

More freight operators will have to make fleet replacement decisions over the next 10 years. Not only will selecting aircraft type be an issue, but picking the best individuals for modification requires careful consideration of the aircraft available.

Narrowbody freighters: sourcing the right aircraft

The economic zone of convertibility for aircraft is reached when they become uneconomic for passenger operations, often when aircraft reach 15-25 years old and their market value drops. This is usually followed by a wave of retirements leading to a glut of aircraft on the market. Aircraft values must be low to make the total cost of purchasing and converting an aircraft, and preparing it for service, acceptable to freight carriers and lessors. In some cases aircraft values must be almost at scrap level.

Not all old aircraft will make suitable freighters, however, and low values are not the only requirement. Aircraft still need sufficient remaining operating life to make conversion worthwhile, and freight operators also prefer the higher gross weight and longer-range examples of a type, the best performing engines, and the latest standards in avionics.

The current situation

The economic recession has caused freight traffic volumes to fall. Nevertheless, airlines and lessors have had to honour most new aircraft orders and deliveries, while consolidating their fleets and finances. This has led to many older aircraft being retired, in some cases entire fleets, as with United and Continental, which have retired large numbers of 737-300s.

Some of these fleets of older aircraft can be prime candidates for freighter conversion. The problem is, however, that freight carriers have also had to consolidate their fleets.

The first signs of a recovery in freight traffic have emerged, and freight operators and lessors will again have to consider fleet replacements and the best candidates for conversion. The current surplus of aircraft, and weak passenger and freight traffic make this an ideal time

to acquire good quality aircraft at low values. Any level of recovery will see the value of aircraft and engines rise again.

Robert Dahl, managing director at the Air Cargo Management Group, points out that the freight market tends to be consistent with the global trade numbers for traffic growth. Even if the global freight market grows by a conservative average of 3% annually, there will still be a need to replace older freighters.

The 727-200 is still the most popular narrowbody freighter. Numbers are decreasing, however, and the 757-200 and 737-300/-400 are following behind.

The 727's popularity is due to its low financing costs, but its increasing maintenance costs, high fuel burn and three-man flightcrew make it uneconomic for most operators. Most 727s are likely to be retired within 10 years.

There are several candidates for narrowbody freighter fleet replacement: the 737-300/-400, 757-200, A320/321 and the MD-80. The payload capacities and accommodation, conversion programmes and their cost, and the total cost of preparing most of these for service as freighters have previously been examined (*see The costs of acquiring narrowbody freighters, Aircraft Commerce, April/May 2008, page 59*).

737 Classic

The 737-300s and -400s have an average age of 18 years, and there are still over 1,200 active examples. With 244 aircraft already parked, many of the active passenger models are likely to follow within the next few years as passenger airlines phase out older fleets.

While a large number of aircraft could become available and be converted to freighter, not all 737s are the same and not all are suitable. Many factors must be taken into consideration when looking for suitable conversion candidates.

There are about 700 active 737-300s. While freight carriers may not be too concerned with aircraft specifications and engine type, there are about 190 aircraft with the highest-rated CFM56-3C1 engine. These would be the ideal conversion candidates, as they are the youngest and have the highest weight specification, but they would also be in demand from passenger carriers interested in used aircraft.

There are also about 380 -300s equipped with the lowest rated -3B1 engine. These are the oldest aircraft, and so are probably the least desirable.

Then there are about 120 737-300s with -3B2 engines. These would probably be adequate for most freight airlines' requirements. They are also less likely to be in demand from passenger carriers than -3C1-powered aircraft.

There are about 400 active 737-400s, split between almost 60 equipped with -3B2 engines, and 350 powered by -3C1 engines. Many of the -3B2-powered aircraft are operated by USAirways, and could make desirable freighter conversion candidates as they come available.

The fleet of 350 -3C1-equipped 737-400s is operated by a mix of first-tier airlines, including British Airways, KLM, Qantas, Garuda Indonesia, Malaysia Airlines, Alaska Airlines, and Turkish Airlines, which are all due to begin phasing out these aircraft within the next 10 years. These 737-400s are some of the most desirable freighter conversion candidates among the 737 Classic fleet.

Bob Convey, vice president of sales & marketing at AEI, explains that while some 737-300s are still being converted, there is a trend towards more 737-400 conversions. Within the 737-400 fleet, the high gross weight (HGW) variants are more popular than the low gross weight (LGW) variants. However, more LGW aircraft were built, and about 70% of all -400s converted are the LGW variant,

GLOBAL FLEETS OF RELEVANT NARROWBODY AIRCRAFT

Aircraft/engine	Passenger		Freighter	
	Active	Parked	Active	Parked
737-300				
CFM56-3B1	383	98	48	3
CFM56-3B2	124	84	44	1
CFM56-3C1	192	14	10	
737-400				
CFM56-3B2	57	3		1
CFM56-3C1	350	40	12	
757				
PW2037	246	29	4	
PW2040	91	6	37	
RB211-535C	195	1	34	
RB211-535E4	207	53	62	5
RB211-535E4-B	8	8	1	
RB211-535E4-C		4		
MD-80				
JT8D-217	102	92		
JT8D-217A	62	85		
JT8D-217C	177	51		
JT8D-219	92	71		
A320				
CFM56-5A1	218	18		
CFM56-5A3	99	10		
CFM56-5B4	10			
CFM56-5B4/2	24			
CFM56-5B4/2P	31			
CFM56-5B4/3	239	1		
CFM56-5B4/P	468	5		
CFM56-5B6/3	73			
CFM56-5B6/P	37			
V2500-A1	114	15		
V2527-A5	725	15		
V2527E-A5	78	6		
A321				
CFM56-5B1	6			
CFM56-5B1/2	9	1		
CFM56-5B1/2P	2			
CFM56-5B1/3	4			
CFM56-5B1/P	13			
CFM56-5B2	14			
CFM56-5B2/3	19			
CFM56-5B2/P	9			
CFM56-5B3/2P	13	1		
CFM56-5B3/3	35			
CFM56-5B3/3B1	5			
CFM56-5B3/P	125			
V2530-A5	54	3		
V2533-A5	257	2		

purely due to aircraft availability.

Boeing has a system that will tell a 737 owner if their aircraft is suitable for freighter conversion, by assessing many variables, including its maximum zero fuel weight (MZFW). "Unlike other aircraft types, there is no magic line number for 737-300s and -400s that determines which are better and which are poorer conversion candidates," comments Convey. "Neither is there any preference when it comes to engines, since all the CFMs are similarly efficient for cargo operators."

The good news for those interested in 737-300 and -400 conversions is that aircraft availability has increased since the downturn. The availability of 737NGs and A320 family types at

knockdown lease rates has accelerated retirement of 737 Classics, and this is set to continue. Values of late 1980s- and early 1990s-built 737-300s have dropped from \$10 million in 2007 to \$3.5 million, and values are likely to continue falling to as low as \$1-2 million. Values of -3B1 and -3B2 engines have also dropped.

Values of 737-400s have also suffered, and good quality aircraft now cost only \$5-6 million.

The reduced values of 737-300s and -400s now mean that the total cost of preparing aircraft for service as freighters is accessible to more operators and lessors.

A development is AET's new modification programme for the 737-400. This will allow the aircraft to transport

10 full-size AAA containers, compared to the previous layout, which had a smaller tenth container. "The new layout has increased the volume by modifying the frame at the rear of the aircraft, with the door being further back than on other conversion programmes," says Convey. "This conversion goes head-to-head with the new A320 freighter conversion. The type's main selling point is its ability to take 10 full-size containers." The new AEI programme will be available sooner, and is much less expensive than the A320 one. The launch customer is MNG of Turkey, which aims to have its aircraft in service by the middle of 2010.

Bedek Aviation Group, which specialises in Boeing freighter conversions, offers freighter conversions for the 737-300 and -400. The converted 737-300 has a gross payload of 67,300lbs and can carry nine maindeck containers, which provide 3,672 cubic feet of containerised volume. The cost of conversion is \$2.5 million, including the cargo loading system. It has so far converted 38 737-300s,

Bedek's programme for the 737-400 provides a gross payload of 47,200lbs, and the aircraft can accommodate nine standard maindeck containers plus a smaller unit. These provide a total volume of 4,112 cubic feet. The cost of modification is about \$3.2 million. Bedek has converted four aircraft.

Pemco currently converts 737-300s and -400s into freighter, combi and quick-change aircraft. Kevin Casey, President of Pemco World Air Services, says that due to plenty of 737-300s/-400s becoming available, acquisition prices are down, making conversion an increasingly likely option for owners. "Pemco is now about one-third to a half of the way through the potential 737-300/-400 conversion market, so there is plenty of life left in the programme. Indeed the youngest aircraft is just 10 years old, so there are at least 25 years of useful life still left," says Casey.

757

There are 909 active 757s, both passenger and freighter, with an average age of 16 years, and 138 active freighter or combi aircraft.

The 757 freighter has increased in popularity. A large number are due to be converted by FedEx, and many other airlines are showing interest in the type. The 757's fuselage length puts it in a class of its own as a narrowbody freighter. It can also integrate well with a cargo operator's 737 operation.

Not all 757 aircraft are prime conversion candidates. There are three main passenger-to-freighter conversion programmes (see *The used market potential of 757-200s, Aircraft*

Commerce, February/March 2009, page 7), offered by Boeing, Precision Conversions (PC) and Pemco. Pemco recently acquired the Alcoa-SIE 757F supplemental type certificate (STC) and associated conversion programmes, because it believes that the 757 has a better combination of economics and capabilities than other convertible aircraft that it does not already deal with. Casey estimates that the 757 conversion market could easily be worth \$700 million in

future deliveries. The main factors that affect an aircraft's suitability are engine type, maximum take-off weight (MTOW), line number and the presence of winglets.

The Pratt & Whitney (PW) powered aircraft are to a certain extent preferable to the Rolls Royce (RR) equipped aircraft, because the PW engine is slightly lighter. The RB211-535E4 engine also has shop visit costs that are at least 35% more expensive than for the PW2000 (see

Owner's & operator's guide: RB211-535E4 & PW2000, Aircraft Commerce, August/September 2008, page 11). This could make the RB211-powered aircraft uneconomic for some cargo operators. "Although RR engines are extremely reliable, the aircraft must be operated at high rates of utilisation to be economic," says Brian McCarthy, vice president of marketing and sales at Precision Conversions. "With this in mind, the PW-powered 757 might be better for low-utilisation operations, but there is not enough data yet to be totally sure."

Older aircraft (up to line number 210), converted by Precision Conversions, have lower MZFWs than aircraft higher than line number 210 (see *The used market potential of 757-200s, Aircraft Commerce, February/March 2009, page 7*). Aircraft that are 21 years old or younger are more attractive for conversion because they still have at least 15 years of operational life remaining. Older aircraft, however, are workhorses of the industry, and their low acquisition costs make them ideal replacements for the 727 freighters.

Aircraft from line number 210 and above have a payload that is up to 10,500lbs higher, and also have longer-range capability. Precision Conversions has recently gained STCs to increase the MZFW of the younger aircraft up to 196,000lbs for RR-powered 757s and 194,000lbs for PW-powered 757s. It has also obtained an STC to increase the MZFW to 188,000lbs for aircraft below line number 210.

Both will be popular, but many operations that carry low-value or low-density freight need low-cost aircraft to replace older 727s.

Passenger aircraft tend to have high utilisations and need the lowest possible cash operating costs. One way to reduce drag, and therefore fuel burn, has been to fit winglets to 757s. Although winglets have become popular with passenger operators, there are currently no passenger-to-freighter modification programmes that permit winglets. They therefore have to be removed for structural reasons if the aircraft is to be converted. Winglets also add about 1,400lbs of weight.

"Aircraft with winglets should be a cause for concern for the investment industry," says McCarthy. "It cannot be assumed that all 757s can go on to be converted to freighters at the end of their passenger life, and their ability to be converted will affect residual values."

The weight of winglets also means that 1,400lbs of cargo revenue can be lost for every flight. Precision Conversions is working on several solutions to the problem, and is hopeful of achieving a compatible conversion programme. The winglets could either be removed, which

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is expensive, or the conversion could work around the winglets. The future conversion of many 757s therefore depends on a conversion facility gaining an STC to convert aircraft with winglets.

There are 290 passenger-configured 757 aircraft with winglets, with most aircraft being higher than line number 210. The popularity of the younger aircraft with winglets as candidates for conversion could, therefore, be negatively affected, thereby making younger aircraft without winglets the most popular ones. This could keep their values at a premium.

The number of 757s converted will of course depend on the number that are retired and parked by passenger operators, and how far the values decrease. "Older 757s below line number 210 (1986-1989), with some remaining engine life acceptable to cargo operators, seem to be commanding \$7-9 million, with older aircraft's part-out values typically being \$4-6 million, depending on engine type and condition," comments McCarthy. "757s above line number 210 (1989-1992) are trading for \$9-10.5 million. Conversion and fresh heavy maintenance add to the above values."

There are about 460 active passenger aircraft of line number 211 or higher that do not have winglets. These are divided between 220 aircraft equipped with

PW2037/40 engines, and another 245 aircraft with RB211-535 engines.

Many of these are still popular with European charter carriers. Large fleets are still operated by United Airlines, Delta and American.

The 220 2000-powered aircraft are split between 170 aircraft equipped with PW2037 engines, and 50 powered by PW2040 engines. The PW2037-powered aircraft are mainly operated by United and Delta, while United accounts for many of the PW2040-powered aircraft.

The 245 RB211-powered aircraft are mostly operated by American Airlines and a variety of other carriers.

There are also 66 PW2000-powered aircraft below line number 210. Many of these are operated by Delta Airlines, including some from the original Northwest fleet. These older aircraft may be of interest to airlines that have low freight densities.

Despite the recession, availability is still tight. The situation is not helped by FedEx choosing the 757 to replace its 727 fleet. This has meant that values, as far as lessors are concerned, are still strong.

It may be some time before many aircraft with the most desirable features start becoming available. This will change when a US carrier retires a large number.

It is possible that there will be a protracted period of 757 conversions.

The youngest models are still only 5-10 years old, and will enter into the ideal conversion window in 10 years' time.

A320/321 family

Currently all A320/321s are passenger aircraft. Airbus Freighter Conversion (AFC) has recently developed a passenger-to-freighter conversion programme for the A320 and A321, as the older examples start to reach the ideal freighter conversion age of 15 years or more. The A320/A321 should be suitable for conversion to freighter because it has lower cash operating costs than, and payload advantages over, some of the alternatives. The A320/A321 have also been built over an extended period, and are still in production. Anja Schwarze, marketing manager for Airbus Freighter Conversions, estimates that more than 150 A320-family freighters will be flying by 2020.

The A320 freighter conversion is due to enter service in 2012, when many of the world's narrowbody freighters will be 40 years old. AerCap owns a number of suitable A320s and is the launch customer for the conversion. "We are primarily focused on aircraft built in 1990-1995, of which there are some in AerCap's fleet already," says Schwarze. "Engine choice is the second most



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important factor. We do not believe that enough IAE V2500-A1-powered aircraft will still be in service by the time the conversion ramps up, so we are focusing on CFM56-5A1/3-powered aircraft.”

The A320 will have an MZFW of up to 137,800lbs and gross structural payload of up to 49,823lbs. The conversion list price is \$4.1 million, with a similar amount needed for additional maintenance. The oldest aircraft still have values of \$10-14 million, taking the total cost for preparation for service to \$18-22 million. This is likely to be too high for most freight carriers.

The A321 will have an MZFW of up to 162,700lbs and a gross structural payload of up to 62,843lbs. The A321's main advantage is that it has a larger payload than the 727, and is smaller than the 757. This puts the A321F in a class of its own. Both the A320F and A321F both benefit from being the only narrowbody freighters with containerised belly freight.

The conversion list price is \$4.5 million. The values of the oldest A321s are still as much as \$18 million, taking the total cost for preparation for service to over \$25 million.

Values of older A320s and A321s have dropped in recent years due to the slump in passenger traffic, but their availability is limited compared to 737-300s and -400s.

MD-80

The MD-80 fleet has an average age of 20 years, and despite its low value, simple engines and cheaper economics, its narrower fuselage has prevented it from having a passenger-to-freighter

conversion programme.

AEI announced in February 2010 that it had started an MD-80 passenger-to-freighter conversion programme. Convey thinks there is a big market. “Ten or 12 years ago an MD-80 had a market value of \$10 million, but now an operator can buy, convert and prepare an MD-80 freighter for only \$3.5 million,” he says. “At these prices the narrower fuselage does not matter, especially when an engine can be bought for \$400,000.”

This is echoed by Dahl, who says that while the narrow fuselage used to be a real impediment, the low price now means the MD-80 could be a successful freighter. Convey adds that the aircraft has greater capability than the 737-400 in terms of payload and volume. At the same time, engine shop visit and airframe check costs are less than those typically incurred for a 737-400. Overall, the two aircraft will have similar economics, but AEI feels the MD-80 is more robust and will make a good freighter.

The MD-80 is still a popular passenger aircraft, in particular with American and Delta which have large fleets. American is likely to continue using its MD-80s until 2021, so conversions are likely to continue for at least another 10 years for aircraft that have remained operational. AEI says it already has eight aircraft under contract to convert, and at least 50 operators are interested in the programme. Convey says that with the first conversion being ready in 2011, a very conservative estimate is that 100-plus MD-80s will be converted over the next 10 years. The MD-80 will appeal to airlines needing an aircraft that is cheap to buy, convert and operate as a freighter.

Care is needed when selecting 757s for conversion. Aircraft higher than line number 210 provide the highest gross payloads, while aircraft with winglets cannot be converted. Some freight carriers may also prefer PW2000 engines. These criteria reduce the number of most suitable candidate aircraft to about 220 units.

Future conversions

The 737-400, and the 757 especially, will continue to be converted over the next 10 years as additional examples retire from passenger use. The MD-80 clearly has the right economics, but needs to be accepted by airlines. While there are mixed attitudes about the MD-80, some are confident it will be a serious contender as a mainstream freighter. The A320/321 conversion programme will mature and attract more interest over the next 10 years. The A320/321 conversion programme will mature and should gain more interest over the next 10 years, but is dependent on a drop in values.

Schwarze acknowledges that A320/A321 values are higher than 737 and 757 values, but argues that the investment costs are quickly depreciated by significantly lower cash operating costs on the A320/A321P2F. This echoes AerCap's feeling that freighter operators will slowly move to more modern aircraft as environmental and technological restrictions are tightened.

The newer 737NG models are also advanced aircraft. “Something that is likely, but not for at least five years, is the next wave of 737 conversions,” says Convey. “The 737-800 is not an option currently, since its values and use to passenger services is still high. Although expensive, its modern technology and low fuel burn could make it an option at some point. It will provide its own unique challenges due to its passenger-friendly design, meaning a lot of structural work will be needed, but it will be a great freighter in the future.”

The 737-800's fuselage length certainly means it will be able to accommodate at least the same number of standard maindeck containers as the A320, which is 10. The 737-800 may even be able to carry 11.

Dahl agrees with Convey about the 737-800, and adds that the 737-700 could also be a candidate for conversion. Casey goes further, saying that any next generation 737 could be considered for conversion, but only at the point when demand and pricing make sense. **AC**

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