Passenger-to-freighter conversion programmes have been launched for the 737-700 and -800. Important feedstock selection criteria include the aircraft's model series, age and accumulated FC and FH. The most suitable future conversion candidates are identified here.

Cherry picking 737NGs for P-to-F conversion

There have been no new-build narrowbody freighters available since Boeing ceased production of its 757-200F. Operators in this market therefore rely on converted aircraft. In recent years the 737-300, 737-400 and 757-200 have been the most popular narrowbody conversion candidates, but suitable feedstock for these types may become harder to find in the future.

Several new narrowbody conversion programme options for younger generation aircraft will enter the market over the next few years. These include a number of conversion programmes for Next Generation 737s (737NGs).

With more than 5,400 737NGs in active passenger service, feedstock levels for future conversions will be high.

The most suitable 737NG family candidates for P-to-F conversion are identified here.

Conversion options

The 737NG family includes four main variants: the -600, -700, -800 and -900.

Conversion programmes have only been launched for the 737-700 and 737-800 so far. The 737-600, like its predecessor the 737-500, is considered too small to make an efficient freighter and was only produced in limited numbers. The largest members of the family, the 737-900 and -900ER, may be considered for conversion in the future, depending on the availability of suitable feedstock at the right age and price.

The 737-700 first entered service in 1998. There are three main passenger sub-variants: the standard -700, the -700 Convertible (C) and the -700ER. There are 1,032 737-700s in service and 28 stored aircraft. There are at least a further 71 737-700s on order. There is only one active -700C and two stored -700ERs.

The 737-800 also entered service in 1998. There is only one variant of this model series. There are 3,909 737-800s in active service, with a further 29 aircraft in storage and at least 895 more on order.

There is one conversion programme in confirmed development for the 737-700 There are three conversion programmes in development for the 737-800.

737-700

IAI Bedek is the only organisation to have officially launched P-to-F conversion programmes for both the 737-700 and -800. Its 737-700 conversion will be available first. Converted aircraft will be designated 737-700BDSFs and will offer a gross structural payload of up to 45,000lbs *(see table, page 89)*.

IAI Bedek has a launch customer for its 737-700BDSF programme, and has inducted the prototype aircraft for conversion. "The first conversion will be complete by July or August 2016, and we will receive supplemental type certificates (STCs) shortly afterwards," explains Rafi Matalon, general manager of marketing and business development at IAI Bedek.

737-800

Aeronautical Engineers Inc (AEI), Boeing and IAI Bedek have all officially launched 737-800 conversion programmes. All three conversions could be available by the end of 2017.

AEI expects to receive STCs for its 737-800 conversion by mid-2017. The conversion programme is expected to enter the production phase in late 2017 or early 2018. Converted aircraft will be designated 737-800SFs, and will have a gross structural payload of up to 52,000lbs *(see table, page 89)*. AEI has 65 firm orders and 15 options for 737-800SF conversions. "Aviation Capital Group has booked 30 conversions and GECAS has ordered 20," explains Robert Convey, senior vice president of sales and marketing at AEI. "We have also just announced an agreement for 15 firm orders and 15 options from an undisclosed customer, and expect to have more than 125 orders for 737-800SF conversions by the end of 2016."

Boeing officially launched its 737-800BCF conversion programme in early 2016. "Entry into service is targeted for third quarter 2017," says Kurt Kraft, vice president of modification and conversion services at Boeing. "We have received orders and commitments for up to 55 conversions from seven customers." The 737-800BCF is expected to offer a maximum structural payload of up to 52,850lbs.

IAI Bedek is in final negotiations with a launch customer for its 737-800BDSF conversion programme. It expects the prototype conversion to be complete by September 2017. A 737-800BDSF is expected to offer a gross structural payload of up to 52,000lbs *(see table, page 89)*. "Both the 737-700BDSF and 737-800BDSF conversions will feature the same cargo door and surround structure that we have used for 737 Classic conversions," says Matalon. "The large cargo door is situated very close to the forward entry door providing the maximum possible loading clearance in front of the engine."

Cargo configurations

All the 737-700 and -800 conversion programmes will involve the installation of a large cargo door forward of the wing on the left-hand side of the fuselage, and the installation of a Class E interior, a manual cargo loading system, a 9G cargo

737-700 & 737-800 FREIGHTER SPECIFICATIONS

Aircraft	737-700BDSF	737-800BDSF	737-800SF	737-800BCF
MTOW (lbs)	Up to 154,500	Up to 174,200	Up to 174,200	Up to 174,200
MZFW (lbs)	Up to 121,000	Up to 138,300	Up to 138,300	Up to 138,300
Max structural payload (lbs)	45,000	52,000	52,000	52,850
ULDs	8 x AAY + 1 AYK + 1 AYF	11 x AAY + 1 AKE	11 x AAY + 1 AKE	11 x AAY + 1 AKE

Notes:
1). Specifications based on max weight specifications. Lower basic weights are also available.
2). Max structural payload figures are estimates. These could vary slightly by aircraft owing to different OEWs.

barrier and a reinforced main deck floor.

The 737-700 has the same fuselage dimensions as a 737-300. A converted 737-700 will therefore offer similar cargo volume to a 737-300 freighter, although the -700 would have a higher gross structural payload. IAI Bedek claims that the 737-700BDSF will be able to accommodate up to 10 unit load devices (ULDs) or pallets on its main deck. This includes eight 88-inch X 125-inch containers or pallets, plus two smaller containers or pallets *(see table, this page)*. In this configuration a 737-700BDSF would offer a typical containerised cargo volume of about 3,800 cubic feet (cu ft) *(see 737NG P-to-F conversion programmes, Aircraft Commerce, April/May 2015, page 74)*. A 737-700BDSF would also have a lower deck bulk cargo volume of 966 cu ft, leading to a total volume approaching 4,800 cu ft in this configuration. This compares to typical total cargo volumes of 4,731-4,817 cu ft for 737-300 freighters.

The 737-800's fuselage is about 10 feet longer than a 737-400's. Converted 737-800s will therefore offer more cargo volume than 737-400 freighters. A 737-800 freighter will accommodate up to 11 88-inch X 125-inch containers or pallets, plus an additional reduced-size container or pallet on its main deck *(see table, this page)*. This will provide a containerised main deck cargo volume of about 5,000 cu ft. The aircraft will also have a lower deck bulk volume of about 1,500 cu ft. A 737-800 freighter would therefore provide a total cargo volume of 6,500 cu ft, compared to a typical total cargo volume of 5,700-5,800 cu ft for a 737-400 freighter.

Airframe selection

There are a number of important criteria that potential operators should take into consideration when selecting 737-700s and 737-800s for P-to-F conversion. These include: the aircraft's age and market value; model series; weight specifications; accumulated flight cycles (FC) and flight hours (FH); engine variant; maintenance condition; the presence or absence of winglets; and fleet commonality.

Age and cost

Most P-to-F conversions take place when aircraft are 15-20 years of age. This typical feedstock age window is influenced by a combination of aircraft values and their useful remaining life.

An aircraft that is less than 15 years old is likely to remain in demand with passenger operators. This demand boosts market values of younger aircraft. Once they exceed a certain age aircraft become less popular with passenger operators, and their values drop to levels where freight conversions begin to make economic sense.

"Acquisition cost is a major parameter in the feedstock selection process," says Matalon. IAI Bedek decided to bring its 737-700BDSF conversion to market ahead of its -800BDSF programme because it forecast that used 737-700 values would come down sooner than those for 737-800s. "The price for used 737-800s is a little high right now," claims Matalon. "By 2018 we expect these prices will drop to levels where freight conversions become an economic option."

An aircraft that is more than 20 years old may not have enough useful economic life remaining for it to be considered for conversion. It could also suffer from more ageing maintenance issues such as corrosion. It is generally accepted that an owner will want to achieve a minimum of 15 years and perhaps more than 20 years of operation with a converted freighter to make an acceptable return on investment.

Aircraft that are more than 20 years old are therefore not considered viable future conversion candidates in this analysis.

IAI Bedek's 737-700BDSF conversion and the three 737-800 conversion programmes could all be available by the fourth quarter (Q4) of 2017. It is estimated that the market value of 15-year-old 737-700s and -800s in half-life maintenance condition with half-life engines will be $9.10-13.00 million and $12.60-17.30 million by Q4 2017 *(see table, this page)*. The market value of 20-year-old 737-700s and -800s is expected to be $6.60-10.20 million and $9.50-14.00 million by that point in time.

AEI estimates that the cost for its 737-800SF conversion will be $3.5 million based on January 2017 prices. This means that the cost of acquiring and converting a 737-800 into -800SF configuration could be $13.00-20.80 million in 2017. IAI Bedek and Boeing do not currently quote prices for their conversion programmes.

Model series

There are three commercial sub-variants of the 737-700: the standard -700, -700C and -700ER. The only commercial variant of the -800 is the standard model. These four model series account for an active and parked fleet of 5,001 aircraft. The only members of this fleet that can be discounted as conversion candidates, based solely on their model series, are -700C and -700ER airframes. This is because IAI Bedek will only initially offer conversions for standard -700 aircraft. IAI Bedek has chosen to focus its -700BDSF conversion on the standard -700, since this model accounts for the overwhelming majority of the 737-700 fleet.

Weight specification

The 737-700 and -800 both come with two weight specification options, which Boeing refers to as the 'Basic' or 'Maximum' weight options.

The 737-700's 'Basic' specification includes a maximum take-off weight (MTOW) of 133,000lbs and a maximum zero fuel weight (MFZW) of 120,500lbs. Its 'Maximum' weight specification offers an MTOW of 154,500lbs and an MZFW of 121,000lbs *(see table, this page)*.

The 737-800's 'Basic' weights include an MTOW of 155,500lbs and an MZFW of 136,000lbs, while its 'Maximum' weight specification offers an MTOW of 174,200lbs and an MZFW of 138,300lbs *(see table, this page)*.

Potential 737-700 or -800 freighter operators might have a preference for the 'Maximum' weight specifications, since these will offer higher payloads. The weight specification of a potential conversion candidate is not considered to

IAI Bedek is the only organisation to have officially launched a freighter conversion programme for the 737-700. Only the standard -700 variant will be converted. A large portion of the 737-700s that will fall within the typical feedstock age range by 2017 are operated by Southwest Airlines.

be a defining criterion in the feedstock selection process, since it is possible to upgrade all 737-700 and -800 airframes to the 'Maximum' weight specifications without carry out any structural modifications.

"It is not uncommon for passenger airlines to have the MTOW certification de-rated if they do not need the maximum weight for their operation," explains Jacob Netz, senior analyst at the Air Cargo Management Group, expressing his own opinion. "Certifying a lower MTOW saves operators costs in navigation charges and landing fees. If such an aircraft goes for conversion, it is quite easy to increase and certify the converted freighter to the maximum weights, because the process only involves a paperwork exercise and does not require structural changes."

It should be noted that operators that want to upgrade their weight specifications will still have to pay a fee to Boeing for the re-certification process. Operators should consult Boeing for details.

Utilisation

The 737-700 and -800 have a structural limit of validity (LOV) expressed in terms of FC and FH. This determines the threshold up to which current engineering data has established the aircraft can be operated, without risk of widespread fatigue damage.

The current LOV is 100,000FC and 150,000FH. These thresholds may be extended in the future as more engineering data become available for the ageing fleet. For now, however, potential freighter operators will want to ensure any feedstock candidates will not exceed these limits within their required economic lifecycles.

It has been established that operators may want to get up to 20 years of utilisation from a 737-700 or -800 freighter following conversion. The average annual utilisation of a 737-700 or -800 will vary depending on the type of cargo operation and its geographic location. Express package or integrator operators typically operate on a hub-and-spoke basis with aircraft flying two to four cycles a day, five days a week. General freight operators are more likely to fly point-to-point services, but may still have regular contracted schedules. They are also more likely to perform additional ad-hoc charters.

Various sources estimate that typical converted 737-700 and -800 freighters will operate at 14-20FC per week on average. The typical duration of each FC could range from one to three flight hours (FH).

This analysis assumes that a converted 737-700 or -800 freighter may be required to operate up to 1,200FC per year for 20 years with an average FH:FC ratio of 2:1. This provides a safe margin for estimating the remaining useful life of a feedstock aircraft, since many operators will have lower levels of utilisation.

Based on the assumptions used here, a converted 737-700 or -800 freighter will accumulate 24,000FC and 48,000FH over a 20-year period. To avoid exceeding the current LOV, only those feedstock aircraft that have accumulated fewer than 76,000FC and 102,000FH are considered suitable for conversion.

Winglets

The majority of active and parked 737-700 and -800 passenger aircraft are configured with 'Blended Winglets'.

Blended Winglets were certified for the 737-700 and -800 in 2001. They are carbon-fibre upward-swept wing extensions, and are produced by Boeing and Aviation Partners Boeing (APB).

Winglets are designed to reduce induced drag. It has been demonstrated that winglets can reduce block fuel burn by 4-5% on sector lengths approaching the limit of an aircraft's range. The performance enhancement provided by winglets can provide an increase in payload-range capability. It is also certified by the Federal Aviation Administration (FAA) that Blended Winglets can improve take-off performance, and reduce engine maintenance costs by allowing the flight crew to perform take-off procedures that result in less engine wear.

A new Split Scimitar winglet was certified for the 737-700 and -800 in 2014, and has also been available for retrofit since 2014. This builds on the existing Blended Winglet design; but features a large ventral strake, aerodynamic scimitar tips and new strengthened spars.

According to Flightglobal's Fleets Analyzer, about 90% of the active and parked 737-700 fleet is equipped with winglets. This includes 918 aircraft with Blended Winglets and 35 with the Split Scimitar design. Winglets are also installed on 97% of the 737-800 fleet. This includes 3,372 aircraft with Blended Winglets and a further 435 featuring the Split Scimitar design.

All of the 737NG P-to-F modification programmes will permit the conversion of aircraft without winglets. They will also cover the conversion of aircraft that have Blended Winglets. Most of the aircraft that are equipped with Split Scimitar winglets are only a few years old, and are unlikely to be conversion candidates until around 2030. The conversion programmes are unlikely to develop STCs for the conversion of these aircraft until the first airframes approach the feedstock age threshold.

ESTIMATED ACQUISITION COSTS FOR 737-700 & 737-800 AIRCRAFT

Aircraft Type	MTOW (lbs)	Q4 2017 value est (US$-millions) 15-year-old	20-year-old
737-700	133,000	9.10-12.70	6.60-10.20
737-700	154,500	9.40-13.00	6.60-10.20
737-800	155,500	12.60-17.10	9.50-14.00
737-800	174,200	12.80-17.30	9.50-14.00

Source: Oriel

Q4 2017 values, assuming 1.5% inflation, half-life maintenance condition with half life engines

The presence or absence of winglets is not a high priority feedstock selection consideration. More winglet-equipped 737-700s and -800s are likely to be converted in the long term, since they account for the majority of the fleet. In the first few years of conversion, operators may be able to choose between feedstock with and without winglets, according to their individual operational requirements.

Engines

The 737-700 and -800 are both exclusively powered by CFM56-7B series engines.

There are five main variants of the -7B series in operation. These are the -7B20, -7B22, -7B24, 7B26 and -7B27. The last two digits indicate the engine's thrust rating on thousands of pounds. The -7B20 is the lowest rated engine with an installed thrust of 20,600lbs. The -7B27 is the highest rated engine with a thrust of 27,300lbs.

There are three different build standards or sub-variants for passenger aircraft within each of the five main -7B variants. These are the original build standard, the 'Tech Insertion'-standard, and the latest 'Enhancement' standard. The turbomachinery and the parts installed are the same for each thrust rating within each of these build standards. The thrust rating is determined by the full authority digital engine control (FADEC) device.

Engines with the 'Tech Insertion' configuration are indicated by a '/3' suffix. These engines provide up to a 1% improvement in specific fuel consumption over their lifecycles, in comparison to the original build standard. They also have 5-15% lower maintenance costs. The 'Tech Insertion' modification became the production standard for new-built CFM56-7Bs in January 2008.

Engines with the 'Enhancement' configuration are indicated by an 'E' suffix. These engines feature further modifications that provide additional reductions in fuel consumption and maintenance costs of 1% and 4%. The 'E' production standard was introduced in 2011. All new CFM56-7Bs are now built to this standard.

The engine type can be an important consideration in the feedstock selection process when the fleet contains aircraft powered by multiple engine options. Engine options on an aircraft type vary in weight, size or shape. These can influence factors such as an aircraft's available payload, or cargo loading considerations. Since all 737-700s and -800s are powered by variants of the same engine family, these factors are not a concern. There are no physical limitations or restrictions associated with any of the different CFM56-7B variants that make one more suitable than another for a generic freighter operation. The choice of feedstock engine variant is more likely to be influenced by individual operational preferences and market conditions at the time of acquisition.

Some operators might require a specific thrust rating for challenging operational conditions. For others, market conditions, such as cost and availability, may play a role in determining which engine variant their feedstock aircraft are equipped with. The CFM56-7B can be re-rated to lower or higher thrust ratings, however.

The estimated market values for CFM56-7B engines increase for higher thrust variants within each build standard sub-category. The -7B27 has a higher market value than the -7B20, for example, and the -7B27E has a higher value than a -7B20E. CFM56-7B values also increase according to the build standard. 'Enhanced' engines come with a premium over 'Tech Insertion' variants, which, in turn, come with a premium over the original build standard. A -7B26E therefore has a higher value than a -7B26/3, which has a higher value than the original -7B26.

Engine values have a corresponding influence on the entire aircraft's value. It is estimated that the Q4 2017 market value for a high-weight specification, 15-year-old 737-800, could be $12.80-17.30 million depending on the engine variant. Some operators might determine their feedstock selection according to the market value at the time of acquisition.

The selection process will also be influenced by which aircraft and engine combinations are available at the time of acquisition. The original build standard CFM56-7B22 and -7B24 are the most common variants among the active and parked 737-700 fleet. The 737-800 fleet is dominated by the three different build standards of the -7B26 series. The most common engine variant at the time of conversion is likely to vary with the fleet's age profile. Many of the first 737-700s and -800s to reach the typical feedstock age threshold in Q4 2017 will be equipped with original build standard engines.

Fleet commonality

For any operators looking to build a fleet of multiple 737-700 or -800 freighters, fleet commonality might be a high priority in the feedstock selection process. The concept of commonality involves assembling a fleet of similarly configured 'sisterships'. These are groups of aircraft that will have equal or similar component configurations and have been operated by the same airline in the same environment. They are therefore likely to have the same system and modification status, and will also have been operated and maintained under the same procedures and quality standards.

Operating a fleet of 'sisterships' can provide various cost savings. Airlines may be able to avoid investing in multiple spares inventories and any maintenance complexities relating to aircraft with different components and modification status.

Maintenance condition

The maintenance condition of an aircraft is an important consideration when identifying feedstock for conversion. Some operators might prefer to acquire aircraft that have just completed a heavy maintenance check, but these will come with a value premium.

It is common for operators to put aircraft through a maintenance check during the conversion process to minimise subsequent aircraft downtime for maintenance following the conversion. Heavy checks for the 737NG, such as six-, eight- and 12-year checks will include deep structural inspection tasks that require the removal of interior fixtures and fittings to provide access to the fuselage. These structural tasks have some of the highest access man-hour (MH) requirements in an aircraft's maintenance planning document (MPD).

737-700 & 737-800 SUITABLE FUTURE CONVERSION CANDIDATES

Aircraft variant	15-20-years-old by Q4 2017	All aircraft by Q4 2017
737-700		
Active	348	1,032
Parked	13	28
Total	**361**	**1,060**
737-800		
Active	623	3,909
Parked	10	29
Total	**633**	**3,938**
All Aircraft		
Active total	971	4,941
Parked total	23	57
Total	**994**	**4,998**

Notes:
1). Figures based on current fleet only and do not take account of future deliveries.
2). Fleet data correct as of April 2016.
3). Figures show all aircraft up to a maximum of 20-years-of age.
4). Figures show all aircraft with fewer than 102,000 FH and 76,000 FC.

The conversion process will also involve the removal of the passenger cabin and interior items. It therefore makes sense to combine deep structural inspections with the conversion process. This will avoid incurring the costs associated with grounding the aircraft and removing the interior twice within a relatively short time frame.

The MPD for the 737NG family assigns each individual task its own interval specified in FH, FC, calendar time, or in a combination of any two of these criteria. This allows operators to optimise their maintenance planning according to their level of utilisation *(see Assessing the 737NG's base maintenance requirements, Aircraft Commerce, October/November 2013, page 40).*

Some 737NG operators have adopted equalised maintenance programmes. These involve spreading maintenance tasks over more frequent but smaller checks, comparable to traditional 'A' checks. This is designed to minimise the number of large base checks that require longer downtime. Other operators prefer to stick to more traditional base check cycles.

737NG freighter operators may consider moving their aircraft onto a low utilization maintenance programme (LUMP), which is more efficient for aircraft that accumulate less than 100FH per month or 1,200FH per year.

There are a large number of task groups in the 737NG MPD with calendar or FC/calendar intervals that are multiples of 24 months. This has resulted in some operators adopting a base check cycle of six checks, with a check every two years and a total cycle interval of 12 years. The largest number of deep access inspections come due at six-, eight- and 12-year intervals. The repeat intervals for these tasks can vary in some cases.

It could make sense for potential 737-700 or -800 freighter operators to look for feedstock aircraft that are approaching one of these six-, eight- or 12-year checks. These aircraft would have a lower acquisition price and putting them through a check during the conversion process will maximise the time available before the next heavy inspection is due. This would need to be weighed up against the risk of uncovering unscheduled and unknown defects during the check and the associated costs to rectify them.

It might also make sense to perform a group of flight-length sensitive (FLS) tasks during the conversion process. These are structural inspections with intervals determined via a combination of FH and FC limits. There are two charts in section 9 of the 737NG family's MPD which are used to determine exactly when these tasks will come due, according to the aircraft's accumulated utilisation. There are 99 FLS tasks in total, and 78 of these require either deep or light structural access. A potential feedstock aircraft that is due FLS inspections should not be ruled out as a suitable conversion candidate. Operators should, however, be aware of the costs associated with the tooling, additional access and NDT inspections required to satisfy the FLS tasks.

Another issue that future potential 737NG freighter operators should consider is 249 and 212 structures tasks that have initial intervals of 50,000FC and 56,000FC. The second group at 56,000FC involve inspections of the stabiliser, wings, and engine pylons. These may require relatively deep access. These two groups of tasks could possibly consume a large number of MH, and so present an economic issue with continued aircraft operation. Initial indications, from aircraft that have had these tasks performed, are that MH consumption is not excessive.

During the feedstock selection process operators should check if there are any significant airworthiness directives (ADs) or service bulletins (SBs) affecting potential conversion candidates. *Aircraft Commerce* did not identify any ADs or SBs affecting the 737-700 or -800 that would be significant enough to rule out certain airframes as feedstock candidates.

One AD that operators should be aware of is AD 2010-26-06, which relates to scribe line inspections. This has an associated SB 737-53A1289, which requires the inspection of damage caused by tooling when an aircraft is stripped of its paint and sealant and has any decals removed. Aircraft that have had more owners will have had more paint schemes and decal changes and are therefore more likely to have suffered scribe line damage. Additionally, the removal and refit of fuselage wing-to-body fairing panels is a primary area of risk for scribe lines as a result of the removal and installation process.

Another maintenance consideration for potential 737-700 and -800 freighter operators concerns external fuselage repairs. Damage such as equipment loading impacts or hail strikes is repaired by using several internal and external metal plates over the area where the damage has been cut out. Operators may want to establish how many external fuselage repairs a feedstock candidate has undergone, since these will cause additional weight and drag, which will impact fuel, burn performance. There is also a limit to the number of fuselage patches that are allowed.

Suitable aircraft

There are three priority selection criteria that should be applied when identifying suitable 737-700 and -800 candidates for P-to-F conversion. These are the model series, the aircraft's age and its accumulated FH and FC. Once these filters have been applied, the priority assigned to other considerations such as fleet commonality, weight specifications, the precise engine variant, and the presence or absence of winglets, is likely to vary according to individual operational requirements and market conditions at the time of acquisition.

Aircraft Commerce has applied the three priority selection criteria to the current fleet of 737-700s and -800s. The analysis identifies which members of the fleet will be suitable conversion candidates by Q4 2017. It assumes more

AEI, Boeing and IAI Bedek have all launched freighter conversion programmes for the 737-800. A 737-800 freighter will be able to accommodate up to 12 88-inch X 125-inch containers and pallets on its main deck and will have a gross structural payload of about 52,000lbs.

operators will be actively seeking feedstock by this time, since all of the 737NG conversion programmes are due to be under way or about to enter production by then.

Each aircraft's average utilisation was used to estimate the current fleet's accumulated FH and FC by Q4 2017.

The requirement to filter feedstock candidates by model series only really applies to the 737-700 fleet, since there is only one base model of the commercial -800. Where the 737-700 series is concerned, only the standard -700 model should be considered for conversion. This currently rules out three airframes as potential conversion candidates: one -700C and two -700ERs.

The 737-800 fleet and qualifying -700 series candidates should then be filtered according to their age. Aircraft that will be 20 years old or younger by Q4 2017 are considered to be the most suitable future conversion candidates. No 737-700s or -800s will exceed 20 years of age by Q4 2017. On this basis, no 737-700s or -800s can be ruled out as conversion candidates based on just their age.

The next filter involves establishing the feedstock candidate's accumulated FH and FC. 737-700s and -800s that have accumulated less than 102,000FH and 72,000FC will be the best candidates for conversion. None of the current fleet is close to accumulating this many FH or FC. None of the current fleet can therefore be ruled out as conversion candidates based on their accumulated utilisation. The current LOV for 737-700s and -800s is high enough that an operator could convert a member of the current fleet and operate it at 1,200FC per year for 20 years with an FH:FC ratio of 3:1, and still not exceed the validity threshold.

Utilisation data were not available for aircraft aged nine years or younger. Based on their age and the average utilisation of the rest of the fleet, these aircraft should all be within the required FH and FC thresholds to qualify as suitable conversion candidates in Q4 2017.

Only three members of the current 737-700 and 737-800 fleet can be ruled out as conversion candidates after the three priority selection criteria are applied. These are the single 737-700C and the two 737-700ERs.

The remaining aircraft are deemed suitable for conversion and are split into 737-700 and -800 candidates to help operators identify the most suitable airframes for their specific requirements. Each fleet is grouped by operator to identify the potential for commonality.

The analysis identifies the number of 737-700s and -800s that will be within the typical conversion age range by Q4 2017. It also considers younger aircraft, since they represent future conversion candidates. The analysis does not take account of the 737-700s and -800s that are still on order. These will provide additional future conversion candidates.

737-700 candidates

There are 1,060 active and parked 737-700s that will meet the three priority feedstock selection criteria in Q4 2017 *(see table, page 94)*.

Southwest Airlines (488 aircraft) is by far the largest operator of these aircraft, with 467 in service and a further 21 in storage. Its 737-700 fleet includes aircraft with eight different variants of the CFM56-7B family ranging from the -7B20 to the -7B26. The most common engine sub series in Southwest's 737-700 fleet is the -7B22 which equips 318 aircraft.

The next largest operators of 737-700 conversion candidates are WestJet (58), China Eastern Yunnan (42), United Airlines (40), GOL (37), China Southern Airlines (29) and SAS (29).

The largest lessors of suitable 737-700 conversion candidates are AerCap (35) and BOC Aviation USA (14).

There will be 361 suitable 737-700s within the typical conversion age range by Q4 2017. The largest current lessor of these aircraft is AerCap (10). The largest operators are Southwest Airlines (160), United (39), GOL (27), SAS (20) and Alaska Airlines (13).

The majority of 737-700s that will fall within the feedstock age bracket by Q4 2017 are equipped with CFM56-7B22 (231) or CFM56-7B24 (108) engines.

737-800 candidates

There are 3,938 active and parked 737-800s that will meet the three priority feedstock selection criteria in Q4 2017 *(see table, page 94)*.

The largest operators of these aircraft are Ryanair (345), American Airlines (270), United (130), China Southern (129), Air China (116), Hainan Airlines (114), Southwest Airlines (111), Xiamen Airlines (108) and GOL (100). Many of these airlines have equipped their aircraft with -7B26, -7B26/3 or -7B26E engines.

The largest lessors of suitable 737-800 conversion candidates are AerCap (145), SMBC Aviation Capital (106) and GECAS (80).

There will be 633 737-800 conversion candidates within the typical feedstock age range by Q4 2017. The lessors with the largest fleets are GECAS (27) and AerCap (26). The largest operators are United (77), American Airlines (76), Delta Air Lines (71), Turkish Airlines (23) and Jet2 (19).

The majority of 737-800s that will fall within the typical conversion age range by Q4 2017 are equipped with CFM56-7B26 (459), -7B27 (97) or -7B24 engines (52). AC