



Member's Paper

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Investigating an historic ship wreck: the Australian Historic Shipwrecks Preservation Project

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In this year, the centenary of the sinking of the Titanic, a new project which seeks to develop a new methodology for the study of shipwrecks is being undertaken. The subject is not so grand and opulent as the Titanic, which was a large, steel built steam driven vessel, with three screws (882' long, 52,310 tons displacement), had glamorous fittings, and carried the cream of English and American society as passengers. It sank travelling at high speed after a collision with an iceberg, killing 1514 people.

No. Our subject is more modest. Constructed on the Williams River (Northern New South Wales, Australia) in 1841 using timber unfamiliar to the shipwright, the Clarence was a mere 67 ton displacement. It was a wooden two-masted carvel-built schooner, described as having a square stern, standing bowsprit, no galleries and one deck. It sank in Port Phillip Bay (Victoria, Australia), having broken its mooring during a storm, foundering on a sandbank. Its passengers were 131 ewes. Clarence was indeed not glamorous. It is, however, the best preserved accessible wreck of an early colonial vessel constructed using Australian timbers.

The Australian Historic Shipwrecks Preservation Project (<http://www.ahspp.org.au/clarence/>) is the result of the successful bid by Professor Peter Veth (University of Western Australia) and others for funds from the Australian Research Council. The funding granted (A\$500,000) is small compared to that required to undertake the project. A large number of government instrumentalities, universities, private firms, and volunteers have contributed time, effort, and their own funds into enabling the project to proceed. About 70 people are contributing their efforts to the project. There are 14 participating organizations.

When artefacts are retrieved from a shipwreck they are extremely vulnerable to degradation and deformation. Great care has to be taken to ensure that the structural and chemical integrity of the specimen is maintained. This is a costly, time-consuming process, and collecting institutions do not have either the physical or financial capability to discharge their responsibility to maintain the artefacts in air.

It is essential that an alternative strategy be adopted: one in which the artefacts are retrieved and characterized, and then returned whence they came, for reburial. The Clarence project aims to develop a capability for rapid recovery, documentation, assessment and reburial that meets object conservation requirements. It will provide a forensic approach to data collection and management in a GIS database. Specifically it will develop a sophisticated protocol for the rapid excavation, detailed recording and reburial of significant shipwrecks at risk, fostering a strategic national approach for shipwreck management. To achieve the aims of the protocol the project will: develop innovative techniques to rapidly record vessel fittings and objects using 3D imaging; record the

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sedimentary and biological context of the wreck and monitor its condition following reburial; trial, monitor and evaluate the reburial of “at-risk” materials away from the site in more stable conditions; correlate underwater experimental data with data obtained from geo-archaeology on land; and collect palaeo-environmental samples to inform on voyaging tracks, ports of call and previous cargos.

In this project the platform from which the diving will take place, and on which the bulk of the analyses will take place, is a jacked-up barge sited close to the wreck of Clarence (Fig. 1). The three 20' shipping containers provide on its deck: a storage area for diving equipment, a facility in which artefacts are studied by the conservators, and a laboratory to house the data analysis and X-ray imaging equipment.



Fig. 1. Jacked up barge in position to the wreck of the Clarence. The dark blue container contains the data analysis room and the X-ray enclosure.

Many techniques will be used to analyze the artefacts retrieved from the wreck. Of these, X-ray and photographic imaging techniques will be major components of the specimen characterization process. In what follows the X-ray and 3D camera system will be described.

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The X-ray facility occupies half the blue container in Fig. 1. The 20' insulated shipping container has been divided by a 2mm thick steel wall to provide an X-ray system compartment and another room where the data will be analyzed and logged into the master catalogue.

Each X-ray image is a 2-dimensional X-ray representation of the material in the artefact. To construct a 3-dimensional computed tomography (CT) X-ray image the artefact must be rotated in the beam. Special algorithms enable the data set resulting from the 2D images taken at, for instance, 4° intervals in a full rotation of the artefact, to be converted into a 3D image.

For each position of the artefact mounted on the rotating stage a 3D photographic image is taken using a Sony Cybershot DSC TX10 camera, which is positioned in the same location as the X-ray source and points along the axis of the X-ray system. For every X-ray image a 3D photographic image will exist.

The Australian Federal Police provided the X-ray source (GE XR200) and a portable imaging plate scanner (GE CR25P) and the personnel to operate them. This portable system is usually used to examine suspicious parcels in public places. For this scenario the AFP can set up a large exclusion zone to protect the public from the effects of a possible explosion and to minimize the radiation hazard. On the barge such an exclusion zone cannot be established. To enable operation on the barge Professor Creagh designed an enclosure to house the X-ray system to meet Australian radiation safety regulations. This bespoke enclosure (Fig.2) was fabricated by a team led by Ben Nash of the Australian National University (Faculty of Engineering and Information Technology).



Fig. 2. X-ray enclosure showing the access doors for the X-ray source, the specimen stage, and the imaging plates. The X-ray source has been removed, and the camera inserted. The photographic image, presented on the viewing screen of the camera can be seen.

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The X-ray protection system is essentially a box within a box. The outer box (1700mm X 600mm X 600mm) is clad with 2mm stainless steel covered with 2mm lead. There are four doors. From bottom to top: source access door, two side access doors to enable the artefact to be mounted on the rotary stage, and a door to allow the loading of the imaging plate. Within the box a 25mm thick aluminium plate is mounted on four vibration isolators. This carries the box in which the source is mounted, the rotary stage, and the imaging plate carrier. The source box itself is made from 2mm stainless steel clad with 2mm lead. The front of the box, in which the beam-defining aperture is cut, has an additional 2mm of lead applied. The beam defining aperture restricts the beam so that it only illuminates the imaging plate. None of the emitted X-ray beam can directly illuminate the sides, top, or bottom of the outer box. In Fig.2 the top of the source box and the source have been removed, and the back of the 3D camera can be seen. This camera is removed when X-ray imaging is undertaken (Fig.3).

Fig.3 shows the box with the X-ray source in position.



Fig. 3. The X-ray source in the source box, with the 3D camera removed.
The beam defining aperture can be seen.

After the each of the X-ray data sets have been taken for a particular artefact the artefact is then photographed using a 3D camera (Cybershot DSC TX10) placed in the position of the X-ray source for each orientation of the artefact. This 3D dataset has a one-to-one correspondence with each 2D X-ray image, and, by extension, the 3D X-ray image.

Excavating the Clarence will not produce the glittering artefacts which would be found in the wreck of the Titanic. A recent find is shown in Fig.4.

The corresponding X-ray image is shown in Fig.5.

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Fig.4 Leather items and half of a wooden lid.



Fig. 5 X-ray image of the half of the wooden lid.

But it will yield valuable information about the construction techniques of early Colonial shipwrights. And, above all, it will establish the methodology for the future excavation of the many wrecks which are to be found along the Australian coastline.

For further details of this project see <http://www.ahspp.org.au/clarence/>. Video footage will be available on YouTube.