NVision recently reverse engineered the rotor assembly, diffusers and diaphragm of a turbine for a major turbomachinery engineering firm in Texas. The full reverse engineering process only took five weeks, far less than six months that the engineering company had originally allotted for the project using less sophisticated measurement methods. “Using our own HandHeld scanner, we were able to measure the parts’ geometry to extremely high levels of accuracy and produce the necessary CAD files. This made it possible for the company to perform simulations to optimize the turbine’s design, substantially improving its energy efficiency,” said Steve Kersen, NVision’s Vice President of Sales and Marketing.

The engineering firm specializes in industrial turbomachinery design and power generation engineering, focusing on steam turbine design and power plant engineering as well as other turbomachinery such as gas turbines, pumps and compressors.

“This was a classic scenario for reverse engineering,” said Kersen. “Lacking the original CAD file, the company needed to create a new one by collecting the turbine geometry at the highest possible level of accuracy and in the shortest amount of time.”

The engineering firm contacted NVision, which sent technicians to the firm’s site where they encountered difficult working conditions. The project area was outdoors without a covered structure, which posed a material concern as sunlight would interfere with NVision’s scanning equipment and both the equipment and technicians would be exposed to the elements. Before scanning could begin, NVision technicians worked to drape black plastic sheeting across the top of the work area to protect their equipment and ensure the accuracy of the scanning. They then proceeded to scan the turbine using the HandHeld scanner.

After completing the scanning, NVision processed the data to a native parametric SolidWorks CAD model. The finished rotor assembly contained over 3,000 blades.

Upon examining the rotor and diaphragm models, an engineer at the turbomachinery firm wrote “very impressive to say the least” and praised the “diligence and caliber” of the NVision team’s work.

Kersen agrees. “The adverse conditions at the work site were extremely challenging. Without our technicians’ devoted and professional work ethic, the scanning would not have been possible. The completion of this project is a testament to our staff’s dedication to customer satisfaction.”

The rotor assembly CAD model
Delta Optimizes Turbine Measurement

Delta Airlines uses NVision’s MAXOS non-contact measurement system in its contract maintenance operations to achieve the highest possible accuracy in overhauling turbine blades and vanes. The traditional method of measuring blades and vanes to determine the level of repair required and to inspect subsequent repairs involves a series of manual measurements. “We have substantially improved on the traditional approach by using the MAXOS to provide consistent and repeatable measurements on parts with complex geometries and shiny finishes,” said Cameron Leonard, Special Projects Coordinator for Delta Air Lines.

Manual measurement methods work well for parts with simple shapes but they are not easy to use on odd-shaped and contoured parts. “If eight different people measure a part they will get eight different answers,” Leonard said. “MAXOS scanning provides a substantial improvement because traditional scanners have difficulty capturing images from highly polished surfaces such as turbine blades. The blades need to be coated before scanning, requiring considerable extra time to put on and remove. The MAXOS alleviates all of these issues.”

“Optical measurement removes the human element, providing substantially greater accuracy and repeatability than manual methods,” Leonard said. “The MAXOS produces a far greater volume of more accurate data than we could ever hope to obtain from manual measurements. We can easily compare critical measurements to the CAD model regardless of the complexity of the part, producing a color deviation report showing the precise differences between them. The result is that we can now repair parts that we were unable to repair previously because of limitations in our ability to measure them.”

Handheld Scanner Ensures Top Quality LED Lights

Lighting Science® uses the Handheld laser scanner from NVision to ensure the dimensional integrity of the extremely complicated castings it purchases and uses in its roadway light emitting diode (LED) fixtures. In the past, it was difficult to inspect the castings because their geometry was too complex for gauges and templates and they would have taken a long time to program and inspect on a coordinate measuring machine (CMM). “With the NVision Hand-held laser scanner we can obtain the complete 3D geometry of a casting in about one hour and compare it to the CAD model to determine not only if the part meets the design intent but also whether it is trending in the correct direction,” said Richard Williams, Manager, Product Quality Assurance for Lighting Science.

Lighting Science designs, develops, manufactures and markets LED lighting solutions that are environmentally friendly and more energy efficient than traditional lighting products. The company uses the Handheld scanner to evaluate many of its LED solid state lighting components. The company’s new RoadMaster™ street light is one example of the component parts evaluated by the scanner.

“We heard about the NVision Handheld scanners’ ability to quickly capture the complete geometry of a complex part and thought it would be perfect for this application,” Williams said. “It takes the operator about one hour to scan the casting and generate a point cloud that completely defines its geometry. The inspection software highlights in green those areas of the part that are well within tolerance, in yellow the areas on the high side of tolerance, and in red areas that are out of tolerance. This information provides an early warning when we are moving towards the edge of the spec so we can make corrections and avoid the need for scrapping parts.”

Heavy Equipment Scanner Manufacturer Saves $$$

Materials Analysis, Inc., a Dallas, Texas engineering firm specializing in litigation support, has used NVision’s non-contact MAXOS measurement system and Handheld scanners to provide critical assistance in a number of recent product liability cases. “The high levels of accuracy provided by non-contact scanning can often rule out hypothesized causes of accidents. In one case they even served as a benchmark to prove that a defect was too small to be adequately documented, preventing the need for unproductive and unnecessary sectioning,” said Mark Allen Lewis, Staff Engineer for Materials Analysis. “Another key advantage of scanning is the ability to quickly generate electronic solid models that are much easier for non-technical people to visualize than blueprints.”

In another product liability case involving an airplane crash, an important element of the plaintiff’s theory was present, though it was invisible to the naked eye. Lewis said, “Their work allowed us to use the plaintiff’s expert’s own data to support our position and was instrumental in helping our client settle the case for a relatively small amount of money.”

NVision's Handheld scanner is able to accurately inspect the replaceable teeth on earth-moving equipment.

Engineering Analysis Improves Fracking Parts

A major manufacturer of hydraulic fracturing parts for the oil and gas industry is using NVision’s engineering services to analyze multiple samples to improve the design and test performance. Using the CAD models provided by NVision, the manufacturer was able to successfully certify their parts to industry standards.

Hydraulic fracturing involves pumping a fracturing fluid into a well bore at a high enough level of pressure to cause the formation to crack. Failures under high pressure can result in catastrophic failure, so proper design and tight tolerances are paramount.

Initial part design was completed outside the USA. The manufacturer ran into problems when some of the parts failed to withstand the pressure testing. They were forced to go back to the drawing board to determine whether it was a design or tolerance problem. The geometry of the parts was too complex for hand measurement and CMM probing would take too long and not provide enough information. They needed a way to capture and compare all of the complex geometric differences between good parts and bad parts.

The manufacturer was referred to NVision by an existing client. NVision engineers were able to high accuracy scan and interrogate the measurements to determine key geometrical differences between passing and failing parts. “The engineers used the variations between passing parts to create the CAD nominal model with manufacturing tolerances.”

As a result, the manufacturer passed testing and is able to move forward to the production phase. “The accuracy of the Handheld measurements and experience of NVision engineers helped the manufacturer improve both design and functionality of their parts.”

Automated Non-Contact Technology

MobileScan 3D automates the process of 3D object scanning allowing efficient repeatable inspection in a production environment.

MAXOS: High Speed Blade Scanner

The MAXOS blade scanner is based on proven technology developed specifically for the measurement of turbine blades.

Certifiable Accuracy

MAXOS is the only optical system certifiable to ISO 10360-3 with an overall accuracy of 10 microns. Surface Insensitive

Polished surfaces can be scanned without coating.

High Accuracy

Resolution down to 0.2 microns. MAXOS can inspect leading and trailing edge radii of 1mm or less.

Significantly reduced cycle times for increased production throughput.
Misfit Industries (Plano, Texas) provides parts for custom Harley Davidson touring models known as baggers. The company provides cutting-edge products engineered for a perfect fit that are used to create radical machines that turn heads and attract attention. Misfit recently converted many of its parts from composites to aluminum and steel in order to reduce labor costs and production leadtime.

NVision’s scanning and CAD modeling services helped Misfit reverse-engineer the previous generation parts, factory parts, and sections of the motorcycles that interface with the parts. The resulting computer aided design (CAD) models were then provided to the die maker, substantially compressing the design cycle. The reverse engineering process also ensured that each custom part interfaced seamlessly with previous and new generation Harley models. “By switching to die cast steel and aluminum for these parts we have substantially reduced leadtime and production costs,” said Chris Eder, President of Misfit Industries. “However, making the change required that we re-design our entire product line. We needed precise CAD models of each of our parts to provide to the company that builds the dies. What was needed was an efficient way to reverse-engineer the parts at minimal cost. NVision engineers performed laser scanning on the interfacing sections of the motorcycle and on the previous generation of parts. NVision scanned a factory fender to identify the exact position of its mounting holes. They also scanned the wheel to derive its true horizontal and vertical radius. Next they scanned the previous generation Misfit fender in order to obtain its specific styling and geometry. “Our engineering team reviewed and polished the final designs and provided them to a supplier who built the dies to produce the parts,” Eder said.

“...The new parts provide a perfect fit and are considerably less expensive and time-consuming to manufacture than the previous generation. NVision gave us a superb job at a reasonable price in a very short period of time.”

~ Chris Eder, President of Misfit Industries

NVision is recognized as the leader in the 3D digitizing industry. Since 1990, we have provided unique 3D scanners, software and contract services for reverse engineering, inspection/gaging and rapid prototyping. With a wide range of non-contact 3D scanners, we have the correct solution for your digitizing needs. Whether reverse engineering your product or fitting a comprehensive inspection solution to your requirements, we have a solution.