**The 767 is one prospective freight conversion candidate of several widebody aircraft. Acceptable lease rates dictate maximum build cost for converted aircraft and thus in turn determine the current market value that will trigger a stream of conversions.**

# Are the 767-200/-300 ready for freight conversion?

Current market values of 767-200s are approaching the level where purchase and conversion to freighter will generate a build cost that permits an economic lease rate as freighters.

The 767-200F has several market opportunities. These start with replacement of 707s, plus several different DC-8 variants operating in different roles. Most of these older aircraft operate either trans-continental US routes, or international services north-south between the US and central/south America, across the North Atlantic, or north-south between Europe and Africa or the Middle East.

In some cases this will be as a small package carrier, and in others transporting general freight. The problem facing the 767 is that the market for freight conversion is constrained by the limited number of airlines that can justify what will initially be a high lease rate.

## Acceptability

The 767-200F can only become economically acceptable if its lease rates approach $225,000-250,000 per month. Considering typical financing structures put in place by lessors, lease rate factors will be in the region of 1.25% per month. This puts a limit on total build cost at about $20 million. Manufacturer-assisted financing may be able to reduce the monthly lease-rate factor nearer to 1%, although this is hard to achieve for a used aircraft aged 15-20 years. This would then allow build costs to approach a maximum of $25 million.

Under Boeing's freight conversion modification, upon installation of a conventional freight door, the 767-200F's structural payload is 95,000lbs. This is about 4,000lbs less than the A300B4-200F, and 6,000lbs less than the DC-8-73.

The lease rate that will make the 767-200F acceptable to airlines considering 707 or DC-8 replacement, and other replacement alternatives, will have to take account of cash operating costs, payload characteristics and payload-range performance.

## 767 alternatives

Besides maintaining operation with the 707 or DC-8, airlines have other alternatives. Current options are the A300B4 and A310-300F.

The A300B4-200F has a total build cost in the region of $12-15 million, and so the corresponding lease rate will be $200-250,000. The A300B4 has a structural payload of just over 99,000lbs, but its weaknesses are short range and the lack of current availability. This is similar to lease rates for the DC-8-70, which have trans-Atlantic range.

The A310-300F freighter conversion programme has recently been launched, providing a third alternative to the 767-200. The A310-300 has a structural payload of 88,000lbs. Market values of passenger aircraft are in the $18-22 million range. Total build cost following conversion to freighter and bridging maintenance will take build cost to $27-31 million, and lease rates will have to be $380,000-400,000 for a lessor to make financing viable.

This lease rate is too high when the A310's payload is taken into account against the A300B4's. With the advantage of its range capability and low cash operating costs compared to the 707 and DC-8 variants, the A310 would not become competitive until lease rates had dropped to the $225,000-250,000 level. This will require market values to drop to about $15 million, so that build cost is in the region of $25 million.

A third option that is looming is the A300-600F. Few A300-600s were built, but 165 A300-600Rs with longer range are in operation, and these will be the preferred candidates for conversion. The A300-600R will have to compete with the A300B4, A310 and 767 on a lease rate basis. The A300-600R has a structural payload of about 109,000lbs, and so it is generally accepted that its monthly lease rate will have to be no higher than $300,000. This puts maximum build cost at about $30 million. This will probably be too high for most airlines, and current values will have to fall for build costs to be low enough to make the aircraft viable.

## 767-200F conversions

There are two freighter conversion programmes for the 767. The first of these is Boeing Airplane Services' modification using a conventional freight door, which will be installed by Aeronavali.

The modification will allow large containers or pallets to be loaded onto the main deck. There are two maindeck container configurations. The first loads two rows of curved nine A2 containers side by side, plus an additional one at the rear of the cabin. This provides a containerised volume of 7,992 cubic feet. The alternative is the use of 18 curved commercial unit load devises (ULDs) and a standard A2 container to provide 9,882 cubic feet of capacity.

The belly can accommodate 22 LD-2 containers, each with an internal volume of 120 cubic feet, with a total belly


*There are a limited number of sizeable 767-200ER fleets that would be attractive to a major freight carrier for acquisition. Values will have to fall to $13-14 million for freight conversion to become viable. This is unlikely considering there are few prospects of any major 767-200ER fleet retirements.*

capacity volume of 2,640 cubic feet. These two options then provide a total containerised capacity of 9,432 or 12,522 cubic feet.

The aircraft's structural payload of 95,000lbs means that it has a maximum packing density of 10lbs per cubic foot when taking up all containerised volume for the configuration using 19 A2s. It can be as low as 7lbs per cubic foot when using the M1 containers.

Both configurations make the 767-200F a suitable small package freighter since typical packing densities of small packages will not be compromised by the aircraft's configuration.

List price for the modification is $10.4 million, which is high for an aircraft of this size. Elbe Flugzeugwerke's list price for A310-300 conversion is $7.4 million. Conversion cost for the 767-200F is also high in relation to the maximum build cost of $25 million, which will permit an acceptably low lease rate. Conversion thus puts a pressure on the maximum acquisition price possible for used aircraft.

The second conversion available for the 767-200 is the one offered by Airborne Express (ABX). This modification avoids installation of a conventional freight door, and passes specially designed, patented containers through the original passenger door. ABX holds the supplemental type certificate (STC), and has already converted 19 aircraft itself under the modification. Conversions have been performed by TIMCO and Bedek Aviation.

Under this modification the 767-200 upper deck can accommodate 102 specially configured containers, each with an internal volume of 75 cubic feet. This provides a containerised volume of 7,650 cubic feet on the upper deck. The lower deck again uses specially designed containers, each with an internal volume of 55 cubic feet. Total lower deck volume is 1,925 cubic feet. Total containerised volume is therefore 9,575 cubic feet.

This volume puts maximum packing density at 9.9lbs per cubic foot if all volume is utilised. The volumetric payload of this conversion is similar to the modification using a conventional freight door. If a carrier only intends to use the aircraft for small package operations, there are no conceivable advantages a large freight door would have. The ABX modification is cheaper than installing a large freight door. ABX, however, is not offering its conversion to other airlines. ABX has recently built 767-200Fs with its modification for a total of about $28 million, including aircraft acquisition, bridging maintenance and modification.

The downside of the ABX conversion is that it limits the aircraft to small-package carriage only. This has suited ABX so far, since it earlier used the modification for its DC-8s. These aircraft have been kept by ABX and will continue to operate until old age and will not be sold to other carriers. The same conversion for the 767 means the aircraft will be too old to be converted with a conventional freight programme if attempts are made to sell to a third operator.

Because of limited re-marketing prospects and limited residual values, the ABX modification is probably limited to those airlines with high credit ratings and those that can finance their own acquisitions and modifications.

## Aircraft selection

The 767-300 can also be converted under the Boeing modification programme. Using A2 containers, the aircraft has an upper deck containerised volume of 9,240 cubic feet. The lower deck takes 30 LD-2s, providing another 3,600 cubic feet. Total volume is 12,840 cubic feet, 3,400 cubic feet more than the -200 using the same container types. Structural payload is about 121,000lbs, meaning maximum packing density will be 9.4 lbs per cubic foot if all volume is utilised.

While this aircraft will also make a good package freighter, current market values for the lowest gross weight and youngest -300s are $28-32 million. Total build cost is therefore unlikely to be less than $40 million, and so resulting in a lease rate in the region of $425,000 per month. This is high compared to the A300B4 and DC-10-30, which have lease rates in the region of $225,000-275,000. Market values of 767-300s therefore still need to fall by another $10 million before conversion becomes viable.

This then leaves the 767-200 as the variant more likely to become an economically viable candidate for freight conversion in the short term.

There are 73 767-200s in passenger configuration. These aircraft have maximum take-off weights (MTOWs) of 282,000-315,000lbs and fuel tankages of 16,700 US gallons. None of these aircraft can have their MTOWs increased by structural upgrades. The largest fleets of -200s are operated by Air Canada (8), American (8), All Nippon Airways (11), Ansett (8), Delta (15) and United (15).

The -200ER has higher fuel capacity of 20,450-24,140 US gallons, and so longer range capability than the -200 variants. MTOWs are 335,000-387,000lbs, and it is possible to upgrade lower weight versions to the higher variant of 387,000lbs.

A total of 128 -200ERs are in passenger operation. The largest -200ER fleets are Air Canada (14), American (22), Qantas (7), United (8) and US Airways (12).

**CONVENTIONAL FREIGHTER CONVERTED 767 SPECIFICATIONS**

| 767 variant | -200 | -300 |
|---|---|---|
| Maximum structural payload (lbs) | 95,000 | 121,000 |
| **Upper deck** | | |
| Container types | A2 | A2 |
| Container numbers | 19 | 23 |
| Container unit volume (cubic feet) | 420 | 420 |
| Total container volume (cubic feet) | 7,992 | 9,240 |
| **Lower deck** | | |
| Container types | LD-2 | LD-2 |
| Container numbers | 22 | 30 |
| Unit container volume (cubic feet) | 120 | 12 |
| Total container volume (cubic feet) | 2,640 | 3,600 |
| **Total aircraft** | | |
| Total container volume | 9,432 | 12,840 |
| Maximum packing density (lbs per cubic foot) | 10.0 | 9.4 |

For the 767-200 to become economically viable for conversion values have to fall to the region of $10 million, for a maximum build cost of $22-25 million to be possible. This build cost will generate a lease rate of $225,000-250,000 per month, which is necessary if the 767-200 is to be competitive on a cost per ton-mile basis.

This will only occur once one or several large fleets come due for retirement, and there are no other secondary market prospects for the aircraft. Despite their age, there are no signs that any major 767-200 fleets will be phased out by their operators. American, for example, finds that now its aircraft are fully depreciated they are the perfect vehicle for trans-continental US operations, and so has no plans to retire them in the forseeable future.

The prospect of few retirements will keep current market values of 767-200s high, as well as make it more difficult to get the programme launched. The first 767s to be converted will probably have to be for a major freight carrier, and this will require a substantial fleet.

Conversions will only start if current market values are low enough. While values are dependent on age and maintenance condition, supply of used aircraft is a major factor. Current market values of the lowest gross weight and oldest -200s are estimated by *Avitas* to be $13-16 million. These will have to drop by at least $5 million to the region of $8 million, considering conversion cost and probable bridging maintenance. Total build costs for these earliest aircraft probably cannot exceed about $18 million if their resultant lease rates are to be acceptable to the lessee. The earliest build -200s will have only trans-continental range performance, as well as capability for shorter southerly routes from the US and Europe.

The 767-200's range capability makes it a freighter more suitable for trans-continental routes. It is thus positioned as a DC-8-50, -60 or 707 replacement. It could also provide additional capacity to the 727 or 757 following traffic growth.

The paradox facing the 767-200 is that airlines will prefer higher gross weight -200s, or yet more -200ERs. Boeing Airplane Services predicts that most operators will want to convert -200s with MTOWs of 320,000lbs or 351,000lbs, indicating that the -200 could be seen as unattractive compared to the -200ER by most freight carriers. The 767-200ER will therefore be suitable as a DC-8-70 replacement on trans-Atlantic and other long-range routes replacing the 707 and smaller DC-8-50 and -60. The 767-200ERF could also be used to open new long-range routes, as the A300B4 and A300-600F have already been used to do.

Current market values of the oldest -200ERs are $18-22 million. Acquisition at these values would take total build cost to about $30 million, assuming little or no discount were given on the conversion price. Values of these aircraft will have to fall by another $5-8 million before conversion becomes viable. This would take total build cost to $22-25 million, generating lease rates of $250,000-275,000. Despite values of 767-200ERs being too high, there are only about 100 DC-8-70s that require replacing. About half of these are operated by UPS, which has already placed large orders for A300-600Fs and 767PFs. There is therefore plenty of scope for other DC-8-70 operators to wait for 767-200ER values to fall to the right level.

Values for 767-200s will only be low enough when several used passenger fleets become available, and there are few signs this will occur for some time.

In the meantime the A310-300, one of the 767-200s closest rivals, has already begun to have conversions made. A310-300's build costs will have to be at a similar level of $22-25 million for lease rates to be competitive. Several A310-300 fleets have already begun to be retired. The implications of this are that the A310-300 may become a more attractive conversion candidate earlier than the 767-200.

## 767-200F build costs

Besides acquisition, the major components of build costs are bridging maintenance, conversion to freighter and installation of a cargo loading system and MTOW upgrade as required.

Bridging maintenance required can vary widely, and maintenance condition and status will affect aircraft values. The elements of bridging maintenance will be conversion to a new maintenance programme, a heavy airframe check, repair or exchange of several major components and a shop visit or overhaul for one or both engines.

A C check for a 767 costs in the region of $175,000, except for the heavy 4C check which will incur a higher charge of $1.2 million. Selection of aircraft for conversion will take into consideration the time elapsed since the last 4C check. Lessors will want to


*ABX's conversion for the 767 avoids installation of a conventional freight door, which minimises build cost. Despite this advantage, ABX is not offering the modification to other airlines.*

maximise the interval to 4C check after conversion, and so are likely to want to combine modification to freighter with a 4C check. The 4C check will add a substantial cost to conversion, but the purchase price of the aircraft will also take an equal adjustment downwards. Performing the 4C check will also aid change to a new maintenance programme, if required.

A shop visit for a CF6-80 or PW4000 will incur about $1.7 million, although a light repair will be less. A heavier shop visit will cost closer to $2 million, while a full set of life limited parts (LLPs) costs in the region of $2.3 million for a PW4000.

On-wing intervals for these powerplants exceed 10,000 engine flight hours in many cases. It is therefore unlikely that both engines will require a shop visit at or close to the time of acquisition for conversion. The lives of LLPs are also long, which reduces the chance that they will need to be replaced. The remaining lives of LLPs will have one of the largest impacts on aircraft value, as will time since the last shop visit and anticipated interval to the next removal.

Lives of LLPs are 20,000 flight cycles (FC) in most cases. The oldest aircraft that have been consistently used for long-haul operations will have only accumulated an average of 800FC per year, and so about 15,000FC in total. Aircraft that have been used for medium- and short-haul operations will be close to LLP replacement, which will seriously affect aircraft value. Some aircraft will have already had their first set of LLPs replaced in one or both engines. These examples are unlikely to require LLP replacement again for the rest of their working lives. Consequently they will be attractive candidates.

In the worst case scenario, a light and heavy shop visit could be required for both engines. The lives of remaining LLPs on both engines could also be low. In this case up to $7 million could be required, making a large impact on aircraft value. A mid-way engine condition would mean about $3 million may have to be spent. Adjustments in purchase price would have to be made to take account of engine maintenance events anticipated shortly after entry into service as a freighter.

Major component repairs would be landing gear exchanges, auxiliary power unit shop visits, thrust reverser repairs or brake unit overhauls. Any one of these will be $100,000-200,000, and several repairs are likely to be needed at or soon after freight conversion. Smaller component repairs, such as the exchange of some avionic items or wheel replacements could incur total costs in the region of $100,000. Component maintenance costs during conversion could therefore be $200,000-300,000, while more exceptional circumstances could double this to $600,000. Again, inspection at purchase and maintenance records will be used to adjust the aircraft purchase price accordingly.

A total charge in the region of $4 million could be incurred for maintenance at or soon after freight conversion. Further costs for engine shop visits and LLP replacement will also have to be anticipated in the few years following conversion.

The conversion list price cost of $10.4 million for Boeing Airplane Services' modification is high when the cost of $7.5 million for the A300-600 and A310-300 is taken into consideration. The cost for the 767 is also high when considered in relation to the way in which it affects total build costs. Discounts may be necessary to lower total build cost in order to make 767-200 conversion attractive.

Conversion at list price of $10.4 million, bridging maintenance totalling $4 million and acquisition of the oldest and lowest gross weight -200 at $13 million will take total build cost to about $27 million. Acquisition and modification of younger -200ERs at a current market value of $18 million will take build cost up to $32 million. In both cases these are too high, and need to fall by about $9-10 million to generate attractive lease rates.

ABX has built freighters in recent years for $28 million. This is high when the freighter modification used is considered against a conventional large freight door installation. To put this into perspective, ABX started buying aircraft from All Nippon Airways in the mid 1990s. This was when market values were up to $10 million higher than current levels.

## Financing

Financing the acquisition and conversion of these aircraft is the final consideration. Debt financing for an operating lease partially relies on a debt balloon being negotiated for the end of the lease term. This balloon reduces debt repayments during the lease, which come from the lease rentals. The size of the debt balloon negotiated is influenced by the future appraised value at the end of the lease term. A low appraised value will prevent a large enough balloon being negotiated, and so debt repayments will be high.

Appraised value at the start of the lease is also important, since the amount of debt raised is dependent on this rather than the actual build cost. A high appraised value will allow more debt to be raised in relation to build cost, reducing the equity required by the lessor.

If it is not possible to acquire high appraised values then debt financing will be hard to structure. Airlines will then have to consider financing the aircraft on the strength of their own balance sheets. This implies that major small package airlines will be the first to convert the aircraft. The other remaining option will be financing assistance from Boeing Airplane Services, as has been the case with the 757s acquired for DHL. AC