O’Fallon Casting Inc.

increases prototyping speed and quality using Cross Scanner and PolyWorks software

O’Fallon Casting in St. Louis, Missouri USA took a new approach by installing a Cross Scanner from Nikon Metrology and PolyWorks software from InnovMetric Inc. A prototyping project illustrating the innovation of 3D scanning and point cloud based inspection involved the housing for an integrated wing tip light of the Boeing 787 Dreamliner. O’Fallon engineers inspected both the housing’s foam pattern and inherent aluminum part, and managed to cut the entire process throughput time by 50%. The countless measurement points acquired and the CAD comparison analysis graphics enabled them to better supervise the process, eliminate prototype rounds and deliver top quality.

Cross Scanner
@ O’Fallon Casting (USA)

The Cross Scanner digitized a housing prototype of an integrated Boeing 787 Dreamliner wing tip part. The point cloud data of the housing’s foam pattern and inherent aluminum part were fed into PolyWorks for further processing.

• Process cuts throughput time by 50%, reducing turnaround time for customer
• Detailed scans and graphic analysis improve quality and eliminate prototype rounds
• Reduced tooling cost through fast and accurate prototype verification

Rapid prototyping of cast parts is good business

O’Fallon Casting of St. Louis, Missouri, is a premier nonferrous investment casting company that has built its reputation on making high-quality, competitively priced castings to meet demanding end-user applications. In its 50,000 square-foot facility, the company is specialized in casting a range of aluminum, metal and composite alloys, and serves a broad range of markets.
Here is how O’Fallon successfully integrated the point cloud based analysis in all phases of its rapid-prototyping process:

- A pattern of the wing tip light housing was created from the customer’s 3D CAD model of the part using stereolithography (SLA) and selective laser sintering (SLS).
- The pattern was then visually and manually inspected to determine if it conformed to the reference CAD model of the part and if it was properly proportioned to account for shrinkage.
- Once the pattern was verified and approved through Nikon Metrology 3D scanning and PolyWorks inspection, O’Fallon Casting built a ceramic shell around the rapid prototype pattern.
- The ceramic shell with the pattern went through a burn out process, where the pattern was vaporized to leave only the ceramic mold. The part was cast from A356 aluminum artificially aged to the T6 condition.
- The part was then measured using the Global CMM and the laser scanner. The point cloud data gathered during this routine was transferred to the PolyWorks software electronically via the company’s internal network.

In the overall process, O’Fallon Casting used 3D digitizing and PolyWorks to inspect both the foam pattern and its inherent aluminum part. In the scan process, excess data is collected to capture freeform surfaces and accurately characterize 3D features. As the Nikon Metrology scanner sweeps lasers in 3 directions, the entire geometry of features is captured consistently, regardless of the scanning direction. This allows PolyWorks software to extract features through hundreds of points, rather than relying on a handful of tactile inspection points. Simplified scanner motion paths also means more straightforward off-line CMM programming.

“"The Cross Scanner and Focus Inspection software from Nikon Metrology is a powerful package," marked Galmiche. "In less than one week we were up and running to use 3D scanning in real customer projects. The non-contact scanning solution offers the tremendous advantage of gathering complete data sets, better than what we have ever been able to accomplish through tactile inspection. Likewise, we now perform a laser scanning job in less than a day whereas it previously took us nearly one week. We have reached the point where laser scanning is used in virtually all our rapid prototyping projects, paying off big time both for inspection and troubleshooting purposes."
Powerful point cloud processing and graphic geometry analysis

PolyWorks software’s IMAlign™ module was used to align partial scans, verify surface coverage and remove scan overlap data in creating a single set of data points. Next, the aligned scans were merged using the IMMerge™ module to create a highly accurate finely detailed polygonal mesh model of the digitized parts.

The polygonal mesh model was then exported to PolyWorks IMInspect™ module for the actual dimensional inspection process. For this specific project, a global comparison was performed by calculating the deviation between each digitized point and its corresponding CAD reference. A color map was displayed according to the tolerances set by O’Fallon Casting. O’Fallon Casting engineers measured the clearance of the part by comparing 3D distances between two planes to ensure that the ray of light is projected without interference.

Gaining deeper insight through graphic geometry analysis

“In addition to the data, we include snapshots of the model comparison so that customers can quickly see where the part is out of tolerance,” Galmiche said. “We can also illustrate where the part is just a small amount out of tolerance or greatly so by using different colors to indicate different tolerance ranges. Finally, thanks to the PolyWorks IMView free viewer software, our customers can visualize their inspection projects in 3D from their own workstations.”