

Access to maritime archaeology for all: tools to visualise, understand and value significant heritage assets

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The wreck thought to be the Ocean exposed following winter storms and accessible at low spring tides off Hayling Island, Hampshire

Divers surfacing following photogrammetric recording of a 108m-long wreck site at 40m depth in a total of just 78 minutes over two dives

The previous article explored how maritime archaeology geophysical survey techniques are being used to collect more extensive and better data and visualise it to help us better understand historic environment assets underwater. These techniques are also helping archaeologists to overcome the fact that few people can physically visit these shipwrecks and submerged landscapes, so helping people to value them more. This article focuses on how maritime archaeologists are using these and other technologies to improve interpretation and access and develop diverse ways of presenting maritime and coastal sites, helping to overcome the perception that sites are remote, scarce and difficult to access. This is enabling maritime heritage to be fully explored, understood and enjoyed by all.

The Maritime Archaeology Trust (MAT) is one of the longest-running specialist maritime archaeological organisations in the UK, undertaking a wide range of work across the UK and internationally. The need to make sites accessible has driven the MAT's holistic approach, which embeds learning, involvement and enjoyment of heritage within

its projects. An active education and outreach programme and running the Isle of Wight Shipwreck Centre and Maritime Museum provide opportunities for public engagement for all ages through a range of traditional visits and workshops, in addition to expanding online, digital and virtual access and learning.

In 2004 the MAT established a trading company – Maritime Archaeology Ltd (MA) – which undertakes development-led work, with all surplus generated going to support the charitable work of the MAT. This organisational set up allows MAT to pioneer innovative research and recording techniques in an area of the discipline that is rapidly changing due to the application of technology. Its development-led work benefits from this experience, where solutions ahead of marine construction are using the most up-to-date equipment and approaches as well as promoting opportunities for public engagement.

The use of technology is apparent in all aspects of archaeological practice; geophysical survey, data capture and analysis; artefact scanning and 3D printing, modelling and visualisation have all become

familiar techniques. Within the marine and coastal environments, these advances are facilitating progressive levels of discovery, recording and dissemination. Many new wrecks have been located using acoustic seabed survey data gathered for a range of purposes including dredging and offshore development, such as aggregate extraction and wind farms. The use of diver-based and drone-based multi-image photogrammetry has been a particular game-changer in the speed and precision with which it is possible to capture details of sites and landscapes. The resulting datasets utilise a pipeline of software packages to create 3D models, renders and immersive digital environments.

The following case studies demonstrate how new technologies for recording and visualising archaeology that has previously been out of reach are enhancing value for clients while enabling public access and the enjoyment of heritage for all.

VISUALISATION FOR ACCESS, EDUCATION AND OUTREACH

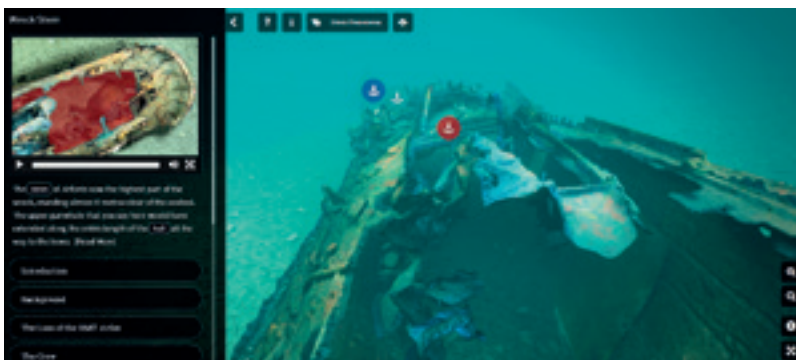
Providing virtual access to underwater sites through 3D modelling and visualisations has rapidly brought marine cultural heritage to new audiences, as techniques in the previous article illustrate. The 3D visualisations produced can be supplemented with information, annotations, extrapolations, images and video to provide more detailed interpretation. The use of high resolution, true colour photogrammetry captured by archaeological divers who train their cameras on every detail creates virtual reality visualisations that transport the viewer to an animated wreck site environment that comes astonishingly close to the real-world experience of otherwise elusive underwater cultural heritage.

Techniques that the MAT has developed through research-focused projects are now increasingly being applied in commercial environments where maritime cultural heritage

Rapid 3D recording allows finds to be lifted, recorded, and redeposited ahead of wind farm development, offsetting impacts on the historic environment by obtaining detailed knowledge of a complete assemblage.

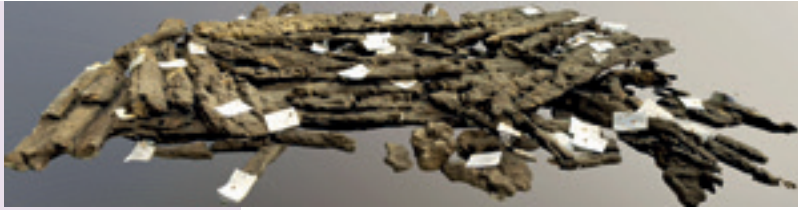


The John Mitchell, a steam drifter, sunk off Dorset, can be experienced as an annotated 3D model or in full virtual reality (<https://www.maritimearchaeologytrust.org/hmd-john-mitchell-interactive-model>)



HMT Arfon, a recently designated protected wreck of a requisitioned trawler lost while on mine-sweeping duties, which has been developed into an online dive tour (<https://www.cloudtour.tv/arfon>)





At the Mesolithic occupation site of Bouldnor Cliff, 12m below the water off the Isle of Wight, a significant timber platform feature was recorded in situ using photogrammetry, prior to rescue recovery. The resulting 3D seabed model aided reconstruction in the laboratory.

is encountered. Beyond the extensive data and increased potential for engagement, these techniques have also helped to reduce time and cost to developers through more efficient data gathering. Better data then enables more informed curatorial decision-making and long-term management of submerged archaeological sites. When significant sites or features are encountered, outreach content can facilitate engagement with the public. For example, digital visualisations of historic assets are being used to engage clients, the public and schools as inspirational tools to aid learning and understanding.

The benefits of disseminating new knowledge about our past is recognised in planning policy and is increasingly realised as an integral part of the development process.

The *Forgotten Wrecks of the First World War* interactive map viewer



While the *SS Gallia* was initially imaged and surveyed as part of the planned Navitus Bay Offshore Wind Farm using sidescan sonar, MAT divers returned to the wreck in 2015 deploying multi-image photogrammetry in just two dives, from which a high-resolution digital terrain model (DTM) was developed.

VISUALISATION FOR INTERPRETATION

An area where new approaches to archaeological interpretation using visualisations has been particularly beneficial is in understanding submerged and buried prehistoric landscapes and associated archaeological sites and features. An example is the 8,000-year-old site at Bouldnor Cliff off the Isle of Wight, now 12m below the water in the north-west Solent, which is of international significance for its sequence of submerged prehistoric landscapes.

3D modelling has enabled large-scale, area-based interpretation of submerged landscapes, such as the Langstone Harbour 3D visualisation. A 3D Google-Maps-style interactive viewer allows exploration of this important area, which was occupied from the Mesolithic onwards.

The wide-ranging analysis made possible with online viewers is advancing the interrogation of large marine data sets; this helps with considerations of significance that can feed into interpreting sites discovered during commercial activity. The *Forgotten Wrecks of the First World War* project considered over 1,100 wrecks off the south coast of England, representing over 10 per cent of world-wide losses; see <https://forgottenwrecks.maritimearchaeologytrust.org>. Interrogating this detailed baseline information reveals new perspectives on the war at sea, exposing patterns related to the numbers of vessels lost during each year of the war, the causes of loss, the types of vessel lost, the nationalities of ships, their ports of departure and planned destination, and what they were being used for at the time of sinking. This quantification and characterisation contribute to priorities within national and thematic research agendas and provide data to support judgements on the rarity and significance of individual sites, which helps future management and protection of the wider underwater cultural heritage (UCH) from the First World War period.

These results feed back into knowledge derived from commercial projects, with a key example from the *Forgotten Wrecks* project being the wreck currently identified as *SS Gallia* (1917), which is located off the south-west coast of the Isle of Wight. This work provides unparalleled resolution of this extensive site and a unique baseline for understanding change and sediment transport processes, which will inform any potential future development work in this area.

VISUALISATION FOR MANAGEMENT IN AN EVER-CHANGING ENVIRONMENT

The wealth of archaeology surviving in the intertidal and coastal zone is phenomenal. Traces of our past include wrecks, hulks, hards, jetties, docks, forts, breakwaters, defences, remains from saltmaking, brickmaking and shellfish industries, maritime training sites, prehistoric landscapes and structures once

on land. The coast is a dynamic environment where storms and erosion threaten sites, which then become exposed, posing challenges for archaeological recording. This zone is also impacted or traversed for marine development and management projects such as port developments, coastal defences or renewables connecting offshore wind power to the national grid.

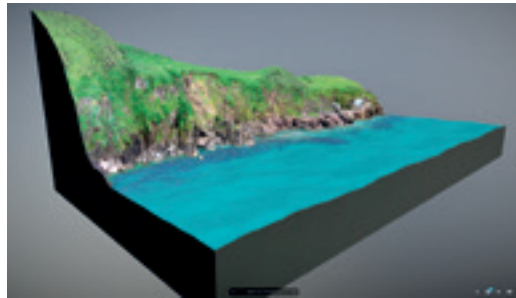
New technology means that available techniques for recording are changing almost as fast as the coastline. The use of drone surveys and aerial cameras for photogrammetry enable rapid recording of sites that the tide only uncovers for short periods, or that have recently been revealed due to shifting deposits. These survey ‘snapshots’ enable an understanding of site conditions and, when combined with further periodic survey, can show changes over time to aid interpretation and to provide an evidence-based approach to cultural resource management.

A variety of drones exists for a wide range of applications and environments, from confined-space mini-drones to fixed-wing platforms for coastal survey. These can be deployed to record intertidal features at low water on spring tides, monitor sedimentary changes, cliff erosion and other hard-to-reach sites including urban historic monuments, in research and commercial settings. In all these instances, drones are changing our perspective on the past, both literally and figuratively.

USING THE HERITAGE RESOURCE TO UNDERSTAND ONGOING CHANGE

The value of archaeology in understanding coastal change, within a climate change framework, is proving to be a very useful tool for coastal managers. Knowledge of the history of coastal change has become increasingly necessary when planning for future scenarios. Coastal managers face an ongoing battle to moderate impacts from the sea in the face of a changing climate and pressures from human use of the coastal zone. When decisions are required to determine levels of future risk, science-based evidence is necessary to support these decisions. The use of sites such as hulks, buildings and prehistoric peat deposits as indicators for coastal change reveals information on the scale and pace of erosion spanning from the past decade to thousands of millennia.

This work links with similar coastal management issues in other western European countries. The EU-funded Arch-Manche project (www.archmanche.maritimearchaeologytrust.org) worked with EU partners to use archaeological, historical and artistic evidence to inform on long-term coastal change, the results of which used a geo-portal for data interrogation and dissemination. A new EU, ERDF, Interreg VA project titled *Sustainable and Resilient Coastal Cities* (SARCC) is also



Top: Perspective view of drone-based condition survey of Fort Victoria, Isle of Wight, supplemented with DSLR multi-image photogrammetry

Middle: The lost village of Hallsands, Devon, a 19th-century fishing village destroyed by aggregate dredging in the early 20th century, is an example of a site recorded by our drone team in just 25 minutes using a drone deployed from a boat.

Bottom: Drone survey of the Isle of Wight coast where Military Road is under threat from erosion

under way; see <https://www.interreg2seas.eu/en/SARCC>. This initiative is incorporating historical data to inform threats to coastal cities, including underwater and intertidal information. Visualisation of these previously obscured areas has been key to engaging with decision-makers and stakeholders.

CONCLUSION

The use of visualisations to analyse and present archaeological data to develop management approaches is being increasingly applied to the marine zone. These developments are likely to accelerate as we enter the UN Decade of Ocean Science for Sustainable Development (2021–2030); this brings together scientists, policy makers, managers and service users to develop a range of initiatives, one being a comprehensive digital atlas of the oceans. Through such mechanisms the value of the marine historic environment can be realised. There is now an opportunity for researchers and maritime developers to assess the resource collectively, maximising benefits by enhancing understanding of our past while aiding knowledge of the oceans. When all sectors work together, maritime heritage will gain wider recognition as a tool to increase our understanding of the seas and ourselves.

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