

There are about 1,100 turboprop freighters in service. These operate for major small package carriers, various postal services and independent airlines. Many are now more than 30 years old, and small package traffic is growing at about 20% per year. This is expected to stimulate the conversion of more than 800 aircraft in the next 10 years.

Can turboprop freight conversions prevent a glut of used passenger aircraft?

With an increasing availability of 1980s generation turboprops, many owners and lessors are putting their hopes in the market for conversion to freighter. Support for this view comes from industry forecasts which all predict that the air freight market is growing at a higher rate than the passenger market.

Freight shippers are increasingly demanding seamless cargo handling from pick-up to delivery. Containerisation offers this together with a reduction in shipping time, but at a cost. The majority of today's turboprop freight aircraft can only offer a bulk loading capability, but the cost of introducing new aircraft is high. Annual growth of small package traffic of about 20% and the age of current turboprop freighters should stimulate the demand for conversion of younger aircraft, some of which carry containerised freight. Growth in the number of turboprop freighter conversions is also expected to be stimulated by growth in the consolidator feeder market. FedEx, for example, has several fleets of turboprops for this role. These include F.27s and Cessna Caravans.

There are basically two options for turboprop freighter configuration. These are bulk loading through the existing passenger door, and container loading through an installed large freight door.

In relation to aircraft size, installation of a large freight door on a turboprop is more expensive compared to a larger jet with higher payload. Large freight door installation therefore accounts for a large portion of aircraft acquisition costs, so

will raise the monthly lease rate. This can only be justified by operators that have regular contracts that allow them to generate high aircraft utilisations, and carry loads that pay high yields. A large freight door also has to offer operational advantages. These include interlining, which could improve speed of shipping and reduce ground times. Packages are likely to be unpacked and repacked at other containers, which diminishes some advantages of interlining. Turboprops with higher payloads will be less sensitive to high lease rates.

The markets for bulk loading aircraft and large freight door aircraft have to be considered separately.

Turboprop freighter fleet

Today's fleet of turboprop freighters is summarised (*see table, page 38*). It totals 1,090 aircraft, the majority of which are Fairchild Metros, F.27s, CV580/600/640s, Beech 99s, HS.748s, Shorts 330/360s and Lockheed Electras. Of the global fleet, about 200 are used for the US postal service.

The Lockheed Electra L188, CV580 and F.27 use containers and have the highest payloads. The other aircraft are bulk loading types. These are a mixture of several types and include the Emb-110, Emb-120, Beech 1900, YS-11 and Casa 212.

The F.27 is particularly successful, because all F.27-500s were delivered with a large freight door as standard. New operators still consider the F.27 to be an ideal entry-level aircraft.

The Convair CV580/600/640 were all originally built in 1948-1958. Despite

their age they continue to provide reliable service, and at low cost.

The L188 is not quite as old as the CV580/600/640. The Electra offers a unique capability with a 15 ton payload. In recent years Atlantic Airways has carried out a major investment programme on its aircraft, which is intended to give the fleet at least a further decade of useful life.

The remaining types are bulk loading aircraft. This is mainly because they are smaller, and could not justify the cost of installing a large freight door.

Nearly half of the surviving 239 Beech 99s aircraft are flown by freight operators, with Ameriflight alone accounting for 46 examples.

Few HS.748s were delivered with a large freight door. The square fuselage cross-section of the SD 330/360 is ideal for the freight role. The early obsolescence of the latter aircraft in the passenger role also encouraged their use, since they were available cheaply. Later generation 30-seaters introduced higher speed, which is of less importance to freight operators.

The operators

The operators of turboprop freighters range from small independent carriers with a single aircraft to US operator Ameriflight with a fleet of 100.

The table (*see page 38*) details the fleets of the world's 28 largest operators of turboprop freight aircraft. These account for 61% of the total fleet of 1,090 such aircraft, and so will shape the future market. Other operators account for the remaining 426 aircraft.

TURBOROP FREIGHTER FLEETS, OPERATORS & OPERATIONS

Airline	Fleet	Principal customer
North America		
Baron Aviation Services	40 Cessna 208B	FedEx
Corporate Air	41 Cessna 208B	FedEx
CSA Air	22 Cessna 208B	FedEx
Empire Airlines	10 F.27	FedEx
	36 Cessna 208B	FedEx
Kelowna	15 CV580	FedEx
Mountain Air Cargo	2 SD330	FedEx
	23 F.27	FedEx
	47 Cessna 208B	FedEx
West Air	34 Cessna 208B	FedEx
Wiggins Airways	32 Cessna 208B	FedEx
Air Cargo Carriers	25 SD330/360	DHL
Ameriflight	46 Beech 99	DHL
	11 Beech 1900C	DHL
	40 Fairchild Metro	DHL
	3 EMB-120	DHL
Martinaire	35 Cessna 208B	DHL
Merlin Express	13 Fairchild Metro	DHL
Airnow	11 EMB-110	
Alpine Air	12 Beech 99	
Kelowna Flightcraft	15 CV580	
Phoenix Air	14 Gulfstream I	
Rhoades Aviation	9 CV600/640	
Zantop International Airlines	5 CV640	
	13 L188	
Europe		
Atlantic Airlines	1 Fairchild Metro	
	8 L188	
BAC Express	7 SD360	
	3 F.27	
Channel Express	8 F.27	
	4 L188	
Emerald Airways	14 HS748	UK Post Office
Express Airways		
Farnair	11 SD360	
	2 F.27	FEDEX
Swiftair	8 Fairchild Metro	
	3 EMB-120	
	9 CV580	DHL
WDL Aviation	13 F.27	Various
West Air Sweden	11 HS.748	
	1 BAE ATP	
Rest or World		
Jetcraft	14 Fairchild Metro	
Other fleets		
Fairchild Metro	78	
F.27	52	
CV580/600/640	36	
Beech 99	29	
HS.748	29	
SD 330/360, Skyvan	52	
L188	17	
Emb-110	16	
Beech 1900	16	
Gulfstream	10	
Casa 212	20	
YS-11	15	
DHC-6, Emb-120, ATR 42/72, Do 228, Viscount	36	

FedEx

FedEx contracts out its feeder operations to a number of independent contract operators. The aircraft comprise Cessna 208A Caravan Cargomasters, Cessna 208B Super Cargomasters, SD 360s and F.27s.

FedEx owns most of the aircraft and they are operated in FedEx colours. The airlines which operate these services are Baron Aviation Services, Corporate Air, CSA Air, Empire Airlines, Express Airways, Morningstar Air Express, Mountain Air Cargo, West Air and Wiggins Airways.

FedEx has placed a firm order for 75 and 150 options for the Ayres Loadmaster to replace 200 Cessna Caravan/Cargo Master aircraft. Financial problems with the Ayres company probably could mean the order for the Ayres Loadmaster will not be fulfilled. The aircraft is still viable, but the manufacturer needs capital commitment. Other manufacturers have shown interest in the Ayres company. It is essential for FedEx that the aircraft maintains its originally low capital cost for the order to remain viable.

In the US, FedEx operators Empire Airlines and Mountain Air Cargo operate 10 and 23 Fokker F.27s respectively. In Europe, Express Airways operates 11 SD 360-300s, 32 of which are owned by FedEx.

The requirement to replace its F.27s remains unfulfilled. FedEx has been looking at many different types, including the ATR 42/72, BAE ATP, Fokker 50 and even the Saab 2000.

FedEx's main priority is that the aircraft will have a fuselage cross-section that will allow it to accommodate LD-3 containers. This limits the number of viable candidates.

The availability of large numbers of aircraft is an important factor in type selection, since FedEx would not want to limit the opportunities to grow the fleet. This means acquiring a large number of a single suitable type.

The ATR42 could be a favourite as a result. The ATR42 offers 7,070lbs volumetric payload, while the Fokker 50 has a 7,826lbs capacity.

DHL

Compared with the extensive turboprop operations of FedEx, DHL's European fleet of smaller aircraft is limited to the nine CV580s owned by its Belgian subsidiary European Air Transport. Two are operated from Belgium and seven are leased to Swiftair of Spain.

In addition, a number of operators fly for DHL on a contract basis in the US, including Air Cargo Carriers, Air

FedEx has a requirement to replace Cessna Caravans and F.27s. This will provide a large opportunity for both bulk loading and large freight door turboprops.

Tahoma, Ameriflight, Martinaire, Merlin Express, Mid-Atlantic Freight, Superior Aviation and Union Flights.

The independents

Many of the smaller independent freight operators operate for the likes of DHL and FedEx. The contracts these operators receive are typically of limited duration, that is 1-2 years. This volatility in the tenure of contracts means these airlines are sensitive to aircraft acquisition costs, and low lease rates take priority. This rules out expensive aircraft.

Although FedEx and DHL do not have ownership interests in their operators, they are not truly independent since in general they only fly on their behalf. The true independent operators may still operate for the likes of Airborne, DHL, FedEx, UPS and the national post office organisations, but are not tied to any one of them.

A typical independent freight carrier will only hold short-term contracts for its services. Commitments can range from a few years. Mail contracts in Europe are typically of two years duration, to zero in the ad-hoc business. Short-term renewable contracts are common and cancellation notice is usually a matter of a few months. This absence of long-term contracts limits the ability of these airlines to invest in expensive younger aircraft.

True independents own their aircraft outright. The value in these airlines is primarily in the contracts they hold and their aircraft. Operating leases are therefore seen as a waste of money. Ownership of the older, cheaper aircraft does not require the same level of investment as that required by the newer aircraft

An independent will also operate aircraft in its fleet at a utilisation of less than two hours a day. Annual utilisation for these aircraft averages 550 hours/550 cycles. This reduces the benefits of younger equipment with lower maintenance costs and fuel consumption.

Fleet planning

There are basically two markets for new turboprop freighters. These are bulk loading aircraft and those with large freight doors. Only a few aircraft have payloads large enough to justify the cost of installing a large freight door.



Aircraft with conversion programmes for large freight doors are the Emb-120, known as the Emb-120K, BAE ATP and ATR 42/72. Fokker Services is also considering several conversion options for the Fokker 50, one of which could be a large freight door modification.

All of these types also have supplemental type certificates (STCs) for bulk loading freighter conversion programmes. The Saab 340 also has an STC for a bulk loading freight conversion modification.

Bulk freighters

Bulk loading turboprop freighters can be sub-divided into Class B and Class E aircraft. Class B aircraft only have smoke detectors fitted in the freight compartment. The fire extinguishing facilities are manual fire extinguishers, which have to be used by the flight crew. Because of the required access to the freight compartment, the portion of the volume in the freight compartment that can be used is limited.

Class E conversion programmes install an automatic fire extinguishing system, which allows the cabin's full payload capacity to be utilised. This also increases the freight conversion cost. Aircraft must also have a Class E conversion if they are to use pallets or containers used in a large freight door conversion. Class B conversions are cheap compared to Class E modifications. The Class B bulk conversion for the ATR 42/72 is \$70,000-80,000, while the Class E modification costs \$250,000-500,000.

Under a bulk loading, Class E modification the ATR 42 can accommodate up to 1,800 cubic feet. The ATR 72 has a 2,470 cubic feet capacity. This volume allows up to 12,600lbs and 17,290lbs to be carried on the ATR 42 and 72.

Bulk loading modifications will be the only option for most small turboprops. It is generally accepted that airlines will not pay more than \$2 million for aircraft with payloads of 7,000-9,000lbs. This payload range corresponds to 30-seat turboprops.

There are 1,300-1,500 aircraft in this category in operation, but the only types operating as freighters are the SD330/360. The SD330 has a structural payload of 7,280lbs.

The glut of Emb-120s has pushed ahead the bulk loading conversion for the Emb-120. The Emb-120 bulk freighter has a structural payload of 8,157lbs and usable volume of 1,095 cubic feet. A few Emb-120s owned by International Airline Support Group have already been converted. The conversion cost is about \$175,000.

Saab will also offer a service bulletin (SB) to convert the Saab 340 into a bulk freighter. This will be a basic conversion, and cost about \$200,000.

Under a Class E bulk conversion programme the Fokker 50 will have a capacity of 2,120 cubic feet.

It is essential these conversion programmes have low costs so that the total capital acquisition costs of these aircraft does not exceed \$2 million. This is still high compared to the acquisition



Lockheed L188s are unique in that their 15 ton payload means replacement candidates are likely to be jets rather than turboprops. Despite their age many turboprops operate at low utilizations and continue to provide reliable service, making it hard to provide an economic case for their replacement.

costs of older and larger turboprop freighters, such as the HS.748 or F.27, which can be acquired for about \$0.5 million. The HS.748 has a structural payload of 11,320lbs, while the F.27 can carry up to 13,000lbs.

Of the 1,090 turboprops in service as freighters, about 945 are bulk loading aircraft (see table, page 38). The majority of these have payloads of up to four tons, although the HS.748 is an exception with a larger capacity. These are about 16 different types. This includes 350 Fairchild Metros, Beech 99s, HS.748s and SD330/360s. There are also about another 200 of another 11 different types.

Growth in freight traffic means most of the smaller of these aircraft will have to be replaced by larger aircraft in the 30-seat category.

The market for replacement of older and smaller types and providing capacity to accommodate growth is therefore substantial. This could include an order for FedEx as an alternative to the Ayres Loadmaster. This order alone is for 75 firm aircraft and 150 options. FedEx has also expressed interest in the IAI Airtruck. Half of FedEx's current fleet of 300 turboprops are bulk loading aircraft.

Of the aircraft in the current fleet, not all will need replacing with bulk loading aircraft. Traffic growth will mean larger types will be needed, and some will have large freight doors. This is especially in the case of HS.748s, SD360s and YS-11s.

Large freighters

As previously discussed, this category is currently confined to the Emb-120K, ATR 42/72 and BAE ATP. The Fokker 50

may also enter this category. All aircraft with large freight doors require an extensive modification, since they need a 9G cargo barrier, reinforced cargo floor and container handling devices.

The current fleet of large freight door turboprops is about 145 aircraft, and includes 111 F.27s, 89 CV580/600/640s and 42 L188s. The CV580/600/640 and F.27 have payloads in the 5.8-7.4 ton category, while the L188 is twice the size with a 15 ton capacity, 6.5 tons more than the ATR 72.

A large portion of F.27s and CV580/600/640s are operated on feeder contracts for FedEx and DHL. These airlines are likely, therefore, to continue to need aircraft with large freight doors. All of these aircraft will need replacing over the next 15 years, and others will be needed to satisfy growth.

The L188 is operated by large independent freight carriers, and its payload means it is more likely to be replaced by small jets.

The Emb-120K is a conversion proposed by Embraer, but not yet launched. This modification will also allow the Emb-120 to be a convertible aircraft that can be converted to carry 24 passengers. The principal target for the Emb-120K is the Brazilian Air Force.

The large freight door will be 2.4 metres x 1.55 metres. The fuselage cross section will permit 88-inch by 108-inch pallets, or LD3-46 containers. Embraer estimates a commercial airline market for 66 Emb-120Ks in the next 10 years. The aircraft's payload is in the region of 7,500lbs, and has a usable cargo volume of 1,095 cubic feet. This allows a maximum packing density of 7lbs per cubic foot.

The BAE ATP is one of two current large turboprops with a payload in the region of 7.5-8.5 tons; the other being the ATR 72.

The BAE ATP can accommodate eight LD-3 containers plus a LD3-46. This gives it a containerised volume of 1,375 cubic feet. Structural payload is 17,366lbs, but when packed at 7lbs per cubic foot equals a volumetric payload of 9,925lbs or 4.5 tons. The high cost of large freight door turboprops is illustrated by the \$1 million conversion cost BAE System Asset Management is asking for. This compares to the current market value of about \$1 million. BAE, however, has control over 40 ATPs it has on lease. These will become conversion candidates as they get returned from lease. BAE Systems will therefore also have control over the lease rate it can charge lessees. The ATP's main weakness is that only 62 were built. Carriers looking for large door freighters are likely to be those with a large fleet requirement, which could put the ATP at a disadvantage.

The ATR 42/72 conversion has the most advantages of large door turboprop freighters. The biggest of these is the number in service. To date more than 600 ATR 42/72s have been built. Several variants have been introduced since the mid-1980s. The most recent have cabin and noise standards more acceptable to passengers.

To date 300 ATR 42s and 250 ATR 72s have been built. The older ATR 42-300 and ATR 72-200 series are the likely candidates for freighter conversion, and 325 of these are in service. The large fleets of ATRs in operation, particularly those with American Eagle and Delta

LARGE FREIGHT DOOR TURBOPROP FREIGHTERS

Aircraft type	BAE ATP	ATR 42-300	ATR 72-200	Fokker 50
Structural payload lbs	17,366	12,808	18,960	16,500
Containers	9 LD-3	5 x LD-3	7 x LD-3	6 LD-3
Container volume (cu ft)	1,375	790	1,106	918
Bulk compartment (cu ft)		220	220	200
Total volume (cu ft)	1,375	1,010	1,326	1,118
Volumetric payload (7lbs/ cu ft)	9,925	7,070	9,282	7,826
Containers	N/A	3 x ULD	5 x ULD	N/A
Container volume (cu ft)	N/A	960	1,600	N/A
Bulk compartment (cu ft)	N/A	300	300	N/A
Total volume (cu ft)	N/A	1,260	1,900	N/A
Volumetric payload (7lbs/ cu ft)	N/A	6,985	13,300	N/A

Connection carrier ASE, potentially make attractive acquisition opportunities for FedEx and DHL, as well as other major small package operators which may expand their regional feeder services.

The ATRs and Fokker 50's fuselage cross-section are the only turboprops that can accommodate a standard LD-3 container, which is used in the belly hold of the DC-10, MD-11 and Airbus widebodies. The implications of this are that it gives the ATR 42/72 and Fokker 50 further advantages, since major carriers like DHL and FedEx rely on interlining small packages on their jet aircraft with these containers. The ATR cross-section also allows the carriage of 88-inch by 108-inch pallets.

Although other large small-package operators, such as UPS and Emery, do not have feeder operations with regional aircraft, they may add them to their networks as small package traffic continues to grow at a rate exceeding 20% per year, boosted by e-commerce.

Cost of conversion for the ATR 42/72 for installing a large freight door installation is about \$1 million. The ATR 42 has the capacity to carry five LD-3 containers. These each have an internal volume of 153 cubic feet. There is an

additional 220 cubic feet of bulk volume, taking total volume to 985 cubic feet (see *table, this page*). Alternatively the aircraft can use three 88-inch by 108-inch ULD containers, each with 320 cubic feet, and make better use of the rear bulk compartment, taking total volume to 1,260 cubic feet.

The ATR 42-300 has a structural payload of 12,808lbs. At a packing density of 7lbs per cubic foot, the LD-3 configuration gives the aircraft a volumetric payload of 6,895 lbs. The ULD configuration is 8,820lbs (see *table, this page*).

The ATR 72 can take seven LD-3s or five ULDs. These provide volumes of 1,326 and 1,900 cubic feet respectively. Corresponding volumetric payloads are 9,282lbs and 13,300lbs (see *table, this page*).

The Fokker 50 has a structural payload of 16,500lbs and can accommodate five LD-3 containers plus rear compartment bulk volume. With a floor modification the aircraft can take six LD-3 containers (see *table, this page*). This provides 1,326 cubic feet of containerised volume. At a packing density of 7lbs per cubic foot, volumetric payload is 7,826lbs.

The Fokker 50 could be the fourth turboprop with a large freight door conversion. There are only 191 Fokker 50s in operation, and the largest fleet is 31 aircraft with Air Nostrum and its subsidiary Denim Air. There are a few other fleets of more than 20 aircraft. Despite the Fokker 50 having smaller fleets than the ATR, there are sufficiently large Fokker 50 fleets potentially to satisfy a requirement from FedEx or other carriers to replace F.27s.

Market forecasts

Unlike large freight aircraft, few in-depth forecasts have been made about the potential for growth in the turboprop fleet. Some predictions are that the current fleet of 850-900 turboprops, excluding bulk freighters used for the US postal service, will grow to about 1,300 in 10 years. This net increase of about 400 aircraft will include replacement of up to about 450 of the current fleet. Thus 850 turboprops may have to be modified over the next 10 years. This market will continue to be fuelled by traffic growth and retirement of aircraft in the current fleet, many of which are more than 30 years old.

The majority of these 850 additions will be bulk loading aircraft, although about one third, or 250, are likely to be container aircraft with large freight doors. ATR's prediction is that 150 ATR 42/72s will have to be converted in the next 10 years. This will then still leave scope for a large number of BAE ATPs and Fokker 50s to be converted.

The 20% annual growth rate in small package traffic means more express package airlines are likely to start using extensive feeder operations. This demand for large freighter converted aircraft means the supply of used turboprops will be kept short, keeping values and lease rates of passenger aircraft buoyant.

The prediction that about 600 new bulk loading turboprops may be required over the next 10 years will also absorb large numbers of used Emb-120s and Saab 340s. This compares to 1,100 Emb-120s, Saab 340s and Dash 8-100/-300s in operation. Even though certain aircraft may not have a freight conversion STC developed for them, this increasing demand for turboprop freighters will keep the supply of all used types low, and so again keep lease rates and values buoyant.

The rapid growth in small package operations will therefore fuel demand for turboprop freighters at a time when many are approaching lease expiry or retirement from their primary operators, because of the increasing presence of regional jets. This arrival of a new market for used turboprops may come in time to prevent a market surplus.

