Smart Stacking

Axiam aims to improve the engine assembly process with new software offerings. By Kristin Majcher

As a long-time supplier of measuring and stacking equipment for engine overhaul shops, Axiam has helped companies such as Delta TechOps, Lufthansa Technik and Pratt & Whitney improve the engine assembly process. Now Axiam is upgrading its Engine Core Restoration (ECR) software, which two commercial engine repair shops use. Axiam will add two new assembly processes called Flow Path Management and Geometric Rotor Stacking and Balancing to its software suite.

Understanding the innovation of geometric balance requires a closer look at Axiam's current ECR software offering, which consists of eight applications for optimizing the build of the engine core, says Don Lohin, Axiam's president and CEO. He says the main purpose of his company's software is to help operators and MRO facilities save money by quickly identifying engine parts that need to be repaired and optimizing the reassembly process.

"When you use our Axiam assembly process, [it] can isolate areas that require some additional machining," says Lohin. "You don't have to replace as many parts with new parts, so the airline saves money on materials."

Traditionally, overhaul shops completely disassemble engines as they come in. Technicians clean the parts, but sometimes hot-section components such as blades, nuts, bolts, discs, shafts and hubs require more machining to meet the standards specified in engine manuals. The process of adding materials to make these parts compliant with standards is known as "building up" the part.

Axiam

A shaft of a GE CF-34 engine set up for measurement on the gauge in the Delta TechOps engine shop.

Axiam's system measures engine parts with the absolute diameter measurement arm (ADMA), which its customers currently use. This machine works in tandem with a gauge to take relative and absolute measurements of engine parts. The ADMA set-up and measurement time for each engine is 5 min. or less, with measurement accuracy of up to twenty-millionths of an inch for relative measurements and one-hundred millionths of an inch for absolute measurements. The system also stabilizes engine components using tilt and centering software for measurement.

After the gauge collects measurements of the rotor assembly, operators can use run tests with Axiam software to compare the data with a predictive model for each engine type. These

models, designed by the Massachusetts Institute of Technology's School of Engineering, show how engine parts fit together to facilitate the optimal life of each component.

After maintenance technicians repair and clean each part, the engines must be put back together. This is where flow-path management and geometric balance capabilities can improve the process of assembling engines even more.

Axiam says it is working with a European engine shop on upgrading its current ECR process to include a flow-path management system for engine assembly, which can measure not only the engine components but also the static casing surrounding them. This software will show the blade tip gap for each stage of the engine core, which allows maintenance technicians to take corrective action to adjust the gap before building the components back up.

The ability to adjust the blade tip gap before performing maintenance makes the engine run more efficiently, says Lohin.

"You have better control of the air flow through the blades, and you don't have as much leakage between the blade tips and the casing," says Lohin. "The leakage takes away from the engine's performance, so you want to control that distance at each stage of the engine core so you optimize performance of the engine."

Lohin predicts that the flow-path management process can improve Axiam's current fuel-saving software capabilities by about 10%. So, when customers upgrade from the ECR product to the FPM, the total fuel burn improvement is between 0.6% and 2.2% compared to engine manual procedures.

Axiam's past projections show that a customer using the ECR process has saved $1 million for each operator and engine shop in both material and labor costs for a GE CFM56 engine, and Lohin projects that ECR use already decreases engine vibration by at least 40%.

Software upgrades also can bring efficiencies to balancing processes. During reassembly, technicians strive to make the rotor assembly as balanced and straight as possible. Traditionally, facilities do this by distributing blades around an individual disc and using a static balance machine to check the runout of a rotor, calculating how far forward and backward a disc moves as it rotates.

The problem with this method, says Lohin, is that it is a trial-and-error operation.

"What traditionally happens is engine shops measure each disc, and then they'll offset each adjacent disc rotor assembly 180 deg. and hope they can meet the runout when the entire rotor is assembled," says Lohin, adding that this method dates back to the advent of the turbine in the 1950s.

The merit of geometric balance is that it allows maintenance technicians to build an engine around the center line of rotation for a whole rotor assembly instead of calculating the "theoretical" center line when measuring the runout of each disc.

This actual centerline alsocan be calculated using new software called SuperStack, which is an upgraded version of a three-dimensional measuring program called SmartStack.

Lohin predicts that Axiam will have the flow path management and geometric balance capabilities on the market by 2012. . OM

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