GE restarts UDF testing

EVENDALE

General Electric is due to restart outdoor testing of its full-scale Unducted Fan engine as we go to press. The test programme for the direct-drive propfan came to an abrupt halt towards the end of last year when the power turbine failed owing to unforeseen turbine blade resonance.

GE faces a tough running schedule if it is to meet its July target for flight testing of the UDF, and has compressed the programme slightly, combining some tests and reducing the duration of others. The Boeing 727 testbed aircraft has been baseline calibrated, and is now being prepared to accommodate the UDF on its starboard side. The JT8D engine has been removed, and the Boeing-designed pylon tried for size. Following the 727 tests, which are expected to last up to six months, the UDF is due to be fitted to the port side of a McDonnell Douglas DC-9.

According to GE the UDF failure was unexceptional, being of a nature sometimes experienced in the initial stages of testing conventional turbine engines. “We found that the first-stage power turbine blades were more responsive to upstream stimuli than we expected,” says GE’s Norman Epstein. “This led to a resonance condition, and initiation of a high-cycle fatigue failure at the blade roots.” The blades bent back, touching the next power turbine stage, which in the UDF rotates in the opposite direction. The power turbine then slowed, causing the F404 core to stall. The UDF was shut down. Damage was limited to bent blading and some foreign object damage.

The power turbine blades have been redesigned and equipped with damper pins. These behave in much the same way as the mid-span stubbers on turbofan fan blades, preventing destructive resonance.

GE says that it does not foresee any further setbacks to the UDF test programme. The engine had already been run at the full 25,000lb thrust rating, the variable pitch mechanism has been fully tested, and vibration levels found to be similar to those of turbosfans.

The crucial question on UDF is its ability to match turbofan noise levels. In the Peebles, Ohio, tests, subjective assessments indicated that the engine was as quiet as turbosfans. But not until the UDF is installed on the flight test aircraft will the truth be known, since only then will the engine be working in its design environment. On the flight test aircraft the aluminium sheeting will be replaced by aluminium honeycomb. On the Boeing 737 the entire empennage will be constructed from carbon composites.

GE is pressing ahead with development of a new 40:1 pressure ratio core for the 22,000lb thrust engine that will power the Boeing 737, slated for certification in 1992. Full-scale development of this engine is set to begin in early 1987, with first run of production standard UDF in mid-1988. This would lead to UDF certification in December 1990.

Garrett flies F109 by wire

TUCSON

Garrett’s AiResearch Electronic Systems Division has developed an electronic control unit (ECU) for the F109-GA-100 engines powering the Fairchild T-46 trainer. The ECU, a full-authority unit with manual backup, provides normal fly-by-wire control of the engine. Each Garrett F109 in the twin-engined T-46 has its own ECU providing automatic ignition and starting, blowout restart, fuel specific gravity adjustment, and speed and temperature limiting. The unit also automatically switches to hydromechanical backup fuel control in the event of a critical failure.

Garrett claims that the linear thrust relationship to throttle position and an automatic engine calibration function are unique features of its F109 ECU.

Within each ECU two microprocessors share duty, one controlling engine functions while the other handles non-engine control functions. Fault accommodation is achieved by using a cross-ECU link which compares right and left engine pressure and temperature data sources and then switches from the bad to the good sensor. The traditional built-in test panel is missing from the ECU, which accommodates troubleshooting via a test connection on the wing leading edge.

A built-in engine health monitoring system logs basic engine parameters for later analysis, and monitors long-term trends to detect deterioration of the F109.

MODULE

Pratt & Whitney has streamlined its commercial products division to improve its competitiveness abroad, particularly in China. A new subsidiary, Pratt & Whitney of China, has been formed to market and support all P&W products in the country. Management changes carried out by P&W president Lawrence Clarkson include the appointment of Henri Picard, previously marketing vice-president for north and south America, to marketing vice-president responsible for worldwide sales outside China. James Kennedy becomes marketing vice-president, China.

Rolls-Royce has specified Smiths Industries as the new supplier of igniters for the RB.211. Problems had been experienced with tip failures of the AC Delco items originally specified. Igniters made by Champion were then tried, but were found to have insufficient life. Smiths says the new igniters will confer “excellent” cold start capability, lower cost of ownership, and high “continuous ignition” duration.

Snecma has rolled out the 1,000th Atar 9K50. In production since 1973, the 15,900lb-thrust turbojet first powered the Dassault Mirage F.1, and subsequently the Mirage III, Mirage 50, and Mirage NG. The engine is now in service with the air forces of 12 countries.

Oxford-based CSE Aviation and FFV of Sweden have joined to provide a specialised UK support service for Allison 250 series engines. CSE will offer the full range of FFV services, and has arranged, via FFV, for quick turnaround of a number of 250-series engine parts.