Gathering the facts

IBA's Phil Seymour, Mal Cowley & Kane Ray set out the main issues to consider when making a narrowbody engine selection.

For the two primary narrow body engine manufacturers, CFMi and Pratt & Whitney (P&W), the competition to have their respective engine acknowledged as the engine of choice on the A320neo is compelling. With over 3,500 aircraft orders, neither manufacturer can afford to be out of this race. In addition, the fact that the 737 MAX does not does not have the P&W option means that a successful entry into service and solid order book for the GTF on the A320neo is critical. Overall orders for the GTF 1100G are at circa 7,000 whereas orders for the LEAP have surpassed the 10,000 mark. Of the 4,500 A320neos ordered to date, the LEAP and GTF have approximately equal proportions confirmed but with approximately one third of customers yet to confirm their engine selection.

The Pratt and Whitney development of the GTF is the culmination of a concept that it and other manufacturers have been developing over the last 30 years. The basic idea is to use gearing to drive the fan at its optimum speed while the turbines operate at much higher, more efficient speeds. The result is a higher bypass ratio, lower fuel consumption and significantly lower noise levels. While some media reports position the concept as technological breakthrough, it is not new and has been in place on a number of aircraft, notably the AL502 engines

"Operators selecting the engine type for their A320neo have an interesting choice. Many will be attracted by the 15% lower fuel burn claims of the GTF... Reliability, both short and long term, will also be a factor, as will the longer-term cost of ownership."

fitted to the BAe 146 and the Honeywell TFE731 which has numerous business jet applications. P&W's challenge for the GTF will be to demonstrate that it can translate this technology to the higher thrust regime and to the operationally intensive environments that commercial airlines operate in. Any engine issues that impact technical despatch reliability for the A320neo will be very closely monitored.

For Pratt and Whitney the choice was to further develop the successful V2500 engine with IAE or to concentrate on the GTF. The potential benefits of the GTF of up to 15% fuel efficiency improvement, reduced emissions and 50%-75% reduction in noise levels over conventional designs, proved overwhelming. A major investment programme with partner MTU has resulted in the Pure Power range of engines, which will now power the A320neo, Bombardier CSeries, Sukhoi Superjet and Embraer E-Jet, among others. The GTF design also leaves ample scope for future development and this will also have been a consideration for Pratt and Whitney as there is a view that current conventional turbofans are reaching their development limit. The advancements in materials, manufacturing techniques and engine control systems being employed to improve conventional designs will be effective but also carry a technical risk.

The CFM approach for the A320neo was to develop the LEAP engine. This is a development of the conventional two spool design, which has been so successful for CFMI over the years with the CFM56 family of engines. The engine is based on the GEnx design and advanced materials and cooling has provided an engine that challenges the performance claims of the GTF. Apart from the A320neo, it is also the choice engine on the 737MAX and the COMAC C919. The proven reliability of CFM engines over the years will be a determining factor for some operators.

All engine introductions have teething problems and the GTF and LEAP engines are unlikely to be exceptions. Since the first GTF introduction with Lufthansa earlier this year, the start problems and rotor bow issues have been a concern. Pratt

ENGINE VALUES

Engine Variant	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CFM56-5B4/P	$4,300,000	$4,550,000	$5,290,000	$5,633,000	$5,727,000	$5,850,000	$5,941,000	$5,950,000	$6,000,000	$5,800,000	$5,770,000	$5,600,000	$5,350,000
CFM56-5B4/3	-	-	-	$5,880,000	$6,000,000	$6,170,000	$6,311,000	$6,566,000	$6,590,000	$6,820,000	$6,700,000	$6,700,000	$6,450,000
V2527-A5	$4,300,000	$4,495,000	$4,987,000	$5,340,000	$5,682,000	$5,780,000	$5,535,000	$5,700,000	$5,750,000	$5,410,000	$5,420,000	$5,400,000	$5,200,000
V2527-A5 SelectOne	-	-	-	-	-	$5,780,000	$5,780,000	$5,800,000	$6,050,000	$6,000,000	$6,000,000	$6,100,000	$6,130,000
$2.450	$2.450									$2.950	$2.450		

and Whitney claim they have resolved the bow issue and will have permanent fixes in place through 2016 for the start issues. How quickly and effectively this is achieved will be noted by the industry and serve to enhance or otherwise colour early perceptions of the GTF.

The first LEAP-1A entry into service on an A320neo is scheduled for later this year and it remains to be seen how well it performs. Early suggestions have been that demonstrating the 15% fuel consumption goals is proving to be a challenge for CFMI, while the Lufthansa fuel burn experience with the GTF is so far reported as positive.

Operators selecting the engine type for their A320neo have an interesting choice. Many will be attracted by the 15% lower fuel burn claims of the GTF, which is a massive saving if it is realised in practice and will be compounded when fuel costs rise. Reliability, both short and long term, will also be a factor as will the longer-term cost of ownership. So far, there is little data to hand but early adopters for either type are likely to benefit from attractive initial pricing and both performance and longer term maintenance cost guarantees. The reported engine price of a GTF is also assessed as lower than a LEAP and while this may not translate fully into lower initial aircraft acquisition costs, the indications are that the GTF should be a less expensive engine to initially purchase.

MRO support for both types is likely to be similar with both OEMs providing a suite of maintenance agreements backed up by strategically-placed facilities across the globe. The longer-term cost of ownership will be a key question. Pratt and Whitney points out that the GTF design is simpler and has a lower parts count by virtue of having less compressor and turbine stages than the competition so in theory it should be easier and less expensive to maintain, despite the gearbox.

CFMi will point to the proven performance and exceptional time-on-wing of its extant fleet of engines so the costs of added complexity and advanced technology material should balance out. Both manufacturers suggest that their maintenance costs will be in line with current CFM56 and V2500 variants respectively but, with the major design differences that both encompass over their predecessors, this is considered unlikely.

Engine residual values will be influenced by performance, for example upgrade packages, and reliability. Another key determinant of residuals will be the OEMs' ability to maintain supply. There are examples of current generation engines experience uplift in lease rates and values due to restricted supply around both spare engines and parts.

A key factor here will also be performance retention and operators will be anxious to see how the engines compare over time. Similarly, engine performance in harsh environments may differ between the engine types as a range of variants come into play. The aircraft performance will also differ somewhat given the different fan and nacelle sizes. How these factors impact particular operations and regions remains to be seen but it is likely that one of these types will prove more versatile than the other, thus enhancing their market attraction residual values.

Another factor that is likely to play out over time is the improved environmental performance of these new engine types. Both claim lower NOx emissions but the GTF will have a significant advantage in noise. This may raise the bar into the future with legislators likely to set goals based on best available technology. This will be a consideration for all airlines but may prove to be a more important factor for those who operate in areas more conscious of the environmental impact of aviation.

To make an informed decision, operators will need to take all of the above into account. Each OEM openly declares its own superiority and savvy customers will include OEM data as a key input alongside other datasets.

At IBA we manage a fleet of over 100 aircraft and have advised on engine selection for decades. We have never seen real world performance data match the corresponding OEM numbers so would always suggest that a third party opinion is added to the decision making process. Both of the new engines are incredible examples of engineering excellence and both will share traits with the previous generation, allowing forecasts and estimates around real world cost, performance and residuals to be developed using comprehensive datasets across operators and regions.

The limited operational and maintenance data that is available will mean that the negotiation of robust and workable performance and cost guarantees will be of paramount importance and independent advice can be invaluable in these areas also. Ultimately, the operator will be guided by his own experience with the OEM, his own market knowledge and pragmatic independent advice.