Freighters can have lower maintenance costs than passenger aircraft in several areas. Most of these are associated with the lack of passenger cabin fittings. Some of the potential cost savings are identified here.

Maintenance differences between freighters & passenger aircraft

There are many similarities between passenger and cargo-configured variants of the same aircraft type, including the same systems, structures, engines and components. There are also key differences, however, in configuration and rates of utilisation. These lead to different maintenance requirements and costs between passenger and freighter aircraft.

Aircraft Commerce has identified some of the key areas where the maintenance costs of passenger- and cargo- configured variants of the same aircraft type differ.

Maintenance programme

An aircraft's approved maintenance programme (AMP) includes a combination of operator-specific tasks, and mandatory tasks in the maintenance planning document (MPD).

Operator-specific tasks will be a mixture of safety-related tasks that the airline has decided to add to the mandatory tasks, and non-mandatory cosmetic tasks and maintenance related to the aircraft's interior. These non-mandatory tasks are performed for marketing purposes in the case of passenger aircraft, particularly widebodies, which are more likely to have mixed-class cabins.

Overall, a minority of tasks for the interior will be safety-related tasks that are listed in the MPD. The majority of the tasks are non-mandatory, and not listed in the MPD. These relate to the aircraft's cosmetic appearance. Some will be regular actions, such as cleaning and replacing seat covers and carpets; and others will be on-condition, such as repairing or replacing sidewall panels.

There will therefore be a number of tasks in a passenger operator's AMP that will not apply to freighters. These are addressed here in terms of base, line, component, and engine maintenance.

Base maintenance

An aircraft's maintenance cycle usually comprises a given number of checks at certain calendar or flight hour (FH) intervals. The final check in the cycle is the heaviest, involving the largest number of tasks, and the deepest. Traditionally tasks were grouped into letter checks.

A checks are relatively light with little access required and short downtime. The majority might be completed on the line, or during an overnight stop.

C or base checks require more access and longer downtime. After several checks, the heaviest and final check in the cycle is often referred to as a 'D' or 'heavy C' check. This requires the longest downtime in each check cycle because the tasks require the deepest access, and so the highest degree of removal and installation of interior equipment.

Most of the tasks performed at each C and D check are listed in the MPD. These include structural and zonal inspections, system tests and functional checks. These checks also include cosmetic maintenance related to the aircraft's interior.

Base maintenance tasks include the main elements of routine and non-routine rectifications, the implementation of service bulletins (SBs) and airworthiness directives (ADs), and interior cleaning and refurbishment. Operators may also have engineering orders (EOs) to action. Airlines tend to re-paint their aircraft after it has undergone a heavy check.

Interior maintenance & refurbishment

The most obvious difference between passenger aircraft and freighters is the interior cabin configuration.

A passenger cabin includes fixtures and fittings which need to be regularly cleaned, maintained, refurbished or replaced. These can be sub-divided into categories that include: panels and overhead bins; monuments and large structures; seats; carpets; in-flight entertainment (IFE) systems; and emergency equipment.

Panels and overhead bins comprise sidewall panels, passenger door linings, bulkheads and curtains, cabin dividers, lighting, dado panels and passenger service units (PSUs). PSUs are situated above passengers' heads in the base of the overhead bins, and contain reading lights, air nozzles, illuminated signs, deployable oxygen masks and flight attendant call lights.

Large cabin structures such as galleys, lavatories and wardrobes are referred to as monuments. Galleys come with additional equipment such as ovens, coffee machines, fridges, coolers, ice machines and carts.

Carpets are required in the aisles and under the seats, and are periodically cleaned and replaced. Servicing areas for galleys and lavatories have non-textile flooring (NTF), which also has to be replaced several times during an aircraft's life. The replacement of seat covers and cushions is mandatory when they lose their fire-resistant properties. Seat frames also have to be removed and maintained, during base checks.

IFE systems may include seatback or drop-down screens. Current trends have seen some airlines offering on-board cellular or WiFi connectivity to enable wireless IFE systems so that passengers can use their own personal electronic devices (PEDs).

The regular cleaning, maintenance and refurbishment of many interior items is not mandatory, however. It is nevertheless carried out for cosmetic purposes, and accounts for a high percentage of maintenance costs. These are clearly not applicable to freighters.

Individual operators will specify the intervals between non-mandatory interior maintenance tasks and the extent of the

REGULAR PASSENGER INTERIOR MAINTENANCE FOR 747-400

Interior item	Timing	Interval FH	Cost $
747-400			
Aisle carpets replacement	C check		16,000
Seat area carpets replacement	Every 45 months	17,000	44,000
Cleaning seat covers	C check		23,000
Replacing seat covers	Every 3-4 years		50,000
Seat cushions	Every 5 years		112,000
Seat frame maintenance	Every 5 years		115,000
Panels, bins & PSUs	D check	22,500	310,000
Galleys & toilets	D check	22,500	220,000
Servicing area NTF	D check	22,500	95,000

work that is performed.

Some of the interior-related tasks that are safety-related, and so have tasks listed in the MPD, include those for the emergency equipment such as gas bottles for emergency slides, emergency slides, and fire extinguishers.

Aircraft Commerce previously analysed the potential costs associated with regular interior maintenance for a 747-400 *(see The costs of large widebody interior refurbishment, Aircraft Commerce, October/November 2011, page 28)*.

Many airlines will vacuum clean carpets after every flight, and replace them at certain intervals. For the 747, typical replacement intervals might be every C check for aisle carpets and every 45 months for seat-area carpets. This will result in total MH and material costs of about $16,000 and $44,000 respectively *(see table, this page)*.

Seat covers and cushions will need to be cleaned and eventually renewed. The seat covers may be removed and cleaned at every C check, before being replaced every three to four years. The cleaning and replacement costs for an aircraft configured with 372 seats will be $23,000 and $50,000. The cushions might be replaced every five years at a cost of $112,000.

Seat frames might be overhauled every five years. This will include inspections of the frames, reclining mechanisms, tray tables and IFE screens or equipment. A shipset of seats on a 747-400 will cost about $115,000.

A host of other interior items will need to be removed during heavy checks to provide access for deep inspections. These include panels, overhead bins, PSUs, galleys, toilets and service-area flooring. It makes sense to refurbish these items at the same time. This can result in an additional $625,000 in labour and material costs *(see table, this page)*.

In addition to regular maintenance and refurbishment, some operators may decide to completely refurbish the cabin.

The cabin may be upgraded to keep up with, or surpass, competitors in terms of the product offering. Some operators may wish to introduce new products, such as the latest lie-flat beds or IFE systems. There may also be a requirement to reconfigure the seating and cabin layout. An airline may want to move from a three- to a four-class configuration for example, or from three to two classes.

The potential costs of a complete cabin refurbishment of a 747-400 were analysed by *Aircraft Commerce*. These will be influenced by several variables, including the chosen seating layout.

The analysis revealed that the potential replacement costs for seller-furnished equipment (SFE), including overhead bins and toilets, could reach $4.8 million *(see table, page 92)*.

The costs for buyer-furnished equipment (BFE) including new lie-flat and economy seats, IFE systems, and galleys, could approach $13.0 million.

It was also estimated that 9,000MH would be required to remove the old interior and fit the new one in the case of a complete cabin reconfiguration. The overall cost of these MH will depend on the labour rate.

Most of the interior fixtures and furnishings present in a passenger aircraft will not be present on a freighter. A factory-built freighter will not have them installed, and an aircraft undergoing passenger-to-freighter (P-to-F) conversion will have virtually all of them removed.

Freighters therefore avoid many of the costs associated with repairing, refurbishing or reconfiguring a passenger cabin, but they do have different interior furnishings with their own maintenance requirements.

"A freighter's main deck cabin will include liner around the walls and ceilings, a cargo net or barrier, smoke detectors and a cargo loading system (CLS)," explains Robert Convey, senior vice president of sales and marketing at Aeronautical Engineers Inc (AEI).

"The liner material in a cargo cabin is fire-resistant and lasts for many years, even under the wear and tear of freighter operations," explains Brian McCarthy, vice president of sales and marketing at Precision Aircraft Solutions.

Freighters may also have a single lavatory or limited galley function for crew use.

The comparative lack of interior equipment on freighters means that freighter operators should have lower interior-related maintenance costs, in terms of MH and materials, than those of passenger-configured aircraft.

This is reinforced by an analysis of the proportion of D check MH required just for the routine cleaning and refurbishment of passenger interior items.

For a 737 Classic, 8-12% of the total MH for the first four D check cycles could be needed for interior cleaning and refurbishment *(see table, page 94)*. For a 757, 11-18% of the total MH could be required for interior cleaning and refurbishment over the first five D checks. This would increase to 14-20% for a 767, and 21-25% for a 747-400.

Operators may also take the opportunity to strip and re-paint their aircraft during a major base check. For passenger carriers, an aircraft's livery could be important for marketing purposes.

McCarthy does not believe, however, that there is a significant difference in painting costs between passenger and freighter aircraft. "Some freight operators may not focus on the same level of detail for the condition of a paint scheme, but large integrators such as FedEx and UPS will be brand-conscious. In addition stripping the aircraft is the best time to address scribe lines and surface corrosion hiding underneath old paint."

Routine airframe maintenance

Routine maintenance tasks are carried out in accordance with each operator's AMP, which is based on the MPD. The detailed description of how tasks are to be performed is found in other manuals, including the Aircraft Maintenance Manual (AMM).

There are several ways in which freighters can have lower routine maintenance inputs and costs than passenger-configured aircraft.

Routine maintenance costs include the labour and materials required to perform the actual tests and inspections. Operators also need to budget for the MH required for aircraft preparation and docking, and for opening and closing access to inspection areas.

Passenger aircraft will be subject to a number of mandatory interior-related maintenance tasks that will fall under the routine inspection criteria. These might include: inspections of passenger doors; galley and lavatory systems; equipment and attachments; emergency lighting; seat

COMPLETE PASSENGER INTERIOR REFURBISHMENT OF 747-400

747-400	Labour MH	Equipment cost ($)
Seller furnished equipment		
Overhead bins		2,000,000
Sidewall & ceiling panels		500,000
PSUs		600,000
Toilets		1,700,000
Total for SFE		**4,800,000**
Labour for installation:		
Overhead bins	600	
PSUs	120	
Sidewall & ceiling panels	300	
Toilets	250	
Total MH	**1,300**	
Buyer furnished equipment		
Materials:		
Carpet		12,000-20,000
Lie-flat seats		4,500,000
Economy class seats		1,500,000
IFE System		4,500,000
Galleys		1,800,000
Service areas & bulkheads		750,000
Total		**13,000,000**
Labour for installation:		
Carpet	700	
Lie-flat seats	3,500	
Economy class seats	300	
IFE system	2,500	
Galleys	900	
Total	**7,900**	

structures and belts; emergency equipment; overhead bins; side panels and ceilings; and PSUs. They will include the replacement of the life limited parts (LLPs) of items such as gas bottles, escape slides and life jackets.

Freighter aircraft will have a comparatively small number of interior items that require mandatory inspections.

Passenger aircraft will also be subject to routine inspections of cabin windows, which are usually performed in the heavier checks. New-build freighters do not have cabin windows installed, and converted aircraft tend to have them removed and blanked. "At AEI we use metal plugs to replace the cabin windows," explains Convey. "These become part of the aircraft's structure."

"Windows are replaced with aluminium plugs on freighters," explains McCarthy. "These have infinitely longer lives than windows, which have to be regularly inspected. Windows can become scratched when washed and have to be replaced if the scratches exceed limits. The window shades also require regular replacement. These issues do not affect freighters."

The lack of a passenger interior could have an impact on the number of routine systems tasks required for freighters.

"A lot of systems are simpler or may even not be present on freighters," says Thomas Sonigo, Air France Boeing fleet director, AFI KLM E&M. "This includes the air conditioning and grey water systems."

Grey water systems provide drainage from passenger lavatories and galleys. These would also be absent on freighters.

Passenger-configured aircraft have an entire system for air conditioning installed above the ceiling panels. Most of this can be removed when an aircraft is converted to a freighter. A freighter aircraft only requires an air conditioning system on the flightdeck and crew area, and uses a smaller system in the cabin.

It should be noted that freighters will require some routine inspections that passenger aircraft will not, however. These will be for items installed for the cargo-carrying role such as large cargo doors and cargo loading systems (CLSs) on the floor of the main and lower decks. These tend to be items that are maintained on an on-condition basis, so freighter aircraft require fewer overall routine MH than passenger cabin items.

Over the course of a base check cycle, freighters are also likely to require fewer overall routine MH than passenger aircraft for the purposes of opening and closing panels to gain access to areas and zones of the aircraft for deep inspections. This is particularly the case for larger structural inspections and corrosion inspection tasks.

Some routine tasks will require the removal and later reinstallation of interior items to provide access to the inspection areas. Deep structural tasks may require the complete removal of all interior fixtures and fittings. This can use several thousands of MH, especially for larger aircraft.

The 737 Classic family has a maximum base check cycle interval of 24,000MH. It consists of six checks, with the final C6/D check at an interval of 24,000FH. A group of 195 structural inspection (SI) tasks with an interval of 24,000FH has to be performed. In addition to seven other non-SI tasks, these take up to 1,600MH to complete because they require the complete removal of the aircraft's interior *(see Assessing the 737 Classic's ageing maintenance, Aircraft Commerce, June/July 2012, page 36)*. The complete removal and reinstallation of a 737 Classic's upper lobe interior is estimated to use more than 950 MH. Most of this labour expenditure is not applicable to freighters, which would only use a small fraction of these MH to remove the interior.

The 737 Classic family is also subject to a number of Corrosion Prevention and Control Programme (CPCP) tasks. Some of these require inspections of the upper and lower lobes of the fuselage. That is, the bare structure of the fuselage, above and below the floor, has to be inspected. The inspections therefore require the complete removal of interior items to gain access to the inspection areas. The interior then has to be reinstalled. Again, the large number of MH would not be used on a freighter aircraft.

The smaller quantity of interior items on a freighter should make it easier to remove and reinstall them than those of passenger aircraft. This will lead to savings in the number of routine MH required for deep access inspections.

It has been estimated that a 737 Classic or 757 freighter will require 50% fewer access MH to allow routine inspections at a D check than passenger variants. This can result in a saving of up to 1,000MH in the case of a 737 Classic.

The removal and reinstallation of fewer interior items on a freighter will also result in the use of fewer materials and consumables.

Some of the advantages that freighter aircraft have in routine inspections over passenger aircraft, could be offset for older converted freighters when they are compared to younger passenger variants. This is because the repeat intervals of many flight cycle (FC) and calendar-based structural, zonal and CPCP tasks are shorter than initial intervals. There are,

PASSENGER INTERIOR CLEAN & REFURB MH AS % OF TOTAL BASE/D CHECK

Aircraft & Check	Interior Clean & refurb MH	Total check MH	Interior Clean & refurb MH % of total
737 Classic			
C6/D1	1,730	14,000	12%
C12/D2	1,730	21,500	8%
C18/D3	1,730	17,100	10%
C24/D4	1,730	21,800	8%
757			
C4/D1	2,250	12,700	18%
C8/D2	2,250	14,300	16%
C12/D3	2,300	21,850	11%
C16/D4	2,300	18,750	12%
C20/D5	2,300	19,200	12%
767			
C4/D1	3,800	19,430	20%
C8/D2	3,800	24,030	16%
C12/D3	3,800	26,250	14%
C16/D4	3,800	26,310	14%
C20/D5	3,800	25,445	15%
747-400			
C4/D1	11,500	45,352	25%
C8/D2	13,500	62,603	22%
C11/D3	13,500	56,359	24%
C14/D4	13,500	65,089	21%
C17/D5	13,500	63,592	21%

Notes:
1). Data taken from Aircraft Commerce ageing maintenance articles issues 80,81,82,83.
2). 747-400 check cycle based on assumption for 1989/1990 vintage aircraft

for example, a number of CPCP upper lobe interior inspections for the 737 Classic with an initial inspection interval of 12 years and a repeat interval of eight years. These require significant access MH to remove the cabin interior.

The number of routine tasks, especially those related to deep access structural and CPCP inspections, therefore increases with each successive base check cycle. Converted freighters are usually already in at least their second, and often third, base check cycle at the time of modification and then entering service as a freighter. They will therefore face more structural and CPCP inspection requirements than some younger passenger variants.

Some aircraft types also have new tasks added to the mandatory tasks in the MPD as they age.

The 747-400 provides a good example. It has a number of ageing aircraft programmes including the repair assessment programme (RAP), supplemental structural inspection document (SSID) and the widespread fatigue damage (WFD) programme *(see Assessing the 747-400's ageing maintenance, Aircraft Commerce, August/September 2012, page 43).*

The RAP includes inspections for previous repairs, while the SSID involves inspections of the wings and fuselage for fatigue, cracks or corrosion. The WFD aims to test for fatigue damage in areas around damage or previous repairs.

An ageing converted 747-400 freighter may therefore have more routine inspection tasks related to these three programmes than a younger passenger-configured variant.

Defects and non-routine maintenance

Non-routine maintenance tasks are those performed on defects and findings identified during routine inspections.

The labour required for non-routine defects is often expressed as an MH ratio in comparison to routine tasks. The rate of non-routine defects generally increases with aircraft age. The largest number of defects and findings is rectified during the heavy check at the end of a base cycle. The non-routine ratio of the subsequent base check at the start of the next base cycle is therefore lower. The non-routine ratio then increases with each successive check over the next base check cycle.

On passenger aircraft, many non-routine defects are associated with the deterioration of the cabin equipment.

Freighters have fewer interior items and should subsequently see fewer non-routine defects in the main cabin. These benefits may be partly offset by the need for non-routine rectifications of damage to freighter-specific equipment such as large cargo doors, interior panels, smoke detection equipment, or the CLS.

"In general, maintenance costs for main cabin items are significantly lower for freighters than for equivalent passenger aircraft," claims Moshe Haimovich, director of marketing and business development at IAI Bedek Aviation Group.

Another significant cause of non-routine defects is corrosion of the airframe structure. On passenger aircraft, floor areas around lavatories, galleys and seat areas can suffer from corrosion.

"Heavy corrosion can occur in the floor beams under lavatories and galleys," explains Pastor Lopez, chief executive officer at PEMCO World Air Service.

"Corrosion can also occur in the seat tracks on passenger aircraft, due to liquid spillages like water and cola," adds McCarthy.

Freighters may not be exposed to water damage from spilled drinks, but they can still suffer from corrosion issues.

"Water still gets in and corrosion prevention and protection must be enhanced on any freighter that expects a long life,"explains McCarthy.

"Cargo containers often collect water or snow while waiting to be loaded," says McCarthy. "A large amount of water can subsequently be transferred to the aircraft's cabin. Freighters can also suffer from grime and dirt in the floor tracks, which can harbour water and so cause corrosion."

"A freighter's main cabin floor can be more exposed to water than the floor of a passenger aircraft," adds Haimovich. "The type of cargo carried will affect the extent of any corrosion. The carriage of live animals, fish or perishables may lead to higher levels of corrosion, for example, so it is possible that the cost of rectifying corrosion will be higher for freighters than for equivalent passenger aircraft."

Haimovich points out that the lower lobes of passenger- and cargo-configured aircraft are utilised for freight in the same manner. "The routine and non-routine maintenance requirements and associated costs for lower lobe structures will therefore be of a similar magnitude for both passenger aircraft and freighters," claims Haimovich.

Freighters may require more MH for non-routine maintenance than equivalent passenger aircraft. This could mean that they have a higher non-routine ratio. For a 737 Classic undergoing its third D check the non-routine ratio might be 1.15 for a passenger-configured aircraft. That is for every MH required for routine maintenance, 1.15 MH will be needed for non-routine rectifications. For a cargo-

Freighters do not have many of the interior cabin fittings associated with passenger aircraft. This means they have lower interior cleaning, repair and refurbishment costs. This can also mean that freighters have fewer routine maintenance man-hours since it is quicker to remove their interior when gaining access for deep inspection tasks.

configured 737 Classic the non-routine ratio is likely to rise to 1.35.

This does not necessarily mean that freighters will suffer from more non-routine defects, but that the defects that do occur are more labour-intensive.

Some non-routine defects on passenger aircraft may involve a relatively quick fix such as a wiring issue with an IFE system. Defects occurring in a freighter are likely to be less cosmetic and more mechanical. In a cargo-carrying environment, wear and tear and increased exposure to climate conditions can lead to more intensive structural repairs.

In a freighter the whole main deck floor can be vulnerable to corrosion. Depending on the level of corrosion some aircraft may need to have their entire main cabin floor structures replaced at certain intervals. It is not uncommon for older 757 freighters to need several floor beams replaced at every C4 or D check.

Freighters can still experience lower non-routine maintenance costs than passenger variants, provided they are protected from corrosion. The cost associated with a freighter's higher non-routine ratio, but this higher maintenance requirement might be partly or completely offset by a passenger aircraft's higher non-routine material requirements, that come from its interior fixtures and fittings.

EOs/ADs/SBs

Work specified in EOs, ADs and SBs is usually performed during base checks. ADs and SBs may require immediate action, depending on the scenario.

ADs are issued by national regulatory authorities in response to identified safety concerns. The nature of the required inspections or modifications is detailed in linked SBs. Any work related to ADs will have mandatory compliance dates or thresholds.

SBs are issued by aircraft manufacturers, stipulating modifications that will improve the aircraft's design and in service reliability. Not all SBs are related to airworthiness issues. Those that are will be mandatory and linked to ADs.

EOs are created by the operator and are drawn up with the purpose of carrying out a modification or inspection to the aircraft. These may be designed internally or based on personalising AD or SB requirements. Where they are related to ADs or SBs the EO will need to meet any mandatory requirements, but may then exceed them in terms of detail or scope.

Some EOs, ADs and SBs will apply to fittings or equipment that are not present on freighters, such as certain interior or safety items. This could mean freighters will have lower MH and material costs than passenger aircraft in this regard.

Many SBs are issued to improve the reliability of the aircraft. More SBs are likely to be given to passenger aircraft than freighters. Operators of freighters that carry general freight are more likely to choose not to implement a large number of SBs.

Many ADs and SBs will apply to all aircraft regardless of whether they are configured to carry passengers or freight.

Freighters may enjoy lower MH and material costs than passenger aircraft for those ADs or SBs that require the removal and reinstallation of the cabin interior to open and close access to inspection areas. This would be particularly relevant to ADs and SBs that require deep structural access.

Line maintenance

Line maintenance requirements result from a mix of MPD tasks, reliability analysis and defect reports.

Freighters and passenger aircraft will have different line maintenance requirements. Freighters will clearly not be subject to any line maintenance requirements relating to passenger cabin items. This should lead to fewer line maintenance tasks and lower costs, particularly because there will be no in-flight faults and defects relating to seats, IFE systems, galleys and lavatories, and emergency equipment.

Some of these savings may be offset by freighter-specific line maintenance tasks, such as technical problems related to cargo door hydraulic systems or the CLS.

Sonigo believes that freighters will have lower overall line maintenance costs than equivalent passenger aircraft. "Where widebody aircraft are concerned I would expect a freighter to have 20% lower line maintenance costs than a passenger aircraft," says Sonigo.

Low utilisation maintenance

Some freighters, especially converted ones, will operate at lower utilisation rates than their passenger-configured counterparts.

"Operators with lower utilisation can seek to move their aircraft on to a low utilisation maintenance programme or LUMP," explains McCarthy.

"This extends the intervals between base checks. For the 757, the equivalent C check interval moves from 18 to 24 months," explains McCarthy.

Despite having longer calendar intervals between checks, the number of FH accumulated between checks can still be lower than for passenger-configured aircraft. The overall cost of airframe maintenance per FH will therefore still be higher per FH for freighters.

Engine maintenance

Engine maintenance costs may be lower for freighters than passenger aircraft. This is particularly true for older converted freighters.

"Passenger airlines tend to put

A freighter's main deck floor can be more exposed to corrosion than a passenger aircraft's floor. Some older freighters may need to have floor beams to be replaced during base checks.

engines through more comprehensive workscopes than freighter operators," explains McCarthy. "This often means that engines on passenger aircraft will have a larger number of life limited parts (LLPs) installed on their engines with a large number of engine flight cycles (EFCs) remaining."

This generally leads to a longer remaining engine life when the aircraft is sold for conversion. Passenger carriers can amortise the cost of engine shop visits and LLP replacements over a larger number of engine flight hours (FH) and EFCs.

Freight airlines operating older converted aircraft will seek to minimise engine maintenance costs. One option will be to use time-and-material engine shop visit costs, and so avoid the expensive power-by-the-hour type of all-inclusive maintenance programmes. Airlines can then avoid high shop visit and LLP replacements. "Rather than putting engines through shop visits, converted freighter operators might source green time or time-continued engines and engine modules from the used market," says McCarthy. "These are engines with some or limited life remaining to the LLP with the shortest limit or remaining life, or next shop visit. The cargo operator will fully utilise the remaining on-wing life of the green time engine, and then source another time-continued replacement from the aftermarket when the remaining time of the first engine has expired."

Most converted freighters are at least 15-years-old. This means there is often a surplus of used engines and components available on the aftermarket. Sourcing green time engines can cost less than a shop visit and LLP replacements. This is emphasised by market values for 737 Classic and 757 engines.

"The cost of a full shop visit for a CFM56-3 is $1.5-1.7 million," estimates Martin Matthews, programme manager at AerFin Ltd. "The replacement LLP stack would be another $1.0 million. Time-continued CFM56-3C1 engines are available for less than $700,000, so operators are opting for replacement green time engines over shop visits.

"The cost of a full level 3/4 shop visit for an RB211-535 is $3.5-4.0 million," adds Matthews. There are green time engines available for $1.5-2.5 million, but finding a good one may be a challenge, and could cost closer to $3.0 million.

"The shop visit cost for a PW2000 engine is $3.0 million, while aftermarket values for green time engines start at $2.0 million," concludes Matthews.

Component maintenance

Landing gear, thrust reversers, line replaceable units and auxiliary power units (APUs) can all incur significant maintenance costs.

It is possible that converted freighters could also enjoy component maintenance cost savings in comparison to passenger aircraft. They can take more advantage of the large amount of material and number of components available on the aftermarket.

It is possible that operators of older, converted freighters will approach component repair and maintenance in a similar fashion to engine maintenance, by sourcing time-continued replacement units on the aftermarket, rather than incurring the cost of acquiring, managing and maintaining a full inventory of parts.

Freighters should benefit from lower APU maintenance costs than passenger aircraft. APUs are used to provide air conditioning to the cabin, among other functions. Freighters should therefore have longer calendar time between shop visits. Freight operators can also avoid the high costs of a full shop visit by acquiring time-continued APUs on the aftermarket.

Summary

There are several areas in which freighters could have lower maintenance costs than equivalent passenger aircraft.

Many of the potential savings are associated with a freighter's lack of passenger interior fixtures and fittings.

This means freighters have fewer interior cleaning, and refurbishment requirements. They will also have lower routine MH and material costs, both for interior-related tasks, and those that require the removal of the interior for deep access inspections.

Freighters may have higher non-routine defect ratios than passenger aircraft but this could be offset by lower non-routine material costs.

Some older converted freighters operators might benefit from lower engine maintenance costs by sourcing green time engines from the aftermarket rather than incurring shop visit and LLP replacement costs.

Despite the many potential savings, some of these will be offset by maintenance requirements that apply specifically to freighters such as those related to large cargo doors or a CLS.

In many cases freighters could have lower overall maintenance costs than equivalent passenger aircraft, although this is not guaranteed.

"There are a number of maintenance requirements and costs that will specifically apply to freighters and not passenger aircraft," says Sonigo. "These will not generally offset the cost savings freighters enjoy in other areas. In most cases cargo-configured widebodies will have lower overall maintenance costs than equivalent passenger-configured aircraft." AC