UDF: no sign of an order—yet

Certification of General Electric's GE36 unducted fan engine would come between 36 and 48 months after launch of the engine, and depends on orders from two or three major airlines for a "significant number of airplanes", says GE engine chief Brian Rowe.

"There are a lot of interested people out there," he adds. "We intend to sell it, and we intend the programme to go ahead in the next couple of years."

Rowe's optimism is reflected by Ron Welsch, general manager of commercial engine operations. "It's not a case of if, it's a case of when," he tells Flight. Welsch admits that the airlines are hardly queuing up to buy UDF-powered 150-seaters. "They're still in the same mode as they've been in for several years... acquisitions, mergers, rationalisation". But he is convinced that they are coming out of that and looking at the future. The market for aircraft to replace older-generation 150-seaters still stands at 2,500-2,800 aircraft, says Welsch, "and that's the potential UDF market".

There remains, however, the fuel-burn question. At 65 cents per gallon, fuel prices are still too low to justify buying the UDF, which is 25 per cent more fuel-efficient than a conventional turbofan. "But if you try to forecast demand versus production somewhere in the mid 1990s, fuel demand begins to exceed supply. If fuel were at a buck or so a gallon, they'd be clamouring," says Welsch. Would UDF die if, in the wake of the Aloha accident, the airlines started replacing their Boeing 727s, 737s, and DC-9s with UDFs? "I don't think so. If anything, it will speed things up," he says.

Development of the new UDF core continues. The compressor, combustor, and turbine have all run separately, and the first complete gas generator will run within a year. This will have the same configuration as the production core, providing 25,000lb of thrust with more fuel-efficiency than the present F404 gas generator powering the MD-80 demonstrator.

MTU committed to shrouded propfan

MTU's development programme for a contrarotating shrouded propfan (Crisp) has begun windtunnel testing at the German Aerospace Research Establishment (DFVLR), West Germany. The programme is part of a joint technology effort with Pratt & Whitney and Fiat. Funding is in place to take it into 90, after which a decision will be made about whether to proceed with a full demonstrator programme.

Tests at the DFVLR on a 0.4m-diameter model of the contrarotating fan started in July this year. The fan has two rows of ten swept titanium blades which are designed to run at 12,000 rpm at a pressure ratio of 1:25. The two rotors each have adjustable pitch, so that engineers can evaluate the off-design fan performance.

MTU's general manager of advanced projects, Dr Eckhardt, tells Flight that the company expects a shrouded propfan to show an improvement of between 12 and 17 per cent on specific fuel consumption relative to an equivalent turbofan version. In MTU's opinion wing-mounted unshrouded propfans are not viable for large four-engined transport aircraft.

MTU recognises that the first flight of General Electric's unducted fan marked an important milestone in the push for new engine developments. GE's programme is helping to break down some of the barriers of market acceptance which are so important in the civil aircraft business. Investigations at MTU have, according to Dr Eckhardt, shown that a wing-mounted propfan would lead to a "considerable weight penalty". This factor alone creates a good case for the development of a new ducted engine, claims MTU. Such an engine represents the missing link between conventional turbofans and unducted propfans, the company says.

In the Crisp programme several configurations are under study. Each represents an increasing level of complexity which would need more development, and thus more expenditure. The simplest configuration has fixed, straight blades, a long engine cowl, a conventional thrust reverser, and no gearbox between the turbine and the fan. MTU says that this would give an improvement of around 10 per cent in fuel consumption, compared with an equivalent turbofan.

At the other extreme of the complexity scale is the geared ducted propfan, featuring swept, variable-pitch blades in a slim cowl, with a gearbox between the turbine and the fan. This concept could provide an improvement in fuel consumption of as much as 17 per cent, claims MTU.

The company maintains that Crisp provides many advantages over unducted propfans in addition to reducing fuel-burn. A ducted propfan can be mounted in a conventional manner on an existing pylon, which makes retrofitting the engine simpler and cheaper. Noise attenuation from insulation in the cowl will significantly reduce both near-field and far-field noise, and fan containment can be included in the design of the cowl.

Studies included in the Crisp programme have been based on the use of an advanced existing engine core, such as the International Aero Engines V.2500 or the Pratt & Whitney PW4000. Engine failure soon after take-off affects the design of the nacelle more than any other factor. With a turbofan the spillage flow which occurs following an engine failure demands a thick nacelle to prevent the split flow from separating, leading to a large yawing force on the aircraft. In the case of a geared ducted propfan, the fan can be made to windmill and still swallow a large quantity of air. This allows the nacelle designer to use a thin cowl, which produces a dramatic weight saving.

With the help of Rohr Industries, an evaluation of the nacelle design is currently being conducted to verify the feasibility of a lightweight composite nacelle design.