A300-600/A310 modification programmes

The most important modification and upgrade programmes for the A300-600 & A310 are freighter conversion and various avionic improvements.

Production of A300-600s and A310s has ended and there are now two passenger-to-freighter conversion lines. Another quarter-century of active life as freighters means that there is also scope for what was, in its day, a ground-breaking flightdeck to be upgraded.

Airbus has produced a total of 821 A300-series aircraft, including 313 A300-600s and 255 A310-200s and -300s. The last of these was delivered to FedEx on 12th July 2007, by which point the A300 had been in production for more than 30 years. Airbus expects to be supporting it for at least another 30, predicting that half the current fleet of more than 630 aircraft will remain in service beyond 2025.

Freighter conversion

The majority of A300-600s and A310 are likely to remain in service as freighters.

Deutsche Airbus started offering cargo conversions at the beginning of the 1990s. The design was based on the A300-600F series production aircraft, of which FedEx ordered the first 25 in July 1991, and adapted to meet the requirements of the A300B4 and A310. Airbus has delivered a total of 109 new-build -600 series factory freighters, including 61 A300F4-600Rs (53 of them for UPS), 42 -605Rs for FedEx, five convertibles and a single A300-600F.

The conversion process in Dresden, where EFW started converting A300B2s and B4s in 1995, takes about four months and uses parts produced on the same jigs used to build the assemblies for the production aircraft. That was a constraint in the past. Production was limited to 20 shipsets annually, and to accommodate demand for new aircraft EFW could offer only 14 conversion slots each year. A new hangar extension combined with the end of new freighter production has increased annual capacity to 20.

The new maindeck cargo door, 141 inches wide and 101 inches in height, along with upper and lower frame shells, is supported by four new milled frames. The maximum height of the maindeck sill is 181 inches, and the door can be opened to 70 degrees, raising the lower lip 134 inches above the sill, or a full 145 degrees.

The new maindeck floor involves new crossbeams with support rods and fittings, reinforcement of the frames in the vicinity of the support rod fittings, and new seat rails. Windows are plugged and passenger doors deleted or deactivated, and the conversion is completed by a safety barrier net, smoke curtain and smoke detection system.

A300-600 payload

The converted A300-600 can be equipped with a single-row or a side-by-side maindeck cargo-loading system (MDCLS).

With a single-row system it can accommodate 15 88-inch or 14 96-inch pallets, or seven 96 X 125-inch AMA containers.

The maindeck can also be loaded with 96-inch X 125-inch pallets loaded side by side in two rows. Eight pairs can be loaded plus another four in a single row making a total of 20.

Another configuration is for nine pairs of 88-inch X 125-inch containers and three single containers making a total of 21. Each of these containers has an internal volume of 476 cubic feet, taking the total maindeck volume to 9,996 cubic feet *(see table, page 10)*.

The lower deck cargo hold has room for four pallets or 12 LD-3 containers forward and 10 LD-3s aft. There is also a bulk hold of 610 cubic feet. Each LD-3

The list price for conversion to freighter by EADS-EFW is $8.5-9.0 million, including the freight handling system.

PAYLOAD CHARACTERISTICS OF A300-600RF & A310F CONVERTED BY EADS-EFW

Aircraft type	A300-600RF	A310-300F
MZFW-lbs	286,600	249,120/251,320
OEW-lbs	179,230	162,920
Gross structural payload	107,370	86,200/88,400
Maindeck containers	21	16
Number maindeck containers	88" X 125"	88" X 125"
Unit volume maindeck containers-cu ft	476	476
Total volume maindeck containers-cu ft	9,996	7,616
Tare weight maindeck containers-lbs	5,313	4,048
Type lower deck containers	LD-3	LD-3
Number lower deck containers	22	14
Unit volume lower deck containers-cu ft	146	146
Total volume lower deck containers-cu ft	3,212	2,044
Tare weight lowerdeck containers-lbs	4,730	3,010
Total volume all containers-cu ft	13,208	9,660
Total tare weight all containers-lbs	10,043	7,058
Net structural payload-lbs	97,327	79,142/81,342
Packing density-lbs/cu ft	7.36	8.19/8.42

has an internal volume of 146 cubic feet and the 22 containers provide a total capacity of 3,212 cubic feet *(see table, this page)*.

The total container capacity for the aircraft is therefore 13,208 cubic feet. The bulk volume takes the total to 13,818 cubic feet *(see table, this page)*.

The A300-600RF has a maximum zero fuel weight (MZFW) of 286,600lbs and an operating empty weight (OEW) of 179,230lbs. This provides the aircraft with a maximum structural payload of 107,370lbs *(see table, this page)*.

The tare weights of the main and lower deck containers are 5,313lbs and 4,730lbs, totalling 10,043lbs. This leaves the aircraft with a net structural payload of 97,327lbs *(see table, this page)*. Considered against total containerised volume, the aircraft has a maximum packing density of 7.36lbs per cubic foot.

A310 payload

The A310 was designed to accept 96-inch as well as standard 88-inch pallets on its cargo deck. It has a 106-inch freight-hold door and a semi-automatic loading system.

The aircraft can accommodate three pallets or eight LD-3 containers in the forward hold and six LD-3s aft. The bulk hold has a volume of 610 cubic feet. The unit volume of 146 cubic feet for each LD-3 takes the total LD-3 belly capacity to 2,044 cubic feet *(see table, this page)*. The additional bulk capacity takes the total to 2,654 cubic feet.

With containers loaded in a single row, the A310's maindeck can carry 12 88-inch or 11 96-inch pallets on the main deck, or five 96 X 125-inch AMA containers.

In a double-row configuration, the maindeck can accommodate 16 88-inch or 15 96-inch containers. The unit capacity of 476 cubic feet of the 88-inch containers means that total capacity for the maindeck is 7,616 cubic feet *(see table, this page)*.

The aircraft's total containerised cubic capacity is therefore 9,660 cubic feet.

The A310-300F has two MZFW options of 249,120lbs or 251,320lbs and an OEW of 162,920lbs. This gives the aircraft a gross structural payload of 86,200lbs and 88,400lbs.

The tare weight of the main deck containers is 4,048lbs, and the tare weight of the lower deck containers is 3,010lbs. This provides a total tare weight of 7,058lbs which leaves the aircraft with net structural payloads of 79,142lbs and 81,342lbs *(see table, this page)*. This allows a maximum packing density of 8.19lbs per cubic foot and 8.42 lbs per cubic foot.

The A310-200F's MZFW is 246,910lbs and its OEW is 159,610lbs. This gives the aircraft a gross structural payload of 87,300lbs.

The container tare weight of 7,058lbs leaves the aircraft with a net structural payload of 80,242lbs, and allows a packing density of up to 8.3lbs per cubic foot.

B/E Aerospace

Before EADS established the freighter conversion line in Dresden, a number of A300B2/B4 airframes had been converted in Hamburg, while Sogerma had converted 17 in Toulouse. Starting in 1996, the former BAE Systems Aviation Services division at Filton in the UK converted 39 A300B4s.

Flight Structures (FSI), BAE's partner in the programme, and now a subsidiary of B/E Aerospace, had developed the supplemental type certificate (STC) in 1995. In 2002 it took over the line, along with the STC and engineering work in order to support a move into the A300-600 market. Last year B/E announced that FSI would develop the engineering and certification package, and manufacture the necessary structural components for the conversion of six A300-600s operated by China Southern Airlines.

The conversions are being carried out in Guangzhou by GAMECO, the carrier's maintenance joint venture with Hutchison Whampoa. The first aircraft, B2315, arrived to start the process on 31st May 2007.

Glass cockpits

The two-pilot 'forward-facing crew cockpit' introduced by the A310, and used subsequently on the A300-600, was advanced enough in its day to be a cause of major controversy. That was 25 years ago, and flightdeck upgrades are becoming attractive for operators planning to fly the aircraft for another quarter of a century.

Lufthansa has specified the CMA-9000 flight management system (FMS) from Canada's CMC Electronics as a retrofit for its 14 A300-600s, which remain in passenger service. Stephane Villeneuve, CMC's director of sales and marketing for Europe, Asia and Australasia, says that while Lufthansa has opted for just the dual CMA-9000s, the FMS can also form the core of more extensive cockpit retrofits.

For example, the German airline is happy to use the global positioning system (GPS) card in the enhanced ground proximity warning system (EGPWS) to feed the FMS with position data. The CMC could also integrate its own GPS hardware in the form of the CMA-5024 satellite-based augmentation system (SBAS) receiver. This combines the GPS with precision approach functions and supports advanced capabilities, such as automatic dependent surveillance (ADS-B), required navigation performance area navigation (RNP-RNAV) and RNP-based special aircraft and aircrew authorisation required (SAAAR) procedures. "We do not make

The A300-600RF has a net structural payload of 97,327lbs, and the A310-300P2F a net structural payload of 79,142lbs or 81,342lbs.

displays ourselves for this type of application, but we do integration work. We are the prime integrator when required by the customer," says Villeneuve.

An electronic flight bag (EFB) that can be coupled with an enhanced vision system (EVS) is another option. "It is a check box type of approach," says Villeneuve. "We start from the FMS and then we add on as per customer requirements."

The reasons why an operator might want to retrofit an A300 vary. Long-term considerations include the size of the navigation database that can be accommodated in the existing system, and capabilities that might prove limiting over a further 25 or 30 years of service. "A lot of airlines will have big operational constraints because of the size of the database," he says. "The CMA-9000 is state of the art with a larger database which will allow them to enter all their routes and all their alternates, and be able to do precision approaches further down the line."

Villeneuve points out that other operators have more short-term operational reasons, such as wanting to save weight. The CMA-9000 combines the flight management computer and multi-function control display unit (MCDU) in a single box. Replacing the existing four boxes with just two new ones can save up to 60lbs in a typical FMS application.

"When you are looking at a 25-year lifespan, the growth potential becomes much more important," elaborates Villeneuve. "Another airline may just want the operational savings, to be able to have tighter routes, more routes, and save weight for more short- or medium-term benefits."

CMC believes the whole A300 fleet is a potential retrofit candidate, Villeneuve says, pointing out that with the existing system, it is possible to use a portable data loader with multiple diskettes to update the navigation database. But it can take around 90 minutes to reload a full database. "There are big operational constraints if you are planning to use the aircraft to go somewhere, and it takes an hour and a half to reload a new navigation database."

Some of the operators Villeneuve has canvassed are looking at the combination of FMS and GPS, others at FMS plus displays. While declining to specify costs, he says that Airbus's cockpit upgrade proposals tend to be, "way too big and way too expensive for any of the airlines to be able to move forward. The result of that is people like us going in at a much more reasonable price, with a much more reasonable, scalable approach to be able to answer the specific needs."

Flat panel displays

Innovative Solutions & Support has developed a glass cockpit upgrade for 737 Classics using flat panel liquid crystal displays (LCDs). The company says that it has also developed an architecture for the A300 cockpit, using thin displays that can be fitted in the cockpit without requiring excessive structural work.

Fuel system

Airbus offers an auto fuel feed controller (AFFC) upgrade for the A310 and A300-600. Developed with Goodrich Fuel and Utility Systems, the new AFFC is designed to improve maintainability and reliability by replacing the original system, which consists of up to 30 fault and control relays housed in multiple avionics panels. The system controls the centre and inner tank fuel pumps and the water scavenge pumps. Troubleshooting it requires substantial system knowledge, and can be further complicated as the relays themselves become less reliable with age.

The AFFC replaces all but six of the relays with a line replaceable digital computer that takes inputs from the aircraft power circuits, flight deck push-button switches and the refuel panel, as well as the tank level sensors, the fuel quantity computers and pump feedback signals. Automatic operation is selected by the crew on the overhead fuel panel.

The controller's built-in test equipment (BITE) provides improved assistance to maintenance crews for troubleshooting when genuine system failures are indicated. Light-emitting diodes (LEDs) on the AFFC's front panel display fault codes, while for base maintenance an ARINC 429 transmitter can be interrogated to provide system data for the previous 20 flights.

Airbus service bulletins (SBs) cover the two-stage provisioning and installation process.

Goodrich also offers a fuel-quantity-indicating system in-tank retrofit kit for the A300 and A310. Replacing all existing in-tank composite fuel probes, composite compensators, coaxial connectors and wet-side wiring, the kit avoids the problem of water shorting the compensator while improving reliability and avoiding connection corrosion. It uses heavier-gauge nickel-plated wiring with gold-plated round terminal lugs, chafe-resistant shielding, non-hygroscopic metal fuel probes and a wide gap all-metal compensator to provide what the vendor says is a mean time between failures (MTBF) of 70,000 hours. AC