



Seeing beyond

Success Story

Orchid Orthopedic Solutions



Orchid Orthopedic Solutions Increases Throughput and Inspection Information with Automated 3D Scanning Technology



An example of a complete knee implant product from Orchid Orthopedic Solutions.

Formed in 2005, Orchid Orthopedic Solutions is a medical device manufacturer providing contract manufacturing services for orthopedic procedures to Original Equipment Manufacturers (OEMs) and other companies within the orthopedic industry. With 11 locations worldwide, Orchid specializes in solutions for implant procedures in major orthopedic markets, including hip reconstruction, knee reconstruction, spine, trauma, extremities and sports medicine. Orchid's location in Oregon City, Oregon, specializes in the investment casting manufacturing process for knee implants, including 3D wax printing, machining and finishing knee femoral components and stemmed tibial plates. These small parts begin as wax and turn into cobalt-chromium castings.

Customer's specifications require accurate and repeatable inspection

Though Orchid offers design services, customers typically contract with Orchid to manufacture their private designs to their own requirements. Ensuring the knee implant components meet the customer's specifications requires accurate and repeatable inspection. Due to the organic shape and curvatures, inspection using a single point trigger coordinate measuring machine (CMM) was time-consuming and challenging to measure a few features. Customers wanted to inspect more features, and Orchid wanted to meet the demand faster. Additionally, operating a CMM requires specific skills, training and environmental temperature, creating more limitations.



Automated ATOS 5 3D scanning knee implant components on a fixture inside ScanBox.



Time-saving pallet measurements of implant components

Fully automated production, in-process and final inspection

In 2019, Orchid's automation engineer led an effort to seek technologies that would automate their dimensional measurement and quality processes to decrease inspection time and increase information. Orchid also considered 3D measurement solutions with the ATOS system. After reviewing the results of a gage R&R (repeatability and reproducibility) study performed with the technology, Orchid purchased a non-contact blue light 3D scanner including ZEISS INSPECT and VMR (Virtual Measuring Room) App to fully automate final inspection, in-process and production inspection.

Because many of Orchid's customer requirements dictate what metrology equipment is acceptable for inspection, implementing ATOS technology took gaining buy-in from those customers.

Find the part the same way every time

"They want a gage R&R, and they want to make sure that no matter how many different ways you set the part up on a fixture, that inspection will find the part the same way every time and correlate with a computerized CMM inspection method, which has historically been the industry standard. So, if we could correlate the CMM and show a good gage R&R, which is about 10% of the feature tolerance, it's much easier for customers to buy off on the process. There's a lot of other inspection systems out there, but they're not able to get down to 10% of the feature tolerance, which is where we want to be," said Frank Sears, Lead Quality Engineer at Orchid's Oregon

location. In addition, ATOS measures full-field surface geometry using advanced blue light fringe projection technology, thus creating a digital twin of the entire product.

After ATOS technology passed numerous correlation and gage R&R studies, Orchid earned buy-in from two customers for a total of five different products within the first 12 months following the purchase.

Hardware and software communicate seamlessly

Sears and his team use the Smart Teach offline and online programming functions in the VMR App to automatically position and optimize the robotic arm inside the ScanBox to achieve optimal angles for the ATOS sensor to collect adequate data. To advance their process further, they worked with ZEISS' team of automation experts to create a customized template using scripting methods to perform automated 3D scanning and inspection specific to Orchid's customers' requirements. The script is processed through the Kiosk Mode, which seamlessly communicates to the VMR App to execute batch scanning for multi-part inspections. The operator places multiple knee implant components, averaging 24 at a time, onto a fixture within the ScanBox. Pressing a button activates the ScanBox to begin digitizing the batch of parts. The software intelligently separates the 3D mesh data sets of the multiple components and stores each in a specified folder. The software then loops and takes each individual data set, applies the proper measurement inspection template, and automatically generates a report.



Decreasing inspection time and increasing part information

By implementing this process, Orchid's initial goal of decreasing inspection time and increasing part information was immediately met.

"One knee implant product previously took us about four minutes a piece to inspect, and we only had four features being measured on it using a traditional measuring method. The customer wanted us to check a lot more features, so we added many more features to be inspected than we normally would and using our ScanBox, we still save time – 40 pieces would take three hours to inspect just four features on each piece with a single point trigger CMM. Now it takes us about 45 minutes to an hour for the same number of parts, and we're inspecting way more features," said Kirk Dorr, a Quality Control Supervisor at Orchid Orthopedic Solutions.

Creating inspection templates for each component is fast and easy

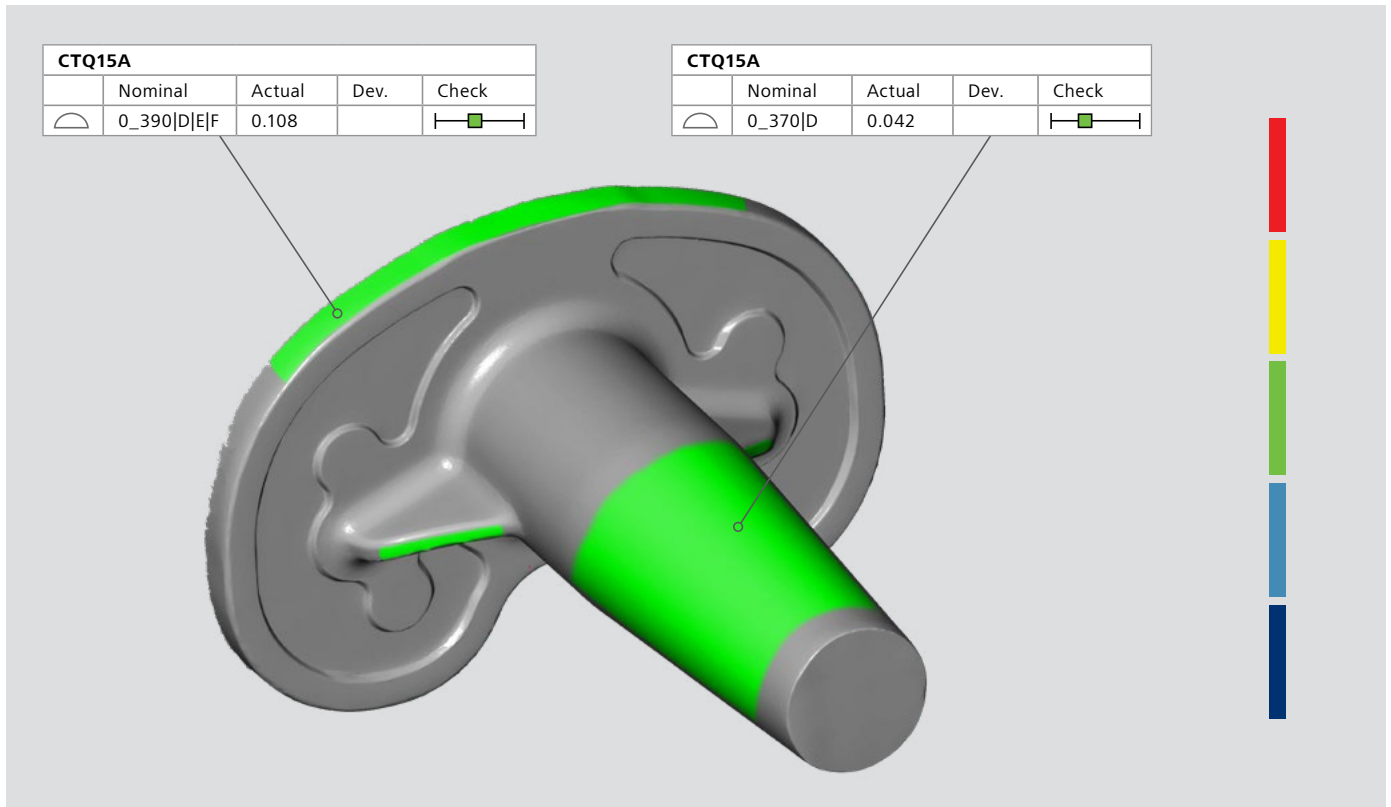
Inspection templates for any given component designate which features will be inspected and reported. Orchid primarily uses ATOS technology to inspect casting components that have surface profiles, such as the inside fitting surface of the femoral component that mates with the bone. For example, an inspection template for a stemmed tibial plate would check surface profiles to ensure that the part conforms.

These geometric dimensional profiles vary from tight profiles, like the stem of the tibial plate, to details like the injection site in the wax state. Data visualization also reveals if a part needs reworking by allowing them to check features like pocket depth between one area and an outside rail to ensure that the part is conforming properly. Creating inspection templates for each component is fast and easy. Once created, the specific inspection elements and analysis are automatically applied based on the template, increasing efficiency further.

The full-field 3D data capture ScanBox provides also enables reverse engineering. Sears and his team use ScanBox to scan the in-house tooling used to create the waxes that start the casting, generating an STL mesh, or digital twin, representing the actual tool after reworking. Depending on the circumstance, they bring the data into a CAD platform and create a solid model to provide to a tool manufacturer to recreate the tool when needed.

Some of Orchid's wax tools are 20 – 25 years old and have no model available, making the ability to use ScanBox to quickly create an accurate model for reproduction a critical advantage. Archiving the data also allows it to be retrieved for various reasons, such as if it were damaged in production or needed to be replaced due to wear.





ZEISS INSPECT visualizes data to display the information more clearly

Orchid's team also benefits from interacting with ZEISS INSPECT visual data to display the information more clearly, while having the flexibility to make it as detailed or undetailed as necessary. The ability to process the data flexibly to display inspection features, visualizations and models helps make inspection reports that support clear customer communication and collaboration.

"ZEISS INSPECT provides a 3D surface map (color map, heat map) where you can rotate and analyze it real-time in 3D coordinate space. Color maps show you where the high points are, exactly where you need to rework, and other areas that may need improvement. It's been really helpful," said Sears.

Cost savings are the biggest driver

Orchid's future plans include gaining more customer acceptance of ScanBox technology to expand the product families they can inspect with this advanced technology. Time savings is one reason for this push, but the biggest driver is cost savings.

"Over the past year and some, we've processed more than 100,000 castings using our ScanBox that used to be CMM inspected. We wanted to calculate our actual savings and found that we received the return on investment within the first 12 months and the cost savings are only going to continue to get better as we transition more parts from CMM to ScanBox," said Sears. "Our plan is to continue saving money and speeding up inspection by adding more products to the ScanBox. Our current ScanBox sits at an 80% utilization rate over two eight-hour shifts. A second ScanBox will enable us to process more product per day, eventually doubling our throughput and savings by moving more product families to the ZEISS."

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