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REPORT

SCANNING OVER THE CRACKS

The construction of large yachts can be simplified considerably by the use of laser technology. Wrede Consulting scans complete yachts in an attempt to minimise the cost of rework. The CEO of Wrede Consulting, **Kay Wrede**, explains how.

Some designers break out in a cold sweat when they see the actual shell form of their meticulously computer-designed vessel. We see this frequently as, no matter how careful shipbuilders are, reality means aberrations are introduced to the process. These range from plate welding distortions and inaccurate bracings in the dock to the expansion or contraction of the entire hull of more than several centimetres – depending on the temperature. During construction, the vessel changes continuously. Once completed, all its dimensions differ from those in the construction drawing. The outer skin might show dents and the foundations for the shell doors or GRP bulwarks only vaguely match the dimensions specified in the computer-aided design (CAD).

For commercial vessels this normally doesn't pose any problems and is relatively insignificant. For yachts, however, the effects of such errors can be devastating. Supplied components – bespoke shell doors, anchor pockets or GRP bulwarks, etc – that match precisely the dimensions specified in the designer's drawings may not fit the yacht's actual dimensions and costly reworks are becoming more common. Ships are not rectangular, neither are superyachts. For this reason we have developed a laser-guided measuring method that shows the yacht shell in three dimensions with all its construction variances.

Similar methods have been used for several years in architecture to map façades of buildings. In shipbuilding these methods now allow for the construction of high-precision yachts. The technology involves several lasers screening the surface at short intervals and transmitting the resulting so-called 'point cloud' to a computer. What is an easy exercise for static objects previously posed a difficult problem within the shipbuilding industry because the flood of data provided by vessel surfaces bending and twisting in various directions could not be handled accurately. Thanks to modern measuring instruments, as well as to the engineers of Hanack and Partners and the HafenCity University (HCU) in Hamburg, this issue has been solved. Currently, this three-dimensional sampling method can be used for entire hulls. As well as measuring the hull and superstructure, individual sections and components can be scanned and compared with the respective bespoke vessel elements on the computer.

Scanning the shell construction of a 100m yacht costs approximately €100,000. This can be offset against the key benefits of the 3D scanning methods: saving the shipyard time and therefore money. In our experience, for a 100m yacht with construction costs of about €300 million, 10 to 15 per cent of these costs are sometimes re-allocated to cover rework expenses. This huge cost must be borne almost entirely by the shipyard as only a small proportion of it can be passed on to the supplier. This leads to not only a loss of profit, but moreover to a significant loss of time. To scan a 100m yacht takes between 120 to well over 200 scanner positions, taking between five and 10 minutes per position. Approximately six million points are scanned, requiring a storage capacity of 400-800MB for a single scan.

Another problem to combat lies in the coating of surfaces. Tons of filler is applied to the shell to turn it into a smooth, high-gloss luxury yacht. Using the 3D scan, we optimise and, above all, calculate the amount of filler that needs to be applied. This means that we can predict the impact on the trim of the yacht, for example, and thus address any faults in advance. The same applies to the fitting of fairleads, shell doors or anchor pockets. In these cases it is important to calculate the exact amount of the filler in advance before they are welded.

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Using the 3D scan this amount can be calculated precisely beforehand as well as during the construction phase. The scanner detects the actual dimension of the shell, which is then assembled into an image in the computer with the CAD template. This direct comparison allows an exact overview of bumps or dents in the outer skin. Even larger structural defects, such as a lopsided transom or a protruding bow, are tracked by the system, which then allows timely corrections. The sooner a scan is performed, the easier it is to actively influence the specified dimensions and thus the thickness of the filler layer. The steel shell is often corrected after the analysis, for example to avoid excessive filler application or to make sure that hawses or shell doors are flush with the filler layer, and any major errors in the hull can be corrected by the shipyards before the finish. Moreover, the cut-outs in the hull that are to house externally produced components, such as shell doors, can be checked for dimensional accuracy and correct data can then be submitted to subcontractors. This guarantees that the vessel and fitted components will fit together with minimum rework.

Finally, the required material can be accurately calculated and mixed depending on the thickness of the layer to prevent cracking, which is often caused by the so-called bimetallic effect. Here, steel and filler expand differently with temperature variations, and the filler eventually cracks. This effect is aggravated by high filler thickness.

All these problems can be prevented through 3D scanning and in this way the construction of megayachts becomes a more predictable risk for shipyards. ■

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WITH SUBJECT: SCANNING OVER THE CRACKS

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