Axiam's Assembly Processes Deliver Straight Builds About the Centerline: Improved Engine Performance, Reliability and Quality while Reducing Costs.

Axiam, Inc. provides the only repeatable, integrated engine core assembly processes for turbine engine cores, delivering improved fuel savings, EGT Margins, vibration and wing time. Axiam's proprietary assembly optimization processes, or AOPs, consist of: software for each turbine module; software to optimally mate modules; assembly procedures; rotor hydraulic build tooling; and fixtures, as required. These AOPs are used together with its proprietary, high-accuracy measurement gauges.

So what are the benefits of using Axiam in place of the OEM's assembly processes?

> **For Operators**: improved engine performance; improved engine quality and reliability; fuel cost savings; reduced maintenance costs; CO2 reduction; and, longer time on wing.
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> **For the Engine Shop:** improved engine quality and efficiency while reducing shop costs. An engine shop can now control assembly process variables and achieve predictability and reliability. As a result, some of the improvements include: 1) reduced assembly, trim, and balancing times; 2) the elimination of rebuilds and re-balancing; the elimination of Test Cell rejects due to vibration; 3) less engine wear and reduced material costs; 4) improved Vibration, EGT Margins, SFC consumption; and, 5) the elimination of many of the common engine problems often attributed to balance.

Can others do this? The answer is no, although some may claim they can. Axiam's software preemptively provides the optimal build for each set of parts. Its straight builds about the engine core's actual centerline of rotation give much better control of the blade-tip gap; thereby improving performance and retarding performance deterioration.

The Engine Manual assembly process is a "Trial-and-Error" method that was first developed in the 1950s. It first builds the rotors and then measures the runout at the end of each rotor, hoping it is less than the maximum allowable runout limit. This procedure often results in relatively "bowed" rotor assemblies, creating engine performance issues and shop inefficiencies. The addition of weights does not straighten a bowed rotor assembly. The targets for the mating of rotors to a shaft; and the building of bearings and seals are largely left up to the individual shop mechanics. The extent to which an engine core is "bowed" determines how quickly performance deterioration and excessive vibration appear on wing.

Axiam's unique, repeatable assembly processes always produce optimal builds on the first attempt, resulting in a 60+% total assembly time reduction. The assembly processes start with the collection of 8,000 measurement data points per part to a volumetric accuracy of +/-0.000020 inch. The software uses this data to calculate straight, optimal builds for each set of parts about the engine core centerline; generating software build models with an integrated structural alignment of the engine core.

These build models only represent the target builds for that specific set of parts. Now the challenge is to make the actual build approximate the target build. Axiam develops hydraulic tooling and fixtures to fully seat rotors, and develops custom assembly procedures to achieve assembly process repeatability and optimal builds. All of these assembly process components are required to achieve predictable, repeatable engine core builds.

Axiam's practice is to obtain FAA approval for each commercial engine model for which it develops an assembly process. FAA approval translates into local authority approval via inter-country treaties.

In summary, Axiam's Assembly Processes enable operators to reduce costs (fuel & maintenance) while improving engine performance and wing time. Operators gain a competitive advantage through fuel consumption savings, improved EGT Margins, longer engine Wing Time, and reduced parts & maintenance costs. Engine shops gain a competitive advantage through delivery of a better quality product, reduced total assembly times, shop efficiencies, predictability, and reliability. This brings customer loyalty and more business.