MEASURING-UP IN KIEL

REFLECTORLESS MEASUREMENT AND INDUSTRIAL SURVEYING SKILLS HELP MAKE AN AGEING HULL AS GOOD AS NEW FOR ANOTHER GENERATION OF GERMAN SEAFARERS. REPORT BY PETER FITZGIBBON

Built in 1930 to carry freight on the South Atlantic and Caribbean trade routes, the motorised topsail schooner "Thor Heyerdahl" has in recent years provided seamanship and adventure training for thousands of German youngsters including many from disadvantaged backgrounds. Today operated by a not-for-profit organisation based in Kiel, this jewel of the sea acts as an ambassador for the nation on its regular voyages around the North Sea and further afield.

Yet time takes its toll, and despite refurbishment at the HDW shipyard in Kiel two decades ago, the 50m vessel found itself in dry dock at the end of last year with its riveted iron hull plates weakened to the point where regulatory authorities considered replacement essential.

With finances under pressure, a rapid but ultra-accurate survey was the first step in assessing exactly which plates should be replaced. The survey became even more critical when set against the fact that none of the original shipyard drawings of the "Thor Heyerdahl" existed and no nominal data was available. Fabricating replacement plates – few of which have the same dimensions - normally relies on following the complex shell plating diagram that is individual to every vessel. Here, the survey would re-create vital missing information.

Rare commodities

Instruments that can accurately scan large structures in 3D and *'in situ'* are rare commodities, and the skills needed to utilise them rarer still, for it is still a relatively new process. However, HDW (a ThyssenKrupp Marine Systems subsidiary) needed to look no further than GLM Lasermeßtechnik GmbH to find both.

Originally a commercial spin-off from the University of Bochum, Witten-based GLM has established itself over the past 17 years as the European market leader in providing optical 3-D measurement surveys for shipbuilders (including HDW), railroad engineers, bridge builders, paper plant operators and many other customers. A second but no less important aspect of its thriving business is 3-DIM, a range of measuring and data logging software solutions developed over many years in partnership with Sokkia.

The company's credentials were put to the test on a chilly day in December 2007 when surveying engineer Jennifer Neuhoff headed north and arrived at HDW's yard in Kiel with two motorised Sokkia Total Stations – a NET1 and SET230RM - and a pair of the latest Archer ultra-rugged Field PCs from Juniper Systems running GLM's 3-DIM Observer Motorised data logging software.

Getting shipshape

Neuhoff set up the Total Stations at each end of the "Thor Heyerdahl", defined a local co-ordinate system, and controlled them wirelessly via the data loggers. Some 3,000 points identified from an earlier acoustic survey (and identified on the hull as chalk marks, fig.2) were incrementally scanned in reflectorless target mode and the 3D coordinates downloaded into point grids on the data loggers *via* Class 1 Bluetooth links. The side of the hull that needed most remedial work was scanned in detail and the results mirrored back at

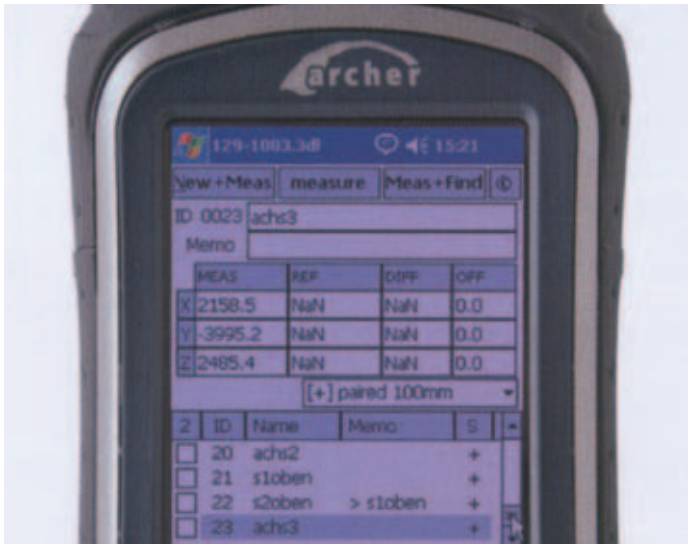

FIG.1: The GLM 3-DIM Observer is fully integrated with Sokkia's MONMOS range of industrial Total Stations.

the office in the 3-DIM PC-Basic desktop package to build a complete picture

GLM's marketing manager Martin Hartmann elaborates on the procedure. "Finding a position by staking out a 3D point is very difficult to do manually. 3-DIM Observer automates this process by taking a first order co-ordinate reading and applying an intelligent iterative algorithm to establish whether subsequent readings fall within defined tolerances."

The entire on-site survey was completed in a surprisingly quick 12 hours and with no compromise on accuracy. "Obtaining accurate reflectorless measurements can be problematic in heavy rain so we were perhaps a little lucky that the weather held," notes Neuhoff. Another potential drawback was that the upper part of the hull was painted black. "As such, I wondered whether it would be sufficiently reflective. In the event and much to my surprise it posed no problem at all," she adds.

While the shipwrights needed results accurate to within +/- 3mm, the scans achieved three times this level, with the NET1 able to deliver a typical accuracy of 0.5mm at ranges of up to 200m in reflectorless mode. As such, it is an ideal instrument for those working alone and who need to complete their surveys quickly and efficiently. Consistency is assured, for every instrument undergoes rigorous testing at a laboratory of the German Calibration Service (DKD) before being put to work.

On the line

The NET1 had another much-valued feature, as Jennifer Neuhoff explains: "A particular requirement of the exercise was to faithfully capture some lines that had been painted on the hull for re-plating purposes. These lines would not normally be picked up by a 3D laser scanner and the alternative of short-range photogrammetric data capture is a time-consuming process. However, scanning defined lines as well as shapes and areas – all to the same high level of accuracy – is easy work for the NET1."

From the point cloud, a 3-D model of the hull with the lines mentioned above and indicating where the thickness of the hull was less than 6mm was subsequently generated in 3-DIM PT, a desktop analysis and visualisation package, for export to HDW's CAD system.

Armed with this essential information, the task of re-plating the hull and refurbishing much of the rest of the vessel will proceed over the next two years at a cost of 1.4 million euros. The project is being backed by the generosity of sponsors such as HDW, Nord Metall (an industry organisation representing some 300 enterprises in northern Germany), the State of Schleswig-Holstein and countless individual donors and supporters including Thor Heyerdahl junior. It bodes well for the ship that bears his father's name and which looks set to sail long into the future.

WEB LINKS

Thor Heyerdahl association: www.th-sailing.de
GLM Lasermeßtechnik GmbH: www.glm-laser.com
Howaldtswerke-Deutsche Werft GmbH (HDW): www.hdw.de
Sokkia Europe: www.sokkia.net

FIG.2: Some 3,000 points and defined lines were scanned during the hull survey

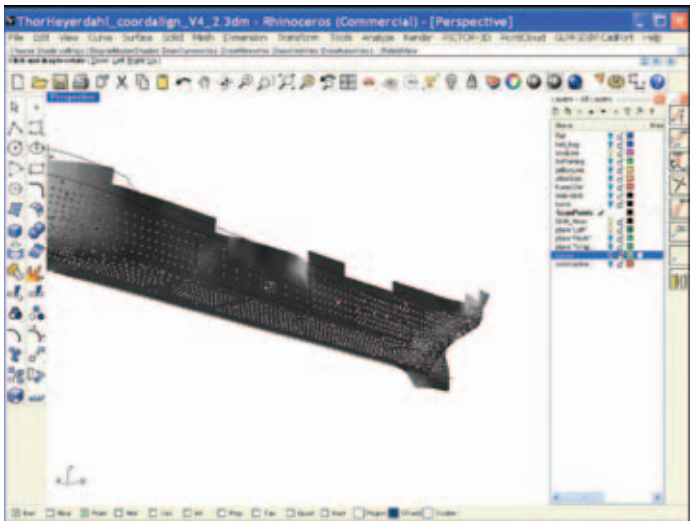

FIG.3: 3-D model generated from point cloud provides an input for HDW's CAD system

FIG.4: With a hull as good as new and a complete overhaul, the future of the Thor Heyerdahl looks assured.

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