The air freight market has only recently begun to experience renewed traffic growth following a five year stagnation in the intercontinental markets. Delayed retirements and replacements, plus traffic growth could result in large numbers of aircraft being required over the next 5 years.

Freighter requirements for the next five years

After five years of stagnant traffic volumes, global traffic freight recorded an 11% growth rate in 2004. The extended downturn led to financial weakness for many air freight operators from 1999 to 2004. While these airlines had no need to increase capacity, their fleets aged by another five years, as a result of which there is now a backlog of freighter aircraft replacements. Another issue to be considered is the pace of air freight traffic growth now that the industry is recovering. How large will the demand for freighter aircraft be over the next five years to satisfy replacement and growth requirements?

The rate of traffic growth in 2004 was the highest the industry has experienced since 1997. "An average annual growth rate of 6.2% is expected for the next five years," says Thomas Hoang, regional director, marketing cargo at Boeing. While air freight in total may have a stable growth rate over the next five years, much of this will be carried by belly space on passenger aircraft and so the effect of demand for dedicated freighter aircraft has to be assessed. The likely retirements from the freighter fleet also have to be considered.

Freighter fleet

The current fleet of western jetliner freighters numbers 1,683 aircraft. This is summarised and split into five groups based on payload capacity and size. Each category is also analysed in terms of their age *(see table, page 64):* aircraft older than 30 years; aircraft between 20 and 30 years; and aircraft younger than 20 years.

Small narrowbodies

This group comprises 535 aircraft with payloads of less than 25 tons: the 727-100, 727-200, 737-200, DC-9 and BAE 146. This is the largest group in the freighter fleet *(see table, page 64)*.

The dominant type is the 727, with 348 in service, 160 of which are more than 30 years old. Another 60 aircraft, including the DC-9 and 737-200, are also more than 30 years old. These aircraft are the principal candidates for retirement, although it remains uncertain what their operators will use to replace them.

Another 233 aircraft are 20-30 years old. More than 190 of these are 727s, with most being more than 25 years old.

Many 727s are operated by express package operators, including DHL, FedEx and UPS. All of these operate at low rates of utilisation, meaning that any replacement candidate would need to have a competitive capital or lease cost.

The most likely replacement aircraft are the 737-300/-400, with eight or nine container positions, and the 757, with 14 or 15, compared to the 727-200's 12 container positions. Operators must therefore consider if they want to reduce or increase capacity.

Another consideration is the 727's ageing aircraft programme, which has two groups of modifications. All aircraft have passed the 20-year modifications. The low rates of aircraft utilisation mean few aircraft are likely to reach the second group at the 60,000FC threshold. Other factors such as high fuel prices, three-man flightcrew charges, and growing maintenance costs will gradually force 727s into retirement.

The fleet also includes about 100 737-200s and DC-9s. The 737-200 is affected by ageing modifications, while the DC-9 is operated by only two carriers.

Of the 215 aircraft older than 30 years, the 130 DC-9s, 737-200s and 727-100s can be replaced on a one-for-one basis with 737-300s. Not all of the 87 727-200s are as easily replaced, however, and so may remain in service for a longer period.

Large narrowbodies

This group of aircraft comprises those with payload capacities of 26 to 40 tons, and includes the DC-8, 707 and 757. This totals 276 aircraft, and is dominated by the DC-8 and 707, which account for 160 aircraft, most of which are more than 30 years old. Numbers have been falling over the past five to seven years.

There are 124 DC-8s operating, the majority of which are -70 series aircraft operated by UPS. Most are likely to remain in operation.

There are just eight -50 series and 44 -60 series aircraft in service. The DC-8-60 burns 35% more fuel than the 767 on a 2,500nm route, so high fuel prices will force the early withdrawal of the aircraft. Most DC-8-50s and -60s have already been retired over the past 10 years.

Only 36 707s remain in service. The youngest was built in 1976 and most have accumulated 20,000-30,000FC. Aircraft are operated by carriers in South America, Africa and the Middle East. All are likely to retire over the next five years.

Most of the 116 757-200s are factory-built freighters and are less than 20 years old. Only about 40 aircraft are converted examples, and are still young, having been modified over the past seven years.

Medium widebodies

The third category consists of medium widebody aircraft with payloads of 40-60 tons: the A300B2/B4, A300-600, A310, 767 and L-1011. Medium-sized widebody freighters are the most numerous of all widebody types, the majority being smaller twin-engined widebodies. The L-1011 was converted in small numbers and proved unsuccessful.

There are 331 aircraft in this category, which is dominated by the A300B2/4, A300-600 and A310.

SUMMARY OF FREIGHTER FLEET END 2005

Small narrowbodies	DC-9	727	737	BAE 146/ BAC 1-11	Total
More than 30 years	28	157	30	0	215
Between 20 & 30 years	4	191	37	0	1
Less than 20 years	0	0	60	27	87
Total	32	348	127	28	535
Large narrowbodies		**DC-8**	**707**	**757**	**Total**
More than 30 years		124	32	0	156
Between 20 & 30 years		0	4	20	24
Less than 20 years		0	0	96	96
Total		124	36	116	276
Medium widebodies	**A300B2/B4**	**A300-600/ A310**	**767**	**L-1011**	**Total**
More than 30 years	1	1	0	1	3
Between 20 & 30 years	70	120	4	1	195
Less than 20 years	4	125	53	0	182
Total	75	246	57	2	380
Large widebodies		**MD-11**	**MD-10**	**DC-10**	**Total**
More than 30 years		0	28	39	67
Between 20 & 30 years		0	13	36	49
Less than 20 years		133	2	7	142
Total		133	43	82	258
Ultra large widebodies			**747-100/ -200/-300**	**747-400**	**Total**
More than 30 years			39	0	39
Between 20 & 30 years			102	0	102
Less than 20 years			29	113	142
Total			170	113	283
Total fleet					
More than 30 years					**480**
Between 20 & 30 years					**603**
Less than 20 years					**649**
Total					**1,732**

Source: BACK Aviation Solutions

Most A310s are less than 20 years old, and are operated by FedEx. Most other aircraft have been converted to freighter over the past seven years.

The second main type is the A300-600. The majority of the 176 aircraft are factory-built freighters operated by UPS and FedEx. The remainder are ex-passenger aircraft that have been converted over the past seven years.

The third main type comprises the 75 A300B2/B4s, most of which are operated in Europe and North America. European Air Transport (Belgium) has the largest fleet, with 11 A300B4s. The A300B2/B4 is a niche aircraft, with a 45-ton payload and no direct competitor with the same market value or lease rate. Most were converted in the late 1990s, and underwent a heavy check, which has an eight-year interval, at the same time. This means that most aircraft will go through a heavy check again in 2006 or 2007. Aircraft are unlikely to be retired due to the lack of a replacement alternative, so most will stay in operation for another eight years.

The fleet also includes 57 767s. Most are factory-built freighters operated by UPS. A small number of aircraft converted from passenger models has been added to the fleet in recent years.

Few aircraft are likely to be retired from this category over the next five years.

Large widebodies

This group comprises 258 aircraft with payloads of 60-80 tons, including the MD-11, MD-10 and DC-10.

All 133 MD-11s have been converted over the past 10 years, as a result of which it is now in high demand as one of the most popular freighter types around.

All 43 MD-10s are operated by FedEx, having been converted under a special life-extension programme between the late 1990s and 2001.

There are 82 DC-10s in operation, 39 of which are older than 30 years. FedEx has 39 DC-10s. There are only about 20 DC-10-30s that are more than 30 years old, and most have accumulated less than 30,000FC. Only some of these may be retired on account of weak demand for the DC-10.

Ultra-large widebodies

Ultra-large widebodies are aircraft with payloads greater than 80 tons, and include all 747 variants and the A380.

There are 283 ultra-large widebody freighters in operation, comprising 170 747-100/200/300s and 113 747-400s.

The majority of 747 Classics are less than 30 years old.

The oldest aircraft include 23 -100s operated by five carriers that include UPS and Kalitta Air.

There are 150 747-200 freighters and combis, most of which are are operated by airlines based in North America and Asia. Northwest Airlines is the biggest operator with 13 -200Fs. Most -200s are older than 25 years and so will be approaching or have passed their fifth D check. The sixth will mark a watershed for retirement, and many of the 150 747-200 freighters and combis could be retired over the next five years.

Conversions of 747-400s are gathering pace; another 50 MD-11s are still convertible and the 777F is now available. All are strong replacement candidates.

There are also 16 747-300s, which are either combis or converted freighters. These are still relatively young, but many will pass their fifth D check over the next five years.

Aircraft retirements

Considering the age profile of the five sub-fleets, and the factors that force retirement, up to 433 aircraft may retire over the next five years. This number is high since it represents about one-quarter of the freighter fleet.

Small narrowbody freighters account for about 220 or half of these retirement candidates. About 130 are DC-9s, 737-200s and 727-100s that are all old and can be replaced on a one-for-one basis with the 737-300 or -400.

There are another 90 727-200s older than 30 years, but these could continue to operate for more than five years if replacement aircraft at a low enough capital cost do not come onto the market.

All 52 DC-8-50/-60s and 36 707s are expected to retire.

Few medium widebodies will retire, meaning that less than 10 from this category are likely to be phased out. These would perhaps include a small number of L-1011s and some A300B2s.

Only 10 of the oldest DC-10-30s may be retired.

All 23 747-100s and up to 90 747-200s are expected to be retired over the next five years. This would be the second largest group, accounting for up to 115 aircraft.

Freight market

The global freight market can be divided into two sectors: intercontinental and regional. Intercontinental markets comprise the trans-Pacific, transatlantic, North America-Latin America and intra-Asia. This last region is regarded as being both intercontinental and regional because of its size. Regional markets include the domestic US and intra-Europe.

"The actual tonnage of air freight is a better indicator of demand than revenue ton-miles (RTM), since increasing average route length gives the false impression that traffic is increasing," explains David Hoppin, managing director, Mergeglobal. "The volume of intercontinental air freight tonnage did not increase between 2000 and 2003, but increased by 11% in 2004. It increased again by 4.3% in 2005. Despite the sharp rise in 2004, the growth that was lost between 2000 and 2003 will not be recovered. Intercontinental air freight tonnage is expected to grow at an average annual rate of 6.2% for the next five years. Tonnage will therefore reach 27.76 million tons by 2010.

"The rebound in 2004 and 2005 has stimulated demand for 747-400Fs. Provided growth continues, there will be a continued need for more ultra-large freighters to carry the additional traffic. One issue for the intercontinental market concerns how much longer lease rates for 747-200s, with high fuel burns and maintenance costs, can continue to be discounted to keep the aircraft operational," continues Hoppin. "High fuel prices are likely to stimulate demand for 747-400s as replacements for the -100s and -200s."

While intercontinental traffic has strong potential, many regional markets have stagnant growth.

One major regional market is North America. This has no general freight carriers, and the market is dominated by the express package integrators UPS, FedEx, ABX and DHL, as well as other smaller carriers with contracts. Express package carriers have experienced weak demand and yields for the past five years, as traffic volumes have been eroded by the internet and ground transport.

To combat weakened revenues, the express package carriers have increased aircraft size to drive down unit cost. The problem has generally been that yields have declined faster than unit costs, and the airlines now face a fleet planning dilemma on the issue of replacing their 727-200s.

Their first problem concerns the low utilisations achieved with the 727s, and the need for replacement aircraft to have low finance charges. The second problem is that the 727-200 has 12 container positions.

The primary choices for replacement are the 757 or the 737-300/-400. One option is to continue increasing aircraft size, possibly with the 757 or even widebodies, in an effort to reduce unit costs. This requires more freight, however, and so would see further reductions in yields.

Operators, however, can choose smaller 737Fs, which would probably require the usual frequency of one rotation per day to be doubled to offset the higher lease charges. A second daily rotation could be charged at just the incremental cash operating costs, but this would still require a sufficient volume of low-yield freight to be carried. Smaller freighters may be chosen considering the

POSSIBLE FREIGHTER RETIREMENTS AND NET ADDITIONS 2006-2010

Aircraft size category	Less than 25 tons	26 to 40 tons	40-60 tons	60-80 tons	More than 80 tons	Total
Potential aircraft retirements	220	52	10	10	115	407
Net fleet additions	35	35	90	80	130	370
Total aircraft requirements	255	87	100	90	245	780

low-yield environment. The decision will have a large impact on which aircraft will be in demand, since the fleets operated by FedEx and Astar Air Cargo account for a large percentage of the global freighter fleet.

Another major regional market is the Asia Pacific and China. While double-digit growth rates have been predicted for the domestic Chinese air freight market, the large volume of passenger operations means that there is a high supply of passenger aircraft belly space. Although this negates the need for dedicated freighter aircraft operations, it is also anticipated that China has the potential for a large express package operation, and so could require a large number of aircraft to serve this market. Much of the Chinese population is distributed alongside the country's east coast, and ground transportation is developed enough to carry most of this freight.

So far there are few signs of demand for a large number of dedicated freighters to serve the domestic Chinese market. India, however, is developing its dedicated freighter fleet and several carriers are adding aircraft for express package operations.

Some medium-range markets, such as international services from Latin America to the USA and Europe, are showing signs of steady growth, but traffic volumes are growing from a small base. This will stimulate demand for medium-widebody freighters.

Required freighter capacity

Growth in freight volumes will be partly satisfied by passenger belly capacity as well as dedicated freighters. Capacity will always be provided for any increase in freight volumes.

Mergeglobal's predictions are that belly capacity will reach 129,058 million available tonne-kilometres (ATKs) in 2009 as a result of passenger fleet growth. This is on the basis of an annual increase of 6.1% per year.

Mergeglobal has further analysed the amount of dedicated freighter capacity, in ATKs, required to carry the surplus of traffic not carried by passenger belly space.

The amount of dedicated freighter capacity in ATKs required to carry the balance of freight traffic is forecast to increase by 6.8-7.7% each year. If this is sustained, then there will be an overall increase in freighter ATK capacity of 42% by 2010. How this then translates into the number of additional aircraft in each payload and size category is the ultimate issue.

Mergeglobal has analysed how this predicted additional capacity translates into the number of additional aircraft required. Its conclusion is that the fleet will have grown by 23% (about 370 aircraft) by 2010, mainly because the largest increases in freight traffic are in the 60-80 ton and more-than-80-ton categories. These aircraft fly the longest sectors.

The ultra-large freighter category could increase by about 130 units to the end of 2010 *(see table, this page)*. This is explained by the fact that the growth rate for ultra-large freighter aircraft is expected to average 7.8% over the next five years. This growth will be met with 777-200Fs, 747-400SFs, 747-400Fs, 747-8Fs and A380Fs.

The second highest expected growth in the freighter fleet comes from medium widebody aircraft. The fleet could increase by 15-20 units per year, and total 90 aircraft over five years by the end of 2010 *(see table, this page)*.

The large widebody freighter fleet is expected to grow by 13-20 aircraft each year over the next five years, totalling an overall increase of 82 aircraft.

The expected increase in the small and large narrowbody category is limited, with each only requiring a net increase of about 35 aircraft. This forecast reflects the fact that the international freight business is experiencing high growth rates, while many regional markets are mature or will only have low rates of growth.

Total freighter additions

The predicted net increase in the freighter fleet of 370 aircraft over five years to 2010 alone will be relatively easy for the freighter sector to accomplish. The possibility that more than another 400 aircraft will be retired over the same period will take this total up to 780 *(see table, this page)*. Sourcing this number of aircraft will be difficult to achieve, and so may result in less than 400 being retired.

Small narrowbodies

The large number of potential retirements in the small narrowbody category potentially means it could have the largest requirement for aircraft, up to 255 units *(see table, this page)*.

About 90 of these would be 727-200s. The fact that there is no direct replacement for these in terms of capacity configuration means the retirement of 727s could be delayed. Two aircraft with a capacity configuration close to the 727-200 are the A320 and A321.

This analysis assumes, however, that aircraft will be replaced by those in the same size and payload category. Many of the 90 727-200s could be replaced by 757s or medium-sized widebodies.

The remaining 130 aircraft due to be retired are smaller types. These, and the 35 additional aircraft, could be replaced with the 737-300 and -400.

These can be converted by Bedek Aviation and Pemco. The supply of used passenger aircraft available for conversion is low, however. The surge in passenger traffic has kept the values of these aircraft strong. This may change over the next five years, however, since the order backlogs for the 737NG and A320 are at record highs. There is also the added possibility that a US carrier under Chapter 11 bankruptcy protection could fail, or at least put a large number of aircraft onto the market.

Large narrowbodies

This group will require the smallest number of aircraft to cover replacements and net fleet additions. About 35 new and 52 existing aircraft to replace all DC-8-50s and DC-8-70s are likely to be required. This will total about 90 aircraft, an average of about 18 per year. This will be the preserve of the 757 if all DC-8-50s and -60s are replaced by aircraft of the same capacity. Additional demand for the 757 could come from the replacement of some 727-200s.

There are four different passenger-to-freighter modification programmes for the 757-200. These are offered by Boeing,

The age profile of the freighter fleet means up to 400 aircraft could come due for retirement over the next five years. While traffic growth rates in many regional markets is weak, an average of 55 net additions to the freighter fleet could also be required each year for the next five years. Retirements and net additions combined result in a potential demand for more than 700 aircraft.

Precision Conversions, Alcoa-SIE (ASCC) and Bedek Aviation/ST Aero.

The Boeing conversion has not received any orders for six years. The Precision Conversion 757-200PCF is the first independent modification and accommodates 15 full-sized maindeck containers.

ASCC is in the process of developing its modification, which will accommodate 14 full and one half-sized container.

The fourth conversion is being developed by IAI and ST Aero, and will accommodate 15 full-sized containers.

Medium widebodies

This group will require about 100 aircraft *(see table, page 66)*. It has generally been accepted that this category will replace many of the DC-8s and 707s as they retire. If this is the case, then the 757 may in turn replace many of the 727-200s.

A large number of different aircraft types could be used to satisfy this demand. The majority of the 100 aircraft needed will be to satisfy traffic growth.

Operators may choose from the A310-300, A300-600 and 767-200/-300. Few have so far been converted, but the arrival of the 787 and A350 over the 2008-2009 period will see a large number of the older-generation widebody twins being released from their prime passenger operators. There are also the factory-built A300-600F and 767PF. Only a few operators have selected these aircraft.

Conversions for the A310-300 and A300-600 are offered by EADS-EFW. Passenger-to-freighter modifications for the 767-200 are offered by Boeing/Aeronavali and Bedek Aviation.

Large widebodies

The number required is relatively small, totalling only 90 aircraft, of which 80 are to satisfy traffic growth *(see table, page 66)*. There are, however, few aircraft types available in this category. The MD-11 is the only type with passenger examples still available for potential conversion. There are also DC-10s available, but few of these are now being modified.

There are also no factory-built freighters offered in this size category, although the smaller 767-300 or larger 777F could possibly satisfy some of the potential demand.

The shortage of aircraft may also mean that few or no DC-10s are retired. Other passenger types, such as the A330 and A340, could have passenger-to-freighter modifications offered for them as a result of a shortage of aircraft.

Ultra-large widebodies

This group has the second largest requirement for aircraft of up to 245 units *(see table, page 66)*. The fleet is expected to increase significantly over the next four or five years due to the expectation that China and the Asia Pacific will continue to have a strong need for high-capacity, intercontinental aircraft. A few airlines have made a blueprint to expand the widebody freighter fleet. Air Macau may open a route between Macau and the USA, and so may consider 747-400SFs, although it is concerned that there is looming over-capacity.

The 747-8Fs might be used instead of -400F/SFs, and so slightly fewer ultra-large aircraft would be required. Nippon Cargo Airlines, for example, originally ordered four 747-400BCFs, but cancelled them as part of its order for eight 747-8s.

This requirement for 245 ultra-large aircraft is split almost equally between replacements of old aircraft and additional capacity to absorb growth.

While the retirement of types in other categories, such as the 727-200, can be delayed beyond the next five years if there is a shortage of the appropriate aircraft, the retirement of ageing 747-100s/-200s will be hard to defer. This category is unique, however, in that it is the only one where a high proportion of factory-built freighters in relation to converted aircraft is acceptable.

The factory-built aircraft include the 777F, 747-400F, 747-8F and A380F. Outstanding orders for these four types total 68 units, and most of these will be delivered over the next five years.

The balance of the 245 aircraft required will have to be satisfied by orders for more factory-built aircraft and passenger-to-freighter conversions of the 747-400SF. Orders for 37 747-400 modifications have already been placed with Bedek Aviation and Boeing.

Summary

The predicted requirement for almost 800 aircraft over the next five years is inflated due to the delayed retirement and replacement of a large number of aircraft since 2000. Operators have still to resolve how they are to replace a large number of 727s. While the number is large, most aircraft have accumulated too few FCs to be faced with the second group of ageing aircraft modifications that are due at 60,000FC. The delayed replacement of 727s could therefore take some pressure off the requirement for up to 780 aircraft.

The potential number of small narrowbodies required will also be hard to meet because of the lack of 737-300s/-400s coming available for conversion, although this is likely to change between 2007 and 2010. The 737 conversion facilities could be placed under the most pressure, but the number required could also be reduced by some operators replacing 727s on a two-for-one basis with 757s, 767s and A310/s/A300-600s.

Another factor that may reduce the number of aircraft required is the further development of surface transportation. AC