

Family Doctor Who Performs His Check Ups on Jet Engines

— A Key Person in Maintenance Engineering —

All new jet engines and those after maintenance are required to be tested before delivery to verify their performance. Mizuho Aero-Engine Works, which handles the maintenance of jet engines, has twelve testing facilities (test cells). The key person who took part in the start-up of the latest test cell and manages all of its operations is just like a family doctor for jet engines.

Testing is the “Last Stronghold” of jet engine performance assurance

IHI’s technological ability is not limited to development and production. IHI boasts world-leading maintenance engineering for jet engines. Engines scheduled for periodic maintenance that have been sent from airline companies around the world arrive at Mizuho Aero-Engine Works, Tokyo every day. They are then disassembled, cleaned, and examined, parts are replaced, and then they are reassembled. After that they are sent off to fly in the skies of the world again. Testing is an essential final step in the maintenance process to ensure engine performance and flight safety.



SUGAYA Satoru
Manager,
Production Engineering Department,
Mizuho Aero-Engine Works

Engine testing is conducted in indoor facilities similar to wind tunnels, where it is possible for engines to take in air smoothly and eject the compressed air as high velocity exhaust. These indoor facilities have special soundproofing to prevent the noise from reaching neighbors.

Mizuho Aero-Engine Works has twelve test cells. The most recently completed cell, cell M6, was completed in 2007. It is a large reinforced concrete building 56 m long, 9 m wide, and 22 m high. Medium-size jet engines are mainly tested in this cell. About one hundred V2500 engines for narrow-body civil aircrafts are tested in this cell per year. Testing of one engine requires eight to ten hours.

Satoru Sugaya is the key person in maintenance engineering who took part in the start-up of this test cell and is managing its operation.

Test cells are a synthesis of various technologies

“When we conduct production or maintenance of new types of engines in IHI, we need to prepare a test cell for each type of engine. In preparing the test cell, we design a structure to hold the engine during the tests, taking stiffness into consideration in order to simulate the situation where the engine is hanging from an aircraft wing. In addition, we also have to provide an engine control system equivalent to that of an actual aircraft. To design these systems, knowledge of mechanical engineering, fluid engineering, electrical engineering, information engineering, etc., is required. Also required are a testing control room which looks like a cockpit for monitoring the engine in operation, and an IT system for analyzing data. The maintenance engineering key person consolidates the technologies of specialists in each area to integrate them into the test facilities



Engine testing control room

so that engines can be tested. In order to comprehensively evaluate the results of an engine test, I must have a solid understanding of all the technologies. I must also have knowledge about engines themselves in order to solve unexpected problems.”

It takes about two years to launch a new test system. Satoru Sugaya has completed five systems including the M6 test cell since he joined IHI. He was involved in building the M6 test cell from its design stage, adopting new technologies and incorporating original ideas to increase reliability and efficiency. One of them is a measurement system that is independent and distributed for each engine. The measurement system for ensuring flight safety requires high reliability. The independent measurement system can reduce factors causing errors and increase reliability, which enabled tests to be conducted successfully without stopping the entire test cell.

The key to success is thorough mental simulation of the test process

In order to complete one test, we write many detailed specifications for the test in order to place an order for system design. After that we review finished design drawings, and patiently repeat the process of requesting a change and checking up on the result until all necessary specifications are met. Then, once the construction is started, we inspect the site to confirm that the modifications have been reflected in the system as we had intended. After going through all of this, it is no wonder that the tensest moment is when the first engine test is conducted in the facility.

What is the most important thing for safely testing engines in a test cell? Sugaya says, “To simulate in your mind what will occur during the test by thoroughly imagining the entire testing process.”

He continues, “Design drawings sometimes include errors that have been overlooked. To notice them, I imagine each stage of the engine test process while looking at the drawings. Who will do what? How will they do it, and in

what order? What is the process up to engine start? And so on. In my case, such a detailed mental simulation allows me to find where something is amiss. These days, simulation software is available, but the mental simulation is essential for me to become aware of possible risks in the process all the way up to the engine test itself.”

He also says that an awareness of the fact that “we are producing things people will use” is important. If we always imagine specific situations where an engine is used, we will notice inconsistencies in data, such as “this value looks odd for flying a ten-ton object.” He keeps in mind that he cannot rely on his own abilities alone, but asks for specialists’ opinions and refers to reference materials.

Recently, he has been making an effort to foster younger engineers who can collaborate with overseas engineers, and to expand his own network.

“Since IHI not only performs maintenance but is also engaged in development and production, we have many opportunities for working with overseas companies, and I myself have improved my skills on the job through working with overseas companies. I want my team members to be involved in such jobs as much as possible. After completing a common goal with someone, it is much easier to maintain a personal relationship. Expanding our network is necessary for us to understand our positions in the world and to advance our technologies.”

The desire for higher safety technologies and for passing them down the next generation will also lead to the maintenance and improvement of production technologies. Sugaya smiled with a kind of enlightenment and confidence as he said, “Thoroughly simulating the test process in your mind is the key to success.”



GEEnx engine