AIRFINANCE GLOBAL

CFM56 vs V2500

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As with the battle between the airframe manufacturers in the single-aisle market, the competition between the engine manufacturers is a two-horse race between CFM and IAE. The CFM56 project, a joint venture between General Electric (GE) and Snecma, has become one of the most successful collaborative programmes in the commercial aviation business.

The various engine models in the CFM56 range threaten the Pratt & Whitney (P&W) JT8D?s claim to being the most successful commercial aircraft engine. According to its manufacturer, the CFM56 accounted for 55% of all commercial engine sales in 2003 for aircraft of 100 seats and above. While this figure is reduced if market share is based on value, it remains an imposing statistic. P&W has teamed up with Rolls-Royce, a major competitor in many fields, to produce a new engine in the 10- to 15-tonne thrust class ? the V2500.

The CFM56 engine competes on the entire Airbus narrowbody range of aircraft, while the V2500 is not available on the A318, which has the PW6000, considered by many industry experts as a more direct replacement of the ubiquitous JT8D. As well as the A320 family the CFM56 powers all classic and new-generation 737s (737NGs), as well as four-engined A340s, 707s and DC-8s. The only other application for the V2500 apart from the A320 family is the discontinued MD-90-30. The main characteristics of the respective engines are shown in Tables 1, 2, 3 and 4.

Market share

Because the CFM56 equips more aircraft types than the V2500, market share statistics can be misleading. There is no question that, if the entire single-aisle aircraft market is considered over the period since the CFM engine has been in production, the GE/Snecma joint venture has taken the lion?s share of the market. However, since several aircraft in this sector are no longer in production (737 classics, 757s and MD-90s), the cumulative market share is not necessarily representative of the market trend.

In 2003 the CFM56 took more than 70% of the market, helped by its presence on both the 737NG and A320 families. However, the most direct comparison is to look at the sales of V2500 and CFM56 engines on the Airbus family in the past 12 months. Here the picture is more balanced, although the GE/Snecma engine retains the advantage, having won contracts to power 187 aircraft compared with the 142 achieved by IAE.

Both companies are keen to expand the customer base for their products and honours were even last year as each added four new operators ? a respectable tally given the difficult market conditions.

Service problems/on-wing life

Although it offered fuel savings over the rival CFM56-5A1 engine, initial reliability of the V2500A1 had to be addressed. In 1998, IAE instituted an extensive product improvement programme for the hot section known as the ?Phoenix? package, which is intended to increase on-wing life by 25% and which upgrades the hot section to V2500-A5 standard. The package included redesigned combustor segments, a new high-pressure turbine stage one outer air seal and improved cooling and thermal barrier coating on the first stage. The Phoenix modification ? so-named because it was initiated for the Phoenix-based America West Airlines ? entered service early in 1999. There have been few in-service problems reported with the CFM56. In general the later engines produce better fuel economy and operating reliability, although there is a modification to the CFM56-5A series engine that may be incorporated during overhaul to bring the 5A closer to the 5B standard. However, John Trevett, head of consultancy at IBA, says: ?As with the equivalent Phoenix modification on the rival IAE V2500-A1, we remain unconvinced of the cost-effectiveness of this programme.?

In service the CFM56 experiences a wide variety of operating conditions ranging from long-haul A340 flights of more than 10 hours to sectors of one hour or less on Airbus and Boeing single-aisle aircraft. Clearly the average hours flown per cycle impacts the on-wing life, although the beneficial effects of long duration sectors is partially offset by the higher ratings generally used in such operations.

There are reports of engine runs well in excess of 12,000 hours in some instances, though for shorter-haul services the practical number is closer to 6,000 hours, or typically about 4,000 cycles. CFM claims more than 35,000 hours and 14,000 cycles on-wing for one engine. The V2528-D5 on the MD-90 typically runs up to 12,000 hours between refurbishment shop visits, reflecting the shorter flight times typical of the aircraft?s operation.

The thrust rating of particular models is critical to reliability because, with a common core engine, the higher-rated versions reach their limits before the lower-rated ones. However, subject to rating changes, zero margin high-rated engines can continue to operate at lower thrusts with perfectly adequate margins. There are nonetheless practical limits to how far this can be taken, as ultimately the high-rated fleets still need to have serviceable engines at the relevant thrust ratings. (See also box ?Making commonality pay?.)

Operating costs

The operating cost of an engine involves a trade-off. In general terms a more complex engine can deliver better fuel consumption but at a cost of increased maintenance. In the case of the CFM56 versus V2500, this is encapsulated in the different number of high-pressure turbine stages. The IAE design uses two stages compared with the CFM56?s single stage. A two-stage design is more efficient aerodynamically but is more expensive to maintain. Comparisons are further complicated because the relative importance of fuel burn and maintenance cost for an engine is critically influenced by stage length. The longer the average flight-to-cycle ratio, the greater the impact of fuel burn on operating cost.

On rare occasions the increased range of an aircraft derived from lower fuel consumption can be critical to an airline?s route network. Short cycle operations benefit more from lower maintenance costs. The benefits of simplified design for short-haul operations were part of the original philosophy of offering the PW6000 engine on the A318 rather than a version of the V2500. The PW6000 engine has, like the CFM56, a single high-pressure turbine stage.

Given the complexities outlined above it is difficult to generalize on which engine is the most economical. Figures produced by Airbus show marginal cash operating cost advantages for CFM56-powered A320s and A319s on a 500 nautical mile trip, with virtually no difference for the respective versions of the A321 on the same sector length.

Fuel burn

It is difficult to obtain reliable figures on the fuel burn of the respective engines. Early V2500 engines certainly provided advantages over the comparable CFM56 models, but there is some evidence that the gap has closed as both engines have been developed. Aircraft Economics believes that the V2500 provides slightly more than a 1% advantage on the A319. The margin is close to 2% on the A321, while on the A320 it is down to about 0.5%. These figures are difficult to verify and will vary with parameters such as stage length, flight altitude and en-route temperatures. A good guideline is probably to assume a general 1% advantage for V2500-powered aircraft.

Maintenance costs and reserves

From analysis of maintenance costs the engines are relatively closely matched. As such it is likely that the competition will remain fierce and the relatively even split of orders is likely to continue.

Both manufacturers will be reasonably happy, particularly if the single-aisle market starts to return to the order levels that preceded the recent recession. Hoping for an economic recovery is at least one thing that both manufacturers can agree on.

