Several solutions for converting used A330s into freighters will enter the market in the next few years. There are a number of criteria to consider when selecting the most suitable A330s for conversion including the variant, its weight specifications, engine type and fleet commonality.

Cherry-picking A330s for conversion to freighters

The A330 family has been Airbus' most successful widebody programme, with more than 1,000 aircraft delivered since the first aircraft entered service in 1994.

The introduction of new types including the 787 and A350, as well as the recently announced A330neo (new engine option), could lead to more A330s leaving passenger fleets.

One option for used A330s would be passenger-to-freighter (P-to-F) conversion. A330s could be a replacement option for ageing A300, A310, 767-200 or even DC-10 and MD-11 freighters *(see Replacement options for DC-10, A300B4, A310 & 767-200 freighters, Aircraft Commerce, June/July 2013, page 53)*.

The most suitable A330 candidates for freight conversion are identified here.

Conversion options

The A330 family includes three main variants: the A330-200, A330-300 and the A330-200F production freighter.

The A330-300 is the largest member of the family and was the first variant to enter service. Its fuselage is about 16 feet longer than that of the A330-200.

There are conversion options available for A330-200s and -300s.

Stephen Fortune, principal at Fortune Aviation Services, believes that express package or integrator operators represent the largest market for converted A330s, and that they could appeal to Asian flag carriers for regional freight operations.

There are two contrasting conversion programmes for A330-200s and -300s.

P2F conversion

EFW, in conjunction with its parent companies Airbus and ST Aerospace, offers the A330P2F conversion, the only conventional full freight conversion programme available for A330s.

In this set-up ST Aerospace carries out engineering design work for the conversion programme based on original equipment manufacturer (OEM) data.

The industrialisation will be carried out by EFW, with most conversions being completed at EFW's Dresden facility.

EFW also has responsibility for marketing, sales and customer support.

The A330P2F conversion programme is available for both -200 and -300 variants. Converted aircraft would be respectively designated as an A330-200P2F or -300P2F.

The A330P2F conversion will include modification of the entire aircraft cabin to a Class E cargo compartment, and the installation of reinforced main deck floor grids and panels, a powered cargo loading system (CLS) and a large main deck cargo door. A manual cargo loading system may also be offered if there is sufficient demand. The 141-inch wide by 101-inch high cargo door will be installed forward of the wing.

Based on the design payload target, an A330-200P2F could have a gross structural payload of up to 130,073lbs (59 tonnes) *(see table, page 60)*. Typical low gross weight (LGW) and high gross weight (HGW) A330-300P2Fs would have gross structural payloads of up to 132,277lbs (60t) and 134,482lbs (61t).

EFW expects the prototype A330-300P2F to enter service in 2017, followed by the first A330-200P2F in 2018. EFW is yet to disclose an initial customer for the programme, but suggests that announcements can be expected soon.

LCF Conversion

Low Cost Freighter (LCF) Conversions Ltd was formed by the Eolia Group in 2011 and offers a different approach to cargo conversions.

The LCF concept was developed in association with ACE Corp and is available for all third- and fourth-generation medium-widebody aircraft, including the A330-200 and -300. Modified aircraft would be respectively designated as an A330-200LCF or an A330-300LCF.

"The LCF proposition is that there will be demand in some markets for an alternative approach that reduces the engineering challenge and the cost of conventional P-to-F conversions on third- and fourth- generation widebodies," explains Cliff Duke, chief executive officer at the Eolia Group.

"The underlying demand for low capital cost, low-utilisation widebody lift will remain, but we need to recognise that the appeal for widebody conversions is being eroded," continues Duke. "This will lead to demand for cheaper and more flexible conversion solutions on fuel-efficient platforms."

Unlike a conventional full freight conversion, the LCF modification does not involve the installation of a large cargo door or reinforced main deck floor.

An aircraft converted to LCF status will have its passenger cabin replaced by a Class E cargo compartment.

Containers and pallets will be loaded through the existing lower deck cargo doors. A pair of internal platform lifts will be installed to allow freight to be transferred to the main deck. No floor area is lost as a result of the lift mechanisms. The lift platforms become a load-bearing part of the main deck floor.

The design changes involved in the LCF modification process will not alter the existing passenger certification limits of the feedstock aircraft. This helps to keep engineering development costs and conversion fees down.

The cost of an LCF conversion for an A330-200 or -300 is $6.5 million. LCF expects this to be about one-third of the

A330P2F & A330LCF BASIC SPECIFICATIONS

	A330-200P2F	A330-300P2F LGW	A330-300P2F HGW	A330-200LCF	A330-300LCF LGW	A330-300LCF HGW
Weight Variant	022	004	052	022	004	052
MTOW (lbs)	513,677	460,766	513,677	513,677	460,766	513,677
MTOW (tonnes)	233	209	233	233	209	233
MZFW (lbs)	374,786	379,195	385,809	374,786	379,195	385,809
MZFW (tonnes)	170	172	175	170	172	175
OEW (lbs)	244,713	246,918	251,327	235,544	240,216	240,216
OEW (tonnes)	111	112	114	107	109	109
Gross structural payload (lbs)	up to 130,073	up to 132,277	up to 134,482	139,242	138,979	145,593
Gross structural payload (tonnes)	up to 59	up to 60	up to 61	63	63	66

Notes:
1). Stated OEWs are estimates only - actual OEW will vary by individual aircraft.
2). OEW estimate for A330P2F based on post-conversion aircraft and target payloads. Final payloads to be confirmed following completion of conversion and final weighting.
3). A330LCF OEWs based on Trent powered aircraft, but due to small difference in weights between engine options these have been used as generic OEWs.
4). Metric ton figures converted from lbs and rounded to nearest tonne.

cost of an A330P2F conversion, for which no indicative conversion prices are available.

In addition to offering a cheaper alternative to a standard conversion, LCF believes its solution offers flexibility. It also claims the LCF concept is in line with an increasing trend for airfreight to be configured for carriage in lower holds.

"The LCF proposition is essentially a cabin upgrade," says Duke. "It offers the option to convert the aircraft back into a passenger configuration or even to full OEM freighter status if required."

An A330-200LCF could offer a gross structural payload of up to 139,242lbs *(see table, this page)*, compared to about 138,979lbs and 145,593lbs for LGW and HGW A330-300LCFs respectively.

A330LCFs would offer higher gross structural payloads, but lower freight volumes than A330P2Fs.

The unit load devices (ULDS) or pallets that could be accommodated on the main deck of an A330LCF are limited to a maximum height of 64 inches, since they need to be loaded through the lower cargo doors. This compares to a maximum height allowance of 96 inches on an A330P2F.

Duke claims that A330LCFs would still achieve average packing densities of about 7.5lbs per cubic foot (cu ft), and believes that operators would be required to load cargo at 'unrealistically low' packing densities to make use of the extra volume offered by an A330P2F.

LCF Conversions claims it is currently 18 months from programme completion. The LCF programme does not have a launch customer at this time.

Cargo loading configurations

There are a number of potential freight loading configurations for A330s converted to P2F or LCF status *(see table, page 61)*.

The two conversion options would offer the same potential lower deck loading configurations.

An A330P2F would offer more potential main deck ULD or pallet configurations than an LCF aircraft, due to the flexibility offered by the reinforced main deck floor structure and the large cargo door.

In a configuration designed to offer maximum volume, an A330-200P2F would provide a total containerised cargo volume of about 16,875 cubic feet (cu ft) or a palletised volume of 16,260 cu ft *(see A330P2F versus the A330 & A340LCF: freight & revenue generating capacity, Aircraft Commerce, December 2013/January 2014, page 52)*.

This compares to a containerised volume of 14,081 cu ft and a palletised volume of 13,769 cu ft for an A330-200LCF.

An A330-300P2F configured for maximum volume would provide a containerised volume of about 19,614 cu ft or a palletised volume of 19,351 cu ft.

In comparison, an A330-300LCF would offer a maximum containerised volume of 15,999 cu ft and a palletised volume of up to 15,534 cu ft.

Airframe selection

Operators need to consider a number of criteria when choosing passenger-configured A330 airframes for P-to-F conversion, including: the A330 variant; the accumulated flight cycles (FC) and flight hours (FH); weight specifications; engine type; fleet commonality; and maintenance status.

A330 variant

The larger A330-300 would provide more cargo volume, but the -200 has superior range capabilities.

Current opinion suggests that, although the A330-300 may be converted in larger numbers, a business case can be made for modifying -200 series aircraft.

Wolfgang Schmid, vice president sales, marketing & customer support at EFW believes that the main customers for converted A330s will be integrator operators.

"We assume that most converted A330s will operate with integrators," says Schmid. "The A330-300 will be the preferred option for integrators due to its extra volume compared to the smaller -200. EFW's converted -200s will provide an attractive overall flexibility in terms of payload density and range performance, however, at lower capital cost than a production freighter."

Andy Coupland, independent consultant to LCF Conversions Ltd, agrees that neither variant should be discounted. "The -200 is suited to high-density freight over a greater range, while the -300 is a better option for integrators," he explains.

One factor that could ultimately restrict the conversion potential of the A330-200 fleet is the availability of the A330-200F production freighter.

An airline's typical utilisation can determine if converted or factory freighters are more suitable for its operation. Converted freighters have lower fixed capital costs than factory freighters, but they also have higher fuel burn and maintenance costs.

Since converted aircraft require lower capital investment they are more suited to operators with lower average utilisation. The superior fuel burn and maintenance cost advantage of factory freighters makes them more suited to high utilisation operations where the capital investment can be spread over a larger number of flight hours.

Flight cycles

The A330 family's original design service goal (DSG) is 40,000 flight cycles (FC) and 60,000 flight hours (FH).

The intermediate service goal (ISG) allows better flexibility with a trade-off between FH and FC offering 33,000FC

POTENTIAL A330P2F/LCF ULD/PALLET LOADING CONFIGURATIONS

Main deck configuration	A330-200 ULDS/Pallets	A330-300 ULDs/Pallets
LCF		
1	23 (96”x125”x64”) - 3 plus 20 contoured	25 (96”x125”x64”) - 3 plus 22 contoured
P2F		
1	18 SBS (96”X125”X96”) + 2 SBS (88”X125”X96”) + 3 SR (88”X125”X96”)	22 SBS (96”x125”x96”) + 4 SR (96”x125”x96”)
2	18 SBS (96”X125”X96”) + 4 SR (96”X125”X96”)	22 SBS (88”x125”) + 4 SR (88”x125”)
3	20 SBS (88”X125”) + 3 SR (88”x125”)	18 SR (96”x125”)
4	16 SR (96”x125”)	20 SR (88”x125”)
5	17 SR (88”x125”)	10 SR AMA (96”x125”) + 5 SR (96”x125”)
6	9 SR AMA (96”x125”) + 4 SR (96”X125”)	

Lower deck configuration	A330-200 ULDS/Pallets	A330-300 ULDs/Pallets
LCF/P2F config 1	8 (96”x125”x64”) + 2 (60.4”x61.5”x64”)	9 (96”x125”x64”) + 2 (88”x125”x64”)
LCF/P2F config 2	26 x LD3 (60.4”x61.5”x64”)	32 x LD3 (60.4”x61.5”x64”)

Notes:
1). SR = single row. SBS = side-by-side.

and 100,000FH. This has become the standard limit of validity (LOV) for latter HGW variants.

An extended service goal (ESG) offering 40,000FC and 130,000FH could be available from 2017, when the first aircraft might start to reach current LOVs.

It is assumed that operators of converted freighters will want 10-15 years of service from their aircraft.

The average annual utilisation of a converted A330 is unlikely to exceed 650FC. The average FH per FC ratio will vary according to whether the aircraft is used for short-to-medium regional routes or on longer distance services.

An average ratio of 3.5 FH per FC is assumed for short- to medium-haul integrator operations. These are likely to represent the majority of converted A330 operations.

A converted A330 freighter used for short- to medium-haul integrator services would therefore accrue 9,750FC and 34,125FH over a 15-year period.

Aircraft that have accumulated 30,250FC and 95,875FH or less, will be the best conversion candidates for short-medium haul operators based on the proposed ESG.

Weight specifications

The passenger-configured A330-300 fleet is split between early production LGW aircraft and later higher weight examples.

A330-300s manufactured between line number (L/N) 012 and 244 are considered to be LGW aircraft. The last LGW A330-300, L/N 244, was built in 1998.

There are currently 53 active and 13 parked LGW A330s in a passenger configuration.

LGW A330-300s can be subdivided into two groups: aircraft manufactured between L/N 012 and 112, built between 1992 and 1995; and those built from L/N 113 to 244.

Aircraft built between L/N 012 and 112 have the lowest weight specifications. The most suitable weight variant (WV) in this range (WV004) can have a maximum take-off weight (MTOW) of 460,766lbs and a maximum zero fuel weight (MZFW) of 379,195lbs *(see table, page 60)*.

An aircraft certified to these weights would have a range of up to 2,200nm.

LGW A330-300s manufactured from L/N 113 to 244, can achieve a slightly higher weight certification. They can have an MTOW of up to 480,608lbs, and an MZFW of up to 379,195lbs. These aircraft's range would be up to 2,850nm.

A330-300s produced from L/N 256, built in 1999, and onwards can be certified at higher weights and therefore offer better payload-range performance. Airbus subdivides these aircraft into intermediate gross weight (IGW) and HGW categories.

This analysis will refer to all aircraft from L/N 256 and above as HGW, since the most important distinction in capability is between aircraft before and after this L/N threshold.

By this definition, HGW aircraft can be certified with an MTOW of 513,677lbs, and an MZFW of 385,809lbs. This would provide a range of up to 3,600nm.

With a few individual exceptions, HGW A330-300s from L/N 524 and onwards feature new enhancements, including systems upgrades and weight and engine optimisation.

An MTOW option of 518,086lbs was introduced for A330-300s from L/N 1,276, which entered service in January 2012. Aircraft delivered from mid-2004 onwards can have their MTOWs upgraded to this level, although this would result in a payload trade-off with the MZFW dropping to 381,400lbs.

More recently, Airbus has introduced MTOW options of 524,700lbs to 533,519lbs. The permissible MZFWs range from 385,809lbs to 376,990lbs respectively. These aircraft will be too young to be considered for freight conversion in the near future, however.

In most cases, a freight operator looking for conversion feedstock would prefer higher weight aircraft because they can carry large payloads over a longer distance.

Despite this, EFW believes there could be demand for converted LGW A330-300s on regional freight routes.

"The elder LGW A330-300s are the cheapest available candidates, which makes them attractive for conversion," claims Schmid. "If an operator does not need much range an LGW A330-300 could be a preferred option. In addition, an LGW A330-300 would incur lower landing fees than an IGW or HGW example.

"We also assume that LGW A330-300s will be increasingly phased out by passenger operators due to their age profile and range limitations," continues Schmid. "This will see their values drop more quickly and lead to lower on-ramp costs for the converted freighter."

Fortune is sceptical that all LGW A330-300s would make good conversion candidates.

"A330-300s built between L/Ns 113-244 can be brought up to acceptable weights," says Fortune. "They are not ideal, but I think some will be converted. However, those aircraft from L/N 012 to 112 cannot be upgraded to acceptable weights. These aircraft do not really

LGW A330-300s are likely to have the lowest acquisition costs, and could appeal to integrator operators for short regional routes. Dragonair has the largest active fleet of LGW A330-300s.

make sense as freight conversion candidates from a unit cost perspective."

The main difference between the two LGW subgroups is their range capability.

Aircraft between L/Ns 012 and 112 can provide similar payload capability, but have potentially 600nm shorter range than A330-300s between L/Ns 113 and 244. Provided the operator does not require more than 2,200nm of range, LGW A330-300s between L/Ns 012 and 144 could still be an option.

There are no such disparities in weight specifications among the A330-200 fleet. All A330-200s are capable of achieving certification for an MTOW of up to 513,677lbs combined with an MZFW of 374,786lbs. These aircraft would have a range of up to 3,900nm.

Airbus has since introduced higher weight options, but these may be too young for conversion in the near term.

Both variants of the A330 family contain multiple WV series. Each WV series contains multiple individual weight specifications that are assigned a specific WV number. Each WV series will have an optimum weight specification to which any aircraft manufactured within that particular WV series can be upgraded.

Fortune cautions that some A330 feedstock candidates may require paper, systems, or structural upgrades to achieve certification at the maximum available weight specification within the applicable WV series.

These upgrades need to be provided by Airbus, and may incur additional costs on top of the conversion fee.

This analysis will not rule out any aircraft based on its weight specification.

Engines

There are three engine series options for the A330 family: the Rolls Royce (RR) Trent 700; the General Electric (GE) CF6-80E1; and the Pratt & Whitney (P&W) PW4000-100. Each engine family contains multiple variants.

More than half of the active and parked fleet of A330-200s is equipped with Trent 700s (258). The remainder of the fleet is split between aircraft with CF6-80E1 (139) and PW4000-100 engines (105) *(see table, page 64)*.

The active and parked A330-300 fleet is also dominated by Trent 700-powered aircraft (319). The remainder is split evenly between those with PW4000-100 (108) and CF6-80E1 (101) engines.

The A330P2F and LCF conversion options are open to aircraft with any of the three engine families.

Each engine family will vary slightly in weight, resulting in a difference in operating empty weight (OEW). The difference is unlikely to impact payload potential enough to be a deciding factor in the feedstock selection process.

It has previously been claimed that maintenance costs for Trent 700s could be higher than those for CF6-80E1 and PW4000-100 engines *(see The used market potential for A330s and their engines, Aircraft Commerce, April/May 2013, page 7)*.

This is partially based on the claim that RR has greater aftermarket control of its engines than GE or P&W, with fewer independent or OEM-controlled engine shops for Trent 700s compared to CF6-80E1s or PW4000-100s. It is claimed that this situation has led to a smaller third-party parts market for the Trent 700, which could result in higher material costs.

It is assumed that most freight operators would look to acquire aircraft with life remaining on their engines to avoid the costs associated with an immediate shop visit. This reduces the likely influence on feedstock selection of any differences in maintenance cost between different engine variants.

Some operators might prefer to convert Trent 700-equipped aircraft because they represent a larger pool of feedstock and therefore offer greater potential for building a fleet of 'sisterships'.

The engine variant is not considered to be a defining factor in the A330 feedstock selection process outside of fleet commonality requirements.

Fleet commonality

Operators seeking to build a fleet of converted freighters may place a high priority on sourcing 'sisterships'. These are aircraft with the same engines, parts, and modifications, that have been in service with the same airline. This means they should also have been subject to the same standardised operational and maintenance procedures.

Converting a fleet of sisterships can be more cost-effective than selecting individual aircraft from different sources.

Operating and maintaining aircraft with different specifications can mean investing in multiple spares inventories and additional personnel training.

Maintenance considerations

The maintenance condition of feedstock aircraft could be a defining factor when selecting candidates for conversion.

It makes sense for an operator to coordinate a heavy base maintenance check with the conversion process. This will make optimum use of the downtime required for conversion and can lead to cost efficiency savings.

The heaviest checks in an aircraft's base check cycle typically include structural inspections that require deep airframe access.

A traditional P-to-F conversion, which includes the installation of a large

A330 ON-RAMP COSTS

Aircraft Type	Age	Engine type	MTOW (lbs)	Market Value ($m)	P2F Cost ($m)	LCF Cost ($m)	P2F on ramp cost ($m)	LCF on-ramp cost ($m)
A330-200	15-years	Trent 700	513,677	24.62	N/A	6.5	N/A	31.12
A330-200	15-years	CF6-80E1A4	513,677	23.85	N/A	6.5	N/A	30.35
A330-200	15-years	PW4168A	513,677	23.62	N/A	6.5	N/A	30.12
A330-300 (LGW)	20-years	Trent 700	460,766	15.50	N/A	6.5	N/A	22.00
A330-300 (LGW)	20-years	CF6-80E1A2	460,766	14.40	N/A	6.5	N/A	20.90
A330-300 (LGW)	20-years	PW4168	460,766	13.25	N/A	6.5	N/A	19.75
A330-300 (HGW)	15-years	Trent 700	513,677	32.62	N/A	6.5	N/A	39.12
A330-300 (HGW)	15-years	CF6-80E1A4	513,677	31.85	N/A	6.5	N/A	38.35
A330-300 (HGW)	15-years	PW4168A	513,677	31.62	N/A	6.5	N/A	38.12

Notes:
1). Values provided by Oriel and based on aircraft in half-life maintenance condition with half life engines.
2). Total on-ramp cost does not take account of maintenance costs or any fees associated with weight upgrades.

cargo door, removal of the passenger interior and modifications to the main deck floor, will require similar levels of access.

Combining a base check with the conversion will avoid unnecessary costs associated with a duplication of aircraft downtime and access man hours (MH).

The A330 has an eight-check base maintenance cycle *(see A330 family 1st & 2nd base airframe check cost analysis, Aircraft Commerce, June/July 2011, page 34)*. There are two sets of structural checks which coincide with the fourth (C4) and eighth (C8) checks making them the largest in the cycle.

Operators would benefit from putting an A330 through a C4 and/or C8 check during the conversion process, depending on which is due next.

The A330's base check programme has been revised in recent years to a six-check programme. These include two heavier checks, the third and sixth in sequence. If aircraft have not already been migrated to this new maintenance programme, then conversion to freighter would provide a good opportunity to make this bridging.

Avionics upgrades could also be carried out during this period.

Any outstanding airworthiness directives (ADs) or service bulletins (SBs) affecting the A330 family should also be considered during feedstock selection.

Aircraft Commerce has been unable to identify any current ADs or SBs for the A330 that would influence the feedstock selection process.

Costs

Estimated acquisition costs have been summarised for typical used A330s in a half-life maintenance condition and with half-life engines *(see table, this page)*.

The typical age range for widebody P-to-F conversion feedstock is 15-20 years. At this age the acquisition costs of used airframes tend to fall to levels that make conversion economically viable.

HGW A330-300s would have the highest acquisition costs. Values for 15-year-old HGW A330-300s range from $31.6-32.6 million *(see table, this page)*.

The total acquisition and conversion cost would be $30.1-31.1 million for an A330-200LCF, $19.7-22.0 million for an LGW A330-300LCF, and $38.1-39.1 million for a HGW A330-300LCF.

It is not possible to state the same cost details for an A330P2F due to the lack of pricing information for the conversion.

Operators will need to account for any maintenance costs and weight upgrades in addition to the acquisition and conversions fees.

Suitable aircraft

An investor will start the feedstock selection process by determining which A330 variant is most suited to its operation.

The next most important criteria are the weight specifications and accumulated FC and FH. The engine variant and fleet commonality will be more important selection criteria for operators of multiple aircraft.

If the ESG is implemented in 2017 all of the current passenger-configured A330 fleet should have enough FC and FH remaining to provide 15 years of service as converted freighters. This is based on current utilisation data and assumes the converted aircraft will have average short- to medium-haul utilisation levels.

The aircraft's weight specifications will be more of an issue when selecting A330-300s for conversion due to the split between LGW and HGW aircraft.

No specific WVs have been ruled out in the analysis, since some LGW A330-300s could appeal to integrators.

The entire passenger fleet of A330s can therefore be considered as potential conversion candidates. This accounts for 1,030 active and parked aircraft *(see table, page 64)*.

The fleet has been split between A330-200s and A330-300s to help operators identify the most suitable feedstock for their specific operation. The A330-300 fleet is further sub-divided between LGW and HGW aircraft.

Each variant is grouped by operator and engine type to provide a guide for those with a fleet commonality requirement.

The most likely early conversion candidates are those A330s entering the typical feedstock age range within the next couple of years.

This analysis identifies the largest groups of A330-200s and -300s that will be within the typical feedstock age range when both conversion programmes are available. This will be 2017 for A330-300s and 2018 for A330-200s.

Younger aircraft are still included in the analysis because there is potential to convert them in the future.

A330-200 candidates

There are 482 active and 20 parked A330-200s in a passenger configuration *(see table, page 64)*. About 39 of these are already within the typical conversion age range. Another 106 aircraft will reach the feedstock age threshold by 2018, by which time both conversion programmes should be available.

Air China has the largest fleet of A330-200s, with 30 active aircraft. They are all equipped with Trent 772C-60 engines. The eldest aircraft in the fleet is eight years old. The next largest operators are China Eastern (24), Etihad (24) and Emirates (21).

The China Eastern and Emirates aircraft are all equipped with variants of the Trent 700 family.

PASSENGER-CONFIGURED A330 FLEET

Aircraft variant	CF6-80E1 series engines	PW4000-100 series engines	Trent 700 series engines	Total
A330-200				
Active	133	98	251	482
Parked	6	7	7	20
Total	**139**	**105**	**258**	**502**
LGW A330-300				
Active	7	22	24	53
Parked	8	5	0	13
Total	**15**	**27**	**24**	**66**
HGW A330-300				
Active total	86	81	295	462
Parked total	0	0	0	0
Total	**86**	**81**	**295**	**462**
All Aircraft				
Active total	226	201	570	997
Parked total	14	12	7	33
Total	**240**	**213**	**577**	**1,030**

Notes:
1). Fleet data correct as of September 2014.

Etihad's fleet is split between aircraft with CF6-80E1A4B (4) and Trent 772B60 (20) engines.

The China Eastern and Etihad aircraft are quite young, with a respective average fleet age of 2.7 and 7.0 years.

In contrast the average age of Emirates' A330-200s is 13.5 years.

Emirates operates the largest fleet of A330-200s (21) that will have entered the typical feedstock age range by 2018, and Air France (12) operates the next largest fleet. Its aircraft are all equipped with CF6-80E1A3 engines.

TAP and airberlin both operate 14 A330-200s. Each airline has nine aircraft in its fleet that will be of a suitable age for conversion by 2018. airberlin's aircraft are powered by PW4168A engines. The nine TAP aircraft have either PW4168A (7) or CF6-80E1A3 (2) engines.

LGW A330-300 candidates

There are 66 active and parked LGW A330-300s in a passenger configuration *(see table, this page)*. These aircraft will be 18-25 years old in 2017.

They may all still be considered viable conversion candidates provided their maintenance condition is acceptable.

The largest operators are Dragonair and Thai Airways with 11 aircraft each. The Dragonair aircraft are all active and powered by Trent 772-60 engines. The Thai Airways fleet includes three parked aircraft with PW4164 engines. The eight active aircraft are powered by PW4164 (5) or PW4168 (3) engines.

The next largest fleet of LGW A330-300s belongs to Philippine Airlines (PAL). It has eight parked aircraft equipped with CF6-80E1A2 engines.

HGW A330-300 candidates

There are 462 active HGW A330-300s in a passenger configuration *(see table, this page)*. Only two of these aircraft are already within the typical conversion age range.

Another 42 will have passed the feedstock age threshold by 2017 when the A330-300P2F conversion becomes available.

The largest operators of HGW A330-300s are Cathay Pacific (35), Singapore Airlines (27), China Airlines (24), Delta Air Lines (21) and Lufthansa (19).

All of the Cathay Pacific, Singapore Airlines and Lufthansa aircraft are powered by 772B-60 engines, with the exception of seven aircraft in Cathay Pacific's fleet which have Trent 772-60s.

The China Airlines fleet contains aircraft with CF6-80E1A4 (18) and CF6-80E1A4B (6) engines. The Delta aircraft are all powered by PW4168As.

American Airlines (nine formerly US Airways aircraft), Korean Air (9), Air Canada (8), and Cathay Pacific (8) operate the largest common groups of HGW A330-300s that will be within the typical feedstock age range by 2017.

American Airlines's and Korean Air's aircraft are all equipped with PW4168A engines. Air Canada's and Cathay Pacific's are powered by Trent 772B-60s.

Conclusion

The aircraft variant, its age and its weight specifications are likely to be deciding factors when selecting A330s for P-to-F conversion.

A330-200s could appeal to operators with longer range requirements. LGW A330-300s may be better for integrators that need more volume on shorter regional routes. HGW A330-300s will appeal to operators that need high volume and more range.

Fleet commonality and the aircraft's engine variant will be more important considerations for operators looking to build a fleet of multiple aircraft.

There will be more A330-200s and LGW A330-300s than HGW A330-300s available at typical feedstock ages in the next few years.

There is the potential to source common fleets of A330s by operator and engine type. This analysis has identified common fleets that will fall within the typical conversion age range by 2017-18.

The main sources for LGW A330-300s are Dragonair, Thai Airways and PAL. The age profile of these aircraft should mean they have the lowest acquisition costs among the A330 family. This could make them attractive conversion candidates, despite the advanced age of some airframes and their inferior payload-range performance.

The largest sources for HGW A330-300s that will be of an appropriate age in 2017 are American Airlines, Air Canada, Cathay Pacific and Korean Air.

The main sources for A330-200s that will reach the feedstock age threshold by 2018 are Emirates, Air France, airberlin and TAP.

A330-200s and -300s coming available, however, depends heavily on 787 and A350 deliveries over the next few years. AC