

MD-11 modification programmes

MD-11 modification programmes include freighter conversion, structural modifications & weight upgrades.

There are several groups of modifications and upgrades for the MD-11. These include structural upgrades, weight upgrades, passenger-to-freighter modification and avionic upgrades.

Structural modifications

Three major airworthiness directives (ADs) have been issued for the MD-11: the engine pylon upper spar replacement; the insulation blanket replacement (AD 2000-11-02); and the inspection and treatment of the horizontal stabiliser barrel nuts (see *MD-11 maintenance analysis & budget, page 19*). These have all been completed, but required a large number of man hours (MH).

Other modifications that are common in C checks are the torque shaft bearing inspections on the passenger doors, while service bulletin (SB) MD11-53-066 requires an inspection on the left and right main landing gear doors, which takes about 40 MH to complete. There are also additional wiring inspection SBs.

Weight upgrades

Finnair took its MD-11s with initial maximum take-off weights (MTOWs) of 615,615lbs. "We upgraded the MTOWs over the years, through the application of five modifications, to the maximum 630,500lbs," says Tapio Leskinen, MD-11 fleet manager at Finnair. "This was done using three paper modifications and two structural modifications, one of which was a wing reinforcement, and the other a modification to landing gear bolts. Both modifications can be carried out during a C check. While kits are available from Boeing for adding fuel tanks in the forward cargo compartment,

we never saw the economic case for adding them at the expense of revenue freight, and so have not fitted them." It is not possible to upgrade the maximum landing weight (MLW).

Cargo conversion

The MD-11 has become a popular freighter, with strong demand from FedEx and UPS leaving only 26 passenger-configured aircraft that could potentially be modified. These include aircraft operating with Finnair, KLM and World Airways (see *MD-11 fleet analysis, page 14*).

The freighter conversion modification includes the installation of a 140-inch wide by 102-inch high main cargo door, located in the forward fuselage. Modification takes 90-120 days to complete.

The conversion work also involves the removal of passenger furnishings, installation of a cargo net or solid barrier; installation of a maindeck cargo handling system, and structural enhancements.

The converted freighter (CF) has the same weight specifications and can accommodate the same type and number

of freight containers and pallets as the factory freighter (F). The F and CF have two maximum zero fuel weight (MZFW) options of 451,300lbs and 461,300lbs. These are high relative to the aircraft's size and give it a high structural payload.

There are two main providers of MD-11 conversion, which are also sub-contractors for the Boeing modification programme: Singapore Technologies Aerospace and Alenia Aeronavali. Typically the list price for both programmes is \$12 million per aircraft. Modification to freighter will incur additional costs in respect of the freight door power system, cargo crash barrier and installation of a maindeck freight handling system.

Converted freighter

A converted MD-11 freighter has 26 maindeck positions (two are 84-inch pallets, as opposed to the 96-inch pallets, at the end of the maindeck), and 32 LD-3s in the lower hold. The aircraft has an MTOW of 630,500 lbs and an MLW of between 471,500lbs and 491,500lbs, depending upon the options chosen in the conversion programme. The aircraft has



The MD-11's attractiveness as a freighter comes from its high MZFW that gives it a high structural payload. The aircraft also has a durable airframe and will continue to operate for another 10-15 years.

PAYLOAD CHARACTERISTICS MD-11F/CF

Aircraft type	MD-11F/CF	MD-11F/CF
MZFW-lbs	451,300/ 461,300	451,300/ 461,300
OEW-lbs	248,567	248,567
Gross structural payload-lbs	202,733/ 212,733	202,733/ 212,733
Type maindeck containers	88 in X 125 in	96 in X 125 in
Number maindeck containers	26	26
Unit volume maindeck containers-cu ft	568	607
Unit tare weight maindeck containers-lbs	780	790
Total volume maindeck containers-cu ft	14,738	15,778
Total tare weight maindeck containers-lbs	20,280	20,540
Type lowerdeck containers	LD-3	LD-3
Number lowerdeck containers	32	32
Unit volume lowerdeck containers-cu ft	146	146
Unit tare weight lowerdeck containers-lbs	215	215
Total volume lowerdeck containers-cu ft	4,672	4,672
Total tare weight lowerdeck containers-lb	6,880	6,880
Total volume all containers-cu ft	19,410	20,450
Total tare weight all containers-lbs	27,160	27,420
Net structural payload-lbs	175,573/ 185,573	175,313/ 185,573
Maximum packing density-lbs/cu ft	9.04/ 9.56	8.57/ 9.07

an operating empty weight (OEW) of 248,567lbs, providing the aircraft with a gross structural payload of 202,733lbs or 212,733lbs, depending on the MZFW option selected (see table, this page).

The internal volumes of the maindeck containers vary between 524 and 605 cubic feet. There are five maindeck pallet and container configurations. These include the use of 88-inch by 125-inch and 96-inch by 125-inch container configurations, which are the two most popular maindeck containers. These are both 97 inches tall and 125 inches long, and are contoured to the inside profile of the aircraft.

The 88-inch wide containers have an internal volume of 568 cubic feet, and the 96-inch wide containers have an internal volume of 607 cubic feet. These provide a total of 13,632 cubic feet and 14,568 cubic feet (see table, this page). These are loaded in pairs, with a total of 24 containers taking up the length of the fuselage, except for two at the rear. The two containers at the rear of the fuselage are 125 inches wide, 97 inches tall and either 88 or 96 inches long. These provide 553 cubic feet or 605 cubic feet of volume each, and so add 1,106 or 1,210 cubic feet to the maindeck volume.

The total maindeck volume is therefore 14,738 cubic feet with the 88-inch wide containers, and 15,778 cubic feet with the 96-inch wide containers (see table, this page). The aircraft therefore

has a total freight volume of 19,410 cubic feet when using 88-inch wide containers on the maindeck, or a total of 20,706 cubic feet when using 96-inch wide containers (see table, this page).

The 32 LD-3 containers have a combined tare weight of 6,880lbs and internal volume of 4,672 cubic feet.

The tare weight of the aircraft's containers is 27,160lbs or 27,420lbs, depending on the container type used. This has to be deducted to result in a net structural payload. The container options provide the aircraft with a net structural payload varying between 175,313lbs and 185,573lbs (see table, this page), depending on the MZFW option and containers used.

Avionics upgrades

There are several modifications that are mandatory on all aircraft in Europe. Two sets of VHF communication transceivers must be installed with 8.33kHz frequency spacing above FL245. Additional proposed new communications rules are being considered covering 8.33 kHz, extending it to cover above FL195. Two sets of VHF communication transceivers with 25kHz frequency spacing are mandated below FL245.

Traffic collision avoidance systems (TCASs) have already been mandated.

In addition terrain awareness and

warning systems (TAWS), which are currently known as enhanced ground proximity warning systems (EGPWS), are mandatory, but this requirement is expected to expand as technology moves on.

Reduced vertical separation minima (RVSM) are currently only mandatory in Europe and the Atlantic Ocean areas to support higher traffic densities. "We have made several upgrades and modifications to our MD-11s over recent years," says Tapio Leskinen, MD-11 fleet manager at Finnair. "These include an EGPWS installation in line with Joint Aviation Authorities (JAA) and Federal Aviation Administration (FAA) requirements, a flight management computer (FMC) 921 upgrade, the so-called 'Pegasus modification', and a predictive windshear installation. Finnair has also carried out a replacement modification to the instrument landing system (ILS), installing a multi mode receiver (MMR) with enhanced GPS navigation capability." This last modification is useful looking to the future. The basic form of area navigation requirements (B-RNAV) is mandatory in Europe, with precision (P-RNAV) optional for now, but will be required to fly into major airports in the near future with preferential slots.

The Finnair modification provides support of future P- and required navigation performance (RNP) -RNAV requirements. In addition to these, mode-S transponders are also mandatory, with the elementary and enhanced surveillance becoming mandatory in 2007.

In North America some avionics requirements differ. As with Europe, 8.33kHz frequency spacing and 25kHz frequency spacing are mandated, as are TCAS, EGPWS and Mode-S transponders.

Other modifications

Boeing is also known to be working on changes to system fittings and valves to prevent uncommanded system shutdowns. It has developed modified tail pylon fairings in conjunction with General Electric after several operators reported skin cracks in these areas. Boeing is also experimenting with new coatings to counter unexpectedly high levels of winglet erosion.

There is also the option to add an on-board maintenance terminal (OMT) that provides access to the central maintenance computer messages, together with technical documents and other software applications that can be used on the ground. FedEx has installed a number of these units to its aircraft. **AC**

To download 100s of articles like this, visit:
www.aircraft-commerce.com