Propfans—“the genie is out of the bottle”

NEW DELHI

By the end of this year Boeing will have added 300 more design and engineering staff to its 7J7 propfan team, which is already 700 strong. June is now scheduled for the first flight of a 727-100 modified to take a General Electric UDF engine in place of its starboard JT8D. A decision on whether or not to make the 7J7 primary wing box structure of carbon will be taken this year. A C-wing will have a higher aspect ratio—12 rather than 10.5—and more span but less sweep and area than the 727, reports J.M. Ramsden.

Boeing is “very serious” about the propfan, 7J7 team engineer Walter Gillette has told a New Delhi seminar “Civil Aviation at the Turn of the Century”. Scheduled for 1992 certification and passenger service, the 7J7 will have a seat-mile fuel consumption 50 per cent better than the A320 and 7-7, and a direct operating cost 10 per cent lower, according to Gillette.

The actual passenger engine selected by Boeing may be geared or, like the UDF, ungeared. The prototype will roll out in early 1991.

The Indian conference also heard the propfan plans of Airbus, General Electric, McDonnell Douglas, Pratt & Whitney, and Rolls-Royce.

For General Electric Robert Garvin says that the UDF’s blades weigh about 10lb and will cost about $200,000 million for a typical conventional propeller—greatly moderating out-of-balance forces after, say, a blade separation caused by a bird strike. As for noise, “we expect to meet not only FAR36 Stage 3, but the new Stage 4 and even the special Washington National and Orange County night-operation rules”. Vibration will be low thanks to the “soft mountings” made possible by contrarotation. Samaritan-conform will be integrated with the engine.

Timing will depend on the market, says Garvin, but GE is aiming for 1991 certification and 1992 passenger service. “This genie is out of the bottle, and nobody can stuff it back in. It will come. The only question is the date”.

Lewis Dileo of McDonnell Douglas discloses the designation MD-94X for a 1994 ultra-high bypass (UHB) engined aircraft, following the MD-91X which is for 1991 service and based on the modified MD-80 flight test vehicle due to fly early next year. The propfan “main issues”, says Dileo, are sonic fatigue and noise. Both will be dealt with, and propfans will take their share of a world market for civil airliners worth $250,000 million between now and the turn of the century.

Pratt & Whitney v-p Siddiq Sattar introduces another new term “ducted prop”. This will follow the contrarotating propfan, which P & W says will be geared—“the lowest-risk route”—and certified in 1992.

The ducted propeller will be suitable as an underwing engine for aircraft like the 747 and 767. It will have variable-pitch fan blades. P & W has an internal programme, and another with Nasa, to satisfy the reliability requirements of a 12,000 h.p. gearbox.

Rolls-Royce’s propfan gearbox, a 9:1 12,000 h.p. unit, forms part of the company’s “propfan technical readiness programme”, together with contrarotation and hub exhaust to avoid hot-gas impingement on the pusher propfan’s blade roots. According to Rolls-Royce technical director Gordon Lewis, the gearbox is not such a major technical step as was that of the 1950s Tyne, a 6,000 h.p. turboprop with 12 million service hours.

Lewis reminded the 250 delegates that the 1960 Vanguard, a Tyne-powered turboprop airliner, had a fuel consumption in kg per seat of about 50—about the same that is targeted for the propfan in the 1990s.

Rolls-Royce is talking of 1992 or 1993 for the propfan. The company uses the new term “open rotor” to distinguish the propfan from its “contrafan”, another new term describing its proposed ducted fan.

The open rotor pusher engine is not suitable for underwing mounting, says Lewis, nor for cruising speeds beyond Mach 0.8. Beyond this the contrafan offers a 20 per cent reduction in fuel consumption—similar to that of the UDF—and is suitable for wing or fuselage mounting.

The contrafan has a lower bypass ratio and shorter blades than the UDF. Studies of thrust-reversal include variable-pitch fan blades.

Rolls-Royce’s propfan studies include work on fibres for internal blade containment, “to achieve the sort of blade integrity which we think essential”. The industry must be sure, says Lewis, that the reduced fuel costs of the new engines are not offset by higher prices and maintenance costs.

For Airbus Industrie, v-p Dennis Little favours the very high bypass ducted engine for the future. “We are getting 99 per cent reliability today, and the propfan cannot offer less than that, nor can it skip the debate”.

To questions about the vulnerability of propfans to bird and foreign object strikes, Robert Garvin of GE agrees that “this is one of the most important requirements for the advanced counter-rotating propfan”. GE’s UDF test experience so far is that the birds hit the swept blades at different “slicing” angles of incidence. “We are very encouraged and optimistic, but still in the process of development”.

Several blade configurations were windtunnel-tested by Boeing before last year’s first test run of a General Electric unducted fan.