757 freighter build costs decline

The increased availability of passenger-configured 757-200s has begun to bring down their market values and consequently reduce the costs of preparing a 757 freighter for service.

The total cost of buying a used passenger-configured 757-200, converting it and preparing it for service as a freighter has declined in recent years. This is mainly due to the increased availability of passenger-configured aircraft, which has lowered their market values.

Several factors must be considered by freight operators and lessors when choosing aircraft for conversion. These include: the aircraft and its line number; the presence or absence of winglets; the engines powering the aircraft; the airframe and engine maintenance condition; and the number of flight hours (FH) and flight cycles (FC) the aircraft has accumulated. There are also several other issues relating to quality.

There are now 637 active passenger aircraft, and another 80 parked aircraft, which could be considered for conversion to freighter. The 637 active passenger-configured aircraft are split between 230 PW2037-powered, 73 PW2040-powered and 334 RB211-powered aircraft.

The two main passenger-to-freighter conversion programmes are offered by Boeing and Precision Conversions. Both provide an aircraft that can hold 15 full pallets or containers in its main deck.

A third programme is offered by Pemco. This provides an aircraft that can carry 14 full pallets or containers, plus a smaller device, on the main deck. Pemco, however, has recently entered Chapter 11 bankruptcy protection.

The first issue to consider is age and line number. The maximum structural payload of the converted aircraft depends on maximum zero fuel weight (MZFW). Younger aircraft, up to line number 210, can have just the standard MZFW of 184,000lbs after conversion to freighter. This gives the aircraft a gross structural payload of 68,000lbs. There are 49 PW2037-powered and 17 RB211-powered active passenger-configured aircraft in operation that go up to line number 210, which was built in 1989.

A further 317 passenger-configured 757-200s are post line number 210. These can have the standard MZFW of 184,000lbs, but may also have a Boeing modification that increases MZFW, up to 186,000lbs for PW2000-powered aircraft, and 188,000lbs for RB211-powered aircraft. This gives the aircraft payloads of 70,000lbs and 72,000lbs.

A Precision Conversions upgrade is only available for aircraft that are post line number 210. This increases MZFW by a further 8,000lbs for RB211-powered aircraft, and takes their payload to 80,000lbs.

The next issue for potential operators and lessors to consider is winglets. Despite their ability to reduce fuel burn, their installation on the aircraft increases operating empty weight (OEW) by about 1,400lbs and requires additional structural components to support their weight. None of the passenger-to-freighter conversion programmes is certified for aircraft with winglets fitted. This means winglets must be removed prior to conversion, or aircraft with winglets have to be avoided.

Most of the passenger-configured aircraft do not have winglets, but this issue still limits the number of potential freighter conversion candidates. Precision Conversions is in the process of certifying a passenger-to-freighter modification that will allow aircraft with winglets to be modified. This could be certified in 2012.

The engines with which the aircraft are equipped can be an issue for potential future operators and lessors. RB211-535E4 engines have a reputation for high shop-visit and life-limited part (LLP) costs compared to the PW2037/2040 *(see PW2000 & RB211-535 maintenance analysis & budget, Aircraft Commerce, August/September 2008, page 18)*. PW2000-powered aircraft may therefore be more desirable.

This raises the issue of the age of aircraft in the passenger fleet, and which are likely to become available in an appropriate maintenance condition and overall status. An incorrect perception is that an aircraft with a high calendar age will be undesirable. In fact, the number of accumulated FC is more important. The 757's maintenance programme has a base check interval of 18 months and a heavy check every fourth check, so every six years. This is actually performed once every five years. The routine tasks carried out in these checks increase at several thresholds of accumulated FCs. Several groups of heavy structural inspections have initial thresholds of 24,000FC/144 months and 36,000FC/216 months. The calendar limits of these intervals means most aircraft in the fleet will have already been through the first group, and more than 550 aircraft will have had the second group of inspections performed.

The group of heavy inspections that has a large impact on maintenance cost and the continued operation of the aircraft is those with a threshold of 50,000FC. These do not have a calendar limit, and so can be left until the aircraft actually reach this number of accumulated FC. There are more than 300 of these inspections, and their heavy nature means they represent a retirement watershed for all 757s *(see Assessing the 757's ageing maintenance requirements, page 34)*.

This threshold has to be considered in relation to the accumulated FCs of aircraft in the fleet, as well as the likely rate of utilisation of freighter aircraft. This will be up to, but unlikely to exceed, 1,000FC per year. Since aircraft complete a base check cycle once every five years, those that have already accumulated up to 38,000FC could comfortably operate for another 10 years before reaching this retirement threshold. Only 25 757-200s have accumulated 38,000FC or more, and four of these are freighters. The youngest of these aircraft is 25 years old.

Moreover, about 85 aircraft in the fleet have accumulated 33,000FC or more. These could operate for another 15 years or three base check cycles before reaching this retirement threshold.

Of these 85, 53 are operated by Delta, and are all 25 years or older. Another eight are with other passenger operators. The remaining 24 are freighters. Age and accumulated FC are therefore not an issue for the remainder of the fleet.

This leaves the issue of which aircraft are becoming available for conversion. This has recently increased as US majors phase out some of their 757 fleets. This contrasts with just a few years ago, when 757s were being kept in operation for longer than predicted. This kept values abnormally high, and made the total cost of preparing aircraft for service high.

One problem, however, is that US majors are keeping their aircraft in operation for a long time, and the aircraft are ageing. Values of 1989-91-build 757-200s remained at $9-12 million for a long time, but have fallen over the past 18 months.

Aircraft should be considered in terms of age and maintenance condition. The oldest, which are more likely to be in a scrap condition with a run-out airframe

Initial details of the A330 passenger-to-freighter programme indicate the A330-300 will have a maximum gross structural payload in the order of up to 152,000lbs. List price for the conversion is expected to be in the region of $16 million.

and engines, will be worth $6-6.5 million. The values of PW2000 engines will be higher than RB211-535 engines, because there are more choices of shops and specialists to part out the engines than there are for the RB211-535s.

Early 1990s vintage aircraft, whose maintenance condition will allow them to fly, have a market value of $7.5 million. The airframe of such aircraft will be $1.2-1.8 million, while the engines will have a part-out value of $2.5-3.5 million each. This puts the value for the whole aircraft at $6.5-7.0 million.

A younger, 1992-94-build aircraft, will have a value of $9-11 million if the engines' maintenance status is good, with the engines having up to 2,000 engine flight cycles (EFC) until their next shop visit. Aircraft of this vintage have the most desirable maintenance status.

This value is down from $14-15 million in 2009, when supplies of conversion feedstock were lower. Values should fall further as the number of available aircraft increases.

There are, however, several demands for used 757-200s other than freighter conversion. Delta Airlines, for example, is buying a large number of aircraft, apparently because it has not carried out enough maintenance on its core fleet. It has had to acquire up to 20 aircraft for their engines and other parts, and has absorbed some of the freighter feedstock.

FedEx also needs a large number of 757s. It has already acquired more than 60 aircraft, but may eventually acquire a fleet of up to 150, and so may need up to another 90. FedEx has also acquired aircraft that do not have winglets. It will thus deplete the supply of aircraft that both do not have winglets and have not accumulated an excessive number of FCs.

Several US majors now have large numbers of new narrowbodies on order. This includes American Airlines, which has a large number of 737-800s/-900s and A320s on order. This increases the chance of American retiring large numbers of 757s.

United Airlines is also likely to start phasing out its fleet, which is believed to be in a good overall status, and have lower accumulated FC than Delta's fleet. United's aircraft also have the more desirable PW2000 engines.

There is also the issue of lessors with a large number of 757-200s on leases that are due to expire, and fewer operators that want these aircraft.

There will be a strong market for parting out aircraft for several more years. The engines on retired aircraft will continue to hold up the value of used aircraft.

Additional costs for preparing aircraft for service as a freighter are conversion, cargo loading system and maintenance.

The list price of the freighter conversion modification is $4.5 million.

The most variable factor is maintenance. Maintenance condition will be reflected in the aircraft's value, so a 1992-94-build aircraft at $9-11 million will require little maintenance. Aircraft with engines in a poorer condition will have a lower market value.

A heavy check will use 30,000 man-hours and up to $1.2 million in parts and materials. The cost of repair and maintenance to rotable and heavy components should also be considered.

The total cost will be $14-15 million, depending on several variables, compared to monthly lease rentals of $190,000-200,000 for aircraft with engines in a good maintenance status.

A330 P to F programme

Airbus has announced the passenger-to-freighter conversion programme for the A330-200 and -300 series. The weights and payload capacities for the aircraft are not yet clearly defined, although following conversion the aircraft will have a lower OEW than their passenger-configured counterparts.

An aircraft can have several MZFW specifications, which will be higher than the standard MZFW weights for the passenger variants. A higher MZFW and lower OEW than the passenger variants will mean the freighter variants will have a higher gross structural payload.

It is certain that the maximum take-off (MTOW) and maximum landing weight (MLW) of the converted A330-200 and -300 will be the same as their passenger-configured counterparts. There may be weight upgrades from Airbus.

The first aircraft is expected to be rolled out in 2015 or 2016. Airbus has a memorandum of understanding with ST Aerospace, which will do the engineering work and manufacture the conversion kits. Most of the conversions, as many as 12-14 a year, will be performed by EADS-EFW in Dresden. Some aircraft could be converted in Singapore. List price for the conversion is expected to be about $16 million.

The highest MTOW for the A330-200 and -300 is 513,532lbs *(see table, page 59)*. A lower MTOW is 500,308lbs.

The A330-200F and -300F will be offered in two versions with the same usable fuel capacity, however: a payload mode, and a range mode. In payload mode the aircraft will have a high structural payload, but limited range. In range mode the aircraft will trade structural payload for range, while in payload mode it will carry the highest possible structural payload in trade for range performance.

Aircraft in a payload mode will have a lower MTOW, but higher MLW and MZFW weights. The higher MZFW will provide the aircraft with a high gross structural payload. A higher MLW specification will also enable a higher payload capacity.

In payload mode, the aircraft will have an MTOW of 500,308 lbs; equal to

PAYLOAD SPECIFICATIONS OF A330-200F & A330-300F POST PASSENGER-TO-FREIGHTER CONVERSION

Aircraft type	A330-200F Payload mode	A330-200F Range mode	A330-300F Payload mode	A330-300F Range mode
MTOW lbs	500,308	513,532	500,308	513,532
MLW lbs	418,880	407,680	418,880	418,880
MZFW lbs	398,720	387,520	398,720	392,000
OEW lbs	244,160	244,160	246,400-252,000	246,400-252,000
Gross structural payload lbs	154,560	143,360	146,720-152,320	140,000-145,600
Range @ MZFW-nm:	3,200	4,000	3,150	3,600
Main deck containers:	22 AMJ	22 AMJ	26 AMJ	26 AMJ
Main deck volume-cu ft:	13,068	13,068	15,444	15,444
Main deck tare weight-lbs:	16,940	16,940	20,020	20,020
Lower deck containers:	26 LD-3	26 LD-3	32 LD-3	32 LD-3
Lower deck volume-cu ft	3,770-4,030	3,770-4,030	4,640-4,960	4,640-4,960
Lower deck tare weight-lbs:	5,590-6,760	5,590-6,760	6,880-8,320	6,880-8,320
Total volume-cu ft	16,838-17,098	16,838-17,098	20,084-20,404	20,084-20,404
Container tare weight-lbs	22,530-23,700	22,530-23,700	26,900-28,340	26,900-28,340

223 tons. These weights could later be increased with upgrades from Airbus.

MLW will be 187 tons for both variants; equal to 418,880lbs.

The MZFW for both the -200 and -300 will be 178 tons; equal to 398,720lbs *(see table, this page)*. What is not clear at this stage is the actual OEW of the converted aircraft. It is expected to be 109 tons for the smaller A330-200, equal to 244,160bs; and 110-112.5 tons, equal to 246,400-252,000lbs, for the larger A330-300.

This will generate a gross structural payload of 154,560lbs for the A330-200F, and 146,720-152,320lbs for the A330-300F *(see table, this page)*. These payloads are equal to 69 tons for the A330-200F, and 65.5-68 tons for the A330-300F.

In this mode, it is expected the A330-200F will have a range of 3,200nm when operating at MZFW. The A330-300F will have a range of about 3,150nm *(see table, this page)* when carrying a full payload.

The aircraft in range mode will have a higher MTOW, but lower MLW and MZFW. The highest MTOW for current passenger variants is 513,532lbs *(see table, this page)*. Weights may reach a higher level if Airbus offers an upgrade.

The MLW will still be 418,880lbs for the A330-300, but lower at 182 tons, equal to 407,680lbs, for the smaller A330-200F *(see table, this page)*.

The MZFW will be lower at 173 tons, equal to 387,520lbs, for the A330-200F; and 175 tons, equal to 392,000lbs, for the A330-300F.

With the same OEWs as in the payload mode, the A330-200F will have a payload of 143,360lbs, and the A330-300F a payload of 140,000-145,600lbs. These are equal to 64.0 tons for the A330-200F, and 62.5-65.0 tons for the A330-300F.

In the range mode, the A330-200F will have a capability of 4,000nm, and the A330-300F a capability of 3,600nm *(see table, this page)*.

One factor affecting the converted aircraft's OEW is the choice of cargo-loading system. The length of the A330's nose gear means the aircraft's fuselage slopes forward. Freight containers and pallets loaded through the forward main deck door therefore have to be pushed uphill manually if a non-powered cargo-loading system is installed on the aircraft.

The alternative is a powered cargo-loading system, but this increases cost and sophistication, as well as weight. There is, however, a modification that lowers the nose gear attachment points to make the aircraft level. It gives the nose gear doors a distinctive bubble appearance on the underside of the fuselage. This modification also needs some expensive engineering work, so, like the powered cargo-loading system, will add weight and reduce payload.

Payload accommodation on the A330-200F allows nine pairs of pallets or unit load device (ULD) containers with a 96-inch wide X 125-inch long base, plus four in a single row totalling 22. These ULDs are sometimes referred to as AMJs, and have an internal volume of 594 cubic feet and tare weight of 770lbs *(see Containers & ULDs for main & lower deck freight, Aircraft Commerce, August/September 2009, page 43)*.

These 22 ULDs would have a combined volume and tare weight of 13,068 cubic feet and 16,940lbs.

An alternative is to use the same number of pallets with the same base dimensions. These would provide a similar volume, but have a lower tare weight, so the aircraft would have a high net structural payload.

The A330-200 can accommodate 26 LD-3s in its underfloor compartment. Each has an internal volume of 145-155 cubic feet, depending on manufacturer; and a tare weight of 215-260lbs.

These 22 LD-3s will provide a total volume of 3,770-4,030 cubic feet and 5,590-6,760lbs.

The A330-200F's total containerised volume, when using ULDs on the main deck, is 16,838-17,098 cubic feet; while total tare weight is 22,530-23,700lbs *(see table, this page)*.

The A330-300F's main deck can hold 11 pairs of AMJ ULDs and a single row of four taking the total to 26. These provide a volume of 15,444 cubic feet, and have a tare weight of 20,020lbs.

The lower deck can accommodate 32 LD-3 containers. These provide 4,640-4,960 cubic feet of volume, and have a tare of 6,880-8,320lbs.

Total volume is thus 20,084-20,404 cubic feet, while tare is 26,900-28,340lbs *(see table, this page)*.

These specification weights and payloads only give a rough guide to the aircraft's possible structural payloads. The actual weights will become clear over the next few years as the design and details of the freighter conversion programme are finalised. AC