

Mammoth Freighters in the US has entered the 777 passenger-to-freighter (P-to-F) conversion market. This makes it the second provider of 777 passenger aircraft freighter conversions after Israel Aircraft Industries (IAI). While IAI is offering freighter conversions only for the 777-300ER, Mammoth will offer conversions for both the 777-200LR and -300ER passenger variants. These will be designated the 777-200LRMF and -300ERMF, and will have gross structural payloads of 233,000lbs and 220,000lbs (see table, page 38), as the -300ER has a smaller gross payload. In comparison, the 777-300ERSF has a gross payload of 222,000lbs.

Mammoth hopes to induct the first 777-200LR into conversion in March or April 2022. “The first modification will take about 12 months, so we hope to present the first aircraft to the Federal Aviation Administration (FAA) for certification by the third quarter (Q3) of 2023,” says Brian McCarthy, vice president of sales and marketing, at Mammoth Freighters. “We also hope to have the first 777-300ER enter conversion in Q3 2023, and present the aircraft to the FAA by Q2 2024.”

Large freighter market

Interest in the 777-200LR and -300ER comes from the projected future demand for freighters in this size category. There are more than 600 active freighters in the same size category as the converted 777-200LR and -300ER, including: 107 MD-11Fs, 209 factory-built 777-200LRs, eight 747-200Fs, 213 747-400Fs, and 95 747-8Fs. The MD-11F has the smallest gross payload in this category at 202,000lbs, while the 747-8F has the largest at 292,400lbs.

The main problem facing freight operators is the limited choice of aircraft types. The 777-200LR and -300ER are the only aircraft following conversion whose gross payloads will make them suitable replacement and growth aircraft for this category of freighters. The only other type is the recently launched factory-built A350-1000F, which has a gross structural payload of about 240,000lbs. The aircraft is due to enter service in 2025 and will,

Mammoth Freighters is the only provider of a passenger-to-freighter conversion programme for the 777-200LR. It will provide a gross structural of 233,000lbs, and will have a containerised volumetric capacity of 22,371 cu ft.

Mammoth Freighters has launched a freighter modification programme for the 777-200LR & -300ER. These will provide gross payloads of 233,000lbs & 220,000lbs

Mammoth launches 777-200LR/-300ER P-to-F programme

however, have a list price of more than \$350 million. This will put the aircraft out of reach of most freight carriers and operators; monthly financing costs accounting for a high percentage of total aircraft operating costs.

There were 61 777-200LRs built in passenger configuration, so only a small number of aircraft are potentially available for conversion. There are, however, more than 800 passenger-configured 777-300ERs either in active service or in storage, mainly due to the pandemic.

Payload characteristics

The 777-300ER is the only converted freighter that will have a total palletised or containerised cargo volume that is close to that of the 747-200 and -400 freighters. These have main-deck and belly-space freight volumes of about 27,000 cubic feet. Following conversion, the 777-300ER will

have a total freight volume of about 28,000 cubic feet (see table, page 38).

The combination of the converted 777-300ER's gross structural payload and freight volume make it the only aircraft with suitable capacity to replace most aircraft in the 747 freighter category. There are only 35 passenger-configured 747-8s in service. A passenger-to-freighter programme could be developed, but it is questionable whether it will be economic to do so.

The 777-300ERMF will, however, be restricted to a relatively low maximum packing density, as its gross structural payload is 28,000-48,000lbs lower than the 747-400F's, while having a similar freight volume.

The 777-200LRMF will have a high gross structural payload of 233,000lbs because its maximum zero fuel weight (MZFW) will be 541,000lbs, just 2,000lbs less than the -300ERMF. Its operating



PAYLOAD CHARACTERISTICS OF 777 MAMMOTH FREIGHTERS

Aircraft type	777-200LRMF	777-300ERMF
MTOW - lbs	766,000	775,000
MZFW - lbs	541,000	543,000
OEW - lbs	308,000	323,000
Gross Structural Payload - lbs	233,000	220,000
Main Deck ULDs	27 x AMX	33 x AMX
Main Deck Freight Volume - cu ft	18,301	22,441
Main deck Tare Weights - lbs	17,145	20,955
Lower Deck ULDs	32 x LD-3	44 x LD-3
Containerised Lower Deck Volume - cu ft	4,070	5,698
Lower Deck Tare Weight lbs	5,504	7,568
Total Volume cu ft	22,371	28,139
Total Tare Weight lbs	22,649	28,523
Net Structural Payload lbs	210,351	191,477
Max Packing Density lbs cu ft	9.40	6.80
Volumetric Payload @ 6.5 lbs cu ft	134,226	168,834
Volumetric Payload @ 6.5 lbs cu ft	145,411	182,903

empty eight (OEW) will be 308,000lbs; 15,000lbs lower than the -300ERMF (see table, this page). The -200LRMF's freighter volume is about 20% lower than the -300ERMF's, so the -200LRMF has a higher maximum packing density. This makes the -200LRMF a candidate for MD-11F replacement, but also a possible 747-400F replacement, depending on the type of freight carried and its density.

The 777-300ER has several limitations with respect to its payload. "The original 777 passenger aircraft were built with carbon-fibre floor beams to keep the aircraft's OEW low," says McCarthy. "The cost of replacing these in the 777-200ER has generally been accepted as being too expensive. As a conversion would have to leave the floor beams unchanged, it was originally thought that this would result in a converted aircraft with a relatively low structural payload that would make the aircraft uneconomic to operate. This just leaves the -200LR and the -300ER.

"IAI will try to replace the floor beams in the -300ER, whereas we will not replace them," continues McCarthy. "This will result in the -300ERSF having an OEW that is 13,000-15,000lbs higher than our -300ERMF. The OEW for the -300ERMF is projected to be 323,000lbs, while it is expected to be about 336,000lbs for the -300ERSF. IAI wants to replace the floor beams so that it can have high running loads on the main deck. If the central part of the main deck is loaded with high-density freight, the remaining spaces for

pallets or containers on the main deck can have their packing densities and total weight reduced."

McCarthy adds that Mammoth has found that the floor beams on the 777-200ER's main deck are substantially stronger than previously thought, and can be strengthened relatively inexpensively. "There are still many factors against the -200ER, however, especially related to operating weights, high engine maintenance costs and the high weight of fuel volume carried relative to the payload carried," says McCarthy. "All of these issues mean the economics of a converted 777-200ER are questionable."

In the meantime, the 777-200LRMF will have a higher gross payload than a converted -200ER would be likely to have. McCarthy expects almost every 777-200LR to eventually find its way to conversion. The high gross structural payload of 233,000lbs ultimately allows a high packing density of 10.1lbs per cu ft (see table, this page). This gross structural payload is just 2,000lbs less than the -200LRF factory-built freighter. This has a 2021 list price of \$150-200 million.

"Mammoth has acquired 10 -200LRs that had previously been operated by Delta Airlines. These aircraft went into service in 2008-2010, and will be some of the first -200LRs we will convert," says McCarthy. "We have already removed the interiors on two aircraft to get a close estimation of the aircraft's OEW after conversion."

In addition to the ex-Delta aircraft, many -200LRs will come to the end of

their leases in 2024 and 2025, and McCarthy anticipates a high level of demand for the converted aircraft. "Some -200LRMFs will work in long-haul markets, and the aircraft will have 31,000lbs more payload and about 2,600 cu ft more than the MD-11F," adds McCarthy. "The 777-200LRMF could also be a suitable replacement for 747-200 and 400 freighters."


The advent of a freighter conversion programme for the 777-200LR has provided the aircraft with a secondary market and useful life, and so has boosted its residual values. McCarthy estimates that the all-up cost of putting a converted aircraft into service is \$60-70 million, about \$100 million less than a factory-built freighter.

Freight carriers will clearly need to analyse all the economics of the Mammoth types against alternatives. The only new factory-built freighter on offer is the A350F (see *Airbus secures commitment for first A350 freighter*, page 40). Its high list price of \$350 million will be a particular consideration for any carrier requiring a gross payload capability of 220,000-250,000lbs.

The main considerations in the case of the 777-200LRMF and -200ERMF are the market value feedstock aircraft at acquisition, cost of conversion and production ready for freighter operation, and likely market lease rate.

The market values of -200LRs and -300ERs are both distressed in the current economic climate, and cost \$30 million. While this is likely to go up once long-haul traffic volumes approach levels of late 2019, the value of a -200LR is always likely to remain low, because few are likely to go back into operation as passenger aircraft. Most -300ERs will go back into service, although some of the current fleet is due to be replaced by the A350-1000 and latterly the 777-9X when it enters service.

McCarthy estimates the cost of conversion at \$30-35 million. Although there are other costs to consider, a total build cost in the region of \$60 million is likely to have a monthly lease rate of about \$650,000. This is based on a monthly lease rate factor of 1%, given long-term low interest rates. McCarthy comments that the lease rate factor could be as low as 0.75-0.85%, and adds that the used -200LR and -300ER fleet have about 25 years left in them. The -200LR fleet is young, and the highest time aircraft has accumulated 4,500 flight cycles (FC).

The -300ER has slightly higher market values of about \$2 million, and McCarthy estimates market lease rates will be about \$25,000 higher. 

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