



and Snecma, Hispano-Suiza "has very good experience of these type of complex developments having produced earlier control systems for the RB199 and Eurojet", Kappler adds.

The FADEC also governs propeller speed and phase synchronisation, automatically matching the blade pitch angle to maintain the optimum efficiency speed. The propeller is designed for a maximum speed of 842 RPM, or a blade speed of 290m/s (950ft/s) and a tip speed of M0.68. The FADEC also controls the autofeathering capability of the propeller, which has a wide variable pitch capability, including full reverse. The blades are made from composites, including a composite spar and shell. The leading edge is protected against erosion with a nickel guard, while the blade shell is similarly protected with a polyurethane coating. The blade is also de-iced electrically.

### Unusual profile

The propeller assembly is housed beneath a distinctive, bulbous spinner and associated bulkhead, which is aerodynamically designed to "duct the flow into the hub and the blade root area without the flow detaching", says Kappler. The unusual aerodynamic profile is a key aspect of the

**The TP400-D6 inlet is optimised for low flow distortion and good particle separation**

**Technology from Snecma's M88-2 engine, developed for the Dassault Rafale, is used extensively in the TP400-D6**

## HISTORY

### Tracing the tangled roots

Untangling the roots of today's TP400-D6 turboprop is almost as difficult as sourcing the DNA of the airframe. Although originally configured with turboprops in its initial FIMA study configurations, the notion of turbofans emerged strongly in the early FLA/Euroflag days in 1991.

By 1992 the FLA was firmly embracing studies of an "off-the-shelf" turbofan in the 18,000lb (80kN) thrust range, including a version of the BMW Rolls-Royce BR700 designated the RB583-04. By the time of the 1993 Paris air show it emerged that Euroflag was even the target for a proposed multi-national 12,000-20,000lb turbofan concept dubbed Project Blue. The original team included General Electric, Snecma, MTU and Pratt & Whitney, the latter two eventually pushing the project into reality as the much-altered PW6000 turbofan.

Arguing against the cost and tactical unsuitability of turbofans, planners within the FLA project continued to push for turboprops to stay part of the study. By early 1994 the focus was divided between turbofan and turboprop options, though the requirement for the latter was sketched out to be 9,000-12,000shp (6,700-8,900kW), a power range that straddles the engine eventually selected for the A400M.

Many of today's EPI partners were by then also beginning to position themselves for the programme, with BMW Rolls-Royce having teamed with Hispano-Suiza, Ratier-Figeac, ZF Luftfahrttechnik and Dowty Aerospace. At the same time other contenders were emerging, including Allison Engines' AE2100 turboprop and the ZMKB/Progress D-27 propfan in development for the Antonov An-70 – an aircraft that would itself almost kill the FLA before it ever got going.

By the end of April 1994, the turboprop protagonists seized the day with two main groups emerging to compete for the prize. The first, led by BMW Rolls-Royce, continued to offer a version of the BR700, while Snecma, MTU and FiatAvio joined forces to submit an advanced turboprop based on the core of the M88-2 engine developed for the Dassault Rafale fighter. The argument by both was that turboprops would ultimately be cheaper and more rugged than turbofans in the rough field environment. It also appeared that a turboprop was more suitable to performing the very steep tactical approach required for any C-130 replacement.

At the same time, it became obvious that the FLA needed an all-new turboprop to achieve the aircraft's projected high-altitude cruise speed target of Mach 0.72. Only slightly slower than the turbofan-powered C-17's Mach 0.77, the speed requirement, however, was to pose a stiff challenge for both teams.

Speed was a big enough issue to cause trouble even beyond the apparent "volte face" over the selection of a turboprop, and differing opinions over the ability of the engine to meet the requirement threatened to split the partners. By the end of 1994 the problems still rumbled along, this time with the then-chairman of Snecma, Bernard Dufour, questioning the turboprop decision as "inappropriate". Instead, to the shock of many, Dufour advocated a twin-engined turbofan-powered FLA based on a proposed 43,000lb-thrust version of the CFM56. However, the then-French defence minister Francois Leotard reaffirmed the commitment to the turboprop selection, and Snecma returned to the

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