Propfans win respectability

BRISTOL

Propfans were the main talking point at the Royal Aeronautical Society’s recent symposium on “The selection of propulsion systems for future transport aircraft”, reports Dave Velz

Speakers from Boeing, McDonnell Douglas, Airbus Industrie, and British Aerospace all expressed enthusiasm for the concept, and there was general agreement that a twin "pusher" arrangement with contra-rotating rear-mounted propfans was the best layout.

There was considerable debate about the timescale in which propfans would become available, however. John Morris, director of advanced engineering at Douglas Aircraft, believed that a propfan could be in service by 1992. He also identified propfans as the only technological advance to promise significant benefits in the near-term. Propfans would make most sense to Douglas if it were applied to a derivative MD-80, and Morris envisaged 8 per cent better seat-mile costs in this application.

Morris also made the point that the major cost driver was for 150-seaters and saw little point in developing initial propfans for the 100-seater market—estimated to be half the size of that for 150-seaters.

Boeing appears less enthusiastic about an immediate propfan application, perhaps because, unlike Douglas, it lacks a suitable derivative airframe (the 727 is no longer in production). But it was BAe’s chief of rotating rear-mounted propfans who suggested that development of a new core, and that overall development would take 12-20 years, but he felt that commutes of less than 80 seats would “definitely” be flying with propfans by the year 2000. The chance of an 80-130 seat regional airliner flying by then were 50:50, according to Jagger.

Pratt & Whitney and General Electric are the only engine makers committed to development of propfan hardware, with financial help from NASA, although Rolls-Royce has clearly conducted studies. Pratt & Whitney’s work centres on a propfan driven through a reduction gearbox, for which sister company Hamilton Standard is largely responsible. GE’s approach is more revolutionary and eliminates the gearbox (see following story and diagram). It calls the result an “unducted fan”.

More on GE’s unducted fan

EVENDALE

GE is keeping quiet about the innards of its unducted fan, but Flight’s artists have produced this guess at its layout. Hot gases from an F404 core (left) drive the first set of fan blades (green) in one direction and the second set (yellow) in the opposite sense. Each turbofan has a unique concept into low vibration hardware with efficiency and block-time at cruise speed, and GE believes that the unducted fan will deliver the optimum balance between propulsive efficiency and block-time at Mach 0.75 on 1,000 n.m. sectors. GE’s relevant city-pair traffic analysis predicts an 80-120 seater, which in turn leads to a propfan driven by a core engine slightly smaller than an F404, but with a higher pressure ratio. The NASA-sponsoresd demonstrator programme using an F404 core is therefore not simply academic; it is near enough to a potentially viable commercial UDF engine to provide a genuine proof of concept.

The UDF puts a premium on core efficiency, but for a given core development, GE believes it can deliver 20 per cent better s.f.c. than current high bypass ratio turbofans. That same core development applied to the turbofans themselves, would produce a gain of only 1-4 per cent.

GE’s 25,000lb-thrust demonstrator is due to run in the third quarter of 1985, and is scheduled for first flight aboard a Boeing 727 in late 1986. The company is confident of developing its UDF to the point of service-entry within 4-5 years of the end of the flight trials, while early trials on airliners flying with the powerplant in the early 1990s.

GE runs Gripen fan

LYNN

GE is test-running an F404 with an uprated fan destined for the Saab Gripen’s 18,000lb “tuned” core engine, the 14,000lb F404 core. The Gripen engine will run in June, ready for flight clearance in September 1985 and qualification in 1987.

The new fan can handle 10 per cent extra airflow, but is speed-controlled to use only half of this capability.

General Electric has embarked upon technology programmes (such as single crystal blades) to exploit the new fan, and to enable F404s to produce 20,000lb thrust, while occupying the same space as their progenitors aboard F/A-18s and Gripen.

A parallel weight-saving programme includes a composite fan case, now chemically milled from aluminium.

The first standard F404 for Dassault’s ACX will be delivered to Snecma for bench-testing in December 1985, followed by flight-rated engines in March 1986, ready for first flight in October 1986.

Two unreheated F404s have passed through the Lynn test cells. They are believed to have been delivered to Grumman for compatibility tests on an A-6A US Navy new build airframe. A propulsion to power A-6Fs is expected this spring. The competing engine is a re-worked version of the A-6’s existing PW J52.