The medium widebody freighter sector is forecast expand faster than all other segments of the freight fleet over the next 20 years. About 830 aircraft are expected to enter the fleet, and this market will be contended by converted and new aircraft.

What is the demand for medium widebody freighters?

Twenty-year forecasts by various manufacturers expect an increase in the medium widebody freighter fleet from the current 270 aircraft to almost 1,000 by 2019, a net increase of about 730 units. The total number of aircraft that will have to enter this fleet will be close to 830, since about 100 of the current fleet are forecast to retire over this period.

Of the four categories of freighter aircraft, the medium widebody class is forecast to grow by the largest rate over the next 20 years. This class includes the 767-200/-300, A310, A300B2/4, A300-600, L-1011 and DC-10-10. It is expected to expand by 285%. This compares to 180% for large freighters, the category with the second highest growth in fleet size. In contrast, the large narrowbody bracket is expected to contract by 10%. This is mainly because medium widebodies will replace the DC-8s and 707s in the large narrowbody class.

The medium widebody class thus presents the largest opportunity for converters and manufacturers, as well as lessors and owners of used aircraft. The magnitude of the opportunity in this market raises the issue of what airlines will demand from this category, which models have the most attributes, how many of each are likely to be converted, and how many of the remainder will be factory built aircraft.

Current fleet

The current fleet of medium widebodies is expanding rapidly. The majority of the aircraft in the fleet have entered it in the past seven years. This comprises 19 767-200s, 36 767-300s, 72 A300B2/4s, 45 A310s, 51 A300-600s and 46 MD/DC-10-10s.

For each of these types, there are aircraft that are either being converted or are due to be modified to freighter in the next few years. There are still six A300B4s awaiting conversion, five A310s and the first few A300-600s. Airborne Express (ABX) is still due to convert 11 of All Nippon Airways' 767-200s. The MD-10-10 programme for FedEx will take the current fleet of 46 to about 90 when the programme is completed. This will account for all but 10 DC-10-10s. These remaining aircraft are unlikely to be converted, and will probably be scrapped for parts.

There is the DC-10-15, but a small number were built and the model requires a separate conversion supplemental type certificate (STC). This is prohibitive compared to the maximum number of -15s that could be converted.

In the case of the A300-600 and 767-300 there are also 103 outstanding orders for factory built aircraft. These outstanding freight modifications and orders for factory built aircraft will take the current fleet up to 440 units in the next five years.

Growth drivers

Freight traffic overall is forecast to almost quadruple in 20 years. In response to this the total freighter fleet is forecast to nearly double to 3,200 units, indicating that average aircraft size will double. This explains the high rate of expansion of widebody fleets.

Drivers behind freight growth are e-commerce and the change to a more global market. Freight traffic is nevertheless growing at almost twice the rate of passenger traffic. The first stimulant of large freight aircraft fleet growth is the economies of scale they provide to aid achievement of the lowest unit costs per available ton-mile (ATM). While freight yields continue to decline in real terms, they are also about half the rate of passenger yields by weight. This emphasises the need for economic efficiency, and so triggers demand for large aircraft.

Freight traffic is growing at 2-3 times global GDP, which compares to a factor in the region of twice global GDP for passenger traffic growth. The higher rate of freight traffic growth is partially explained by global businesses changing their methods of distribution. Rather than ship consignments by surface transport, companies are sending manufacturing materials or finished goods for retail by air. Although transit by air is more expensive per ton, the quantity of goods in transit at any one time is reduced to a fraction of what is in transit when shipping or other surface transport is used. This reduces overall cost. In extreme cases transit time for goods is reduced from several weeks to just a few days, as in the case of materials being transported by ship over the Pacific.

Besides materials and finished goods, express mail and time guaranteed deliveries currently represent 9% of total freight carried. This is forecast to increase to about 30% of total traffic in 20 years, and will grow at twice the rate of general freight over this period.

About 130 A310-300s remain in service. Both the A310-300 and A300-600R could account for the majority of the 580 conversions of medium widebody freighters expected over the next 20 years. Values of 767-200s and -300s are likely to remain too high for several years before conversion becomes viable.

Fleet development

As discussed, about 70 of the current fleet of 270 are expected to retire over the next 18-20 years. The most likely candidates for this are the A300B2/4s in service. These are the oldest of the fleet. Their structural checks have eight year intervals, and so retirement decisions will have to be made when they are 24 or 32 years old. That is, when their third or fourth structural checks come due.

The majority of aircraft converted have not yet reached their third structural check, but have passed their second. They are therefore likely to go through their third check. Operators will then make full use of the eight year interval, but will face a fleet planning decision when the fourth check comes due. This will occur for most during the next 20 years.

The expectation that only 72 of the current fleet will retire may be an underestimate, since many of the A300B2/4s could have been retired before this time, and others in the current fleet will also retire. Despite their age, the DC-10-10s have been put through a life extension programme with the MD-10 modification, and should remain in operation throughout this 20 year period.

The majority of the 767s, A310s, A300-600s and DC-10-10s are expected to remain in service over the next 20 years. This leaves a requirement for about 830 aircraft to enter the medium widebody fleet, 70% of which will be converted passenger aircraft. This should then provide a market for 580 conversions.

A portion of these can already be accounted for by outstanding modification commitments. These are 45 by FedEx for the DC-10-10. There are also another six A300B4s due for conversion, and five A310s, five A300-600s and 11 767-200s. This implies there are about another 500 modifications yet to be decided. These will be split between A310s, A300-600Rs and 767-200/-300s.

The number of A300B2/4s committed to conversion may increase, since the A300B4 has a low current market value and thus small total build cost compared to its payload capacity. "Despite there being several fleets of A300B4s in operation, none are currently available on the used market," explains Robin Loader, business director at BAE Systems Aviation Services. "Total build cost is in the region of $15-20 million, but end users are now looking for a fixed price and predictable quality in terms of maintenance condition and reliability. The number of A300B2/4s to be converted in addition to outstanding commitments may only be 20-30 aircraft. We expect a total of about 100-110 A300B2/4s to get converted," says Loader. "This includes the 72 in service and six committed to modification and another 20-30 aircraft."

The A300B2/4 will become overshadowed by the A300-600. "There are about 180 A300-600s in operation, and we forecast about 130 of these will get modified," says Loader. Current market values for the A300-600R are in the region of $25-30 million, and additional maintenance and conversion will take total build cost to $35-40 million. The aircraft will only become economically acceptable with a lease rate in the region of $250,000-275,000, and so capping total build costs at $21-26 million. This means current market values will have to fall to $12-15 million before conversion becomes viable for most A300-600Rs.

Taking into account that about 130 A300-600Rs will probably be converted, then about a further 350 A310s and 767s will have to be converted for the number of predicted modifications to be fulfiled. Total build costs for the A310 and 767-200/-300 are high because of current market values. This is prohibiting modification of aircraft.

The A310-300's current market values are in the region of $18-22 million, although a few low gross weight aircraft have been exchanged for about $15 million. Lease rates need to be in the region of $225,000-250,000 for aircraft to be competitive, meaning total build costs should be no more than about $20 million. This dictates that purchase values should be in the $10-12 million range.

There are about 135 A310-300s in passenger operation. Their values are expected to fall faster than the 767s', making the A310-300 viable as a freight conversion candidate earlier. Although values still have to fall by $8-10 million retirements of large fleets could make the A310-300 a viable freight modification candidate in the next five years.

While values of A300-600Rs and A310-300s are too high for freight conversion to be viable, values of 767-200s and –300s are even higher. An acceptable lease rate for the 767-200 will be $225,000-250,000, and so build costs could not exceed $22-25 million. This dictates that purchase values could be no higher than $10-13 million, depending on gross weight. Actual current market values of low gross weight –200s are $13-16 million, and $18-22 million for high gross weight –200ER models.

These values are likely to remain theoretical, since there are no retirement plans for any major 767-200 fleet. Passenger operators find the aircraft ideal for transcontinental or intercontinental operations, and there is no replacement alternative. Only traffic growth or altering market conditions are likely to force retirement of major 767-200 fleets.

Lease rates for the 767-300 to be competitive are in the $250,000-275,000

CONVERTED MEDIUM WIDEBODY FREIGHTERS VOLUMETRIC PAYLOAD & BUILD COSTS

Aircraft type	A300B4	A310-300	A300-600R	767-200	767-300
Structural payload lbs	100,000	86,300	109,740	95,000	121,000
Main deck container volume-cu ft	9,000	8,000	10,500	7,980	9,660
Lower deck container volume-cu ft	2,920	2,044	3,212	2,640	3,600
Total container volume-cu ft	11,920	10,044	13,712	10,620	13,260
Maximum packing density (lbs per cu ft)	8.4	8.6	8.0	8.9	9.1
Volumetric payload @ 6.5 lbs per cu ft	77,480	65,286	89,128	69,030	86,190
Build cost at current market value $ million	20	32	40	27	42
$ cost/lb payload	258	490	449	391	487
Build cost at acceptable value $ million	20	20	26	23	25
$ cost/lb payload	258	306	292	333	290

region, meaning build cost should not exceed $20-25 million. Current market values of the lowest gross weight –300s are still in the region of $28-32 million, meaning build cost would total $40 million and make its lease rate uncompetitive. Purchase values need to drop to $10-12 million for modification to be viable. Like the 767-200, there are few signs of major 767-300 fleet retirements. Values should therefore stay firm. The aircraft also fills a specific role. Replacement candidates are the 767-400ER and A330-200. Retirement of 767-300s will only come with traffic growth and altering market conditions. It will probably be at least five years before conversion of a large number of 767s becomes economic.

Converted aircraft

The two main determinants of the unit costs of converted aircraft are payload capacity and acquisition cost. A third determinant is cash operating costs of fuel, maintenance and flight crew. These cash costs are small in relation to finance and lease charges in most cases, however, because of the low aircraft utilisations achieved in most freight operations.

Total build cost in relation to payload capacity is therefore the key determinant of economic acceptability. Packing densities of many shipments are now falling to the region of 6.5-7.0 lbs per cubic foot, and so volumetric, rather than structural, payload is the important aircraft characteristic.

The ratio of build cost to volumetric capacity of converted aircraft should therefore be similar. A standard for economic acceptability is the A300B4, since this currently has the lowest total build cost of aircraft in this class. The A300B4 can, however, have a lower build cost per unit of volume compared to the A310-300, A300-600 and 767-200/-300. This is because the A300B4 has the burden of a three-man flight crew, and higher maintenance costs and fuel burn. The A310-300, A300-600 and 767-200/-300 can offset a higher build cost per unit of volume because they have lower cash operating costs. These younger types also have longer range, making them more flexible in operation and providing potential for higher rates of utilisation. Higher ratios of build cost price per unit of volumetric payload are therefore acceptable for the A310-300, A300-600 and 767-200/-300.

Payload capacities

A comparison of volumetric payloads has been made for the A300B4, A310-300, A300-600R, 767-200 and 767-300 *(see table, this page)*. These are on the basis of a packing density of 6.5lbs per cubic foot. Total containerised volumes are on the basis of the largest possible containers being used on the main deck.

The total containerised volumes and packing density of 6.5lbs per cubic foot provide the A300B4 with a volumetric payload of 77,480lbs *(see table, this page)*. A build cost of $20 million puts cost per lb of payload at $258 per lb.

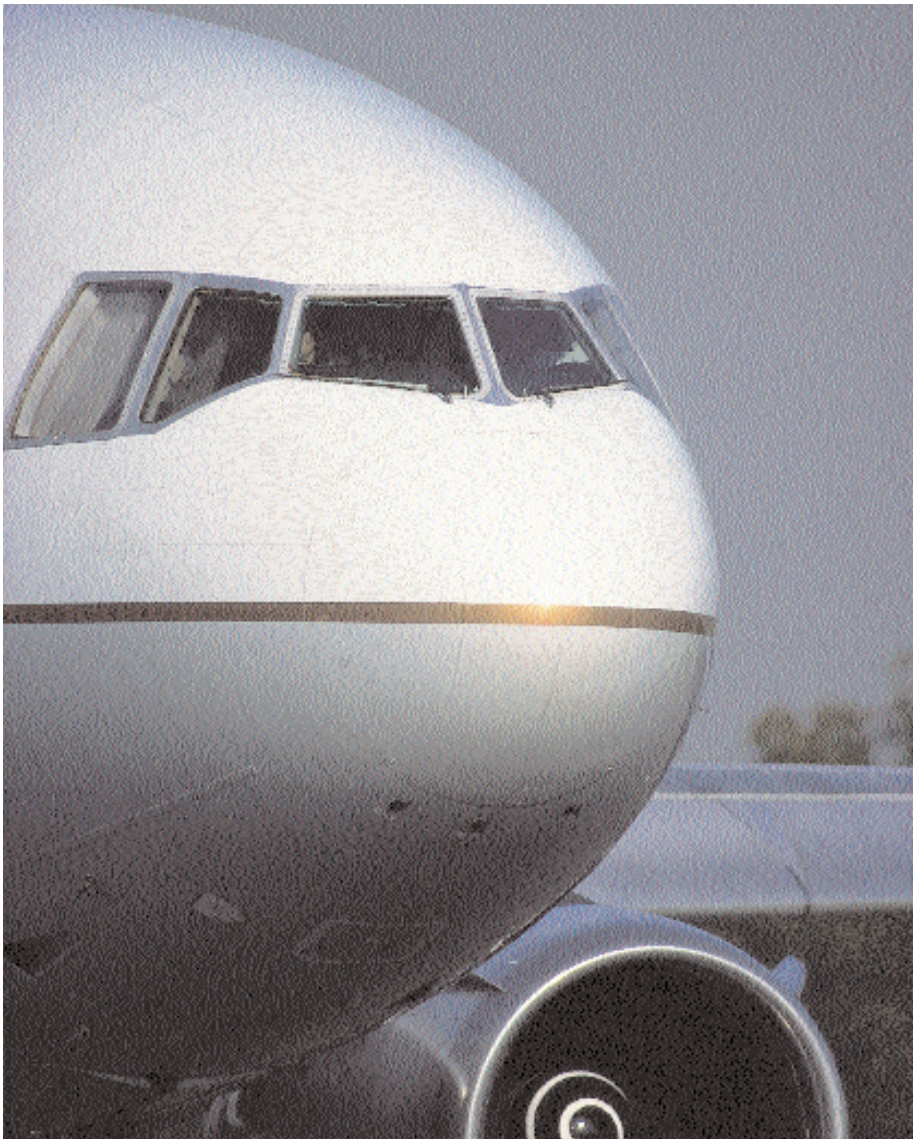
At a current market value of $18-22 million, the A310-300's build cost will be $490 per lb; too high compared to the A300B4's acquisition cost. The A300-600 and 767-200/-300 have similarly high acquisition costs compared to the A300B4. The A300-600R's market values of $25-30 million mean build cost per lb of volumetric payload is $450. Low gross weight 767-200s at $16-18 million will have a cost per lb of $390 and the oldest 767-300s at $28-32 million will have a build cost of $490 per lb.

With the market values previously described that will make the A310-300, A300-600, 767-200 and 767-300 competitive against the A300B4, build cost per lb for all four will fall to the $290-330 range. Although this is higher than the A300B4's cost of $260 per lb, the higher rates for the younger aircraft will be offset by their lower cash operating costs.

A market value of $10-12 million for the A310-300 and build cost of $20 million will bring acquisition cost per lb of volumetric payload down to $305 *(see table, this page)*. The A300-600R will have a cost per lb of $290 once values drop to $12-15 million. Values for the 767-200 need to fall to $10-12 million for a build cost of $300-330 per lb of volumetric payload, and similar purchase costs will bring build cost per lb down to $290 for the 767-300.

These acquisition costs could be higher, and so allow purchase for conversion at higher market values, if operators were able to get higher rates of utilisation. A large number of these aircraft are likely to be used to replace DC-8s, used in small package operations. These typically generate low levels of aircraft utilisation.

Longer range aircraft will be used for international operations, carrying either smaller packages or general freight. In these circumstances aircraft will be able to generate utilisations close to those



Although about 250 new aircraft are expected to enter the medium widebody fleet in the next 20 years, the DC-10's low market value means it can offer competitive unit ATM costs compared to similar sized factory built aircraft.

achieved by the aircraft in passenger service. This will allow higher build and so acquisition costs. The aircraft required for these operations will, however, be the younger and higher gross weight 767-200 and –300 models with longer range performance. The values of these will still need to fall to acceptable levels, and this will take 5-10 years.

New aircraft

Of the 800 additions to the fleet, it is expected that about 240 will come from factory-built aircraft. There are already 103 A300-600Rs and 767-300s on order. This leaves only about another 140 units to be supplied by new freighters.

New aircraft can usually only be justified by the largest small package operators: UPS and FedEx, both of which enjoy high rates of traffic growth and yields. UPS, for example, made $2.9 billion net profit on revenues of $29 billion in 2000, a profit performance unsurpassed by few other passenger or freight airlines. Small package operators, including UPS, are starting charge their tariffs by volume rather than weight, further improving yields.

Yields in small package operations are high, justifying the capital cost of new aircraft, which can be four to five times higher than that of converted aircraft. New aircraft also have twice the life to be depreciated over. Small package carriers also have the option to complete sale and leaseback transactions on depreciated aircraft, which will add to profits. These airlines will not necessarily acquire purely new aircraft. While the A300B4 has been acquired by secondary freight operators, it is anticipated that some of the 130 used A300-600Rs expected to be converted to freighter will be acquired by major small package operators.

The candidates for these new aircraft are the A300-600R, 767-300, and the A330-200. The A330-200 is at the top of this fleet category, with a similar capacity to the DC-10-10/-30.

The A330-200 is the largest aircraft in this category in terms of structural payload; with the DC-10-10 in second place. The class of medium widebodies is based on structural payload, with the upper limit of 65 tonnes. The A330-200 has a structural payload of 139,000lbs (63 tonnes) and the DC-10-10 119,000lbs (54 tonnes). The DC-10-30 is classed as a large widebody freighter, on account of its 67-72 tonne structural payload. The two DC-10 variants have the same fuselage and hence containerised capacity of 17,500 cubic feet. With a packing density of 6.5lbs per cubic foot they both have a volumetric payload of 113,750 lbs. In this respect the DC-10-30 could be classed as a medium widebody, especially for the small package market, which has volume as its main payload determinant.

Although the A330-200 has a higher structural payload than the DC-10-10, the A330-200 has the same number of LD-3s on its lower deck and the same number but smaller containers on its main deck. The A330-200's total containerised volume capacity is 15,300 cubic feet, and a volumetric payload of 99,450lbs, 14,300lbs less than the DC-10-10/-30.

While the DC-10-30 has higher structural payload and longer range than the DC-10-10, the –30 series might be judged to be less suited to regional small package operations because of its higher fuel burn, maintenance charges, weight-based landing fees and higher salaried flight crew. All DC-10-10s have been earmarked for freight conversion, however, and so operators will be left to choose between a converted DC-10-30 and the new A330-200. The list price for the A330-200 will exceed $100 million, while values of DC-10-30s have now fallen sufficiently for total build cost to not exceed $20-25 million. This is explained by DC-10-30 market values having fallen to $7-9 million. This is equal to a build cost of just $220 per lb of volumetric payload, the lowest of all used aircraft in this category. This low acquisition cost makes the DC-10-30 the most economic in this class, provided operators are able to use its capacity. The acquisition cost per lb of payload is low enough to offset the costs of a three-man flight crew, higher fuel burn, maintenance charges and weight-related landing fees. There are still more DC-10-30s due to come on to the market, which will push values down even further. These include large fleets operated by Continental, Northwest and Garuda. There are also two fleets of -40s, operated by Japan Airlines and Northwest. Only three of these have been converted.