Despite being overshadowed by the NG family, there are still 1,900 737 Classics in operation. The aircraft has now become an important player in the used market, making a sufficient level of technical support imperative in many regions of the world. Technical support providers are surveyed.

737 Classic global support providers

This global survey summarises the major aftermarket and technical support providers for the 737-300/-400/-500 family and associated CFM56-3 series engine. It lists the world's major providers of all levels of technical support for the aircraft, its engines and components. It is grouped into seven sections covering the main categories of technical support offered. The categories and the major providers offering the relevant types of support are as follows:

1. Engineering Management and Technical Support *(see table, page 46)*;
2. Line maintenance and in-service operational support *(see table, page 48)*;
3. Base Maintenance *(see table, page 49)*;
4. Engine Maintenance *(see table, page 50)*;
5. Spare Engine Support *(see table, page 53)*;
6. Rotables and Logistics *(see table, page 54)*; and
7. Heavy Component Maintenance *(see table, page 57)*.

Some of the technical support providers are listed in most, if not all, of the seven sections and could be termed as 'one-stop-shop' service providers for the 737 Classic family. This means that they provide most of the technical support services that a third-party customer would require. The tables show the range of services that these facilities are capable of offering. For each of the seven levels of technical support there are many sub-categories. The tables reveal for each provider how comprehensive their support is, and in some cases the volume of support they are able to provide. An example is base maintenance support, where their annual capacity for base checks is listed.

The major maintenance providers that offer a one-stop-shop service are: AAR Aircraft Services; Ameco Beijing; Bedek Aviation; flyLAL Technics; Gameco; GMF AeroAsia; Lufthansa Technik; ST Aerospace; TIMCO; and United Services.

Major engine maintenance providers are: Bedek Aviation; GE Engine Services (GEES); MTU Maintenance; Lufthansa Technik; P&W Engine Services (PWES); Snecma Services; and United Services.

Due to the financial, personnel, time and tooling costs of certain specialist jobs, none of the facilities are able to offer every single listed capability, although the largest providers come close. Turkish Technics is one of the few facilities able to offer almost every aspect of technical support listed in the survey, even though it has less than 1% of the base maintenance market share according to ACAS. Other maintenance, repair and overhaul (MRO) and technical support providers that are capable of carrying out virtually all support aspects are: Bedek Aviation; SR Technics; Lufthansa Technik; and KLM Engineering & Maintenance.

The 737 Classic fleet is still operated in large numbers. The fleet has started to migrate from first-tier operators to secondary users. Large numbers have been transferred from North America and West Europe to East Europe and the Asia Pacific.

737 Classic fleet

There are currently 1,906 737-300, -400 and -500 aircraft in operation with 237 operators. Although the number of 737 Classic aircraft will not increase, so many are in operation that this means it is not a maintenance market that can be

ENGINEERING MANAGEMENT & TECHNICAL SUPPORT

Maintenance Provider	Outsourced engineering service	Design organisation approval	Mtce records manage	Documents & manuals manage	Mtce programme manage	Reliability stats	ADs, SBs, & EOs manage	Check plan & job card manage
AAR Aircraft Services	Y		Y	Y	Y	Y	Y	Y
Air Asia			Y	Y			Y	Y
Air France Industries/ KLM E&M	Y	Y	Y	Y	Y	Y	Y	Y
Ameco Beijing	Y	Y	Y	Y	Y	Y	Y	Y
ATC Lasham, Southend			Y	Y	Y	Y	Y	Y
Aveos		Y			Y	Y	Y	Y
Bedek Aviation		Y	Y	Y	Y	Y	Y	Y
AEI/CommercialJet	Y		Y	Y	Y		Y	Y
Boeing CAS		Y		Y	Y	Y		
Coopesa	Y	Y	Y					Y
EMS & Europe Aviation	Y		Y	Y	Y	Y	Y	Y
flyLAL Technics	Y		Y	Y	Y	Y	Y	Y
Fokker Services	Y	Y	Y	Y	Y	Y	Y	Y
GA Telesis		Y	Y					
GE Engine Services	Y	Y	Y	Y	Y	Y	Y	Y
Goodrich	Y	Y	Y	Y	Y	Y	Y	Y
Icelandair Technical Services		Y	Y	Y	Y	Y	Y	Y
KLM UK Engineering								Y
Lufthansa Technik		Y	Y	Y	Y	Y	Y	Y
MNG Technic	Y		Y	Y	Y			Y
MTU Maintenance	Y	Y	Y	Y	Y	Y	Y	Y
MyTechnic	Y		Y	Y	Y	Y	Y	Y
P&W Engine Services					Y			
Sabena Technics	Y	Y	Y	Y	Y	Y	Y	Y
SR Technics	Y	Y	Y	Y	Y	Y	Y	Y
ST Aerospace	Y	Y	Y	Y	Y	Y	Y	Y
Stella Aviation	Y		On req.	On req.	On req.			Y
Storm Aviation Group	Y							
TAP M&E	Y	Y	Y	Y	Y	Y	Y	Y
Thai Airways			Y	Y	Y	Y	Y	Y
Turkish Technic	Y	Y	Y	Y	Y	Y	Y	Y
VEM M&E	Y		Y	Y	Y		Y	Y

Maintenance Provider	Aircraft config & IPC	Total tech support	Engine trend monitor	Flight data monitor	Aircraft accept & return	Continuing airworthiness approval	Approvals held
AAR Aircraft Services	Y	Y			Y	Y	FAA/EASA
Air Asia	Y	Y					FAA/EASA
Air France Industries/KLM E&M	Y	Y	Y	Y	Y	Y	EASA +30 others
Ameco Beijing	Y	Y	Y	Y	Y	Y	CAAC
ATC Lasham, Southend			Y	Y	Y	Y	EASA/FAA + others
Aveos	Y	Y	Y			Y	FAA/EASA
Bedek Aviation	Y	Y	Y	Y	Y	Y	FAA/EASA
AEI/CommercialJet	Y	Y			Y	Y	FAA/EASA + 4 others
Boeing CAS						Y	EASA/FAA + others
Coopesa	Y						FAA
EMS & Europe Aviation	Y	Y	Y	Y	Y	Y	FAA/EASA + TCAC & Bermuda
flyLAL Technics		Y	Y	Y	Y	Y	FAA/EASA
Fokker Services	Y	Y	Y	Y	Y	Y	FAA/EASA
GA Telesis					Y		FAA/EASA + 3 others
GE Engine Services	Y	Y	Y		Y		FAA/EASA + 30-40 others
Goodrich	Y	Y	Y	Y	Y	Y	FAA/EASA
Icelandair Technical Services	Y	Y	Y		Y	Y	FAA/EASA
KLM UK Engineering		Y			Y		EASA/BDA
Lufthansa Technik	Y	Y	Y	Y	Y	Y	EASA
MNG Technic		Y			Y		EASA/FAA/GACA/Bermuda
MTU Maintenance	Y	Y	Y			Y	FAA/EASA
MyTechnic	Y	Y	Y	Y	Y		FAA/EASA
P&W Engine Services			Y		Y		FAA/EASA + others
Sabena Technics	Y	Y	Y	Y	Y	Y	FAA/EASA
SR Technics	Y	Y	Y	Y	Y	Y	FAA/EASA/CAMO
ST Aerospace	Y	Y	Y	Y	Y	Y	FAA/EASA /CAAS
Stella Aviation	On req.				Y	Y	EASA + 2 others
Storm Aviation					Y		EASA
TAP M&E	Y	Y	Y	Y	Y	Y	EASA/FAA + OTHERS
Thai Airways	Y	Y	Y	Y	Y	Y	EASA/FAA/THAI DCA
Turkish Technic	Y	Y	Y	Y	Y	Y	FAA/EASA
VEM M & E	Y	Y	Y	Y	Y	Y	FAA

LINE AND LIGHT MAINTENANCE SUPPORT

Maintenance Provider	Maint ops ctrl	Off-site & off-line AOG	Line checks	A checks	Eng LRU & QEC change	Engine changes	Ldg gear changes	APU changes	Thrust rev changes	Despatch relia stats	Approvals held
AAR Aircraft Services		Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA
Aeroman					Y	Y	Y	Y	Y		FAA/EASA
Air Asia	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA
Air France Industries / KLM E&M	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA
Ameco Beijing	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA
ATC Lasham, Southend				Y	Y	Y	Y	Y	Y	Y	FAA/EASA +11 others
Bedek Aviation	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA +12 others
AEI/Commercial Jet		Y	Y	Y	Y	Y	Y	Y	Y		FAA/EASA + 4 others
Coopesa			Y	Y	Y	Y	Y	Y	Y		FAA
EMS & Europe Aviation	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	EASA/FAA
ExelTech Aerospace	Y	Y	Y	Y	Y	Y	Y	Y	Y		FAA
flyLAL Technics	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Lithuania & Bermuda
Fokker Services				Y	Y	Y	Y	Y	Y	Y	EASA/FAA
GA Telesis					Y				Y		EASA/FAA
GE Engine Services					Y	Y					EASA/FAA
Goodrich									Y		FAA
Icelandair Technical Services	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	EASA/FAA
KLM UK Engineering		Y	Y	Y	Y	Y	Y	Y	Y		EASA
Lufthansa Technik	Y	Y	Y	Y	Y	Y	Y	Y	Y	Soon	FAA/EASA
MNG Technic			Y	Y	Y	Y	Y	Y	Y		EASA/FAA GACA/ Bermuda
MyTechnic	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	EASA
P&W Engine Services					Y	Y					EASA/FAA
Sabena Technics	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	EASA/FAA
SR Technics	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	EASA
ST Aerospace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	EASA/FAA
Stella Aviation	Y	Y	Y	Y	Y	Y		Y	Y		EASA +2
Storm Aviation	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	EASA
TAP M&E	Y	Y	Y	Y	Y	Y	Y	Y	Y		EASA/FAA
Turkish Technic	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	EASA/FAA
United Services	Y	Y	Y	Y	Y	Y	Y	Y	Y		FAA
VEM M&E	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA

ignored. The average age of this fleet is nearly 17 years, while the oldest aircraft are now 25 years old and the youngest are nine. All aircraft are therefore mature in maintenance terms, so the fleet will have a higher maintenance requirement in the future. Four passenger-to-freighter conversion programmes for the 737-300/-400, are offered by Boeing, Bedek Aviation, Aeronautical Engineers Inc (AEI) and Pemco, so a growing number of 737-300s and -400s will be converted.

The largest sub-fleets are operated in Europe (670 aircraft), North America (596), and the Asia Pacific (430). The type is operated in relatively small numbers in South America (111), Africa (84), and the Middle East (17).

As a short-haul aircraft, maintenance at all levels for its airframe, engine and components is likely to be kept at a regional level. Most airlines will therefore not ferry their aircraft or engines to other continents because of the prohibitive cost of sending them over long distances. The largest levels of technical support are therefore found in North America, Europe and the Asia Pacific where the largest fleets are operated.

The biggest fleets in North America are currently operated by Alaska Airlines (39), Continental Airlines (98), Southwest (212), United (89) and USAirways (76). The fleet profile in the US will change over the next few years. United, for example, announced in 2008 that it will retire 50 737-300s, and other majors will update their fleets. This is likely to result in a migration of a large number of aircraft from the US to South America, Eastern Europe and Russia, Africa and parts of the Asia Pacific.

Many of the European fleets are still with their original operators: including British Airways (29), bmi (20), Czech Airlines (20), KLM (23), Lufthansa (63), Olympic Airways (18) and SAS (17). There is also a large number of small and start-up European airlines that have acquired 737 Classics over the past few years, including: Jet2.com, which now operates 21; Blu Express; Corendon Air; Fly Ant; Jetairfly; Saga Airlines; and Sky Airlines. There are also several Eastern European and Russian carriers, which include: the Aeroflot group of airlines, Aerosvit; Air Baltic; Belavia; Central Wings; Dniproavia; Georgian Airways; KD Avia; Orenair; Roosiya; S7; Smart Wings; Sky Express; and Yamal.

This shift in a large portion of the global fleet to Eastern Europe, Russia and the CIS countries indicates a strong and growing market for 737 Classic technical support and MRO in these areas.

The large fleets in the Asia Pacific still with their original carriers are operated by: Air New Zealand (16), All Nippon Airways (8), Asiana (9), Garuda (39), JAL Express (8), Japan Transocean Air (15), Merpati (8), Qantas (18), and Thai International (7). Airlines in China also

BASE MAINTENANCE SUPPORT

Maintenance Provider	C checks	D& heavy checks	Interior refurb	Strip & paint	Types of back shop	No of base check bays	No of mechanics	No of shifts	Weekend shifts	Annual capacity base checks	Approvals held
AAR Aircraft Services	Y	Y	y	Y	Extensive	25	2,000+	3	Y	Up to 100	FAA/EASA
Aeroman	Y	Y	Y	Y	NDT/Avionics / composites /hydraulics / pneumatics /heat treatment / machining /plastics / upholstery	6	660	2	Y	1.3m MH	FAA/EASA
AIR ASIA	Y	Y	Y	Y	Y	3	110	1	1	Y	8
Air France Industries / KLM E&M	Y	Y	Y	Y	Mechanical/hydraulic / sheetmetal/cabin	2	180	3	Y	2.5m MH	FAA/EASA
ATC Lasham, Southend	Y	Y	Y		Extensive	8	256	3	Y	650,000MH 40 checks	FAA/EASA +11 others
Aveos	Y	Y	Y	Y	All			3	Y		FAA +others
** Bedek Aviation	Y	Y	Y	Y	All	9-12	300-350	3	2	100	FAA/EASA +12 others
** AEI / Commercial Jet	Y	Y	Y	Y	Sheetmetal/seats/ interior /avionics	9	230	2	Y	40+	FAA/EASA +others
Coopesa	Y	Y	Y	Y	Y	6	350	2	2	520,000MH	FAA
Delta TechOps				Y	Partial	20	3,500	3		250,000MH	FAA/EASA
EMS & Europe Aviation	Y	Y	Y	Y	Structure & Cabin	5	80	2	On req.	4 Bays	EASA
ExelTech Aerospace	Y	Y	Y		N/A	N/A	N/A	N/A	N/A	N/A	FAA
flyLAL Technics	Y	Y	Minor			4	50+	2	Y	Y	Lithuania CAA & Bermuda
Fokker Services	Y	Y	Y	Y	All	5	170	2	-	20 Each	EASA/FAA
Icelandair Technical Services	Y	Y	Y		Avionics/W&B	2					
KLM UK Engineering	Y	Y	Y	Y	All	5	350	4-	Y	250,000MH	EASA/BDA
Lufthansa Technik	Y	Y	Y	Y	All	18	4,000	2	Y	540 Checks / 100 D checks	FAA/EASA
MNG Technic	Y	Y	Y	Y		4	450	1	1	70	EASA/FAA/ GACA/Bermuda
MyTechnic	Y	Y	Y	Y		12	200, 1,000 in 3yrs	1 1		80 80	EASA/Bermuda DCA/Egyptian CAA/Saudi GACA
** Pemco World Air Services	Y	Y	Y	Y	Heat treating, sheet metal, Hydraulics, Pneumatics, NDT, interiors, avionics	23	1,150	3	Y	1.9m MH	EASA/FAA CAAC + others
Sabena Technics	Y	Y	Y	Y	Avionics/W&B/ Electromechanical/Structural/ Pneumatics/Hydraulics/ Landing gear	20	1,200	3	Y	700	FAA/EASA
SR Technics	Y	Y	Y		Sheetmetal/Trim/ Composite/Machine shop	9	397	2	Y	750,000MH	EASA
ST Aerospace	Y	Y	Y	Y	All	30+	3,000+	2	Y	Customised	FAA/EASA +others
TAP M&E	Y	Y	Y	Y	Sheetmetal Machining Cabin/Emergency/ W&B/Composite	10	436	10	3	40	EASA
Turkish Technic	Y	Y	Y	Y	Sheetmetal/cabin/ composites/electrics/ structural	7	1,920	3	Y	Y	10+
VEM M&E	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA

** Also provide passenger-to-freighter conversions.

ENGINE MAINTENANCE

Maintenance Provider	Engine maint mgt	Scheduled on-wing engine maint.	Unscheduled on-wing maint.	Engine shop visits	Parts repair scheme	Total Care Packages	Level of test cell capabilities	Aviation Authority Approvals
AAR Aircraft Services		Y	Y					
Air France Industries / KLM E&M	Y	Y	Y	Y	Y	Y	Full test cap	
ATC Lasham, Southend		Y	Y					
Aveos	Y	Y	Y	Y	Y	Y		FAA
Bedek Aviation	Y	Y	Y	Y	Y	Y	Up to 100,000lbs	FAA/EASA CAAC +10
Chromalloy	Y				Y			FAA/EASA+other
AEI / Commercial Jet	Y	Y	Y					FAA/EASA + 4
Coopesa		Y	Y					
Delta TechOps	Y	Y	Y	Y	Y	Y	Complete	FAA/EASA
EMS & Europe Aviation	Y	Y	Y	MGT				
ExelTech Aerospace		Y						FAA
flyLAL Technics	Y	Y	Y					Lithuania & Bermuda
GA Telesis					Y			
GE Engine Services	Y	Y	Y	350+ Per/YR	Y	Y	Up to GE90	30-40
Goodrich					Y			
Icelandair Technical Services	Y	Y	Y			Y		FAA/EASA
KLM UK Engineering		Y	Y					EASA/BDA
Lufthansa Technik	Y	Y	Y	Y	Y	Y	65,000lbs	EASA/FAA +130thers
MTU Maintenance	Y	Y	Y	Y	Y	Y		FAA/EASA
MyTechnic	Y	Y	Y					EASA
P&W Engine Services	Y	Y	Y	Y	Y	Y		FAA/EASA/CAAC
Snecma Services	Y	Y	Y	Y	Y			FAA/EASA
SR Technics	Y	Y	Y	250+	Y	Y	CFM56/PW4000	EASA/FAA
ST Aerospace	Y	Y	Y	Y	Y	Y	Full	FAA/EASA/ CAAS/CAAC /DGCA
TAP M&E	Y	Y	Y	Y	Y	Y	72,000lbs	EASA/FAA/ Brazil RBHA/ Canada TCCA/ Uruguay RAU/ Argentina RAAC
Turkish Technic	Y	Y	Y	Y	Y	Y		EASA
United Services		Y	Y	Y	Y			
VEM M&E	Y	Y	Y	Y	Y			FAA

collectively operate about 120 737 Classics.

A large number of start-up airlines have collectively acquired more than 100 737 Classics over the past 10 years, including: Air Next; Batavia; Hokkaido Air; Indonesia Air Asia; JetConnect; Lion Airlines; Nok Air; Skynet Airways; and Thai Air Asia. Some of these carriers are likely to be in the market for more aircraft.

There are also several new airlines in Africa and the Middle East. In Africa these include: Aero Contractors Nigeria; Alexandria Airlines; Arik Air; Jet4you; Karthago Airlines; and PrecisionAir. These airlines operate 32 aircraft between them, which means that the size of the African 737 Classic fleet has nearly doubled in recent years.

New Middle Eastern operators include: Aurora Aviation; Ave.com; Eastok Air; Safi Air; SAMA; and Silver Air. These have 17 737 Classics between them, which account for all examples of this type in the region.

The 737 Classic used market is clearly active, and the next 10 years will see a further migration of aircraft from major airlines in North America, Western Europe and the Asia Pacific to small and start-up operations in Eastern Europe, Africa, South America, the Middle East and the Asia Pacific.

Engineering management

Many of the large independent MRO providers and larger airline maintenance and engineering departments are able to offer engineering management services. Engineering management functions are those tasks that have traditionally been kept in-house. Airlines are legally required to have a technical director and other senior engineering personnel, and are responsible for the continued airworthiness of their aircraft. They also like to maintain control of the maintenance of their aircraft, and constantly be aware of the maintenance status of each fleet member. All engineering management functions can nevertheless be sub-contracted, while airlines are still able to constantly monitor the maintenance status of their aircraft and maintain responsibility for the continued airworthiness of their fleet.

These management functions include: outsourced engineering service; design organisation approval; maintenance records management; documents and manuals management; maintenance programme management; keeping reliability statistics; managing airworthiness directives (ADs) and service bulletins (SBs); airframe check planning and job card management; aircraft configuration and illustrated parts catalogue (IPC) management; total technical support; engine trend monitoring; flight data monitoring; aircraft acceptance and return services; and continuing airworthiness approval.

Most of the providers listed are able to provide most of these services, and there are several that are able to provide comprehensive engineering management coverage for all management functions. These include: Air France Industries and KLM Engineering & Maintenance; Ameco Beijing; Bedek Aviation; Fokker Services; Goodrich; Lufthansa Technik; Sabena Technics; SR Technics; ST Aerospace; TAP Maintenance & Engineering; and Turkish Technic *(see table, page 46)*.

There are also several specialist engine maintenance providers that offer most or all of these services, although only for the

Maintenance providers are a combination of traditional MROs and airline maintenance divisions, and new-entrant MROs that are setting up in parts of the world that can provide a combination of a skilled workforce and competitive labour rates.

management functions related to engine maintenance. These include GEES, MTU Maintenance and PWES.

There are 237 operators of these aircraft around the world, and the majority operate fleets of 10 aircraft or fewer. These operators are likely to require outsourced engineering and technical management and support.

Another issue is the proportion of the fleet that is owned and leased. A large proportion of the European fleet is currently with their legal owner and between leases. This means that the management and support of aircraft return and acceptance services is important in Europe. This is echoed in the maintenance providers. The vast majority in this section are European, in addition to those that have global locations including Europe.

The Eastern European fleet is one of the fastest growing, and maintenance providers such as flyLAL Technics in Lithuania and MyTechnic in Turkey offer a wide range of capabilities and competitive labour rates.

A large portion of the North American fleet is also leased, and acceptance and return services will also be important when airlines divest their aircraft or terminate leases of older aircraft.

The Asia Pacific fleet is the third largest, but is also growing fast. The major maintenance organisations in the Asia Pacific include Ameco Beijing and ST Aerospace, as well as airlines' engineering departments such as Air Asia, Air New Zealand and Thai Airways. These companies are well placed to take advantage of the growing 737 Classic fleet.

Line & light maintenance

Line and light maintenance is obviously performed on an airline's network, and so is provided by a local supplier. The global operation of 1,900 aircraft means that not all line maintenance providers can be listed. Large airlines perform a lot of their own line maintenance at their home bases and outstations, and also provide line maintenance to a lot of smaller airlines. There are also some specialist line maintenance organisations. One example is the European Maintenance Solutions (EMS) group of companies that includes Louro, Stella Aviation and Europe Aviation. EMS and its members provide independent line maintenance at a large number of European airports for a range of aircraft types, including the 737 Classics.

There is a growing number of these specialist line maintenance providers, and Storm Aviation in the UK is another example. It says it can have a line maintenance operation up and running for a client anywhere in the world in a matter of weeks. This means that more remote areas, such as Africa, where the number of maintenance companies is limited, can still have basic maintenance available for their aircraft locally, even if more heavier maintenance is done by other providers on other continents.

Bedek Aviation, which is located in Israel, provides a total support package for Eastern European and South American customers. Bedek provides line maintenance services teams at the operators' home bases.

Many of the companies that offer engineering management services also offer line maintenance support, which includes: maintenance operations control; off-site and on-site aircraft-on-ground (AOG) services; line checks and A checks. It also includes changing various heavy rotables, which comprise: engine line replaceable units (LRU); quick engine change (QEC) kits; engines; landing gears; auxiliary power units (APUs); and thrust reversers. Line maintenance management also requires despatch reliability statistics to be kept.

Most of the providers listed offer most or all of the different levels of line maintenance support. These include: AAR Aircraft Services; Air Asia; Air France Industries and KLM Engineering & Maintenance; Ameco Beijing; Bedek Aviation; AEI/CommercialJet; EMS and Europe Aviation; flyLAL Technics; Lufthansa Technik; MyTechnic; Sabena Technics; Turkish Technic; and United Services.

Base maintenance

Base maintenance comprises: C checks; heavy or D checks; repair and maintenance of aircraft structures and components in backshops; interior refurbishment; modifications; and

stripping and repainting.

The global distribution of the MRO providers that offer these services closely matches the geographical fleet profile. Some airline engineering & maintenance divisions are leaving the 737 Classic market, however, as their parent airlines phase out their fleets. The maintenance departments have then switched their attention to younger types such as the A320 family and 737NG. The market is also becoming more competitive, and MROs need to offer a wider range of services, have a large number of mechanics and operate a high number of shifts to provide quicker turnaround times for base checks.

Sabena Technics, for example, offers a wide variety of back-shop support, even though it only has less than 1% of the global base check market. Delta TechOps, Sabena Technics and ST Aerospace are the facilities with some of the most mechanics, shift options and base check bays. Despite this, according to ACAS, they have low market shares for the 737 Classic base maintenance.

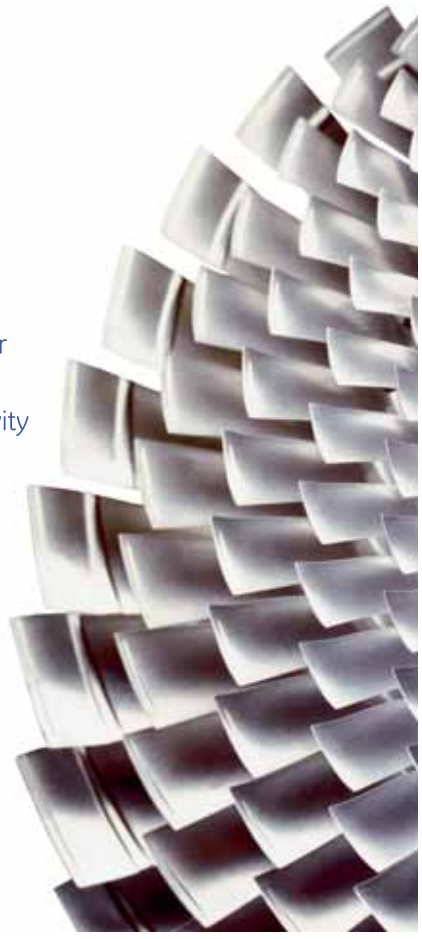
Up to 36% of the C check and 19% of the heavy check market is still completed in-house by airline maintenance departments. The market is spread between all the players, and most facilities have less than 2% of the market. Lufthansa Technik is a big player, with 5.5% of C checks and nearly 7% of the heavy checks market. It has up to 18 base check bays in its global network.

The other big player is AAR Aircraft Services, which completes 17.5% of the heavy checks market. This is hardly surprising, given that it has 25 base check bays across all its facilities.

Bedek Aviation is a large facility, but has less than 1% of the C and D checks

SPARE ENGINE SUPPORT

Maintenance Provider	AOG Services	Short-term leases	Medium /long-term leases	Engine pooling
AAR Aircraft Services	Y	Y	Y	Y
AerCap	Y	Y	Y	
Air France Industries / KLM E&M	Y	Y	Y	Y
AJ Walter	Y	Y	Y	Y
Aveos	Y	Y	Y	Y
Avtrade	Y	Y	Y	Y
Bedek Aviation	Limited			Y
AEI / Commercial Jet	Y			
Delta TechOps		Y	Y	
ExelTech Aerospace		Y		
flyLAL Technics	Y	Y	Y	
GA Telesis	Y	Y	Y	Y
GE Engine Services	Y	Y	Y	Y
Lufthansa Technik	Y	Y	Y	Y
MacQuarie Aviation Capital			Y	
MTU Maintenance	Y	Y	Y	Y
P&W Engine Services	Y	Y	Y	Y
SR Technics	Y	Y	Y	Y
ST Aerospace	Y	Y	Y	
TAP M&E	Y	Y	Y	Y
Turkish Technic	Y	Y	Y	Y
United Services	Y	Y	Y	
VEM M&E	Y	Y	Y	
Willis Lease	Y	Y	Y	Y



ROTABLES AND LOGISTICS

Maintenance Provider	Rotable inventory initial provisioning estimates	Rotable inventory leasing	Rotable inventory pooling	Consumables inventory	Repair & Document mgt	AOG Support	24 hour support	Fixed cost per FH full rotable support contracts	Aviation Authority Approvals
AAR Aircraft Services	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA
Aeroman				Y					FAA/EASA
Air France Industries/ KLM E&M	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA
AJ Walter	Y	Y	Y	Y	Y	Y	Y	Y	NO
Avtrade	Y	Y	Y	Y	Y	Y	Y	Y	EASA
Bedek Aviation	Y	Y	Limited	Y	Y	Y	Y	Y	FAA/EASA
AEI / Commercial Jet	Y			Y	Y	Y	Y		FAA/EASA +4
Boeing CAS	Y	Y	Y	Y	Y	Y	Y		FAA/EASA
Coopesa				Y					FAA
EMS & Europe Aviation				Y		Y	Y		N/A
flyLAL Technics		Y	Y	Y	Y	Y	Y		Lithuanian / Bermuda
Fokker Services	Y	Y	Y	Limited	Y	Y	Y	Y	PART145 FAR145
GA Telesis	Y	Y	Y	Y	Y	Y	Y	Y	EASA/FAA
Goodrich	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA
KLM UK Engineering				Y	Y	Y	Y		EASA/BDA
Lufthansa Technik	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA/ Canada/ Australia /India/China
MNG Technic				$1M					
MTU Maintenance	Y	Y	Y	Y	Y	Y	Y	Y	EASA/FAA
MyTechnic	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA
P&W Engine Services	Y	Y	Y		Y	Y	Y	Y	
Sabena Technics	Y	Y	Y	Y	Y	Y	Y	Y	EASA/FAA
SR Technics	Y	Y	Y	Y	Y	Y	Y	Y	EASA
ST Aerospace	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA/ CAAS +others
Stella Aviation	Y	Some	Per contract	Y	Y	Y	Y		EASA +2
TAP M&E	Y		Partial	Y	Y	Partial	Y	Y	EASA/FAA
Turkish Technic	Y	Y	Y	Y	Y	Y	Y	Y	EASA/FAA
United Services		Y	Y	Y		Y	Y		FAA
VEM M&E	Y	Y		Y	Y	Y		Y	FAA

market. It has up to 12 base check bays, although these are used for a variety of types. It does, however, have large customers such as BMI, Aerosvit and GECAS, and assists the Russian carrier UPAir in its engineering management.

There are also several MROs that have recently entered the market. One such player is the independent Turkish MRO MyTechnic, based at Sabiha Gokcen International Airport on the eastern side of Istanbul. This is the same location as Turkish Technic's new facility and PWES's new engine shop, which is a joint venture with Turkish Technic. MyTechnic has a large, all-new facility with 12 base check bays. It currently employs 450 mechanics, although this will grow, and it has the capacity for up to 70 narrowbody base checks per year. It can provide maintenance for the 737NG, A320 family, and 757, as well as the 737 Classics.

MyTechnic is a new company started in August 2008, and is owned by Onur Air and several other Turkish companies. It has constructed a large facility with comprehensive airframe, engine and component capabilities to take advantage of low labour costs in Eastern Europe. It has comprehensive back shops for repairing airframe components and structures, as well as an engine shop, although it does not have capability for the CFM56-3.

Engine maintenance

Engine maintenance is more specialised, and is also where the various engine manufacturers offer services. PWES and GEES offer extensive capabilities. There are also several independent engine shops, in particular MTU Maintenance and SR Technics. Engine maintenance is also provided by some airline maintenance and engineering departments, including Lufthansa Technik, and Air France Industries and KLM Engineering & Maintenance.

GEES in fact carries out 31% of all CFM56-3 shop visits at its various engine shops around the world.

Snecma Services and Lufthansa Technik each share nearly 10.5% of the market. PWES Norway Engine Center and United Services have 6% and 5% of the engine overhaul market respectively.

Bedek Aviation is another large independent engine shop, which has performed more than 450 shop visits to date. The fact that engine maintenance is a relatively specialist field is shown in the very small proportion of overhauls completed in-house: just 1.15%. A further 7.5%of engine contracts are unaccounted for.

While there are 20 other facilities offering engine overhaul, they account for just 30% of the market. Moreover, the engine manufacturers also provide a selection of other services, including: engine maintenance management; fixed rate per engine flight hour (EFH) maintenance contracts; engine LRU rotable provisioning and repair support; AOG event assistance and support; and short-, medium-, and long-term spare engine provisioning. GEES, for example, can monitor engines in real-time for aircraft that are equipped with aircraft communications, addressing and reporting system (ACARS) hardware. This is referred to as remote diagnostics.

Quite a few companies offer parts repair schemes. These tend to be some of the larger facilities, since this is a high-

skill task and requires extensive facilities that incur a high initial investment. Many engine shops sub-contract these high-level parts repairs to specialist providers.

The are also some specialist providers of engine parts repair schemes. For the CFM56-3 these include Airfoil Technologies, Airfoil Services, PAS Technologies, Chromalloy and CRMA.

The larger engine maintenance providers perform a large portion of high-level parts repairs in-house. This includes Lufthansa Technik, which says it performs 98% of its part repairs within the Lufthansa Technik network. Lufthansa Technik provides engine management services from Frankfurt, and performs engine shop visits at Airmotive Ireland. It also has JTF, which is a joint venture between Lufthansa Technik and Qantas. Overall, it does about 120 CFM56-3 shop visits per year.

MTU Maintenance also has a high level of specialist parts repair capability, utilising its two facilities in Germany and Zuhai, China. It performs about 55 shop visits per year at Vancouver and Zuhai, and forecasts a growing demand in 2009 and 2010.

In addition to engine maintenance and parts repair schemes, there is also the issue of parts manufacturer approved (PMA) parts. These are certified parts, but come from independent specialists, rather than the engine OEM. HEICO is a leading supplier of PMA parts for the CFM56-3.

Spare engine support

This is a support service that some of the major MRO providers, engine manufacturers and specialist engine lessors provide. Specialist engine lessors include AAR Aircraft Services, MacQuarie Aviation Capital, GA Telesis, Willis Lease, and AerCap.

The core of spare engine support is providing spare engines for airlines while engines are removed for shop visit maintenance. Shop visits typically take 60-90 days, so spare engines can be leased for terms of about this length under short-term leases. These are typically paid for on a daily lease rental basis plus a maintenance reserve rate per EFH. All specialist engine lessors offer CFM56-3s on short-term leases.

Specialist engine maintenance providers, such as MTU Maintenance and SR Technics, also offer engines on short-term leases for their customers. Many airline maintenance-division engine shops also offer engines on short-term leases, including Air France Industries and KLM Engineering & Maintenance; Aveos; Delta TechOps; flyLAL Technics; Lufthansa Technik; and TAP Maintenance & Engineering.

Short-term spare engine coverage is clearly not sufficient for fleets with several aircraft that more or less have at least one engine constantly going through an engine shop visit. Airlines have traditionally owned spare engines to provide them with sufficient coverage, although short-term leases can be required when the number of engines going through a shop visit increases for a few months. Acquiring engines through medium- and long-term leases is an alternative to ownership. Moreover, most engine lessors and engine manufacturers are interested in sale and leaseback transactions, whereby they buy spare engines from airlines looking to increase their liquidity and then lease the engines back to the airlines. GA Telesis is one example of an engine lessor interested in acquiring engines from airlines. It has a portfolio of 12 CFM56-3B/-3C engines, all of which are on long-term leases.

All specialist engine lessors provide CFM56-3s on medium- and long-term leases. Airline maintenance divisions and independent engine maintenance providers also have engines available for medium- and long-term leases. These include United Services, KLM Engineering & Maintenance, and VEM Maintenance & Engineering.

Medium- and long-term leasing can also be extended and made cheaper by engine pooling. This allows several airlines access to a pool of engines when they are required, although it requires a threshold of spare engine stock and some technical logistics. AerCap, for example, has more than 50 CFM56s, but still does not offer engine pooling.

Bedek Aviation, however, does have an engine pool. It has an agreement with Shannon Engine Support (SES) and Aeroturbine to have a common engine pool, and spare engines are held in Miami, Shannon and Tel Aviv. Engines are usually provided for about three months, but can have longer-term agreements of up to three years.

In addition to actual spare engine provisioning, airlines are also interested in AOG services and other levels of technical support for engines. Most spare engine providers offer these services, while the specialist engine lessors, such as MacQuarie Aviation Capital, which has 18 CFM56-3s, are purely finance specialists and do not offer any levels of technical support.

Rotables & logistics

This section deals with providing LRU and rotable component provisioning, inventory and logistics management, and repair and

HEAVY COMPONENT MAINTENANCE

Maintenance Provider	Wheels, inspection & repair	Tyre remoulding	APU test & shop visit	Thrust reverser shop visit	Landing gear overhaul	Landing gear exchanges	Aviation Authority Approvals held
AAR Aircraft Services	Y				Y	Y	FAA/EASA
Air Asia	Y		Y		Y		FAA/EASA
Air France Industries/ KLM E&M	Y	Y	Y	Y	Outsourced	Y	FAA/EASA
Aveos	Y		Y	Y	Y		FAA + others
Avtrade	Y	Y	Y				EASA
Bedek Aviation		Y		Y	Y	Y	FAA/EASA
Boeing CAS	Y	Y	Y	Y	Y	Y	FAA/EASA
flyLAL Technics	Y	Y					Lithuania/Bermuda
GA Telesis	Y	Y		Y		Y	EASA/FAA
Goodrich	Y	Y		Y	Y	Y	FAA/EASA/CAAS/CAAC/CASA
Icelandair Technical Services	Y	Y				Y	EASA/FAA
KLM UK Engineering	Y						EASA/BDA
Lufthansa Technik	Y		For APS 2000 + parts repair (95% in-house capability)	Y	Y	Y	FAA/EASA +others
Messier Services					Y	Y	EASA/FAA
MNG Technic	Y						EASA/FAA/GACA/Bermuda
MyTechnic	Y				Y	Y	EASA
Sabena Technics	Y			Y	Y	Y	FAA/EASA
SR Technics	Y	Y	Y	Y	Y	Y	EASA
ST Aerospace	Y	Y		Y	Y	Y	FAA/EASA/CAAS +others
TAP M&E	Y		Y	Y			EASA/FAA
Turkish Technic	Y		Y		Y	Y	10+
United Services			Y	Y	Y	Y	DGCA/EASA/ECASA/FAA/ GCAA/ BCAA/CAA/CAAC/ CAAS/DGAC/JCAB/ KCASA/NCAA/SAA
VEM M&E	Y		Y	Y	Y	Y	FAA

management services. This is another activity that has been kept in-house by many airlines, since the ample supply of serviceable LRUs is key to maintaining a reliable operation.

More airlines are now prepared to consider fully outsourcing this activity, and there are several specialists in this market. There are also several major maintenance providers that offer this type of service.

The specialist providers include AJ Walter, AvTrade, AAR Aircraft Services and ST Aerospace, which acquired SAS Component. GA Telesis has also branched into this market, having originally been an engine lessor. It claims to have one of the largest 737 Classic rotable inventories in the world, and to be capable of supporting a large number of aircraft. British Airways and Air Baltic are two of its main customers. GA Telesis has stores of rotables at Bournemouth, UK and has its own test and repair shops.

The larger maintenance providers that offer this specialist level of service include: Lufthansa Technik; Air France Industries and KLM Engineering & Maintenance; flyLAL Technics; Fokker Services; and ST Aerospace.

PWES is also listed *(see table, page 54)*, but only provides rotables services in relation to engine LRUs and inventories. This is also the case for MTU Maintenance.

Although it is still a new company, My Technic will shortly be able to offer all aspects of a rotables and logistics service for the 737 Classic.

Heavy components

Heavy components include: wheels, tyres and brakes; landing gears; thrust reversers; and APUs. The shops and overhaul facilities for these components are specialised, and fewer airlines now have these facilities. This is particularly true for landing gears, thrust reversers and APUs. The repair and maintenance of these components is specialised, and there are now some large providers *(see table, this page)*.

One new entrant to this market is GA Telesis, which has repair shops in Miami and Tucson, USA. It overhauls wheels, brakes, and thrust reversers. It also provides landing gear exchanges, and sub-contracts their overhaul.

The APU test and shop visits tend to be completed by the manufacturers, engine maintenance providers or larger independent MRO facilities. Honeywell Aerospace overhauls 50% of all 737 Classic APUs, while airlines complete only 1.8% in-house. Other facilities that each have shares of 4-9% include Sundstrand Power Systems, Lufthansa Technik, SR Technics and Bedek Aviation.

Landing gear overhaul is more limited to specialists. These include Messier Services, Goodrich, Hawker Pacific and AAR Aircraft Services.

Landing gear repair and overhaul also requires an exchange service, whereby an airline taking a gear shipset to an overhaul shop is provided with a freshly overhauled shipset in return. This requires a large investment in landing gear inventory by the maintenance provider.

The majority of maintenance and parts repair companies are capable of repairing wheels to a lesser or greater degree. This can be as simple as inspection at line maintenance level and having the wheel sent to a back shop, or it can involve a full repair shop that deals with wheels and brakes and tyre remoulding.

Thrust reverser shop visit intervals have increased with the use of composite materials, and this has led to the repair and overhaul of more shipsets being sub-contracted to specialist providers. Many large airline maintenance divisions and large independent MROs provide thrust reverser overhaul. AC