COMMERCIAL ENGINES

Yak-46

Other problems relate to the operation of
a propfan-powered aircraft. Yakovlev stud-ies have shown an increase in direct operat-ing cost (DOC) for propfan aircraft, assum-ing that fuel costs remain at present levels. Several factors contribute to the DOC in-crease: maintenance of the mechanically more-complex engines and gearboxes and requirements for additional anti-noise and anti-fatigue provisions head the list. Referring to the virtual cessation of propfan development work in the West, Dmitriev says: "I believe it is the combined effect of both a stable economic situation precluding a fuel-cost rise and an awareness among aircraft designers and manufacturers of serious operational problems during the 'switch-to-propfan period' that reportedly halted the propfan efforts of...McDonnell Douglas, Boeing, General Electric, Pratt & Whitney and Hamilton Standard".

PRECIOUS TECHNOLOGY

Dmitriev acknowledges, however: "Western aerospace companies involved in propfan programmes have already gained precious technology benefits to be used successfully in the future".
Tasks to be fulfilled in the course of the Yak-42E-LL flight-test programme include acoustic and vibration measurements, airframe/engineintegration evaluation, inte-rior and exterior noise-level measurements and in-flight operational tests of non-metallic airframe components, including the engine pylon, in a severe acoustic and vibration environment.
Yakovlev also sees other uses for the Yak-42E-LL, with its suitability for a wide range of in-flight propfan engine tests, and plans to demonstrate the aircraft at an exhibition later this year.
The research phase of the Yak-42E-LL programme began in 1987 and design work was complete by the end of that year. The aircraft, its D-236 propfan replacing the right-hand D-36 turbofan, was transferred to the Yakovlev flight test centre in 1990 where it began several months of ground

testing and taxi trials. Flight trials began on 15 March and initial flights confirmed that the aircraft handling and controllability are not affected by asymmetric propfan engine operation.
Yak-42 number 525 was modified to produce the Yak-42E-LL propfan testbed. The D-236 engine, rated at 8,195kW (ll,000shp) or an equivalent thrust of 97kN(21,8001b), drives an SV-36 tractor propeller of 4.2m diameter. The contra-rotating propeller has eight blades on the forward row and six on the aft.
Installation on the Yak-42 required a new starboard engine pylon and other modifica-tions, including special emergency - windmilling and oil systems. SeveralYak-42 systems were modified extensively to allow propfan testing. The rear-fuselage structure, including frames 59 and 62, has been reinforced amd provisions made to protect the rear fuselage in case of propfan blade failure.
The Yak-42E-LL programme should pave the way for the new Yak-46 twin pusher-propfan airliner, development of which is already under way at Yakovlev. The Yak-46 is envisioned as the beginning of a new family of aircraft with differing fuselage lengths and engine types. The basic 150-seat

Soviet propfan research equipment includes an II-',

version will have a 3,500km (l,900nm) range and cruise at 460kt (850km/h).
Two types of propfan engine are consid-ered to be candidates to power the Yak-46. One is a gearless unducted fan being developed by the engine design bureau of general designer Fedor Muravchenko. De-sign studies suggest the Yak-46 powered by these engines would have a fuel burn of 12g/seat-kilometre — a one-third reduction in specific fuel consumption (sfc) compared with modern turbofan aircraft.
Another option is an ultra-high bypass-ratio (UHBR) engine (with a bypass ratio of 20-27:1) which promises a less-dramatic sfc reduction but eliminates many of the design and operational problems of unducted fans. Yakovlev officials consider the UHBR engine as probably a more realistic choice. Propfan experience gained with the Yak-42E-LL will also be applied to several other high-priority designs at Yakovlev, however. Soviet airline Aeroflot is watching the developments closely. Dmitriev says: "Aer-oflot is, of course, well informed on the Yakovlev propfan programmes. The airline's attitude is most favourable. It would be extremely surprising to face a different Aeroflot position. Some routes have already been forced to limit their activity due to a mere lack of fuel in the airports.

SCARCE RESOURCES

"Unfortunately, concentrating the main ef-fort of replacement of its ageing airliners with the new-generation 11-96 and Tu-204 [means] Aeroflot is not in the position now to provide financing of a large long-term propfan programme."
While clearly aware of the difficulties implicit in propfan development efforts, Yakovlev nevertheless considers the propul-sion concept to be promising. "[In the future] transport aviation will [probably] shift to propfan engines, especially taking into account the fuel shortages that man-kind will face in the future. I believe propfan implementation is just a matter of time — so one should get ready for it," Dmitriev concludes. •

test platform

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