Maintenance costs are one factor that determine which of the Airbus and Boeing narrowbody families are more efficient. Analysis of all airframe and component elements reveals little difference between either family. Despite having some disadvantages of an older generation, the 757 is more efficient on a cost per seat basis.

Airbus & Boeing narrowbodies: maintenance cost analysis

The A320 family and 737NG/757 are close competitors. These aircraft types have overlapping vintages of technology. The 757 is the oldest, but largest of all the types. The 737NG was developed from the 737-300/-400/-500 series to combat the more modern A320 family. The 737NG's design was intended to have 15% lower maintenance costs than its predecessor. An analysis of airframe and component maintenance costs indicates how the economics of these aircraft compare.

Aircraft in operation

The majority of A320 family fleets are concentrated in North America and Europe. Most operations have short-haul sector lengths, and average flight cycle (FC) times of 1.2-1.5 flight hours (FHs). Air France, for example, has two sub-fleets which operate either French domestic or intra-European routes, and average FC time is 1.2FH. "Because of the short domestic routes we achieve an average utilisation of 2,300FH and 1,900FC per year," explains Gery Mortreux, A320 department manager at Air France Industries.

Other European operators have varying rates of utilisation and average FC time in relation to their geographical position and route structure. Swiss and Lufthansa generate 2,600FH and 2,000FC and 2,400FH and 2,000FC each year respectively. Air Portugal and Finnair have higher utilisations of 2,900FH and 1,800FC and 3,300FH and 1,700FC respectively.

The A320 family is used in large fleets by several North American carriers, including United, US Airways, Frontier, Northwest, America West and Air Canada. These tend to have longer average route lengths than European carriers, and higher utilisations. United operates average FC times of 2.8FH, and generates 3,300FH and 1,375FC per year.

Unlike the 737 Classics (-300/-400/-500 family), 737NG operations are not restricted to short-haul but also include some medium-haul routes. This generates wide variations in average FC times between different operators.

"We use the 737-800 on intra-European routes, but fly the -900 to destinations in the Middle East," says Hans Poelgeest, senior project engineer for the 737 at KLM Engineering & Maintenance. "The average FC time is 1.7FH as a consequence, and use of the -900 has increased utilisation to about 2,900FH and 1,700FC per year."

The majority of 757s are concentrated in the US, in particular with American, Delta, Northwest and United; but also Continental, America West and National.

Other major fleets are British Airways, Iberia, and various European charter airlines.

The concentration of the 757 in the US means it is largely operated on the longer US domestic routes and longer average sector lengths than its closest competitor, the A321, which mostly operates on intra-European routes.

United, for example, operates average FC times of 2.8FH and generates 3,800FH and 1,360FC each year. German charter carrier Condor operates the 757-200 and -300 into the Mediterranean, and consequently has similar route lengths and utilisations to a US domestic airline. It has a FC time of 2.6FH and generates 3,400FH and 1,300FC per year.

Finnair also uses the 757 for charter operations, and has an average FC time of 3.4FH. The airline generates 3,400FH annually with the aircraft.

Maintenance programmes

Maintenance programmes and style of operation greatly influence resulting maintenance cost in terms of man-hours (MH) and materials per FH.

Although attention is paid to base checks, the large number of line checks performed in a given maintenance cycle multiply total MH used. Labour and MH used in the line checks and the number of line checks performed have a large impact on total maintenance cost. All aircraft require pre-flight and transit checks, performed prior to each flight, and daily checks. Aircraft operating short cycles and low utilisations therefore have a high ratio of these checks per FH.

The number of MH used in line checks has a high impact on the maintenance costs of aircraft analysed here. These aircraft have been designed so most pre-flight and transit checks can be performed by flight crew, except when repairs have to be made, and a mechanic can carry out daily checks.

A320

The A320 family's line check programme is the same with most operators. This consists of a transit check prior to the first flight each day, and a pre-flight check for all subsequent daily flights. Most A320 operators use flight crew for these checks, but repairs and component changes requires inputs from line mechanics. "Labour consumption from mechanics for the operation over the year consumes an average of 0.2MH per pre-flight/transit check," explains Alex Kugler, vice president of aircraft services at SR Technics.

Daily checks are carried out by most operators every 24 hours, but a few have been granted extensions to 48 hours and have an average interval of about 36 hours.

Most A320 operators follow this with a weekly check or 'service' check.

The largest of line checks is the A check. The A320's A check has A1, A2, A4 and A6 multiples, and the A check cycle is completed at the A12 check. The maintenance planning document (MPD) interval for the A check is 500FH, and so the A check cycle is completed at 6,000FH. With typical interval utilisation

Many 737 Classics have been through two base maintenance cycles, and experience will give an indication of what the 737NG will consume in terms of MH and materials. Early estimates indicate the 737NG will consume about 25% fewer MH in its base maintenance cycle.

of 85%, the A12 check is completed at about 5,100FH, which is equal to about two years of operation for most airlines.

Some operators have equalised A check multiples so that the cycle is completed at the A4 check.

The A320's base maintenance programme consists of a C check cycle with a MPD interval of 3,500FH and 15 months. There are C1, C2, C4 and C8 multiples. The C check cycle thus completes at the C8 check, with an interval of 120 months. As with all other Airbus types there are also two structural checks; the IL and D check. These have intervals of five and 10 years. Operators combine the C4 with the IL check and C8 with the D check.

The 15 month interval means operators may be forced to perform the C check during busy operating periods, or have to do checks every 12 months to keep most C check timings during the winter period. Some operators have therefore sought to extend their C check intervals. Mortreux explains that Air France no longer has a calendar limit, and so can use the full 3,500FH interval.

Air Portugal has extended its C check interval to 18 months. While its IL and D check intervals are still five and 10 years, the C check interval allows some flexibility in maintenance scheduling.

SR Technic's C check limit is 18 months, and this benefits from a 4C/IL check interval of 72 months or six years. The C check intervals are all every 18 months, except for the 8C, which is shorter, so it is still at 120 months. Kugler concedes this interval forces an average C check interval of 15 months, but explains that SR Technics aims to extend the 8C/D check interval to 144 months (12 years) so the average C check can be done every 18 months. All its customers will benefit from this interval extension.

737NG

The 737NG's maintenance programme has followed a similar philosophy to the 777. Instead of arranged checks, the MPD has grouped task cards with intervals which are based on phases. Items that are grouped into C checks, for example, have intervals in multiples of 16 months. These are 16 months, 32 months, 48 months, 64 months and 96 months.

The 737NG requires a pre-flight check every FC, and a daily check. The 737NG does not have a weekly check.

There are six A check multiples, with 1A, 2A, 3A, 4A and 6A items and so the cycle is completed at the A12 check. The basic interval is 60 days, 500FH and 350FC whichever arises first. The implications of this are that if annual utilisation is less than 3,000FH, the full 500FH interval cannot be used. An average FC time of 1.4FH prevents the 500FH limit from being fully utilised.

There are five C check multiples, of 1C, 2C, 3C, 4C and 6C. The basic interval is 16 months, 4,000FH and 2,800FC. Like the A check, annual utilisation less than 3,000FH and average FCs of 1.4FH prevents the full 4,000FH interval being fully utilised.

The 6C multiple means the first heavy check is at 96 months (eight years), or 24,000FH. Because the first 737NGs did not enter service until 1998, the first C6 check is not due until about 2006. A heavier check, with all multiple packages, will be performed at the C12 check.

Like the A320, some operators have extended these MPD intervals. KLM has extended its A check interval to 550FH. It has also extended its C check to 5,000FH and 18 months. Not only does this allow greater flexibility in scheduling, it also allows a higher annual utilisation of about 3,300FH while still allowing the full FH limit to be utilised. "We currently have a check about every 17 months. We are also seeking to extend the limit to 24 months," says Poelgeest, "as are many 737NG operators."

757

The 757's maintenance programme is similar to the 767's.

Line maintenance is a series of pre-flight, daily and weekly checks, followed by A checks. The basic A check interval is 500FH, with A1, A2, A4 and A6 multiples. The A12 check completes the cycle, although some operators equalise the A check packages.

The C check items are grouped into system checks (C checks) and structural checks (SC checks). The basic interval for both is 18 months, but the C checks also have another limit of 6,000FH and the SC checks 6,000FC.

Rates of utilisation and average FC times mean the SC interval of 6,000FC cannot be fully utilised, and operators combine the C1 check with the SC1 check.

There are six multiples of C check items; the 1C, 2C, 3C, 4C, 6C and 8C. There are four multiples of SC items: S1C, S2C, S3C and S4C. This results in heavy checks at the 4C/S4C and 8C/second S4C.

Condor has a flexible maintenance programme. "This allows alternating C check intervals of 15 and 21 months, with an average of 18 months. The 4C/S4C is therefore carried out at 72 months (six years)," explains Thomas Decher, technical director of Condor.

Basis for comparison

There is variance between operators in average FC times, annual utilisations, check intervals and utilisation of check intervals. Operators with longer FC times, high annual utilisations, check intervals and utilisation of check intervals

The first base maintenance cycle has been completed by A320s manufactured in the first five or six years of production. MH and material inputs are fairly consistent. The oldest aircraft also indicate that non-routine ratio will increase at a slow rate, resulting in a small climb in maintenance costs.

will have the best maintenance efficiency in terms of MH and materials per FH.

The A320 and 737NG are assumed to both operate at 2,600FH per year and have average FC times of 1.5FH. A check interval for both is 500FH and utilisation is 85%. C checks are at 15 months.

The 757, being used on longer routes, is analysed on the basis of a 2FH average cycle and utilisation of 3,400FH per year. A check interval is 400FH and 85% of this is utilised. C checks are performed every 16 months and 4,500FH, with the C4 at 64 months.

Line check inputs

Line check MH inputs will consist of routine tasks, non-routine items, cabin cleaning, deferred defects and LRU component changes. Few SBs are dealt with in line maintenance, although some small modifications can be made.

A320

Mechanics are required in the event that components have to be changed or defects dealt with. A budget of an average consumption of about 0.2MH for these checks is used. Material and consumable consumption for these checks averages about $15.

Most airlines schedule daily checks to be done overnight at their home base by one mechanic. Because airline schedules result in aircraft being parked at outstations overnight, operators have sought to extend daily check intervals to 36 or 48 hours to avoid the cost of sub-contracting overnight checks.

Daily checks consume in the region of 7-8MH and $40-50 in materials.

Weekly checks use a similar number of MH to the daily checks, but about $140 of materials and consumables.

A checks vary in size and MH requirements due to package multiples. The A6 and A12 are the largest. Some operators equalise the packages to get similar sized checks. Smaller checks, such as the A1, consume only about 80-90MH, while the largest use up to 220MH. Equalised A checks are expected to consume 120-150MH. Material use is in the region of $3,500-4,500.

Total MH consumption for the A check is in the region of 7,400, while materials and consumables total about $130,000. This cycle will be completed in about 5,100FH. This equals 1.4MH per FH and $25 per FH for the materials and consumables for an aircraft generating 2,600FH and 1,700FC annually. At a line labour rate of $70 per MH, this is equal to $100 per FH *(see table, page 34)*.

737NG

The oldest 737NGs have only reached their C3 check. MH and material consumptions for C4 and higher checks in the base maintenance cycle are therefore only estimated.

The inputs for the 737 Classics's first and second base maintenance are well understood, and these can be used as a basis for comparing with the 737NG.

The 737NG uses flight crew for the pre-flight checks, and 0.2MH should be budgeted. Consumption of materials and consumables is about $15.

Daily checks use 7-8MH, but include weekly tasks that have been equalised. Materials and consumables cost $40-50.

Some carriers equalise A checks. "We use about 135MH, which compares to about 190MH for the 737-400," says Poelgeest. "We sub-contract cabin cleaning which requires about another 20MH for both types. Materials and consumables are about $3,500."

The line or A check maintenance cycle will be completed in about 5,100FH. Aircraft which a utilisation of 2,600FH and 1,730FC consume about 7,600MH and $110,000 in materials and consumables. This is equivalent to 1.4MH per FH and $22 per FH. Labour at $70 per MH is a cost of $100 per FH *(see table, page 34)*.

757-200

Like the other types, the 757 can use the flight crew for pre-flight checks. An average of 0.2MH per check should be budgeted for replacing LRUs and other repairs. Consumption of materials and consumables is about $20.

The daily check uses about 8MH, and $60 for materials and consumables. Some carriers, such as Condor, do not have any standard consumption of materials or parts for daily checks.

The weekly or service check can use up to 15MH and $140 of materials and consumables.

Under Condor's programme the light A checks consume about 250MH, while the A6 and A12 checks use 400MH. Average material and consumable consumption is $6,000.

This results in consumption of about 7,400MH over the line maintenance cycle up to the A12 check. Utilisation will be about 5,700FH during this cycle. This is equal to about 1.8MH per FH, and $19 of materials and consumables per FH. Labour rate of $70 per MH makes labour cost equal to $126 per FH *(see table, page 34)*.

Base check inputs

A320

The A320's base maintenance cycle is relatively simple. Light C checks, the C1, C2, C3, C5, C6 and C7 are not combined with the IL and D structural inspections. These light C checks only include the C1 and C2 packages, and some operators equalise these to get even-sized C checks.

The oldest 737NGs are only half-way through their first base maintenance cycles. Inputs for earlier checks and estimates of later checks indicate the 737NG will meet its target of 15% lower maintenance costs than its predecessor. The 737NG's maintenance costs are on the same level as the A320 family.

MH consumption for these checks are relatively light, but varies with differing non-routine ratios.

The non-routine ratio of these light C checks in the first base maintenance cycle is 65-70% for most carriers, although some have recorded lower levels. "We found non-routine ratios were about 50% for the first light C checks," says Hannu Alanen, manager aircraft heavy maintenance at Finnair Technical Services. Some carriers record even lower levels, but these are expected to climb.

MH consumptions for C1/C3/C5/C7 checks are about 1,500-2,000MH, while they are up to 2,800-3,500MH for the C2 and C6 checks. These inputs also include about 100MH for cabin cleaning and 700MH for incorporation of service bulletins (SBs), engineering orders and modifications. Materials and consumables used are $20,000-40,000 depending on MH inputs.

Heavy check inputs are fairly consistent with most operators. The IL/4C and D/8C checks are used by most to perform the majority of SBs and engineering orders, interior and cabin refurbishment, heavy component changes and stripping and painting.

Once aircraft have completed their first D check they start their second base maintenance cycle. The oldest A320s had their D checks in 1998 and 1999, and some have since have their second IL check. Aircraft would expect to have a higher defect or non-routine ratio in their second base maintenance cycle compared to their first. "We have done some second IL/4C checks for a few A320s and they were in excellent condition," says Paddy Ryan, head of engineering and planning at Shannon Aerospace.

Routine MH vary, depending on operators' requirements and how FC-related items are packaged. Ryan estimates routine MH for the first IL/4C check will be 4,000-4,500, including all structural and zonal inspections and A and C package multiples. Defect ratio has been 50-55% on most aircraft at their first IL/4C check, thus generating 2,000-2,200MH. Total routine and non-routine MH will thus be 4,500-4,700.

Ryan expects this ratio to climb to about 0.7-0.8 at the second IL/4C check, and total MH to be about 9,500.

Ryan explains early built aircraft required extensive modifications, especially for the wing rear spar. "These aircraft consumed about 6,000MH for modifications, SBs and engineering orders," says Ryan. "Later built aircraft only require about 1,500MH for modifications, SBs and engineering orders."

"These checks are also used for interior refurbishment, including toilets, galleys, sidewall and ceiling panels, overhead bins and seats. This uses 1,500-1,600MH, although some airlines may only use 1,000MH" Ryan estimates. "The A320 has a barrier coat paint system which makes it hard to remove. The primer has to be sanded, which uses about 800MH. Total for stripping and painting is 2,300MH."

Heavy component changes add a further 300MH. This takes the total MH for a later build aircraft for the first IL/4C check to about 11,600-12,500MH. The range of MH for different operators is 11,000-14,000MH. While Ryan estimates non-routine ratio is 55%, some operators experience higher ratios, adding to MH. High inputs are also incurred for a higher level of modifications and interior refurbishment.

This check will consume $300,000-400,000 in materials and consumables, depending on workscope and level of interior refurbishment.

Routine and non-routine MH of about 9,500MH for the second IL/4C check will take total consumption to about 15,000MH.

Daniel Hoffman, project manager of contracted maintenance aircraft overhaul at Lufthansa Technik estimates the non-routine ratio will increase by about 0.4 between subsequent IL and D checks. The effect of this is to add 3,500-4,000MH between subsequent IL/4C checks. This is equal to about a 30% increase. There will also be an increase in consumables and materials of about $150,000 between subsequent IL/4C checks.

Hoffman also estimates the A321 consumes about 500MH and $100,000 of materials and consumables more than the A320 at the IL/4C check. This is because the A321 has more fuselage frames and requires more inspections. The A319 will have a similar reduction in MH and material consumption compared to the A320 for the same check.

The first D/8C check is a larger package. A similar MH total of 5,800 is required for modifications/SBs (for aircraft that have had major modifications completed), interior refurbishment, stripping and painting and component changes to the IL/4C check.

Ryan explains some aircraft will require additional inspections for the structural sampling programme. This affects the oldest fifth of the fleet, rounded up to the nearest integer. Each variant of the A320 is treated like a separate type. The sampling programme adds about three days to the downtime and 1,000-1,400MH.

"Routine tasks require about 8,000MH depending on the package. This includes the IL check, multiple C check packages and multiple A check packages. Some routine packages are less than 7,000MH" says Ryan. "The D check has a defect ratio of about 0.7-0.8, and so total for routine and non-routine is typically 13,000-14,000. This takes total consumption to about 21,500MH for aircraft in the sampling programme, and 19,000-20,000MH for aircraft not in the sampling programme." Typical range

A320, 737NG & 757-200 HEAVY COMPONENT REPAIR COSTS

Aircraft type	A320	737NG	757-200
FH:FC	1.5	1.5	2.0
Number main wheels	4	4	8
Main tyre retread interval-FC	300	300	300
Nose tyre retread interval-FC	300	250	350
Retread $/main tyre	600	300	350
Retread $/nose tyre	500	175	300
Number of retreads	4	4	3
New main tyre-$	1,000	950	1,000
New nose tyre-$	1,000	500	900
$/FC retread & replace	**13**	**8**	**16**
Main wheel inspection interval-FC	300	300	450
Nose wheel inspection interval-FC	300	250	350
Main wheel inspection-$	1,250	1,250	1,250
Nose wheel inspection-$	900	900	900
$/FC-Wheel repair	**23**	**24**	**27**
Number brakes	4	4	8
Brake repair interval-FC	2,500	3,500	2,500
Brake repair cost-$	45,000	45,000	45,000
$/FC-brake repair	**72**	**51**	**144**
Landing gear interval-years	10	8	8
Landing gear interval-FC	17,300	13,840	13,600
Exchange fee & repair cost-$	340,000	250,000	340,000
$/FC-landing gear repair	**20**	**18**	**25**
Thrust reverser repair interval-FC	12,000	12,000	5,000
Repair & exchange fee-$/unit	170,000	170,000	225,000
$/FC-thrust reverser repair	**28**	**28**	**90**
APU hours repair interval	7,000	8,000	3,800
FC APU repair interval	7,000	8,000	2,900
Shop visit cost-$	200,000	200,000	250,000
$/FC-APU shop visit	**29**	**26**	**86**
Total-$/FC	**185**	**155**	**388**
Total-$/FH	**123**	**103**	**194**

between operators is 17,000-22,000MH, depending on workscope. Material and consumable consumption varies in line with MH use, and is $400,000-600,000.

Labour consumption totals 37,000-45,000MH for eight checks in the first base maintenance cycle. Annual utilisation of 2,600FH and C check interval of 15 months means the base maintenance cycle will be completed after about 26,000FH. An airline with high utilisation, such as United, will complete the cycle in about 33,000FH. MH consumption will thus be 1.4-1.8MH per FH. At a labour cost of $50 per MH, this is equal to $70-90 per FH. Material consumption will be $800,000-1,100,000, equal to between $30 and $45 per FH *(see table, page 34)*.

MH in the second cycle are predicted to be 30-40% higher because of more routine tasks and higher non-routine ratios.

737NG

C check consumptions for the 737 Classics in their first base maintenance cycle of seven C checks totals about 36,000-38,000MH. The 737 Classics' maintenance programme is a system of six light C checks and a heavy C7 check at an MPD interval of 3,200FH and actual interval in the region of 2,700FH. The base maintenance cycle will thus be completed in about 19,000FH. Some operators will have extended intervals.

The C7 check consumes 18,500-20,000MH, while lighter C checks use 2,500-3,300MH. This equals about 1.9MH per FH. At $50 per MH this equates to $90.

Materials and consumables used in the lighter C checks will be $30,000-125,000. The heavy C7 check will use $450,000-500,000, since interior refurbishment and stripping/painting is included in this check. Total material and consumable consumption for the base maintenance cycle is $900,000, equal to $48 per FH.

The 737NG's 16 month MPD interval for the C check means an aircraft generating about 2,600FH and achieving a C check about every 15 months would complete the base maintenance cycle (at the C6 check) after 19,500FH. C check inputs are only known for the C1, C2 and C3 checks. These are 1,800-2,800MH. The C6 check is expected to consume in the region of 16,000-18,000MH.

Although the 737NG is too young at this stage to make accurate predictions of MH used in all C checks in the base maintenance cycle, an approximate estimate is 30,000MH. The cycle will be completed in 20,000-24,000FH, depending on annual utilisation, and so MH consumption will be equal to about 1.25-1.50MH per FH. This is a large improvement on the 737 Classics.

757-200

The base maintenance cycle of the four C checks will be over a period of five and a half to six years. This will be 18,000-20,000FH, depending on annual utilisation. MH consumption, during the first base maintenance cycle, will be about 3,450MH for the C1 check. "This is based on about 1,600MH for routine work and a non-routine ratio of 55-60%, although non-routine ratios can vary widely between different aircraft. About another 400MH are added to each C check for cleaning and 500MH for SBs, modifications and engineering orders," explains Peter Cooper, senior planning engineer at Shannon Aerospace. About $35,000 is used in materials and consumables. The C3 check uses the same labour and materials/consumables.

"The second C check uses about 2,200MH for routine work and has a similar non-routine ratio. With extra MH for cleaning and SBs total consumption rises to about 4,400MH. Materials and consumables total about $40,000."

The C4 check uses about 4,400MH for routine items and has a defect ratio of about 65% in the first base maintenance cycle. A larger package of SBs and modifications are installed in the C4 check. Interior refurbishment will use 1,500-2,000MH, while stripping and painting will add 2,000MH, taking the total for the check to about 12,000MH. This can be as high as 13,500MH for a higher workscope and interior refurbishment package. Materials and consumables used will be $475,000-600,000, depending on interior refurbishment and non-routine ratio.

A320 FAMILY, 737 CLASSIC/NG & 757 FLIGHT HOUR AIRFRAME AND COMPONENT MAINTENANCE COSTS

Aircraft	A320	737 Classic/ 737NG*	757-200
FH/Year	2,600	2,600	3,400
FC/Year	1,730	1,730	1,700
FH:FC	1.5	1.5	2.0
Line & light maintenance MH/FH @ $70/MH	100	100	126
Line & light maintenance material costs-$	25	22	19
Base maintenance MH/FH @ $50/FH	80	90*	65
Base maintenance material costs-$	40	48*	37
Total line & base maintenance-$/FH	**245**	**260**	**247**
Heavy components-$/FH	**123**	**103**	**194**
LRU & rotables-$/FH			
Rotable home base capital cost	27	27	22
Pooling fee	45	40	60
Maintenance & repair	115	105	144
TOTAL AIRFRAME & COMPONENT-$/FH	**555**	**535**	**667**

*** Data is for 737 Classics. All other 737 data is for 737NG**

This level of consumption totals about 24,000MH and in the region of $600,000 for the first base maintenance cycle. This is equal to about 1.3MH per FH and $35 per FH. A labour rate of $50 per MH generates a labour cost of $65 per FH *(see table, this page)*.

The 757's MH consumption rises in the second base maintenance cycle. Routine MH increase, and non-routine ratio also rises to 0.9-1.0 for the heavier C2 and C4 checks. MH consumption rises to about 34,000, and material and consumable uses increase to about $850,000. This takes consumption per FH to about 1.9MH and $50.

Heavy components

The costs per FH for the repair of heavy components are summarised *(see tables, page 32 & this page)*. These are for the five main heavy component types of wheels, brakes, landing gear, thrust reverser and auxiliary power unit (APU). These components have their own maintenance programmes or are repaired on an on-condition basis.

The repair costs for these components are based on typical removal intervals and repair costs. Most cost are FC related, and the resulting cost per FH will depend on the FH:FC ratio in actual operation.

The A320 has higher costs than the 737NG. This is mainly due to higher tyre retread and replacement costs and shorter brake repair interval.

Rotables & LRUs

These aircraft have line replaceable unit (LRU) rotables, rather than the timing of the repair of units being phased with heavy checks. There are many ways airlines can access stock and organise the repair and management of their inventory. Airlines with relatively small fleets will keep a minimum stock at their home base and pay an access fee to a third-party supplier for the remainder of the stock. A flat rate fee per FH will be paid for the repair and management of all the rotables.

As fleets grow in size, it becomes more economic to own more items in the home base stock and pay an access fee for a smaller number of parts.

This analysis considers fleets of 10 aircraft of each type. The stock an airline would hold at its home base would be the minimum equipment list (MEL), plus a stock of parts which have high failure rates or high transport costs. The remainder of items would be accessed from a pooling partner.

Lufthansa Technik provides pool access for rotables for all three types analysed here. Joerg Asbrand, manager of aircraft component services at Lufthansa Technik estimates the capital cost of home base inventory will be $7 million for the A320, $7.3 million for the 737NG and $7.5 million for the 757-200. Depreciated over 15 years at an interest rate of 6% results in costs per FH of $22 for the 757 and $27-28/FH for the A320 and 737NG *(see table, page 34)*.

Airlines would then pay a pool access fee of $45/FH for the A320, $40/FH for the 737NG and $60/FH for the 757. The 737 has lower cost rotables compared to the A320.

Similarly, the repair and management fee for the A320 is higher than for the 737NG. The A320's fee is $115/FH, the 737NG's $105/FH and 757-200's $144/FH.

The total of the three elements for access to, and repair of, LRUs and rotables is $187/FH for the A320, $173/FH for the 737NG and $226/FH for the 757-200.

Summary

The resulting costs per FH for the three aircraft *(see table, this page)* show the A320 and 737 are close. The 737's costs, however, are based on base maintenance inputs of the 737 Classics and the inputs for the 737NG in all other cost elements. The 737NG's base maintenance inputs should result in lower costs per FH, which will give it an advantage over the A320 family.

The costs in the table, however, indicate there is little difference between the A320 and 737 families when all elements of airframe and component maintenance are taken into consideration.

The 757 benefits from economies of scale in terms of light and base maintenance inputs, since these are similar per FH compared to the A320 and 737. If the 757 had been compared against these smaller aircraft families on the basis of the same FH utilisation and FH:FC ratio, the 757's costs per FH would be higher, indicating the effect of its size.

The 757's larger size is shown by its higher heavy component costs. Some of this, however, is due more to its older technology, such as thrust reversers and APU *(see table, page 32)*. The 757's older technology is also reflected by its higher repair and maintenance costs for LRU components *(see table, this page)*. The 757 is more efficient on a per seat basis. AC