

The right technology for measuring long profiles has many advantages for aerospace supplier.

Measure and Save

PFW Aerospace AG, Speyer, specializes in conduit pipe, freight loading systems, and structural components for aerospace. In order to be able to measure parts of nearly ten meters in length, both precisely and economically, the quality team invested in a Werth ScopeCheck MB. This 3D CNC multisensor coordinate measuring machine, from Werth Messtechnik, Giessen, is equipped with a flexible clamping system and provides precise, traceable measurement data with short setup times.



For PFW Aerospace, Werth Messtechnik expanded the Werth ScopeCheck MB, a 3D CNC multi-sensor coordinate measuring machine, with a six meter long, 13 ton granite table

Complex systems of curved conduit tubes run through modern aircraft like veins from the wingtips to the engines. Various media run through them, which is why the conduit systems are made of different materials and have to meet special requirements. Minimal space requirements and maximum safety are the critical points that must be considered when developing and manufacturing these elements. For the specialists at PFW Aerospace, this is no problem. The company, based in Speyer in Rhineland-Palatinate, has many years of experience and is currently number one in the world in “conduit systems for aerospace.” The range of services of this supplier, however, is much broader. It also includes the production of structural components, freight loading systems, and auxiliary tank systems.

All of these aerospace products for Airbus and Boeing have one thing in common: they are subject to strict quality criteria that must be reliably checked and documented.

This is no easy task. For example, it is difficult to measure particularly long elements such as roll conveyors for freight loading systems, or seat rails with drilled hole patterns.

Optical coordinate measuring technology makes an entrance at PFW

Just two years ago, PFW Aerospace invested in cutting-edge optical coordinate measuring technology from Werth Messtechnik for measuring long profiles. Engineer Steffen Fellberg, Manager of the Lean Production Team and Time Management, remembers: “It was not easy to find the right provider with the right product. Unfortunately, there are no standard measuring machines on the market for measuring long profiles, up to 9.3 meters, which is what we need.” This meant that a custom design would be needed, but it could not be too expensive. Steffen Fellberg, who was responsible for the project, also had to consider this aspect.

First, however, the technical requirements had to be specified. “It was important to us to be able to set up and measure a wide range of profiles on the measuring machine, without extensive changeover, and as automatically as possible,” explains Steffen Fellberg.

The aerospace supplier previously had only a ten year old, self-developed measurement system for long parts. It was very solid, but its setup was limited to seat rails and roller track profiles.

“We needed a boom crane to change it over, which took a half hour every time,” says CNC programmer Thomas Groll, who is responsible for measuring the profiles, among his other duties. “Recently our range of part variations has grown enormously.

In seat rails alone, we have 1200 different main component drawings, and another 600 for roller tracks. Because we do a lot of initial samples, we lost a lot of time whenever we changed over. The old system was also not traceable to the PTB length standard.”

With new orders, such as for the Airbus A400M, for which PFW Aerospace is supplying the entire freight loading system, including ramps, a much more flexible system was required. Project manager Fellberg was also already thinking of the future: “We never had any large quantities to measure, but the idea is not out of the question. If the numbers go up, we are well equipped with an automatic measuring system.”

Finding a competent partner in Werth

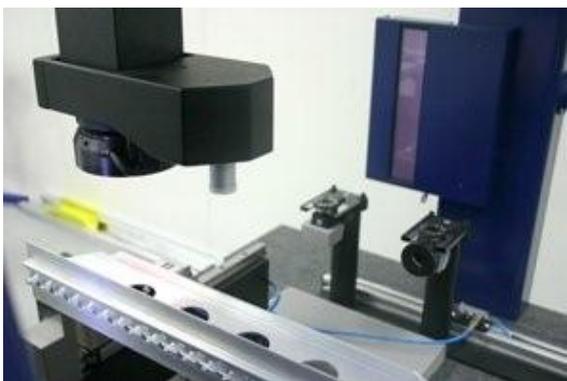
Steffen Fellberg’s team started searching for measurement technology providers who were able and willing to adapt a suitable standard measuring machine to the desired profile measurement by redesigning it to expand it to the required length and setup technology.

They did not find very many providers. “The decisive factor, however, was that we found the right partner,” the project manager reports positively. “The Werth Messtechnik company showed that it is an open-minded and very innovative company, and they took on our task with great competence.”

The basis of the new measuring system is the Werth ScopeCheck MB, a 3D CNC multi-sensor coordinate measuring machine, which is able to precisely measure large volume, heavy components in a production environment in its standard configuration. For PFW, a six meter long, 13 ton granite block was added, which was imported special from South Africa. A bridge gantry “floats” above this table on air bearings, and is equipped with a complete array of sensors. PFW decided against an optional linear drive system, thereby forgoing more dynamics, both for cost reasons, and because the main measuring time, in this case, plays a less critical role. The secondary processing time, namely the setup for changing over parts, was far more important. Serious thought was invested in the creation of the most efficient design.

The construction of the fixture device was in no way “off the shelf.” PFW had very concrete ideas about this and provided all of its development expertise, “which Werth Messtechnik outstandingly and creatively implemented in the design,” as Steffen Fellberg emphasizes. “Clamping the profiles, which takes only a few minutes on the new measuring system, is of great importance for reproducible results. Internal stresses and deformation would otherwise lead to imprecise results. We clamp all long profiles on the new measuring system – now including all A400M profiles – using the same principle as on our profile machining centers.”

The long profiles can be measured today in one setup, on three sides, fully automatically. The Werth ScopeCheck MB is equipped with an optical sensor for this purpose, which measures the component vertically. The measuring machine also has two right angle lenses that allow measuring horizontally from both the left and the right sides. This could be unique in the world, according to Fellberg.



The image processing sensor is connected to the gantry, and measures from the vertical position



The profiles are clamped in just a few minutes

Altogether, there are three different light sources available for non-contacting measurement. Transmitted light, bright field incident light, and dark field incident light. The optical light paths are equipped with the patented Werth Zoom, with adjustable magnification and variable working distance, which increases flexibility and reduces the risk of collision. In

order to be able to perform three-dimensional measurements with the optical sensor, a distance sensor (autofocus) is integrated.

Multi-sensor technology allows measuring in one setup

Using an additional integrated measurement probe, surfaces that cannot be accessed by the optics, such as undercuts, can be probed and scanned.

The probe and angle optic attachments are located in a changeout magazine, from which the measuring machine can load and unload them as needed in CNC mode. An important part of the system is the 3D measurement software. It allows measurement programs to be created easily using menus. It also shows its strength in interactive measurements, as Thomas Groll knows from experience: “For complex components with theoretical references, WinWerth 3D measurement software is an unbeatable advantage. It allows certain measurement points to be calculated using design functions, as in a CAD system, and the machine travels to them automatically. This would not be possible to measure if it were guided by hand.”

It’s easy to evaluate each measurement. The multisensor measuring machine software creates a model from all the measured data, which is compared to the nominal values. Deviations can be detected and evaluated at a glance. Because the data is available electronically, PFW can create the required measurement records at the push of a button, so to speak. The data is also available for statistical process control.

Currently, PFW uses the Werth Scope Check primarily for interactive measurement, because it is used nearly exclusively for first article inspections. Thomas Groll indicates that a CNC machine is worth the cost, even here, because the CNC code is written automatically in the background while the first article is measured in “Teach-In” mode. It is possible to run the program again automatically in case of mismatches, and to make changes: “We also already have the starting points for offline programming of the CAD dataset, have tested it several times already, and will use it in the future to generate series programs.”



The 3D measurement software supports offline programming and interactive measurement

More precise, rapid, and flexible in practice

A typical example of a current measurement task, according to programmer Groll, is a seat rail with borehole patterns. "Passenger seats are mounted on these rails. The raster is used to divide up the seat rows, which are spaced differently in business and tourist class. We need to measure the hole patterns for position and diameter. The tolerance to be inspected is up to 0.2 mm over a length of 5 meters. Similar values apply to the boreholes in roller tracks, in which the transport rolls are anchored." In order to be able to use the Werth Messtechnik machine universally for measuring "normal components", a clamping surface that can be inserted in the holding fixture was developed.



**Steffen Fellberg (left) and Thomas Groll (right) agree:
"In Werth Messtechnik, we found the right partner."**



The previous measuring device will continue to be used for bottlenecks

Worldwide success

The PFW Aerospace AG tradition goes back to the year 1913, when the company was founded under the name “Pfalz Flugzeugwerke” (Palatine Aircraft Works). After an eventful company history, 1996 was a key year: PFW Aerospace AG, which belonged to DASA at the time, was faced with a situation of being closed or dismantled. But the approximately 500 employees fought to keep their plant open. After a management buyout, they set the company on the path to success with a new strategy and lots of hard work. One important goal was to expand the customer portfolio, which was an impressive success. Today, nearly all significant aircraft manufacturers are customers of PFW Aerospace AG, which is based in Speyer and has many subsidiaries around the world.

The company earned about 190 million Euro in 2007, with about 1500 employees. PFW Aerospace is a worldwide market leader in the area of conduit systems for aerospace, and also produces structural components, freight loading systems, and auxiliary tank systems.

Werth Messtechnik, Giessen www.werth.de