

PROJECT OVERVIEW

An extensive survey of the coastal waters near Cadiz, Spain was conducted from May 7 through July 15, 2004 in partnership with the *Centro de Arqueología Subacuática* of the Junta de Andalucía and the Institute of Nautical Archaeology. Archaeologists from CAS provided extensive information from previous work in the area and led diving teams to examine sites located from previous reports and from remote sensing data generated during the project. RPM provided the survey vessels *Hercules* and *Junco* and associated auxiliary vessels, plus diving support. The National Geographic Society Expeditions Council and National Geographic Magazine provided generous financial support, as well as technical assistance with ROV operations and imaging. Defined as a Historic-Archaeological Investigation of the Battle of Trafalgar, the project was, to our knowledge, the first large scale use of multibeam remote sensing for purely archaeological purposes. Over the six weeks of operations, approximately 150 square kilometers were surveyed, despite frequent interruptions due to adverse weather. Post-acquisition processing of the data is now (December 2004) underway. To date, more than 300 anomalies have been identified. Sites identified in the remote sensing data to date include several sites with size or other characteristics consistent with the warships sunk soon after being taken as prizes following the Battle. Numerous more recent shipwreck sites have been identified, while anomalies were also observed that possess characteristics consistent with those of ancient shipwreck sites. In addition to the remote sensing survey campaign, near-shore sites identified by CAS were examined by CAS-led diving teams. These sites include at least two locations where cannons and other materials indicative of warships from the Battle were studied.



Fig.1: The old town of Cadiz formed a picturesque backdrop for the survey work that took place off its coast.



Fig.2: The multi-national, multi-institutional team who took part in the survey



Fig.3: A map showing the location of the scuttle zone that comprised the survey area.

SURVEY AREAS

After the October 21, 1805 Battle, numerous vessels were taken in tow by the British. Some of these were their own crippled warships: others were Spanish and French warships, including the Spanish flagship *Santissima Trinidad* and the 80 gun Spanish warship *Argonauta*. The presence of allied ships and a rapidly approaching storm forced the British to scuttle many of their prizes, including the *Santissima Trinidad* and *Argonauta*. The primary focus of the offshore area remote sensing campaign was to locate these ships. The search area was defined by the logs of the British ships involved in the Battle. Due to the imprecise and sometimes conflicting position reports in the British logs, the "scuttle zone" for *Santissima Trinidad* was defined as a 5 by 10 nautical mile area northwest of Cadiz (Fig. 3). Depth contours in the zone ran generally from NW to SE parallel to the shore, began at 22 meters and reached a maximum depth of circa 80 meters. Along the easternmost area, small patches of rock outcroppings were encountered. The remainder of the scuttle zone seabed consists of a gently sloping area covered with fine silt that forms a thick, soft muddy layer. This silt is a product of river outflows in the area and is highly susceptible to disturbance by the prevailing N-NE current, as well as any local disturbance by ROV thrusters or divers. Zero to near-zero visibility was common at the seabed and prevented visual or photographic examination of sites identified by remote sensing in this initial campaign. In addition to the vessels intentionally scuttled offshore, numerous other crippled vessels foundered close to shore as a result of the storm. Remote sensing was conducted in a near shore area at sites designated by CAS based on previous reports of vessel remains. Immediately outside Cadiz Harbor, around a jutting rock projection that marks the southern limit of Cadiz Bay, there are previously known wreck sites, including the reported location of the French flagship *Bucentaure*. Sites in this area, as well as a wrecksite located close to shore south of Cadiz, were examined by dive teams.



Fig. 4: The multibeam is prepared for deployment.



Fig.5: Archaeologists depart to investigate anomalies generated by the multibeam data.



Fig. 6: The ROV was instrumental in the examination and photography of deep-water anomalies.

OBJECTIVES

With several entities participating, there were various research objectives incorporated within this project. One objective was the attempt to locate vessel remains consistent with several of the ships scuttled during the days directly after the Battle of Trafalgar in October of 1805. The captured vessels from the Allied fleet of Spain and France included the *Santissima Trinidad*, the *Redoubtable*, and the *Argonauta*. The area where it is hypothesized that these warships were scuttled was searched through remote sensing and potential cultural remains from other areas were documented. Particular efforts were given to the verification of possible remains that possessed potential characteristics of scuttled Spanish warships. If coherent remains of these vessels have survived, verification would allow documentation of their present condition and provide more exact location documentation than has been recorded to date. Remote sensing along with diver survey and examination were also conducted on previously located and partially documented sites. The survey and analysis of these sites were undertaken in order to determine their potential association with ships that were engaged in the Battle of Trafalgar. Of particular interest was the reported site of the *Bucentaure*, the flagship of the French fleet, reported to have sunk just offshore near Cadiz. Of the several sites thought to possess remains of the *Bucentaure*, two were scheduled to receive serious attention based on their likely association as determined by archaeologists of CAS. Another objective of the archaeological survey involved the assessment of potential ancient through medieval wrecksites. The general coordinates of several reported ancient vessels lie within the areas designated for survey; thus, investigation of these areas would determine if they are indeed present and their more precise locations. Furthermore, the long history of Cadiz as an active shipping port in the Phoenician and Roman through medieval periods suggests a great likelihood of locating shipwreck finds from these earlier periods.

TRAFALGAR WARSHIP ? INTERPRETING THE ANOMALIES

For all of the anomalies located in the scuttle zone that may be related to the ships of the Battle of Trafalgar, there are several general factors pertinent in their assessment. Key observable characteristics that can be gleaned from the multibeam echosounder data are length, width, height, shape, and regular forms or features. It is extremely unlikely that the maximum lengths and widths of the anomalies will equate with the actual maximum lengths and beams of the original vessels, as the majority of a wooden ship's hull will not be preserved. Thus, in order to assess these anomalies in terms of their potential as the remains of late 18th-century warships, it is necessary to estimate the potential dimensions of such warship remains. The dimensions of the *Argonauta* can be estimated from those of the *Monorca*, which was built two years later in the same shipyard of Ferrol and designed for a similar complement of cannon, and the *Achille*, a warship of similar size. Based on the data, the *Argonauta* had approximate maximum dimensions of 58 meters in length and a maximum beam of 16 meters. The dimensions of the *Redoubtable* were probably similar to these two warships as well, as it carried the same number of cannon as the *Monorca* and the *Achille*. The dimensions of the larger *Santissima Trinidad* are known; it had a maximum length of 63 meters and a maximum beam of almost 17 meters. These dimensions are the maximum lengths and beams of the warships, which occur relatively high in their hulls; particularly maximum length, which reflects the deck transom and transom in the stay, as well as bow structures such as cutwaters and knees. The maximum length is typically high in the hull near the gunwale, while the maximum beam occurs somewhat lower in the hull. This is particularly true of vessels with tumblehome, as was a feature on Battle-of-Trafalgar-period warships. Furthermore, the maximum beam typically occurs near amidships, thus preserved portions of the hull further fore or aft will have less beam. Upon sinking, a vessel reaching the seafloor will typically bury to some degree in the mud or sand and only a portion of the vessel's hull is preserved above this point. Wood remains are rarely preserved for ships coming to rest upon rock, as they do not benefit from the protection that burying provides.

Potential Anomalies Representing Trafalgar vessels

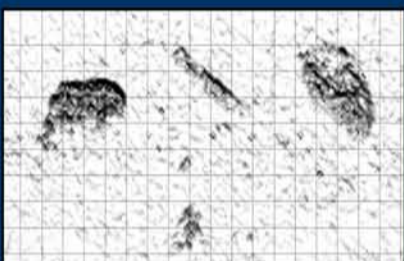


Fig. 7: Processed relief of possible Trafalgar vessels in the scuttle zone.

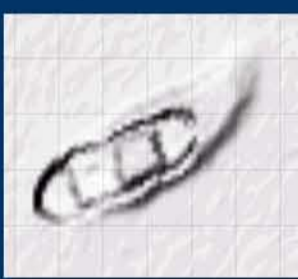


Fig. 8: A multibeam view of an anomaly. The bow and stern shape are clearly evident.



Fig. 9: An additional anomaly detail recovered from the multibeam data.

Potential Anomalies Representing Ancient Amphorae-laden vessels



Fig. 10: (above) 3-D model - the actual modeled shapes of the object were cone-like, which indicates objects of material/form that reflects sounds well.



Fig. 11: (above) A contour map - many of the objects appear to be elongated in overall shape

PROMISING TARGETS FOR TRAFALGAR ERA VESSELS IN SCUTTLE ZONE

The key characteristics of anomalies reflected in the multibeam data are length, width, and general shape of the surviving hull remains and, in some cases, specific features such as cannons, anchors, or (particularly in the case of ancient vessels) cargo shapes such as amphoras. Although some hull preservation may have occurred from partial burial in the soft muddy bottom, the Battle of Trafalgar vessels have been exposed to the destructive processes of the sea for two centuries, and their hulls are too large to have been completely protected by burial. The overall size and shape of a multibeam image of a Battle of Trafalgar warship will therefore no longer match its original dimensions. Nevertheless, to evaluate multibeam images in terms of their potential to be vessels from the Battle, a starting point is to compare the dimension and shape of the anomaly to the known dimensions of the original vessels. The dimensions of the *Santissima Trinidad* are known: it had a maximum length of 63 meters and a maximum beam of 17 meters. Exact dimensions of the somewhat smaller *Argonauta* are not known, but can be estimated at 58 meters in length and a maximum beam of 16 meters based on the known dimensions of the *Monorca*, a similar ship built two years later at the same shipyard. Because Trafalgar-era warships were built with tumblehome, maximum beam width is low in the hull, near the midships waterline, while maximum hull length is typically high in the hull near the gunwale. Other key indicators are of course the presence and size of cannon and anchor shapes and sizes. The multibeam images generated during the 2004 campaign are now being processed and evaluated using these criteria.

SPECIFIC SITE AREAS

Several areas of Cadiz Bay directly in front of Cadiz harbor, and areas to the north and south of the bay, were surveyed based on possible vessel remains reported by CAS. This bay receives a tremendous amount of sediment from the outflow of the Guadilquivir River and thus had a relatively shallow sand-mud subsurface. This bottom gently sloped throughout the area other than where a channel is maintained for ship traffic. Around 20 nautical miles north of the bay were several sites that were also investigated with remote sensing. These areas were near shore and due to the generally N-NE current directions had a shallow sand-mud bottom. Most of these sites were located along a large stretch of flat bottom within the 10-meter contour; however, one site, the *Barcos de las Monedas* wrecksite, was exposed on the surface. Conversely, areas explored circa 20 nautical miles to the south of the bay, namely the *Camposoto* sites, were less inundated with sand and possessed large rock outcrops on the seafloor. This area had depths varying from 5 to 20 meters over a short distance due to the subsurface rock formations.

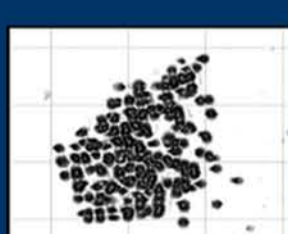


Fig. 13: (above) A relief map - the discrete nature of the objects is clearly observable; although the shape of this anomaly is somewhat elongated towards the northeast, it is clear that some of the objects comprising the anomaly have been scattered, which slightly alters the outline of a basically ovoid-shaped anomaly.

Damaging processes to exposed hull structure include marine organisms, currents, drag-net fishing, and storms; all particularly affecting wooden-hulled vessels. The surviving portion of the hull is often a lower section near the turn of the bilge if the vessel was deposited in a relatively upright position. In either case, the bow and stern will be raised off the bottom to some degree. Diver assessment of several of the modern fishing vessels detected by the multibeam echosounders indicated that vessels did sink into the muddy bottom

RPM Nautical Foundation would like to thank the following institutions, and their professional and dedicated staff, who made this survey season possible:

- The Institute of Nautical Archaeology
- CAS
- Consejería de Cultura of the Junta de Andalucía
- National Geographic Society Expeditions Council
- National Geographic Magazine