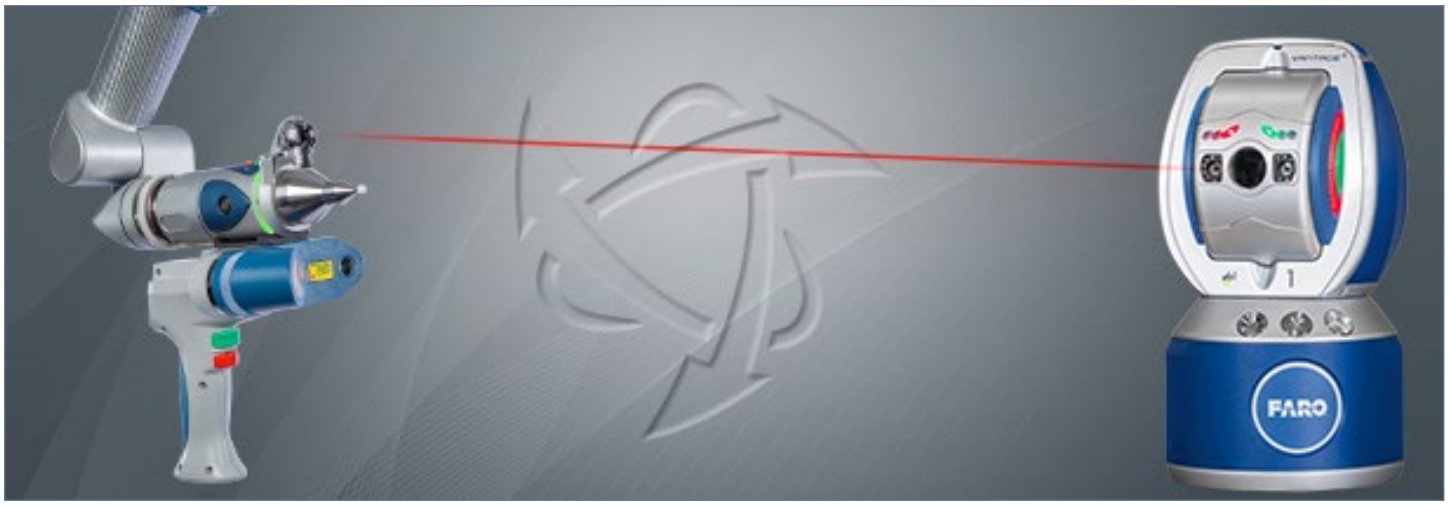
WHITE PAPER

Quality MAGAZINE

Meet the Super 6DoF TrackArm

Michelle Bangert | Managing Editor | Quality Magazine | October 2016

The Ultimate 6-Degrees-of-Freedom Solution



When you work with organizations like BMW or NASA, quality cannot be left to chance.

Whether it is a car body or fuselage, working with large components introduces some unique measurement challenges. High accuracy is required on such large and detailed parts, as operators must negotiate between the sheer size of parts and the necessity of precise measurements.

Measuring components that are ten or fifteen meters long requires a set of very specific features. A Measurement Arm alone wouldn't be enough. Likewise, a stand-alone Laser Tracker cannot measure hidden entities without using several probes or adapters, and continuously changing measurement positions can be time-consuming. That's where FARO's patented Super 6DoF (6 Degrees of Freedom) TrackArm solution comes in.

The Super 6DoF TrackArm Explained

The Super 6DoF TrackArm solution is a combination of the FARO Vantage Laser Tracker with a FaroArm or ScanArm. By bringing together the Laser Tracker, Arm and TrackArm Kit, operators are now able to measure anything, any size, anywhere, at a much lower cost than other comparable systems. Super 6DoF technology allows operators to connect the Vantage Laser Tracker with the ScanArm into a long-reach, 6-degree-of-freedom probe.

FARO's Super 6DoF TrackArm combines all the capabilities of 3D Measurement Arm and Laser Tracker technology to create an integrated 3D measurement system. It is the industry's only 6DoF solution that completely eliminates line-of-sight challenges and significantly expands measurement range while maintaining superior accuracy.

To further expand scanning volume for large scan projects, multiple ScanArms can be paired with a single Vantage Laser Tracker, to enable all of the ScanArms to simultaneously scan into a single coordinate system. This approach saves the time

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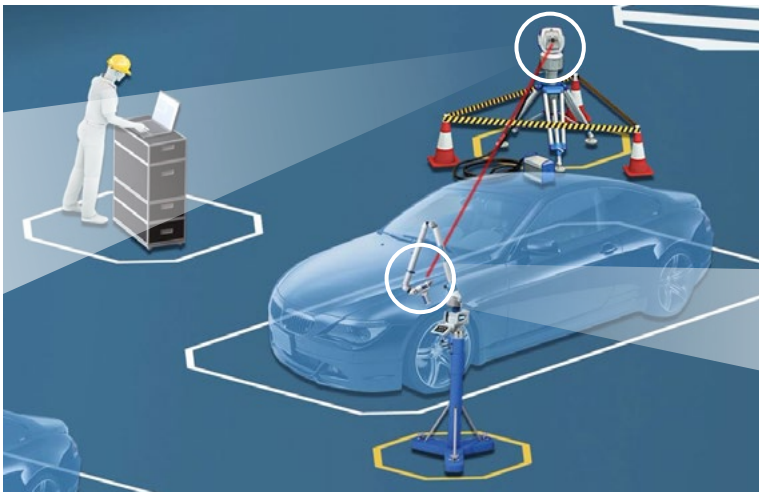

required to move the ScanArm from one position to another. For large-scale 3D measurement projects, Super 6DoF with multiple ScanArms dramatically improves workflow while ensuring accurate measurement data.

The Super 6DoF solution has spherically mounted retro reflectors, or SMRs, attached directly to the FaroArm or ScanArm. Simply by moving the arm in a figure 8 motion, the system will take several thousand points to synchronize the Arm to the Tracker. From there, the operator can start scanning with the integrated laser scanner on the FARO ScanArm.

In the past, operators may have had to choose between accuracy versus flexibility, or long range versus consistency. They would have had to interrupt their workflow as they switched between systems. Automotive manufacturers, for example, might scan the outside of the vehicle in order to gain coverage and speed, and then switch to a measuring arm in order to take inside measurements. The interruption is no longer necessary with FARO's Super 6DoF solution.

Instead, they can switch between tools without interrupting workflow. Operators are no longer limited by the features of one device operating in isolation. Super 6DoF resolves the issues of line-of-sight, sharing a coordinate system, and cables. The system allows for an expanded FARO ScanArm working volume, which allows it to be repositioned anywhere. Alternately, repositioning can be avoided altogether by simultaneously using multiple ScanArms in a single coordinate system that has been set up using the Vantage Laser Tracker. Operators are able to reach hidden points, including around corners and inside hole and cavity features.

This solution allows operators to inspect, reverse engineer and/or perform CAD-to-Part analysis more easily.

By uniting the Tracker and the Arm, companies receive a host of benefits, including integration, freedom, connectivity and flexibility. Only one laptop is needed to operate both devices. The devices share the same reference coordinate system, and integrate with customers' wireless networks. For situations that don't require the use of both tools, the devices can be used individually as well.

Super 6DoF provides high-accuracy 3D scans, even for large components. It can be used to measure complete cars, car bodies, bodies in white, tools, fittings, fixtures, parts and components, cubings and master jigs for pilot and production phases.

Super 6DoF is ideally suited for applications with parts that are not only large but extremely detailed and complex. This makes it an ideal solution for industries such as automotive, heavy machinery and aerospace. Some aerospace customers have found a 35 percent reduction in machining. If you extend this across the entire aerospace industry, this could create a ripple effect throughout aerospace manufacturing. In 2015, the U.S. aerospace and defense industry generated $300 billion in economic value and 10 percent of manufacturing output, according to a study commissioned by the Aerospace Industries Association.

Aerospace is an important industry in terms of economic impact, and, of course, in terms of the precision required. The FARO Laser Tracker itself is an extremely accurate, portable CMM. By using this instrument in concert with

the ScanArm, companies can get jobs done faster, reduce downtime, eliminate scrap and, most importantly, achieve accurate and consistent measurement data. The Super 6DoF TrackArm solution provides these benefits without any of the limitations.

In summary, here is how FARO's Super 6DoF TrackArm offers unmatched capability versus traditional 6DoF probe solutions.

Capability	Average 6DoF Probes	Super 6DoF Solution
Measure around corners and inside cavities without the need to maintain continuous line-of-sight	NO	YES
Expand measurement volume up to 80M without compromising accuracy by needing to switch to a longer probe	NO	YES
Connect multiple measurement arms, within a single coordinate system, for simultaneous data collection over large volumes	NO	YES
Quickly switch between using a 3D Measurement Arm and Laser Tracker independently, and for Super 6DoF applications	NO	YES
Expand measurement reach by replacing traditional 6-12 inch 6DoF probes with 6-12 foot options	NO	YES
World-class 3D scanning capabilities with optically-superior blue laser technology for high-resolution, accuracy and speed	NO	YES
Seamlessly control the Laser Tracker through quick gestures of the measurement arm	NO	YES
Capable of integration into a dynamic measurement environment through independent control of 3D Measurement Arms with a computer tablet	NO	YES
Increase accuracy on measurement jobs that require multiple arm positions	NO	YES

A Single Solution

Both the Tracker and the Arm use the same single software license. In the measurement software, the scanned points will be visualized in real time. For example, it is possible to make a comparison to the loaded CAD model of a vehicle and its measured results in real time.

Scanning and positioning the Arm are not limited by distance or intricacy of the part. When using an arm around a car, for example, the operator scans and positions the Arm, and it sends all of the data together. As the Arm and the operator move on to another location on the vehicle, the Laser Tracker remains in place and the data continues to be sent to the same computer work station.

The FaroArm or ScanArm can be switched to any measuring position within the range (up to 80 meters) of the Laser Tracker. Gap concision measurements or the analysis of standard geometries will be done automatically. Therefore, the process of digitization and analysis can continue correctly in the same coordinate system.

The instrument does not require a dedicated metrology room to operate. This allows for added mobility, as does the ability to mount the Laser Tracker to the ceiling in production facilities. A broader measurement range can be achieved and it can be easily taken down as needed. This mounting arrangement has already been used for automotive facilities in order to provide more flexibility on the production floor.

The Customer Experience

A major automobile manufacturer based in Germany requires high accuracy, and they found it with FARO. Adoption of Super 6DoF alleviated bottlenecks, removed interruptions in the workflow, and streamlined the inspection process. At their plants in Germany, Super 6DoF provides new levels of flexibility. In the past, operators would have to scan the outside of the car with the laser scanner and then switch to a measuring arm to measure inside the vehicle. But with Super 6DoF, the coordinate system is shared between the Laser Tracker and the FaroArm or ScanArm, allowing for more flexibility. One instrument handles the measurements, and it can be moved throughout the inspection area without worrying about cables, lines-of-sight or references. At one of the plants, the Laser Tracker is suspended from the ceiling, which provides access to several work stations while also preventing any accidental outside contact. But it can also be relocated within five minutes for other applications, if needed. In addition, the FARO Super 6DoF TrackArm system seamlessly connects with the wireless production network in the factory.

Super 6DoF elegantly solves problems common to both the automotive industry as well as aerospace. Janicki Industries is a contract manufacturer to the aerospace industry, specializing in aerospace tooling. The company has worked on such high-profile applications as NASA's Space Launch System and deep-space radio telescopes, and also designs and builds high-precision parts and tooling for marine, energy, military, transportation, and architecture customers. The tooling market demands high quality, but at a competitive price.

Before adopting the Super 6DoF TrackArm solution, Janicki was forced to deal with lost time in the machining stage. The path of their CNC cutting tool was not accurately aligning to the metal part, which meant wasted time as the machine moved to where there was no material. In essence, it was cutting air instead of the part. Super 6DoF solves this problem with software that works with the as-built surface instead of the nominal one.

Combining the 3D Measurement Arm and the Laser Tracker technology resulted in a 35% reduction in required machining, and Janicki estimates that Super 6DoF saves 20 hours per tool, depending on the tool size. In addition, the Super 6DoF TrackArm solutions eliminate the need for leapfrogging the arm from station to station, since all of the data is connected. The solution provides Janicki a high-accuracy 3D scan even for large tools.

Click above to watch a video on Super6DoF TrackArm.

Click Here

To schedule a 15-minute personalized live web demo of the Super 6DoF TrackArm, or call FARO at ***800.736.0234***

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Sources:

http://www.aiaaerospace.org/research_reports/aerospace_and_defense_an_economic_impact_analysis/

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