



Airline Economics

DOWN HILL LANE 2011



BLIND ALLEY 2012

INVEST NOW!



Don't bother with a D Check just park it and use that new delivery

IF YOU CAN FUND IT

HERE WE GO AGAIN BOB

DON'T PANIC GORDON WE CAN DO IT.



PARKING



WHERE HAVE ALL THE DOLLARS GONE?

BEWARE ETS
CARBON TAX

THE BIG FIGHT
NEO VS MAX

NEVER MIND
THE FUNDING GAP

BOOK NOW FOR SPECIAL RATES

EVERGREEN



READ ALL ABOUT IT
THE DESPERATE DASH FOR FINANCE



A promising start

Maurick Groeneveld, director of aircraft management at Doric Asset Finance, takes a look at the Engine Alliance engine developed for the Airbus A380.

In 1996, Pratt & Whitney and General Electric officially announced their joint venture, Engine Alliance, to produce and sell large engines for Boeing's proposed 747-500X/600X. This programme was cancelled, but Engine Alliance was then selected to design and develop an engine to power Airbus's proposed A3XX, which later became the A380. The design of the engine is built around the designs of the core of the GE90 and the fan and low-pressure system of the PW4000: GP7200.

The first run of the GP7200 was in April 2004 and the first flight with a GP7200-powered A380 was in August 2006. Although the GP7200 is certified for up to 77,000 lb thrust, only the 70,000 lb thrust version is in use by the different airlines.

Fleet

With a growing fleet of presently about 25 GP7200-powered A380s in service, the number of installed GP7200s is about 100 engines. Emirates continues to be the biggest GP7200 operator, followed by Air France and Korean Air, which

have smaller fleets. As with any growing fleet, flight hours and flight cycles are accruing rapidly – in June this year the fleet of GP7200 engines passed 500,000 flight hours and 70,000 flight cycles. It can be estimated that the milestone of 1 million flight hours will be reached in the second half of 2012. The average flight duration for the GP7200 engines is about seven flight hours. The average flight duration of the GP7200 engines is shorter than for the Rolls Royce Trent 900 engines, which are also powering a part of the A380 fleet. This is the result of Emirates using a number of its A380s

on flights that are not so long. The 'high-time' engines have about 1,500 flight cycles and about 12,000 flight hours.

Thrust ratings

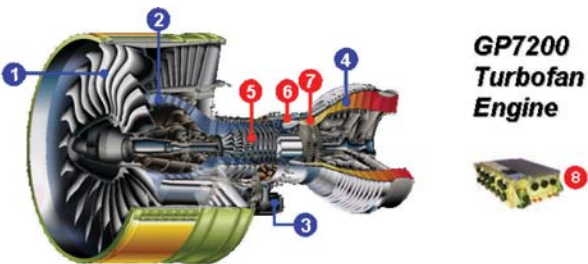
There are three thrust versions for the GP7200 engines available. The 70,000 lb rated GP7200 engine is identified as GP7270 or the GP7270E ('E' stands for extended) and the 76,500 lb rated GP7200 is identified as GP7277. The GP7277 was aimed at the freighter version of the A380, which was cancelled. Another thrust rating to be added soon to the A380 option catalogue, to allow a slightly higher MTOW of the passenger version of the A380, is the GP7272, with 72,000 lb thrust. All versions have the same hardware and the difference in thrust is achieved through a different thrust rating plug. The GP7270 and the GP7270E have exactly the same thrust rating of 70,000 lb, but the GP7270E has a higher flat rating temperature at take-off power (ISA + 22.2 °C for the GP7277E versus ISA + 15°C for the GP7270), which means the aircraft has increased thrust available in hot day conditions and the GP7270E provides the take-off performance capability of the GP7277. On the aircraft side, the GP7270E requires the thrust enhancement kit modification to be embodied.

Operational experience

Based on information available to Doric, the GP7200's performance retention (up to now) looks very satisfactory and the exhaust gas temperature (EGT) deterioration is presently not a contributor to engine removals. As the EGT margin of new GP7200 engines is significant and the deterioration not very high, it can be expected that removals for EGT margin – if being a removal reason – will only start to occur around 2,500 to 3,000 flight cycles for first-run engines. However, due to the lower EGT margins of the GP7270E engines compared with the 'standard' GP7270 engines, the GP7270E engines will reach their removals for EGT margin slightly earlier.

Technical issues

There have not been any Airworthiness Directives issued against the GP7200 engines. It is somewhat difficult, due to the youth of the GP7200 engines, to make



GP7200 Turbofan Engine

1 Swept Hollow Titanium Fan	5 9-Stage HP Compressor
2 5-Stage LP Compressor	6 Low Emission Single Annular Combustor
3 Accessory Gearbox	7 2-Stage HP Turbine
4 6-Stage LP Turbine	8 FADEC III

GP7200 ENGINE CHARACTERISTICS

Fan	Single stage with 24 swept wide-chord hollow titanium blades
Low-pressure compressor	Five stages
High-pressure compressor	Nine stages
Combustor	Annular combustion chamber
High-pressure turbine	Two stages (cooled)
Low-pressure turbine	Six stages (uncooled)
Fan diameter (inches)	116.7
Length (inches)	187.1
Dry weight (lb)	14,800

general remarks and draw conclusions, but in managing the GP7200 engines, Doric has come across the following more significant issues:

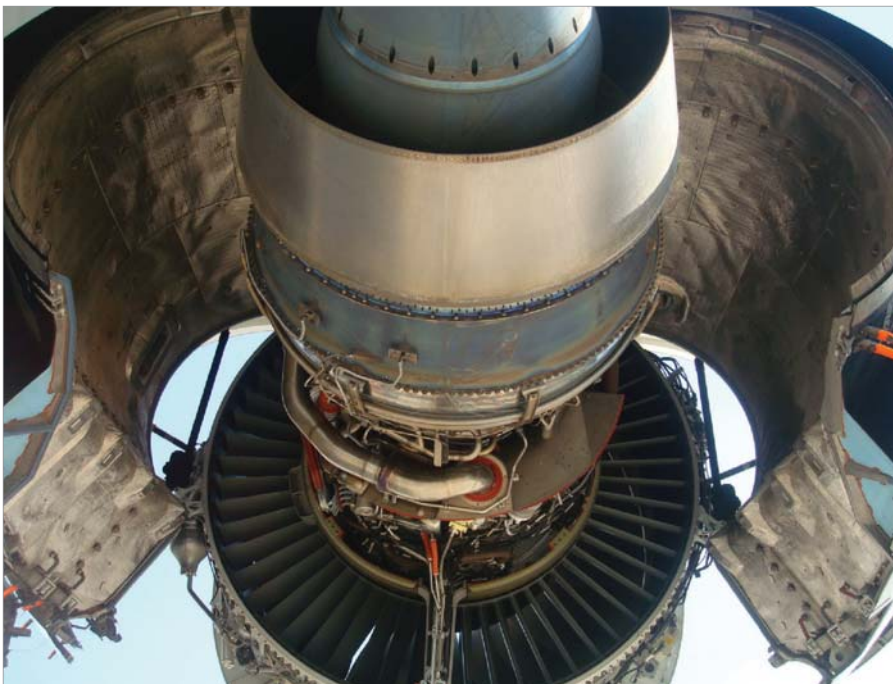
- High oil consumption: there have been some premature engine removals due to excessive oil consumption. The root cause seems to be linked with premature and increased wear of the #5 carbon seal, which results in a loss of oil through the seal. A product improvement plan is in place.
- High-pressure compressor (HPC) 2-5 spool upgrade: engines with a particular part number for the HPC 2-5 spool have been affected by premature removals as, due to higher-than-normal seal rub (as a result of the manufacturing process), the life limit of these parts was reduced to 2,100 cycles. As a result, Engine Alliance initiated a replacement programme for HPC 2-5 spools with a new design part that has a life limit of 4,200 cycles. This replacement and upgrade

programme has been completed on the affected engines.

Shop visits

It seems possible the GP7200 engines would be able to remain on-wing for around 3,000 engine cycles (for first-run engines). The engine's first refurbishment is likely to feature light maintenance of all modules, except for the combustor and the high-pressure turbine, which will undergo heavy maintenance. Thereafter, a second run of about 2,000 to 2,500 engine cycles is likely to follow. The engine's second refurbishment would be more extensive than the first and also feature heavy maintenance of the HPC, the turbine centre frame, the low-pressure turbine and the turbine exit case.

Like the GE90, the GP7200 can be split in the propulsor and the fan module to ease transportation for shop visits. Obviously, from an engine management perspective, this requires additional tracking of the fan modules and propulsors.



Life-limited parts management

The life-limited parts in the GP7200 engines have a target life of 15,000 cycles. However, at present, a large portion of the life-limited parts has certified life limits well below 15,000 cycles. The HPC 2-5 spool has the lowest life limit (4,200 cycles) and other life-limited parts have limits at various levels in between. This life limit of the HPC 2-5 spool means the engine's first refurbishment is not causing a premature first refurbishment of the engine. Simultaneously, Engine Alliance

is working on extending the life limits of those parts that have a lower limit.

Support

Up to now, the number of GP7200 shop visits has been limited and only 20 shop visits have occurred since the GP7200 engines commenced their commercial operation in August 2008. The shop visits typically involved repairs and modifications, and the extent of the work was light. Based on the number of GP7200-powered A380s in service and on order, the annual number of

GP7200 shop visits is expected to increase significantly from about 10 a year now to about 100 a year towards the end of this decade. At the moment, all GP7200 engine shop visits are performed in GE Wales, which is the only maintenance repair and overhaul shop for the GP7200. However, Air France Industries is gearing up its extensive engine maintenance facilities to perform GP7200 shop visits. It expects to perform the first GP7200 shop visit during winter 2013/2014 and have full overhaul and repair capability for the GP7200 by winter 2015/2016, and it is offering its services to Air France and other operators. Emirates Engineering is also gearing up its engine maintenance facilities from changing modules on the GP7200s as of today and it plans to perform GP7200 shop visits from late 2014. Another MRO shop preparing for GP7200 shop visits is Abu Dhabi Aircraft Technologies, which plans to be able to handle GP7200s by 2013. All the MROs are part of the Engine Alliance MRO network.

Smooth entry

Although the experience with the GP7200 is limited, the GP7200 engines have shown a smooth entry into service with the different operators so far. Like any other engine, it features some issues, but Engine Alliance either has a solution in place or is working on it. The performance demonstrated by the GP7200 engine also suggests this engine will live up to its promise.

Doric Asset Finance, based in Germany, the UK and the US, provides proactive, hands-on asset management and remarketing services to owners, investors, financiers and operators of aircraft and engines. Aircraft and engines under long-term asset management by Doric Asset Finance include aircraft such as the Airbus A320 family, the A330/A340 family, the A380 and the Boeing 777, and engines such as the CFM56-5, the Trent 500, the GE90-115 and the GP7200. Doric Asset Finance also performs asset management activities through project assignments with a more limited scope, such as aircraft inspections and technical records audits, remarketing of aircraft, aircraft redelivery support, and assisting with assessing, drafting and negotiation of contracts (for aircraft acquisition and technical support).