A320 family modification programmes

The A320 is compliant with recent mandatory avionic modifications. There are, however, modification and upgrade packages for the CFM56-5B and V.2500-A5 series engines, designed to improve operating performance and reduce maintenance costs.

Modification and upgrade programmes available for the A320 family fall into three categories: engine upgrades; avionics; and future passenger-to-freighter conversions.

Engine upgrades

CFM56-5A and -5B

The CFM56-5A was the first engine to power the A320 into service and to be certified for extended twin-engine operations (Etops) on the aircraft. A derivative of the ubiquitous CFM56-3 engine for the classic 737 family, the CFM56-5A and -5B series has gone through a number of thrust upgrades and performance improvements.

CFM claims there are currently no mandatory modifications against the engine, either the -5A1/A2 or the higher rated -5B4, which power the A320.

There are three main differences between the -5A and -5B engines: the addition of a fourth booster stage in the low-pressure compressor (LPC) of the -5B; the incorporation of the -5C core technology from the A340 engine; and an optional double annular combustor (DAC). There are nine main thrust ratings of -5B:

Variant	Thrust lbs
CFM56-5B1/P	30,000
CFM56-5B2/P	31,000
CFM56-5B3/P	32,000
CFM56-5B4/P	27,000
CFM56-5B5/P	22,000
CFM56-5B6/P	23,500
CFM56-5B7/P	27,000
CFM56-5B8/P	21,600
CFM56-5B9/P	23,300

In 2004, CFM launched a single major modification package for the -5B that encompassed major changes in the compressor section, and also some enhancements in the combustor and turbine. These were aimed at improved fuel burn, increased durability and an improvement in exhaust gas temperature (EGT) margin.

CFM has just completed the Tech Insertion package, an extensive 63-hour flight test programme, and announced its availability.

The Tech Insertion programme incorporates technologies developed and validated as part of Project TECH56, and includes improvements to the HPC, the combustor, and the high- and low-pressure turbines (HPT and LPT). The package will provide operators with longer time on-wing, 5% lower maintenance costs, 15-20% lower oxides of nitrogen (NOx) emissions, and better fuel burn. The price for kits at this stage is undisclosed, but they will be available from 2007.

The modification can be incorporated at a normal shop visit for engine overhaul. From 2007, the Tech Insertion specification will become the production build standard for the -5B. It will also become the technology standard for the -7B engine on the 737-NG. The last major engine enhancement for the -5B was in 1996 with the introduction of the -5B/P standard, replacing the original build standard from 1994.

V.2500

International Aero Engines (IAE) offers the V2500-A5 engine on the A320 family. Two models power the A320 and A321, although the -A1 series is no longer manufactured.

There are several mandatory modifications on the engine -A5 at the moment.

Airworthiness directive (AD) number 99-13-01 mandates a borescope inspection for evidence of oil or heat damage in the HPT hardware. This AD is applicable to early engines only.

AD 2004-12-08 adds (HPT) 1st and 2nd disks to the Federal Aviation Administration (FAA) enhanced inspection at piece part opportunity, and is part of an FAA life limited part (LLP) evaluation programme being conducted across the industry, with contributions from each manufacturer.

AD CN U2003-355(B) R1 mandates a fuel-cooled oil cooler (FCOC) Inspection within every 500 hours.

AD 2003-10-14 requires shutting off the engine bleed following an oil filter clog message during flight, to prevent possible number-3-bearing failure. The fix is incorporated in production engines.

AD 2003-11-23 requires inspection of the magnetic chip detector (MCD) within 125 hours of service, and repetitive inspection every 125 hours on a group of engines that have a particular number-3-bearing part number. The fix is incorporated in production engines.

IAE has introduced a major modification enhancement package. Called V.2500Select, it is in response to market demands and can be tailored for individual customers. It offers up to 1% fuel burn improvement and a 20-30% reduction in maintenance costs. It will be available from mid-2008 as a retrofittable modification package that can be incorporated at an engine shop visit. The modification involves a number of hardware and engine control unit (ECU) software changes.

Avionics

There are a number of avionic modifications available on the A320 family that operators and owners need to consider.

Airbus has decided to embark on a fleet-wide retrofit of the previous flight warning computer (FWC) to the more recent H2-F2 standard. This is available free of charge.

Autoland is prohibited at some airports if air data inertial reference units (ADIRU) installed on aircraft have obsolete magnetic variation tables, and Airbus offers a free retrofit with a new magnetic variation table for the ADIRU.

Airbus has decided to certify the enhanced ground proximity warning system (EGPWS) with a direct link to global positioning system (GPS) to avoid false warning caused by FM position shift. This modification is offered free of charge to airlines.

Airbus is offering a new electronic

IAE has launched a modification enhancement package for the V.2500 termed V.2500Select. This involves a retrofittable upgrade package which results in up to a 1% reduction in fuel burn and a 20-30% reduction in maintenance costs.

instrument system (EIS) based on liquid crystal display (LCD) technology.

Mandatory modifications

There are a number of structural and systems modifications and ADs.

In ATA chapter 53, which relates to the fuselage, there are two engineering changes.

First, cracks were detected around the rivets of the keel beam side panels below the centre wing box due to fatigue. A mandatory inspection CN 2003-146 was introduced for this area.

Second, in the main landing gear (MLG) area, the MLG door actuator fitting installed on the keel beam and the related upper strap were found to have cracked on some aircraft, due to fatigue. Two ADs were introduced, CN 2004-189 and LTA 2001-120 rev.01.

In ATA chapter 55, which relates to the stabiliser, there are two modifications addressing water ingress. This was detected in the honeycomb panels of A320 elevators, due to cracked honeycomb core. These are CN 2001-062 and LTA 2001-197.

Chapter 57, which relates to wings, includes five modifications. Starting with hydraulic lines, a finding due to modification EO118653 identified chafing marks on both engine suction lines during the second structural check, caused by wrongly-installed struts. This resulted in inspection EO 136097.

Lufthansa has also detected corrosion in the holes and in the flanges of the gear attachment rib 5 on several aircraft. Modification EO125264 has been introduced to address the corrosion.

Chrome flaking of the flap track aft spigot has been detected. Modification EO 116560 has been introduced.

Again in the flap area, loosened and damaged cushion seals have been detected, due to damaged inserts, loose and missing bolts and elongated holes. This is addressed by inspection EO 143870.

Finally, corrosion has been detected on the lower wing skin inside the dry bay, resulting in inspection EO 131951.

There are three main modifications in the systems areas.

First, there is a major AD that addresses cracking in the MLG shock absorber sliding tube. A linear crack of about six inches in length was discovered at the intersection of the cylinder and the axle by Lufthansa Technik during a routine visual check of the right-hand MLG. Laboratory investigations performed by Messier-Dowty have revealed that the cause of the crack was the presence of non-metallic inclusions in the shock-absorber sliding tube base metal. This led to AD CN 2004-022 and AOT A320-32A1273 (5 February 2004).

The second modification addresses in-board flap trunnion wear, which currently only affects seven airlines, one of which is Lufthansa. There is a slot in the belly fairing of the A320 family due to the movement of the in-board flap trunnion during normal flight. This slot is closed in flight by the so-called belly fairing sliding panel, which is connected to the trunnion by a hook. To avoid wear damages, the trunnion is protected by clamp-type steel rubbing pads, which were introduced by SB A320-27-1117 that terminated SB A320-27-1108/CN 1996-271-092.

Finally, an inspection regime has been introduced to combat the cracking of ram air turbine (RAT) carbon blades. Currently this only affects Lufthansa aircraft. Three chord-wise cracks were found on the aft side of the carbon blade. The affected RAT-type was developed by Hamilton Sundstrand for A319 and A321 aircraft and later also became a substitute for the Dowty RAT which was installed on A320 under serial number MSN 1000. For this purpose the A320 RAT box had to be extended in the forward belly fairing. AD CN: F-2005-212 addresses the issue.

Future freighter conversions

While the current fleet of A320s is still far too young to have any candidates for freighter conversion, the aircraft is an ideal fit between the 737- and 757-sized market. Although it will be several years before freighter programmes will become viable, EADS-EFW has ensured that it is well prepared. Jürgen Habermann, vice president sales & customer support for EADS-EFW in Dresden outlines the engineering and preparatory work. "There will definitely be a conversion programme for the aircraft, entering service about 2010 or 2011. The aircraft still retain high residual values and it will take four or five years before the older aircraft in the fleet become good candidates. To launch a freighter conversion programme you need two things: enough customers who want the aircraft; and a large enough supply of economically attractive airframes. We have conducted an initial feasibility study, looking at an outline cost of conversion and at the engineering aspects to ensure it will work. The detailed engineering work will begin in 2008. We have to obviously install a side door and blank other passenger doors, remove the interior, strengthen the floor, install smoke detection systems and change the flight deck and associated systems for freighter mode. In all we expect the conversion to cost $3.5-4.0 million."

As with other aircraft types, undoubtedly there will be a choice of other third-party conversions made available if market demand is strong enough. Gross weight enhancements and engine modifications may also be required to ensure that payload range meets market needs. AC