

MEYER WERFT Builds Cruise Ships with Help from Geomagic Control X

MEYER WERFT uses Geomagic Control X software from 3D Systems for geometric inspection of ship components to help ensure quality, accurate fit, and on-time delivery.

MEYER WERFT GmbH & Co. KG based in Papenburg, Germany, has achieved an excellent worldwide reputation for building special-purpose ships. The company is especially well known for the construction of large, modern, sophisticated cruise ships. Over the years, the shipyard has built 45 luxury liners for customers from all over the world and every ship is unique. To remain globally competitive, MEYER WERFT uses state-of-the-art production technology. Since 2010, the company has been using a Leica laser scanner for geometric analyses and image documentation. A LizardQ camera system is used to create 360-degree panoramas—up to 8,000 every year. For 3D comparisons and precise adjustments of complex point-cloud models, MEYER WERFT metrology engineers use Geomagic® Control X™ inspection software from 3D Systems.

The journey from CAD blueprint to finished ship is a long one in which there are many challenges. “To get an idea of the complexity of the task we face at MEYER WERFT, you have to imagine building a complete, floating town every six months, including water and sanitation, logistics, accommodation for thousands of people,

CHALLENGE

Save time and money in the shipyard by preventing assembly errors and reducing the number of physical adjustments.

SOLUTION

Geomagic Control X metrology and quality management software by 3D Systems, used with a Leica laser scanner and LizardQ camera system

RESULTS

- Reliable measurements
- Efficient part quality management
- Accurate part fitting
- Reduced follow-up costs
- On-time delivery

MEYER WERFT constructed and delivered the *Norwegian Bliss* to Norwegian Cruise Line in April 2018.
Image © MEYER WERFT





The *Norwegian Bliss* cruise ship has a unique leisure attraction on its upper deck—a go-karting track. Everything here and elsewhere on the ship must fit perfectly.
Image © MEYER WERFT

restaurants, food service, theaters, movie theaters, and a host of other leisure attractions ranging from water slides to go-karting tracks,” says Ralph Zimmermann, head of metrology/quality management at MEYER WERFT. “We use up to 30 million components to assemble every cruise ship, whereby even the smallest components, which are called sections, can have dimensions of 30 x 30 x 2.5 meters. When the ship is then assembled, everything must fit together perfectly. For the geometric measurements and point-cloud modeling that we perform every day, we use Geomagic Control X. We have a long-standing partnership with 3D Systems, the software vendor.”

Eric Wind, international senior consultant at 3D Systems, adds, “The wide range of applications for our software helps MEYER WERFT in its quality management, which is a crucial factor in the successful and on-time construction of cruise ships. Geomagic Control X inspection software delivers reliable results quickly and easily. We continually develop the software to ensure that we can continue to meet the challenging requirements of our customers in the future.”

Geometric measurement has been part of the quality management process at MEYER WERFT since 2012 and encompasses the entire production process for building a new ship. The department is responsible for all metrology tasks and works closely with the construction supervisor at the shipyard. One of the key tasks of the department is comparing target and actual states. Work begins with the scanning of components and their virtual assembly on a computer. Checking to ensure an accurate fit before assembly saves a lot of time in the shipyard as it significantly reduces the required number of physical adjustments.

3D comparison of target versus actual states helps ensure accurate fit

In ship building, all materials are subject to changes caused by external influences. Welding causes changes in metal parts due to thermal action. Components are also affected by mechanical influences during transport and assembly, which

can lead to deformation. Even the temperature conditions for the time of year can have an effect. A component that fit perfectly in the blueprint and during production and virtual adjustment may exhibit problematic deviations when it comes to final assembly. Target versus actual comparisons are therefore essential and are created using 3D analysis in Geomagic Control X. Current requirements include surface analyses, geometry inspections, fit checks, and virtual reality.

Surface and deck analyses help reduce follow-up costs

André Schreiber, technologist in the metrology department at MEYER WERFT, explains, “In our surface analyses, we aim to identify deviations from the target state in a fully-assembled section. Once everything has been captured with the laser scanner, we edit and analyze the point cloud with Geomagic Control X. The software makes the entire process much easier for us as it can handle large volumes of data. It is also suitable for all component sizes.” Another advantage is that Geomagic Control X can be used in combination with all scanner types and technologies, enabling all users to measure and validate objects geometrically and create test reports.

The surface analysis (Figure 1) clearly shows where there are real elevations and hollows on the deck surface compared with the target state. Surface unevenness of just a few millimeters on the sun deck of a cruise ship can result in puddles. Deviations of this kind can also occur below deck. For example, some areas of the ship are tiled and an uneven floor could cause floor tiles to crack.

If the commissioning shipping line were to discover such problems upon delivery of the ship, the result would be expensive repair work. Thanks to the work carried out by the metrology engineers using Geomagic Control X, such problems can be rectified at the shipyard. The relevant areas are reworked and the deck surface is leveled by calculating precisely the amount of leveling compound required—meaning no puddles and no passengers arriving at their sunbeds with wet feet.

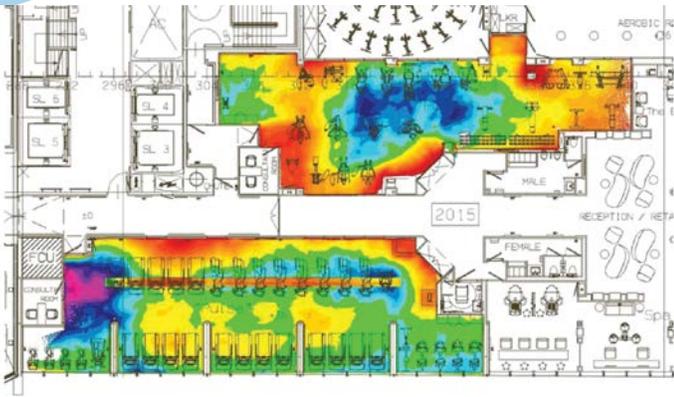


Figure 1: The color map of the surface analysis from Geomagic Control X shows significant differences in height and depth on the deck surface. Image © MEYER WERFT

The deck analysis involves a similar process; the CAD model data is compared with the actual conditions on site and deviations can be identified immediately (Figure 2). The 3D analysis makes it possible to intervene in the construction process if, for example, adjustments are needed due to pipes being positioned at different heights. The 3D analysis also prevents structural complications at a later stage when decorating the interiors.

Geometric inspections help anticipate and address deviations

Geometric inspections of the ship's hull are essential. In the stabilizer used as an example (Figures 3–5), the edges of the shell surface are incongruent; the scan result is visibly different from the CAD model. In the quality assurance process, the 3D comparison is used to decide whether a deviation due to expected deformation lies within the tolerance range. Zimmermann explains: "The 3D analyses provide us with a clear picture of all deviations. It may be necessary to adjust the component in question if its functionality is restricted, if the deviations generally make it more error-prone, or if it does not comply with safety regulations."

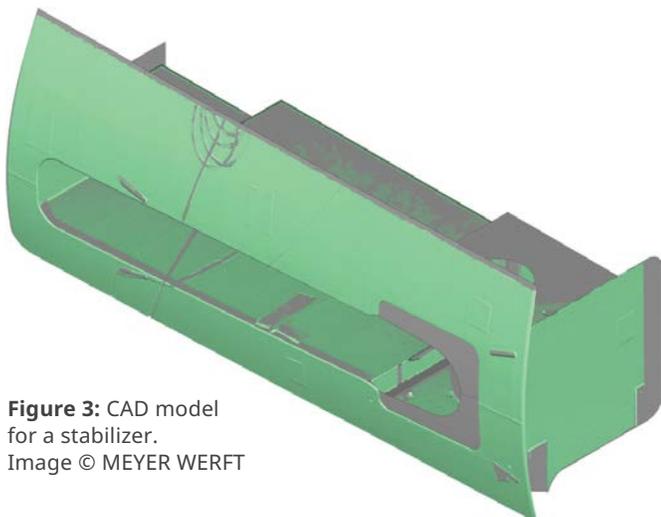


Figure 3: CAD model for a stabilizer. Image © MEYER WERFT

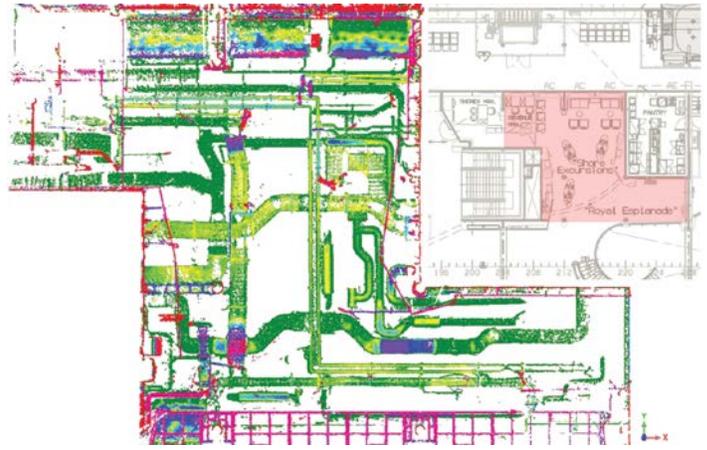


Figure 2: The deck analysis from Geomagic Control X shows where the data of the CAD model deviates from the actual conditions on site. This knowledge is used to ensure necessary adjustments are made in good time. Image © MEYER WERFT

Fit check helps save time and money for last-minute change requests during construction

It is not uncommon for the client to request changes to areas of a cruise ship or its equipment during construction. Zimmermann says: "In one case, a customer wanted a higher capacity for the lifeboats, which were to be produced by a supplier in Italy. The design of the boats was therefore significantly modified and they no longer had our originally planned dimensions. At the shipyard we had to ensure that the resized boats would still fit in the intended lifeboat davits and could be lowered properly." A simple comparison of the dimensions (length, width, height) was too risky. Given that the only other viable alternative would have been to transport a lifeboat from Italy to Germany for adjustment, instead it was scanned by MEYER WERFT engineers at the manufacturer's premises. The metrology department then performed a fit check using Geomagic Control X. The result was positive: the new lifeboats fit perfectly and no further modifications to the ship's structure were required.

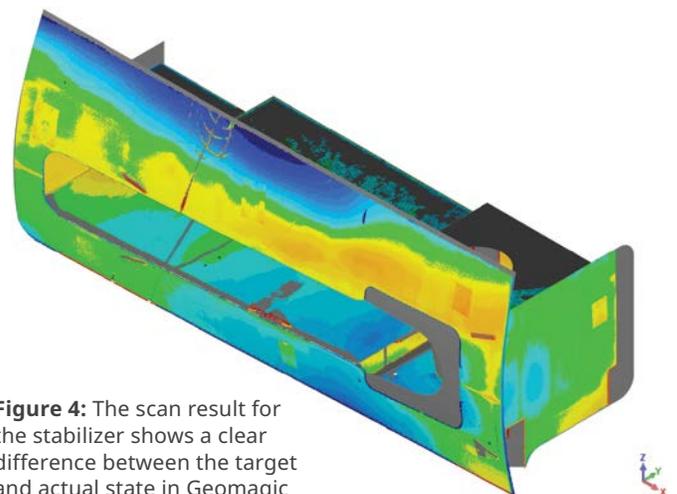


Figure 4: The scan result for the stabilizer shows a clear difference between the target and actual state in Geomagic Control X. Image © MEYER WERFT

Conclusion

Tools such as laser scanners and powerful software for metrology and quality management have become indispensable in modern shipbuilding. They play a key role in ensuring that components fit together perfectly when assembled, that any changes required can be made in good time, and that the ship is completed and delivered on schedule. Zimmermann explains, "We have to be able to rely on our measurement results at all times. With 3D Systems, we have a reliable partner by our side who understands our needs and is constantly improving the inspection software. This enables us at MEYER WERFT to build amazing cruise ships, ferries, and research vessels."

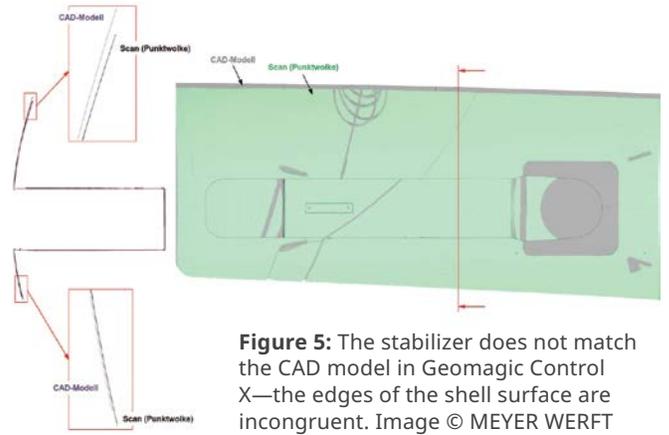


Figure 5: The stabilizer does not match the CAD model in Geomagic Control X—the edges of the shell surface are incongruent. Image © MEYER WERFT

- [Download the *Is 3D Scanning Right for Your Inspection Needs?* eBook.](#)
- [Learn more about Geomagic Control X.](#)

The metrology/quality management department at MEYER WERFT has been using geometric measurement as part of its quality management process since 2012. The department has seven engineers and seven technicians along with apprentices and students. Image © MEYER WERFT



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