military cemeteries and museums and will endeavour to find the headstones of some of the men lost in order that we can pay our respects.

## 5. DIVE MANAGEMENT AND PROGRAMME

The dates selected are neap tides and this will give long dive times and good slack waters adding to the safety of the project.

The SHOM chart for the area is number 7422. Tidal predictions are calculated with UKHO 'Total Tide' software. High and Low water calculations based on Rade de la Capelle. The tidal predictions for area SN160X and SN 160W for the days of the project are as follows; (note: All times are expressed as local time UTC +2).

| 03/06/2017 | Rade de la Capelle | | | | SN160X | | | | | SN160W | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LW | 01:19 | 2.6 | m | slack | 0220-0340 | 80 | mins | | slack | 0140-0300 | 80 | mins |
| HW | 07:02 | 5.9 | m | slack | 0640-0940 | 180 | mins | | slack | 0640-0840 | 120 | mins |
| LW | 13:52 | 2.4 | m | slack | 1500-1630 | 90 | mins | | slack | 1420-1550 | 90 | mins |
| HW | 19:47 | 6.0 | m | slack | 1930-2230 | 180 | mins | | slack | 1920-2130 | 130 | mins |
| | | | | | | | | | | | | |
| 04/06/2017 | | | | | | | | | | | | |
| LW | 02:30 | 2.6 | m | slack | 0320-0450 | 90 | mins | | slack | 0240-0410 | 90 | mins |
| HW | 08:03 | 6.0 | m | slack | 0740-1100 | 200 | mins | | slack | 0740-1000 | 140 | mins |
| LW | 14:59 | 2.3 | m | slack | 1600-1730 | 90 | mins | | slack | 1520-1650 | 90 | mins |
| HW | 20:39 | 6.1 | m | slack | 2030-2330 | 180 | mins | | slack | 2020-2230 | 130 | mins |
| | | | | | | | | | | | | |
| 05/06/2017 | | | | | | | | | | | | |
| LW | 03:33 | 2.4 | m | slack | 0430-0550 | 80 | mins | | slack | 0350-0510 | 80 | mins |
| HW | 08:56 | 6.1 | m | slack | 0850-1140 | 170 | mins | | slack | 0850-1040 | 110 | mins |
| LW | 15:57 | 2.1 | m | slack | 1700-1820 | 80 | mins | | slack | 1620-1740 | 80 | mins |
| HW | 21:26 | 6.3 | m | slack | 2130-0010* | 160 | mins | | slack | 2130-2310 | 100 | mins |
| | | | | | | | | | | | | |
| 06/06/2017 | | | | | | | | | | | | |
| LW | 04:27 | 2.1 | m | slack | 0530-0640 | 70 | mins | | slack | 0450-0600 | 70 | mins |
| HW | 09:43 | 6.3 | m | slack | 0950-1230 | 160 | mins | | slack | 0950-1130 | 100 | mins |
| LW | 16:48 | 2.0 | m | slack | 1800-1900 | 60 | mins | | slack | 1720-1830 | 70 | mins |
| HW | 22:09 | 6.5 | m | slack | 2220-0050* | 150 | mins | | slack | 2220-2359 | 100 | mins |
| | | | | | | | | | | | | |
| 07/06/2017 | | | | | | | | | | | | |
| LW | 05:14 | 2.0 | m | slack | 0620-0720 | 60 | mins | | slack | 0540-0640 | 60 | mins |
| HW | 10:27 | 6.4 | m | slack | 1050-1310 | 140 | mins | | slack | 1040-1210 | 90 | mins |
| LW | 17:32 | 1.9 | m | slack | 1850-1940 | 50 | mins | | slack | 1800-1905 | 65 | mins |
| HW | 22:48 | 6.6 | m | slack | 2310-0130* | 140 | mins | | slack | 2300-0030* | 90 | mins |
| | | | | | | | | | | | | |
| 08/06/2017 | | | | | | | | | | | | |
| LW | 05:56 | 1.8 | m | slack | 0710-0800 | 50 | mins | | slack | 0620-0720 | 60 | mins |
| HW | 11:06 | 6.6 | m | slack | 1130-1350 | 140 | mins | | slack | 1130-1250 | 80 | mins |
| LW | 18:12 | 1.8 | m | slack | 1930-2020 | 50 | mins | | slack | 1840-1940 | 60 | mins |
| HW | 23:23 | 6.8 | m | slack | 1150-0200* | 130 | mins | | slack | 2350-0110* | 80 | mins |
| | | | | | | | | | | | | |
| 09/06/2017 | | | | | | | | | | | | |
| LW | 06:34 | 1.7 | m | slack | 0750-0830 | 40 | mins | | slack | 0700-0800 | 60 | mins |
| HW | 11:42 | 6.7 | m | slack | 1210-1420 | 130 | mins | | slack | 1210-1330 | 80 | mins |
| LW | 18:49 | 1.8 | m | slack | 2010-2050 | 40 | mins | | slack | 1920-2010 | 50 | mins |

*Table 1 Tidal data and slack water times – local time.*

The highlighted times in table 1 above represent those tides which are suitable for diving the sites on and around the Banc du Cardonnet. The long slack water periods of up to 3 hours, particularly on the first tide of the day provides an excellent

opportunity to gather information and photographs. Diving may also be conducted in waves to ensure the sites are not overcrowded. It may be possible to visit more than one site which will be useful when diving smaller sites such as vehicles. Predicted dive times as follows:-

| Date June 2017 | Slack 1 | Slack 2 | Slack 3 | Sunrise | Sunset |
|---|---|---|---|---|---|
| Saturday 03/06/17 | **06.40 – 09.40** | **15.00 – 16.30** | **19.30 – 22.30** | 06.01 | 22.00 |
| Sunday 04/06/17 | **07.40 – 11.00** | **15.00 – 16.30** | | 06.01 | 22.02 |
| Monday 05/06/17 | **08.50 – 11.40** | **16.00 – 17.30** | | 06.00 | 22.02 |
| Tuesday 06/06/17 | **09.50 – 12.30** | **18.00 – 19.00** | | 06.00 | 22.03 |
| Wednesday 07/06/17 | **10.50 – 13.10** | **18.50 – 19.40** | | 05.59 | 22.03 |
| Thursday 08/06/17 | **07.10 – 08.00** | **11.30 – 13.50** | | 05.59 | 22.04 |

*Table 2 Slack water times for diving the wrecks of the Banc du Cardonnet – local time.*

It is probable that some dives may be too early/late in the day (denoted in red) depending on weather conditions and to coincide with operation times of the marina lock system. Because of the logistics of getting the boat back into the Marina some days we may be restricted to one dive each day.

The long slack water periods of up to 3 hours, particularly on the first tide of the day provides an excellent opportunity to gather information and photographs. On these days the slack water times will be long so some of the dive times will be longer, the maximum dive time will be no more than 60 minutes per buddy pair. Diving may also be conducted in waves to ensure the sites are not overcrowded. It may be possible to visit more than one site which will be useful when diving smaller sites such as vehicles.

It is therefore proposed to plan a series of 12 dives to conduct the investigation during the period 3rd June to 8th June 2017.

We will start to embark at Grandcamp-Maisy Marina 60 minutes before dive time with the view to boat being on site 30 minutes before dive time. The initial dive on 3rd will depart earlier to allow sufficient time to locate the wrecks and deploy shot lines.

## Search Techniques

Initial location of the dive sites will be made by using the SHOM/UKHO position data. Once the wreck or a target has been found using the echo sounder a shot line will be used as a point of reference around which to conduct the detailed search of the sea bed using our boat Southsea Explorer's sonar side scan and 'down-vision equipment'. The majority of wrecks stand 1-2m proud of the seabed.

Once the wreck has been marked by a buoy this will be used as the descent reference point for the divers who will then undertake searches on the sea bed surrounding the wreck and photograph/document what they find.

## Project Cardonnet - Participants and roles

The Cardonnet project will be led by Martin Davies who will be supported by Alain Demaire in the management of diving operations. All of the diving team have applied for Level 1B certification by the Institut National de Plongee Proffessionelle (INPP) in order to meet the criteria for permission to document the wrecks. The participants, qualifications and roles of the project team are set out in the table below; (note 1B level certification pending)

| Name | Qualifications | French equivalent | Role |
|---|---|---|---|
| Martin Davies<br><br>A182103 | HSE Scuba Diver<br>BSAC Advanced diver<br>Assistant Open Water Instructor<br>Diver Coxswain/Boat handler<br>O2 Administration<br>First Aid for Divers<br>DSC VHF Radio operator<br>Technical Diver - Open Circuit Mixed Gas Diver (Nx/He)<br>Accelerated Decompression Procedures (80%)<br>Advanced Nitrox Diver<br>Gas Blender O2/N2/He<br>Nautical Archaeology Society Introduction/Part 1<br>RYA level 2 Powerboat<br>RYA International Certificate of Competence<br>RYA Day Skipper<br>Compressor Operator/Instructor<br>Automated External Defibrillator AED | INPP Level 1B<br><br>CMAS 3* diver<br>BS EN 14153-3<br>ISO 24801-3 | Project Leader<br><br>Diving Officer for SSAC<br><br>Photographer |
| Alain Demaire<br><br>A7355937 | MF2 and Instructeur Régional<br>CMAS 3*** Instructor | INPP Level 1B<br><br>MF2 and Instructeur Régional CMAS 3*** Instructor | Diving Operations manager<br><br>Survey Diver. |
| Alison Bessell<br><br>A474222 | HSE Part IV<br>BSc Hons Marine Biology<br>Dive Leader<br>O2 Administration<br>First Aid for Divers | INPP Level 1B<br><br>CMAS 2* diver<br>BS EN 14153-3 | Survey Diver Marine Biologist |

| | | | |
|---|---|---|---|
| | DSC VHF/GMDSS radio operator<br>Nautical Archaeology Society Introduction/Part 1<br>RYA Level 2 Powerboat<br>Compressor Operator | ISO 24801-3 | |
| Doug Carter<br><br>A754692 | BSAC Advanced diver<br>Nautical Archaeology Society Introduction/Part 1<br>VHF/DSC radio operator<br>Compressor Operator | INPP Level 1B<br><br>CMAS 3* diver<br>BS EN 14153-3<br>ISO 24801-3 | Survey Diver |
| Jim Fuller<br><br>A723932 | BSAC Advanced diver<br>BSAC Open Water Instructor<br>VHF Radio Operator<br>Nautical Archaeology Society Introduction/Part 1<br>O2 Administration<br>First Aid for Divers<br>Automated External Defibrillator AED<br>RYA Power boat Level 2<br>Compressor Operator/Instructor | INPP Level 1B<br><br>CMAS 3* diver<br>CMAS 2* Instructor<br>BS EN 14153-3<br>ISO 24801-3 | Survey Diver |
| Alison Mayor<br><br>A742727 | BSAC Advanced diver<br>Assistant Open Water Instructor<br>Technical Diver - Open Circuit Mixed Gas Diver (Nx/He)<br>Accelerated Decompression Procedures (80%)<br>Advanced Nitrox Diver<br>Gas Blender O2/N2/He<br>Compressor Operator<br>Practical Rescue Management<br>First Aid for Divers<br>Oxygen Administration<br>Chart work and Position Fixing<br>RYA Powerboat Level 2<br>Underwater photographer<br>Automated External Defibrillator (AED)<br>Nautical Archaeology Society Intro, Part 1&2<br>Fellow of the Nautical Archaeology Society<br>SeaSearch Observer | INPP Level 1B<br><br>CMAS 3* diver<br>BS EN 14153-3<br>ISO 24801-3 | Surveyor Diver<br>Photographer<br>Report writer |
| Tom Templeton | BSAC Advanced diver<br>BSAC Open Water Instructor<br>Boat Handling | INPP Level 1B<br><br>CMAS 3* diver | Survey Diver<br>Photographer |

| | | | |
|---|---|---|---|
| A743845 | Diver Coxswain Award<br>O2 Administration<br>VHF Radio Certificate<br>RYA Powerboat Level 2<br>Mixed Gas Blender Instructor<br>Explorer Mixed Gas Diver Instructor (60m)<br>Compressor Operator/Instructor | CMAS 2* Instructor<br>BS EN 14153-3<br>ISO 24801-3 | |

*Table 3 Project participants, qualification and roles*

All divers will be certified by a hyperbaric doctor as fit to dive in accordance with French diving regulations and to qualify for INPP certification.

In addition we will be supported by Jenny Watkins (A416984 - BSAC Advanced Diver and OWI), Robert Watkins (A615525 BSAC Advanced Diver and OWI) and Iain Jones (A830860 BSAC Sports Diver/PADI Rescue Diver) in respect of logistics and also Chris Howlett (BSAC Snorkel Diver) as historian and D Day subject matter expert.

All participants are current members of the British Sub-Aqua Club and as such hold Third Party Liability insurance (Third Party Liability Insurance Policy) of £10,000,000.

**Dive Management**

All diving operations will be conducted in accordance with BSAC 'Safe Diving Practices' and French Federation regulations and will be overseen by Southsea Sub-Aqua Clubs Diving Officer Martin Davies or his nominated deputy and Diving Manager Alain Demaire.

A full risk assessment and emergency management plan has been produced and briefed to the expedition team. A .copy of the Project Cardonnet risk assessment and Emergency Plan can be found at Annex B

It is essential to work with the boat coxswains, who have ultimate responsibility for the boat and divers when they are underwater and will ensure the safe and successful outcome of each days diving. All divers and crew will receive a daily brief on the safety features of the boat and its equipment as well as a more general diving brief relating to the diving activities on the day such as photographic exercises and hazards/risks to be aware of as referenced in the risk management plan. There will be a Coxswain and crew member present on the boat at all times. All Diver Coxswains will hold RYA International Certificate of Competence licenses. (ICC License) to operate in foreign waters. A courtesy flag will be flown from Southsea Explorer.

Diving pairs will be established based on experience, capability, dive plans and the specific objectives of the dives. Initially experienced divers with search skills will be needed to find the wreck and other points of interest. After the wrecks have been located and marked it will then be a matter of recording what is seen underwater. Following which the photographic, video and marine life exercises can take place.

Matching these tasks to divers/buddy pairs' experience, skills and availability will need to be carefully managed.

All divers will carry DSMBs and have an Alternative Air Source and other safety equipment (e.g. knives/cutters/torches/strobes). Buddy checks will be conducted before each dive. There will be a diver log kept by the appointed Dive Manager recording the details of each divers air in/or, depth, time and duration. The Dive Manager will also operate a diver 'count' system to ensure that all divers are accounted for at the end of each dive.

The relatively shallow depth means that there are no special requirements for long decompression/trapezes or staged decompression and there are no hazards such as overhead environments to consider as none of the structures are intact anymore. This should mean that the diving routines can be relatively simple although there is a possible task loading issue, which with training and practice can be minimised.

All safety equipment (O2 and First Aid kit, Flares) will be checked before each dive and O2 administrators/first aiders will be identified as a part of the briefings.

## Position of wrecks

The wrecks are positioned around 5 nautical miles to the north Grandcamp-Maisy, a high proportion are on the Banc du Cardonnet which is a raised embankment area and is much shallower than the surrounding area. The RIB (Southsea Explorer) will journey out to the site for each dive, the transit time is estimated between 20 - 30 minutes depending on sea state and weather conditions.

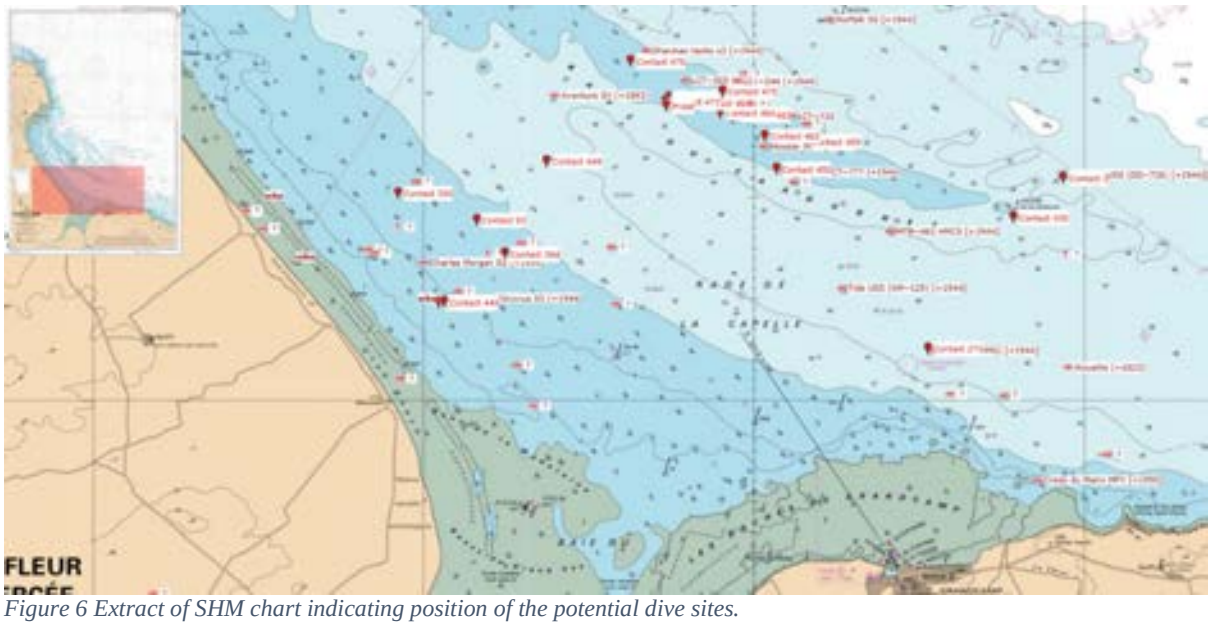


*Figure 6 Extract of SHM chart indicating position of the potential dive sites.*

## Dive Plans

The majority of the sites are less than 20m and so air (21% Oxygen) diving would be perfectly acceptable for the first dive, however on the second dive or if deeper the benefits of Nitrox would be clear.

The depth of the wreck sites is such that there is benefit from the use of Nitrox by all divers who are qualified to do so because of the multiple dives over successive days. The use of Nitrox 32% or 36% will reduce the possibility of De-Compression Illness (DCI) and extend the bottom time to the point where when multiple dives are taking place over several days they can be safely undertaken without the need for decompression.

Two indicative dive plans have been produced to reflect a typical diving day as a part of the project exercise – one for Air and one Nitrox 36% (using BSAC 88 and Nitrox tables). These plans can be found at Annex C to this project plan.

## 6. SHARING OUR FINDINGS - REPORTING AND OUTREACH

The primary reason for our project is the sharing of our findings with others and raising awareness of the heroic sacrifice made by Allied forces in seeking to liberate France. The desire to document and share the information means that permission is required from the French authorities (DRASSM) and this project plan has been developed as part of the approval process.

As a result of the project we aim to complete a detailed report and also 3D (photogrammetry) models that will be available to the public via the World Wide Web. The report will also be shared with DRASSM, the Nautical Archaeology Society (nauticalarchaeologysociety.org), the D Day Museum in Portsmouth (D Day Museum) and the British Sub-Aqua Club (BSAC).

Anyone with access to Google Chrome will be able to view the 3D images of wrecks in a fully interactive way.

The project report will include details of;

- the history of the wrecks and the assault by US forces on UTAH beach;
- the details of the wrecks as we observed when diving
- our conclusions as to the identity of the wrecks
- details of the marine environment.
- Interactive 3D photogrammetry images of the wrecks and their cargo/artefacts.

We also hope to produce articles for special interest publications such as the International Journal of Nautical Archaeology (ijna).

It is also our intention to compile a document that will provide guidance to other BSAC branches about the rules and practicalities of diving in France. This information can he hosted by BSAC HQ on the website to provide a reference guide that will help branches understand the different rules that apply to diving in France and in particular the need to obtain permission from French authorities if a Branch wishes to document and research wrecks or dive in marine conservation areas.

## 7. FINANCE AND BUDGET

Our project is not a commercial enterprise and our divers are volunteers who are diving on a recreational basis. Whilst grant funding may be applied for to assist with the cost of completion of the project there is no assumption that this will be received and all divers are content to fund their share of the costs on an equal basis.

The estimated total cost of the project is included at Annex D.

## 8. CONCLUSION

The team from SSAC have a strong interest in the WW2 Normandy Campaign and in particular understanding the underwater cultural heritage which connects them with the reality of this momentous endeavour. An endeavour which ultimately contributed to the liberation of France and the end of the Second World War.

Building on our successful projects in UK waters we are keen to continue on this natural journey by investigating and documenting the wrecks of the Baie de Seine in order to share the story of the wrecks with the wider community.

We always hold in our minds the sacrifice that many made in the name of freedom and we will endeavour to ensure their place in history is not forgotten. It is our duty and honour to do so.

We wish to sincerely thank Mme Cecile Sauvage (DRASSM) for her advice and support over the last few months in understanding the process and criteria required to obtain permission to conduct this project.

Annex A

Project Cardonnet will investigate a number of wrecks associated with the WW2 Normandy Campaign which are believed to be associated with the invasion of UTAH beach. The wrecks are located in the western end of the Baie de Seine in the vicinity of the Banc du Cardonnet. These wrecks are believed to be the wrecks of US Tank Landing Craft LCT(5) 458 and LCT(6) 593 and their associated cargos of armoured fighting vehicles, predominantly Sherman DD tanks and Priests.

| Target | Latitude/Longitude WGS84 | Depth | Comment | Dimensions | Action |
|---|---|---|---|---|---|
| Contact 464 | 49° 27.849000' N 1° 5.504340' W | 10m | Buried wreck remains. Probably the remains of either LCT(5) 458 or LCT(6) 593. | 44m | Investigate whether an LCT(5) or (6). |
| Contact 468 | 49° 27.941760' N 1° 5.886300' W | 10m | Buried wreck remains. Probably the remains of either LCT(5) 458 or LCT(6) 593. | 34x11x0.61m | Investigate whether an LCT(5) or (6). |
| Contact 470 | 49° 27.921660' N 1° 6.329280' W<br>49° 28.000000' N 1° 6.300000' W | 12m | 3x M7 Priests and vehicle remains. Several vehicle wheels lie around the Priests. Vehicles have disintegrated leaving axles and engine blocks only. Vehicles were: 4x M-10 ammo trailers, 2x 2.5 ton trucks, 2x 3/4 ton weapons carrier and 3x Jeep.<br>Another, unidentified target (second position) lies 83m north east and is probably the 4th M-7 from the loss of LCT(5) 458 that detonated a mine and sank on its approach to the beach. | 14x5m | Investigate M-7s and classify wheels that remain. |
| Contact 470 | 49° 27.998940' N 1° 6.307860' W | 10.8 | Tank – part of contact 470 above. | 5x1.2x3m | Investigate |
| Contact 471 | 49° 27.964320' N 1° 6.343740' W | 11m | Tank – part of contact 470 above. | 7x1.5x3m | Investigate |

| | | | | | |
|---|---|---|---|---|---|
| Contact 475 | 49° 28.061340' N 1° 5.486580' W | 11m | Buried wreck remains. Probably the remains of either LCT(5) 458 or LCT(6) 593. | 29x14m | Investigate whether an LCT(5) or (6). |
| Contact 476 | 49° 28.357740' N 1° 6.871020' W<br>49° 28.366667' N 1° 6.816667' W | 9m | Tank. 3 suspected DD tanks lost when their landing craft (LCT(6) 593) detonated a mine and sank on its way to launch the DD tanks. Another, unidentified target lies 80m north east (at second position) and is possibly the 4th DD tank that was on the LCT. | | Investigate three Shermans to confirm they are DDs. Locate and investigate the 4th target to confirm its identity. |
| Contact 449 | 49° 27.368460' N 1° 8.140860' W | 12m | Tank. Suspected DD tank that was swamped by nearby LCT(R) firing its load of rockets. | | Investigate determine whether a DD. |
| Contact 384 | 49° 26.454180' N 1° 8.778960' W | 10.7 | Shipwreck in 2 parts? Landing Barge Vehicle (LBV) adjacent to large remains of other vessel. LBV Mk1 were dumb barges, LBV Mk2 were powered. | 22x7m | Investigate whether the LBV is a Mk1 or Mk2 and general condition. Identify other wreckage – possibly dropped during salvage of nearby Gooseberry. |
| Contact 300 | 49° 27' 3.1644N 1° 10' 23.7144W | 11.5m | LBV probably | 23.9m x 7.28m | Confirm as LBV and whether a Mk1 or Mk2. |
| Contact 439 | 49° 25' 58.3716N 1° 9' 46.0512W | 9.9m | LBV probably | 21.97m x 7.43m | Confirm as LBV and whether a Mk1 or Mk2. |
| Contact 440 | 49° 25' 59.1708N 1° 9' 41.7018W | 9m | Unidentified ship wreck | 10.75m x 2.87m | Identify type of vessel. |

# MATRIX RISK ASSESSMENT

| **LOCATION** | Diving Operations – Project Cardonnet – Baie de Seine - FRANCE |
|---|---|

**ASSESSMENT CARRIED OUT BY:**

| **NAME** | **SIGNATURE** |
|---|---|
| Tom Templeton | |
| **DESIGNATION** | **DATE** |
| Member Southsea Sub Aqua Club | 20 Mar 17 |

| SER No./ Location | AREA/ ITEM | HAZARD | WHO IS AT RISK | Probability / Severity | Risk Rating | CONTROL MEASURES | REDUCED RATING NO. | DATE CLEARED / REVIEW DATE |
|---|---|---|---|---|---|---|---|---|
| 001 | En Route | Transporting charged gas cylinders. Aboard ferries and in vehicles | All | 3 / 3 | 6 | Dangerous Goods Declaration required for Oxygen, Nitrox and Air contents. 60 litres limit per vehicle. UN green compressed gas stickers to be displayed. All cylinders to be secured in transit. | 4 (1+3) **LOW** | 20 Mar 17 / 20 Mar 18 |
| 002 | En Route | Driving in France. European car and Breakdown Insurance cover. Driving on the RH side of the road. | All | 4 / 3 | 7 | European car and breakdown Insurance required. Mandatory to carry warning triangle, reflective vest for all occupants, DIN standard First Aid kit, Spare headlamp kit, and Breathalyser. Fit GB sticker or Euro plates, Headlamp deflectors and 'Crit' Air' quality certificate in certain areas. New from 31 Mar 17 | 5 (2+3) **MEDIUM** | 20 Mar 17 / 20 Mar 18 |
| 003 | Dive Site | Traffic. Impact injuries from moving vehicles | All | 3 / 3 | 6 | Advice of hazard. Site briefing, supervision. Individuals to exercise care and maintain a good lookout | 4 (1+3) **LOW** | 20 Mar 17 / 20 Mar 18 |

| SER No./ Location | AREA/ ITEM | HAZARD | WHO IS AT RISK | Probability / Severity | Risk Rating | CONTROL MEASURES | REDUCED RATING NO. | DATE CLEARED / REVIEW DATE |
|---|---|---|---|---|---|---|---|---|
| 004 | Dive Site | Loading & unloading from vehicles. Sprains & strains from incorrect lifting. Crush injuries from dropped equipment. | All | 4<br>2 | 6 | Manual handling techniques and load sharing. Use of trolley for heavy equipment. Supervision during lifting activities. | 3 (2+1) **LOW** | 20 Mar 17<br>20 Mar 18 |
| 005 | Dive Site | Slip, Trip and Fall. Sprains, impact fractures from slipping or tripping | All | 4<br>2 | 6 | Site briefing, advice & supervision on quay and pontoon gangway access in wet and windy conditions. | 3 (1+2) **LOW** | 20 Mar 17<br>20 Mar 18 |
| 006 | Dive Site | Entry & Exit. Impact & crush injuries. Drowning | Divers | 3<br>3 | 6 | Advice and supervision on entry and exit by Dive Manager/Coxswain. Ensure appropriate depth of water. | 4 (2+2) **LOW** | 20 Mar 17<br>20 Mar 18 |
| 007 | Dive Site | Poor in-water visibility. Buddy separation. Lost diver(s) | Divers | 4<br>3 | 7 | Use of Buddy lines. Abort dive if unsafe. Follow separation guidelines BSAC Safe Diving Practise | 4 (2+2) **LOW** | 20 Mar 17<br>20 Mar 18 |
| 008 | Dive Site | Poor surface visibility. Separation from buddy or dive boat | Divers | 4<br>3 | 7 | Use DSMB when safe to do so. Access to signalling equipment/ flares/PLB. Recall procedures briefed by Dive Manager | 5 (2+3) **MEDIUM** | 20 Mar 17<br>20 Mar 18 |
| 009 | Dive Site | Equipment malfunction. Injury or death due to panic or rapid ascent | Divers | 3<br>3 | 6 | All equipment maintained within the manufacturers' guidelines (annually) and functionally tested before use. Cylinders in date for test and O2 service where appropriate. Equipment use to remain within designed operating envelope. | 5 (2+3) **MEDIUM** | 20 Mar 17<br>20 Mar 18 |

| SER No./ Location | AREA/ ITEM | HAZARD | WHO IS AT RISK | Probability / Severity | Risk Rating | CONTROL MEASURES | REDUCED RATING NO. | DATE CLEARED / REVIEW DATE |
|---|---|---|---|---|---|---|---|---|
| 010 | Dive Site | Buoyancy control. Injury or death due to panic and rapid ascent (Breath holding over as little as 1.4 metres on ascent within the first 10m of the water column will cause a lung over-expansion injury) | Divers | 4 / 3 | 7 | Training – set neutral buoyancy on mid-breath. Close supervision by Dive Leader to monitor buoyancy of less experienced divers (RISK to buoyancy control, DANGER of breath holding) | 5 (2+3) **MEDIUM** | 20 Mar 17 / 20 Mar 18 |
| 011 | Dive Site | Out of Air. Suffocation or drowning | Divers | 4 / 3 | 7 | Close supervision by Dive Leader to monitor cylinder air pressures (RISK of out of air emergency) Access to Alternative Gas supply | 4 (2+2) **LOW** | 20 Mar 17 / 20 Mar 18 |
| 012 | Dive Site | Hypothermia & hyperthermia. Cold water shock or dehydration/overheating | Divers | 4 / 3 | 7 | Use correct size and weight exposure protection to suit prevailing conditions. Adjust weighting to compensate. Modify exposure times & fluid intake accordingly | 4 (2+2) **LOW** | 20 Mar 17 / 20 Mar 18 |
| 013 | Dive Site | In-water Hazards. Impact & crush injuries, entrapment & drowning | Divers | 3 / 3 | 6 | Site briefing, advice & close supervision (including gas consumption) by Dive Leader | 5 (2+3) **MEDIUM** | 20 Mar 17 / 20 Mar 18 |
| 014 | Dive Site | Sharp objects, fishing line & nets. Puncture wounds & entanglement | Divers | 4 / 2 | 6 | Site briefing, advice & supervision. Spatial awareness. Carry sharp knife and net/line cutters – recommend two sited upper and lower body. | 4 (2+2) **LOW** | 20 Mar 17 / 20 Mar 18 |

| SER No./ Location | AREA/ ITEM | HAZARD | WHO IS AT RISK | Probability / Severity | Risk Rating | CONTROL MEASURES | REDUCED RATING NO. | DATE CLEARED / REVIEW DATE |
|---|---|---|---|---|---|---|---|---|
| 015 | Dive Site | Surface hazards. Impact & propeller injuries from boat traffic | Divers | 3 / 3 | 6 | Use of DSMB or shot on ascent. Advice on hazard. Buoyancy control, hand up first & 360 degree turn on surfacing. Coxswain awareness and policy of engine in neutral whenever divers are deployed and recovered. Only fully trained and qualified coxswains to helm RHIB while diving operations are in progress. | 4 (1+3) **LOW** | 20 Mar 17 / 20 Mar 18 |
| 016 | Dive Site | Loss of shot line on decent or ascent. Loss of buddy, dive site or surface cover. Rapid ascent or descent, panic & injury | Divers | 3 / 3 | 6 | Briefing, advice & supervision. Correct use of shot iaw training. All divers to carry a DSMB and be competent in its use. Controlled descent. Ascent rate no more than 10m/minute. | 4 (1+3) **LOW** | 20 Mar 17 / 20 Mar 18 |
| 017 | Dive Site | Loss of surface cover. Engine failure. Missing divers resulting in hypothermia & drowning | Divers | 3 / 3 | 6 | Properly maintained & serviced engine. Coxswains trained in emergency engine repair. Operating with other vessels when possible. Use of SMB on non-wreck dives. Use of DSMB when not returning to shot. Access to signalling device PLB | 4 (1+3) **LOW** | 20 Mar 17 / 20 Mar 18 |

| SER No./ Location | AREA/ ITEM | HAZARD | WHO IS AT RISK | Probability / Severity | Risk Rating | CONTROL MEASURES | REDUCED RATING NO. | DATE CLEARED / REVIEW DATE |
|---|---|---|---|---|---|---|---|---|
| 018 | Dive Site | 30m depth. Increased risk of DCI, burst lung, Nitrogen narcosis & drowning | Divers | 3 / 3 | 6 | No dives deeper than 30m unless suitably trained & equipped. Strict adherence to decompression obligation and backup tables to be cut for each dive. Medical Oxygen provision. Emergency Plan for DCI. | 4 (2+2) **LOW** | 20 Mar 17 / 20 Mar 18 |
| 019 | Dive Site | Current, tide & swell. Separation from buddy, dive site and surface cover. Rapid ascent or descent leading to panic, injury or death | Divers | 3 / 3 | 6 | Site check by Dive Manager before dive to include analysis of weather forecast and tidal information. Briefing, advice & supervision. Abort dive if unsafe | 4 (1+3) **LOW** | 20 Mar 17 / 20 Mar 18 |
| 020 | Dive Site | Un-exploded ordnance | Divers | 4 / 3 | 7 | All divers are made aware of the dangers of disturbing ordnance on the seabed and within wrecks. Divers to advise Dive manager who will advise Coastguard | 4 (1+3) **LOW** | 20 Mar 17 / 20 Mar 18 |
| 021 | In France | Medical Emergency | All | 3 / 3 | 6 | Telephone 15 – Medical Emergency. Carry European Health Insurance Card | 4 (1+3) **LOW** | 20 Mar 17 / 20 Mar 18 |

RISK ASSESSMENT PROBABILITY AND SEVERITY MATRICES

| | **NEGLIGIBLE (1)** | **MARGINAL (2)** | **CRITICAL (3)** | **CATASTROPHIC(4)** |
|---|---|---|---|---|
| **(5) CERTAIN** | HIGH (6) | HIGH (7) | EXTREME (8) | EXTREME (9) |
| **(4) LIKELY** | MODERATE (5) | HIGH (6) | | |
| **(3) POSSIBLE** | LOW (4) | MODERATE (5) | | |
| **(2) UNLIKELY** | LOW (3) | LOW (4) | | |
| **(1) RARE** | LOW (2) | LOW (3) | | |

EXAMPLES

| | **NEGLIGIBLE (1)** | **MARGINAL (2)** | **CRITICAL (3)** | **CATASTROPHIC(4)** |
|---|---|---|---|---|
| **(5) CERTAIN** | STUBBING TOE | | | |
| **(4) LIKELY** | | FALL | | |
| **(3) POSSIBLE** | | | MAJOR CAR ACCIDENT | |
| **(2) UNLIKELY** | | | AIRCRAFT CRASH | |
| **(1) RARE** | | | | MAJOR TSUNAMI |

## EMERGENCY PLAN – CONTACT EMERGENCY SERVICES

LOCATION: BAIE DE SEINE
NEAREST PORT: GRANDCAMP-MAISY 14450 CALVADOS FRANCE

IN ANY EMERGENCY, TELL THE COASTGUARD IMMEDIATELY,
USING VHF MARINE RADIO **CHANNEL 16**

Radio Information:

**ALWAYS CALL FOR ASSISTANCE ON CHANNEL 16**.
A distress call or urgency call will have absolute priority.
If in a *DISTRESS* situation, WHEN LIFE IS IN GRAVE, OR IMMINENT DANGER, use the distress call as follows:

- MAYDAY – MAYDAY – MAYDAY
- NAME and/or CALL SIGN + MMSI of your craft
- Your present POSITION
- What is the nature of your PROBLEM TO CRAFT OR DIVERS

If in an *URGENCY* situation – when no imminent danger to life exists (e.g. if broken down and drifting), use the urgency call as follows:

- PAN PAN – PAN PAN – PAN PAN
- NAME and/or CALL SIGN + MMSI of your craft
- Present POSITION and INTENTIONS
- Nature of URGENCY

**FIRST AID and MEDICAL ASSISTANCE**

LOCATION O2 and First Aid Kit – O2 attached to A-Frame. First Aid Kit – Under Console

**MEDICAL EMERGENCY**

Nearest Hyperbaric Chamber:

Caisson Militaire
Centre Hospitalier des Armées René la Bas
Docteur RIOU – Service de réanimation
61 Rue de L'Abbaye – BP3
50115 CHERBOUG-NAVAL
**Tel: 02 33 92 78 00**
**Tel: 02 33 92 77 31**
Route: 73km 54minutes Grandcamp-Maisy to Cherbourg via N13

D514 to Osmanville
Third Exit onto D613
Second Exit onto N13
Cherbourg via Carentan, Sainte-Mère-Église and Valognes by-pass
Cherbourg outskirts – Second Exit onto N2013, D900 and D901

# SURVEY PROGRAMME

## DAY 1 Saturday 3rd June

**Dive 1 – Dive Time 06.40 – 09.40** **High Water dive**
**Exercise A** Find target 466, 470, 471, & 468 - drop shot line in the middle of the wreck area with buoy & confirm position.
**Target 466 – M7 Priest**
**Target 470 – M7 Priest**
**Target 471 – M7 Priest**
**Target 468 – Landing craft remains?**
**Exercise B:** 4 pairs of divers each work a 90° sector from shot line to sketch and photograph features found.

**Dive 2 - Dive Time – 15.00 – 16.30** **Low Water dive**
**Exercise A**: Find target 470, 471, 468, drop shot line in the middle of the wreck with buoy & confirm position.
**Target 466 – M7 Priest**
**Target 470 – M7 Priest**
**Target 471 – M7 Priest**
**Target 468 – Landing craft remains?**
**Exercise B:** 4 pairs of divers each work a 90° sector from shot line to sketch and photograph features found.

## DAY 2 Sunday 4th June

**Dive 1 – Dive Time 07.40 to 11.00** **High Water dive**
**Exercise A**: Locate target 463, 464 drop shot line in the middle of the wreck with buoy & confirm position.
**Target 463 – possible remains of LCT? 22m long buried**
**Target 464 - possible remains of ship 44m long buried**
**Exercise B:** 4 pairs of divers each work a 90° sector from shot line to sketch and photograph features found.

**Dive 2 – Dive Time 15.00 to 16.30** **Low Water dive**
**Exercise A**: Locate target 463, 464 drop shot line in the middle of the wreck with buoy & confirm position.
**Target 463 – possible remains of LCT? 22m long buried**
**Target 464 - possible remains of ship 44m long buried**
**Exercise B**: 4 pairs of divers each work a 90° sector from shot line to sketch and photograph features found.

## DAY 3 Monday 5th June

**Dive 1 – Dive Time 08.50 to 11.40** **High Water dive**
**Exercise A**: Locate target 475 drop shot line in the middle of the wreck with buoy & confirm position.
**Target 475 – possible remains of LCT? 30m long buried**
**Exercise B:** 4 pairs of divers each work a 90° sector from shot line to sketch and photograph features found.

**Dive 2 – Dive Time 16.00 to 17.30** **Low Water dive**
**Exercise A**: Locate target 450 drop shot line in the middle of the wreck with buoy & confirm position.
**Target 450 – Remains of buried wreck, unclear size and type**
**Exercise B:** 4 pairs of divers each work a 90° sector from shot line to sketch and photograph features found.

**DAY 4 – Tuesday 6th June**

**Dive 1 – Dive Time 09.50 to 12.30** **High Water dive**
**Exercise A**: Locate and shot Contact 462, drop shot line in the middle of the wreck with buoy & confirm position.
**Target 462 – possible remains of ship not LCT, 64m long buried**
**Exercise B:** 4 pairs of divers each work a 90° sector from shot line to sketch and photograph features found.

**Dive 2 – Dive Time 18.00 to 19.00** **Low Water dive**
**Exercise A**: Locate and shot Contact 462, drop shot line in the middle of the wreck with buoy & confirm position.
**Target 462 – possible remains of ship not LCT, 64m long buried**
**Exercise B:** 4 pairs of divers each work a 90° sector from shot line to sketch and photograph features found.

**DAY 5 Wednesday 7th June**

**Dive 1 – Dive Time 10.50 to 13.10** **High Water dive**
**Exercise A**: Locate and shot Contact 459, drop shot line in the middle of the wreck with buoy & confirm position.
**Target 459 – possible remains of ship or LCT, 30m long buried**
**Exercise B:** 4 pairs of divers each work a 90° sector from shot line to sketch and photograph features found.

**Dive 2 – Dive Time 18.50 to 19.40** **Low Water dive**
**Exercise A**: Locate and shot Contact 476, drop shot line in the middle of the wreck with buoy & confirm position. + Identify and shot debris to the north 50m.
**Target 476 – possible remains of small tank + debris 50m to north**
**Exercise B:** 2 pairs of divers descend shot line to sketch and photograph features found. 2 pairs of divers go North 50m to investigate debris possible vehicles

**DAY 6 Thursday 8th**

**Dive 1 – Dive Time 07.10 to 08.00** **Low Water dive**
**Exercise A:** Locate and shot Contact 384, drop shot line in the middle of the wreck with buoy & confirm position. Drop additional shot on defined square structure.
**Target 384 – possible remains of ship or LCT, 22m long buried + defined square structure to the east nearby**

**Exercise B:** 2 pairs of divers each work a 90° sector from shot line to sketch and photograph features found. + 2 pairs of divers investigate nearby structure.

**Dive 2 – Dive Time 11.30 to 13.50 High Water dive**
**Exercise A**: Locate and shot Contact 300, drop shot line in the middle of the wreck with buoy & confirm position. Drop additional shot on defined square structure.
**Target 300 – possible remains of ship or LCT, 24m long buried**
**Exercise B: 4** pairs of divers each work a 90° sector from shot line to sketch and photograph features found.

**Exercise:-** Recover boat and prepare for return journey to Portsmouth the following day.

## Indicative Dive Plans

### Dive Plan – Air - 12m

**Dive 1 (Table A)**

| CTC A | Depth | Dive time | 6m stops | Surfacing Code |
|---|---|---|---|---|
| **Plan** | 12m | 45 | None | C |
| **Just Longer** | 12m | 70 | None | D |
| **Just Deeper** | 18m | 42 | None | F |
| **Worst Case** | 18m | 70 | 3 | G |

Surface Interval 4 to 5 hours (Table B)

**Dive 2**

| CTC B | Depth | Dive time | 6m stops | Surfacing Code |
|---|---|---|---|---|
| **Plan** | 12m | 45 | None | D |
| **Just Longer** | 12m | 70 | None | D |
| **Just Deeper** | 18m | 42 | 1 | G |
| **Worst Case** | 18m | 70 | 15 | G |

**Indicative Gas planning requirements**
(Assumes 20 surface litres per minute breathing rate and 75 bar reserve (1/3$^{rd}$) and 15L cylinders).

**Typical Dive Plan 45 minutes at 12m = 2.2 bar Absolute**
15L x 232 bar = 3480L free air
75 bar reserve = 1125L reserve
3480L – 1125L = 2355L available air
2.2 bar x 20 SLM x 45 mins = 1980L
Leaving 375L free (+1125L reserve)

**Typical Dive Plan 45 minutes at 18m = 2.8 bar Absolute**
15L x 232 bar = 3480L free air
75 bar reserve = 1125L reserve
3480L – 1125L = 2355L available air
2.8 bar x 20 SLM x 42 mins = 2352L
Leaving 1128L reserve

### Dive Plan – Nitrox 36%

**Dive 1 (Table A 36%)**

| CTC A | Depth | Dive time | 6m stops | Surfacing Code |
|---|---|---|---|---|
| **Plan** | 12m | 45 | None | C |

| | | | | |
|---|---|---|---|---|
| **Just Longer** | 12m | 70 | None | C |
| **Just Deeper** | 18m | 45 | None | D |
| **Worst Case** | 18m | 70 | None | E |

Surface Interval 4 to 5 hours (B)

**Dive 2**

| **CTC** B | **Depth** | **Dive time** | **6m stops** | **Surfacing Code** |
|---|---|---|---|---|
| **Plan** | 12m | 45 | None | D |
| **Just Longer** | 12m | 70 | None | D |
| **Just Deeper** | 18m | 54 | None | E |
| **Worst Case** | 18m | 99 | 1 | G |

**Indicative Gas Nitrox requirements**
(Assumes 20 surface litres per minute breathing rate and 75 bar reserve (1/3rd) and 15L cylinders).

**Dive Plan 42 minutes at 18m = 2.8 bar Absolute**
15L x 232 bar = 3480L free air
75 bar reserve = 1125L reserve
3480 – 1125L = 2355L available air
2.8 bar x 20 SLM x 42 mins
Leaving 1125L reserve

## Financial Estimate

| Item | Quantity | Cost |
|---|---|---|
| | | |
| **Travel, Boat and Diving/Survey Costs** | | |
| | | |
| Ferry costs for boat and 4x4 vehicle | Includes 2 people | £650.00 |
| Ferry cost | 3 x Car + 2 persons | £900.00 |
| Boat fuel @ 75L per day | 450L @ £1.20 per L | £540.00 |
| Boat oil @2L per day | 10L | £120.00 |
| Portable Compressor Filters | 2 | £190.00 |
| Paper chart SHOM 2135 | 1 | £35.00 |
| French Electronic chart for E7 Navigator | 1 | £199.00 |
| Zeecom waterproof paper | 1 pack | £40.00 |
| Photographic scales | 4 | £40.00 |
| ICC coxswain licenses | 3x £45 | £135.00 |
| Marina Fees | 6 nights (@£30 per night) | £180.00 |
| INPP Level 1B certification fees | 7 x 87Euro @1.15 Euro:£ = £75.65 x 7 | £530.00 |
| | | |
| **Accommodation and Food** | | |
| Accomodation | 1 Gite for up to 10 persons (2878 Euro | £2,500.00 |
| Food | 8 persons @ £160 per day (8x£20) | £1,280.00 |
| **Sub-Total** | | |
| | Expedition total | £7,339.00 |
| | | |