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# RETURN TO THE HIGH (DEFINITION SURVEYING) SEAS



Steeped in history, the Mary Rose was King Henry VIII's Tudor warship. Built between 1509 - 1511, the Mary Rose was a successful warship and in Henry VIII's possession for more than 34 years, nearly the entirety of his reign. Adapting with the naval demands of the time, the Mary Rose

started out as a troop ship and ended as a gun ship. During Henry VIII's reign, the Mary Rose fought in three wars, starting in battle in the first French War between 1512 and 1514 and ending in the third French War in 1545, her final battle.



The catastrophic sinking of the Mary Rose 19 July 1545 in front of the king has been a tale often retold. The cause of the tragedy is still uncertain; some accounts say French gunfire, a gust of wind or an unruly crew. Whatever the cause, the Mary Rose's history and her supreme marine excavation have truly captured the minds of the general public for generations.

#### MARY ROSE'S EXCAVATION

The discovery and excavation of the sunken Tudor warship some 437 years later was a milestone in maritime archaeology. Rediscovered in 1971 and salvaged in 1982, the Mary Rose was brought back to No. 3 Dry Dock in Portsmouth's Naval Base, metres away from where she was lovingly built all those years ago. The silt on the seabed helped to preserve some 19,000 artefacts, each excavated and brought to the surface. Here a secure and sheltered building was constructed over the ship so the process of conserving the ship could begin. The Mary Rose was open to visitors 11 October 1983.

Since her excavation in 1982, it was imperative to keep her wet, therefore the ship was sprayed with chilled water to stop the timbers from drying out and to inhibit fungal and bacterial growth. The ship needed to be strengthened before the hull could be dried to avoid

collapsing. Therefore the Mary Rose was sprayed with a chemical called Polyethylene Glycol (PEG), which is like a wax. The concentration of the PEG was gradually built up to avoid damage to the wood. She was sprayed like this for almost 20 years to conserve her.

#### MARY ROSE MUSEUM AND LEICA GEOSYSTEMS' INVOLVEMENT

By 2005, plans were being developed to create a new flagship museum in which to house the Mary Rose hull and her unique collection of artefacts, and to tell the story of her crew. These plans were realised when the new Mary Rose Museum opened in May 2013. Prior to opening the new museum, the wax spray was turned off and the drying process began, keeping the Mary Rose in a controlled environment, called the "hotbox", with a 54 per cent relative humidity and 19 degrees Celsius. Once dried, the PEG will stop the cells from collapsing and will hopefully help to preserve the ship for hundreds of years to come.

In 2013, Leica Geosystems was asked to assist with the conservation project and help to monitor the ongoing drying process of the Mary Rose in the confines of its "hotbox" within the new museum. The system provides vital data to enable the Trust's conservation team to understand the effects of the controlled drying

process on the 500 year old timbers and will be involved in the project for four years, after which time, the majority of the timbers will be dry. As the timbers dry, they can move and understanding the magnitude of this movement and in which direction is significant to this unique scientific research. Once dried, all the black ventilation tubes aiding the drying process will be removed from around the timbers, opening up unhindered views. The ship is also supported with scaffolding and braces to provide extra support and protection and to slow down the movement of the ship, preventing both damage to this unique historical artefact and also safety-of-life for those working on the 500-year-old timbers.

To accurately measure the hull's movement, a Leica Nova MS50 MultiStation was initially installed with optimal line-of-sight coverage onto the hull along with 36 reflector targets attached to the timbers in key locations. The MultiStation automatically calculates its position and orientation prior to each measurement cycle to militate against any movement itself. Five widely distributed control reference targets mounted in stable locations away from the timbers form the basis of the resections. Measurement cycles run three times a day.

Leica Geosystems, with more than 25 years of automated monitoring expertise, has supplied the hardware, software and consultancy for this prestigious project.

Involved from the early stages of the drying

phase, Leica Geosystems Account Manager Mark Francis commented; "Leica Geosystems is proud to be involved in offering the latest state-of-the-art measurement solutions to assist in the research of such a prestigious and unique project, and we look forward to further collaborations."

In May 2015, Leica Geosystems' Steven Ramsey and Francis also assisted with a High Definition Survey (HDS) using the newly released, state-of-the-art ScanStation P40. This technique produces a point cloud of billions of points to accurately model every millimetre of the structure, far beyond the 36 discrete monitoring points. The intention is to re-laser scan in 2016, post construction of the opened viewing galleries for an updated model.

As with any continuous monitoring project, in addition to the sensors, power and communication are key components of the system architecture for the reliability and success of the complete solution. At the Mary Rose Museum, main power and an ethernet cable connected to the site LAN ensured the continuous operation, control and data transfer with a computer in the museum connected to the network server. Leica Geosystems' renowned GeoMoS monitoring software controls the measurement cycles three times a day. Additionally, the data is extracted to a spreadsheet format from the open SQL database and automatically emailed to key stakeholders on a regular basis for continued analysis.



"The incorporation of the MultiStation into our conservation plan provides us with invaluable information, which will greatly enhance our understanding of the drying hull. This will allow us to develop a strategy that will ensure the future of this unique piece of cultural heritage," said Dr. Eleanor Schofield, conservation manager.

The data from the MultiStation is delivered by email to doctoral students from the University of Portsmouth's Civil Engineering and Surveying Department. They are then able to analyse the movement data, identifying trends and correlating to other lines of research including the dryness of the timbers.

#### FUTURE OF THE MARY ROSE

Since the introduction of the MS50 MultiStation to the museum, there has been a lot more interest in how such an instrument works and Leica Geosystems as a company, with visitors young and old alike wanting to understand more. Leica Geosystems works closely in partnership with the Mary Rose Trust to not only monitor the ship's movement but to help support in this important conservation and maritime archaeological project.

The Mary Rose is currently in a period of temporary closure in order for the next chapter in her long and remarkable history to commence. Phase Two of the Mary Rose started at the end of November 2015 and will greatly improve the visitor experience by providing uninterrupted views of the ship from the walkways, as well as all the main galleries at all three levels. For the first time since she was raised in 1982, visitors will also be able to share the same space as the Mary Rose, entering the upper deck through an air lock, allowing visitors to experience the full magnitude of the Mary Rose. During this phase movement, monitoring of the 500-year-old timbers will be critical, and so the MultiStation will remain in its position in the next phase, continuing to provide vital data for the Mary Rose team. The museum will fully re-open in late summer 2016.

