

AS977 promises to deliver

The newly-launched BAE Systems Avro RJX will feature a new engine, the AS977. This has been designed to avoid the poor engine reliability problems of the RJX's predecessors; the BAe 146 and Avro RJ. Honeywell is guaranteeing long fixed on-wing intervals to reduce engine-related maintenance costs per flight hour.

The recent launch of the BAE Systems Avro RJX with an order from British European will now see the introduction of the Honeywell AS977.

The RJX's predecessors, the BAe 146 and Avro RJ, have been dogged by poor engine reliability. This made the aircraft's operating economics particularly difficult considering it had four engines rather than two. The 146 and Avro RJ have always faced competitors with two engines. Some of these, notably the Fokker 70 and 1000, enjoyed high reliability. The 146's, and to a lesser extent Avro RJ's, poor engine reliability made a large difference in engine-related maintenance costs between it and its competitors.

The BAe 146 was powered by the ALF502, the only geared fan engine to so far operate in commercial service. The fan gear mechanism caused poor reliability problems, including a high gear wear rate and bearing failures. There were also difficulties associated with the combustor section and fourth nozzle guide vane. The ALF 502's reliability reached a point when at one time the engine's unscheduled removal rate was equal to an interval of 1,670 engine flight hours (EFH). This did improve to 4,000EFH.

The LF507, powered the Avro RJ, was an improved version of the ALF 502. Design changes were introduced to reduce turbine entry temperature. Unscheduled removal rate for the LF507 increased to 11,000EFH.

The AS977 is an all-new engine. Honeywell had already actually bought Textron Lycoming, the ALF502/LF507's manufacturer. Honeywell had invested \$30 million in improving the ALF502/LF507.

The AS977 was originally conceived by Allied Signal, which bought Honeywell and the Honeywell name has been retained. The AS977 has a direct-drive fan and a class two-shaft configuration. On entry into service, AS977 operators will have the choice of a fixed removal interval for shop visits or an on-condition maintenance programme.

On the RJX the AS977 has disk lives of 25,000 engine flight cycles (EFCs), which will allow a removal and shop visit pattern of several removals each with a long on-wing interval.

Compared with the LF507, the AS977 has been designed for



maintainability. That is, there is easier access to bearing housings and a simpler core engine design featuring fewer blades and parts.

The fan has wide chord damperless blades. The high pressure compressor (HPC) is a four-stage system and developed as a blisk. This will allow the section to be manufactured at a fraction of the cost of a conventional HPC. There will be fewer blades on the blisk compared to a conventional HPC. This will make them more resistant to foreign object damage, allow a longer life and provide greater engine performance retention.

Honeywell expects a 15% fuel burn reduction for the RJX compared to the Avro RJ. This will provide a welcome improvement in operating costs, but the main concern for potential operators will be stable and acceptable engine-related maintenance costs. Honeywell is guaranteeing an on-wing time between removals of 10,000EFH. It will also offer fixed cost power-by-the-hour

The AS977-powered Avro RJX promises to have a powerplant that will not incur the same engine reliability and high engine-related maintenance cost problems of the BAe 146 and Avro RJ.

maintenance deals. The engine's design will allow the engine to have an exhaust gas temperature margin of more than 200 degrees Fahrenheit.

Honeywell predicts a 20-30% lower direct engine maintenance costs of the AS977 compared to the LF507. It has guaranteed reliability performance parameters of an unscheduled removal interval of 12,000EFH and total shop visit rate interval of about 8,100EFH.

Under the on-condition maintenance programme the engine will have a 6,000EFH minimum interval for a hot section refurbishment. There will be a minimum interval of 10,000EFH for a cold section refurbishment. 