The A320 is arguably the most significant aircraft family for MRO suppliers. As older single-aisle aircraft are retired and replaced, its importance is set to grow. Its success in almost all world regions means that support is required in internationally. *Aircraft Commerce* lists the A320's major technical support providers.

A320 family global technical support providers survey

This global survey summarises the major aftermarket and technical support providers for the A320 family and the associated CFM56/V2500 engines. It lists the world's major providers of the various levels of technical support and is grouped into the following areas:

1. Engineering management & technical support *(see table, page 36)*
2. Line & light maintenance support *(see table, page 37)*
3. Base maintenance support *(see table, page 38)*
4. Engine maintenance *(see table, page 40)*
5. Spare engine support provisioning *(see table, page 42)*
6. Rotables & logistics *(see table, page 43)*
7. Heavy component maintenance *(see table, page 44)*

As in the '737 Classic Global Support Providers' feature in the December 2008/January 2009 issue of *Aircraft Commerce*, some of the A320 family's technical support providers are listed in most, if not all, of the seven sections. This means that these providers offer most of the services that an airline customer needs to keep their fleet operational. The tables show the range of services these facilities offer on a third-party basis to airlines and lessors, and reveal how comprehensive the level of support for each facility is. The tables also list all types of technical support required, with the exception of avionics repair.

A320 MRO market

There is little doubt that the A320 family is crucial to the commercial-aircraft maintenance, repair and overhaul (MRO) industry. There are now 3,754 A320 family aircraft in service, with the oldest now 21 years old. This fleet is split between 2,175 aircraft equipped with CFM56-5A/-5B engines and 1,580 with V2500 engines.

Data from ACAS suggest that less than 2% of these aircraft are not in active service, confirming market reports that availability of aircraft is limited.

The most prevalent model is the A320, which accounts for more than 2,025 (54%) of the family fleet. The A319 accounts for 1,165 aircraft (31%) and the A321 for just 490 aircraft, or 13% of the fleet. The impact of the A318 is marginal. There are only 67 aircraft in the fleet, which is less than 2%.

The A320 order book remains robust. According to Airbus's figures there are a further 2,559 aircraft on order.

The backlog is dominated by the A320 model, which accounts for nearly three-quarters of the outstanding orders.

As for all single-aisle aircraft, the A320 market for airframe maintenance tends to be regionalised along similar lines to its fleet distribution, because it is too small in relation to the size of the airframe checks to justify long-distance ferry flights for airframe maintenance. Smaller checks mean shorter downtimes compared to larger aircraft types. The larger MRO providers, such as Lufthansa Technik, have the capability to perform A320 heavy maintenance in several geographic locations.

According to ACAS, the regional distribution is heavily weighted towards Europe, which accounts for 40% of the family fleet. North America is the next largest market, with 24% of the fleet, with the Asia Pacific region accounting for 18%. The A321 distribution is particularly dominated by European operators, which account for 57% of the fleet for this model.

There has been a marked increase in the number of A320 family operators since 2000, which now stands at 221. Many of the new operators have 10 aircraft or less, and there has also been an increase in the number of low-cost carriers (LCCs). Both types of operators typically have limited in-house MRO and engineering infrastructure, so they are more likely to be dependent on original equipment manufacturer (OEM) or third-party MRO providers to support their fleets and operations.

Increasingly, airlines of all sizes have been sub-contracting more of their maintenance and engineering functions, including maintenance management tasks such as check planning and document and manual management.

A major new development in the A320 market, which has particular significance for the MRO industry, is the availability of a passenger-to-freighter conversion for the A320 and A321. The conversion of A320s and A321s has been launched by Airbus with a target entry-into-service date of 2012. Conversions of the A320s and A321s are handled by the

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 Corp	Y		Y	Y		Y	Y	Y
Adria Airways			Y	Y	Y	Y	Y	Y
Aeroman	Y		Y	Y		Y	Y	Y
Air France Industries/KLM M&E	Y					Y	Y	
ATC Lasham			Y	Y			Y	Y
Austrian Airlines/ Technik	Y	Y	Y	Y	Y	Y	Y	Y
Aveos	Y	Y	Y	Y	Y	Y	Y	Y
Bedek Aviation	Y	Y	Y	Y	Y	Y	Y	Y
Egyptair Maintenance& Engineering	Y		Y	Y	Y	Y	Y	Y
Europe Aviation	Y		Y	Y	Y	Y	Y	Y
Finnair Technical Services		Y	Y	Y	Y	Y	Y	Y
GE Engine Services	Y*	Y*	Y*	Y*	Y*	Y*	Y*	Y*
Goodrich	Y	Y	Y	Y	Y	Y	Y	Y
Iberia Maintenance	Y	Y	Y	Y	Y	Y	Y	Y
Lufthansa Technik	Y	Y	Y	Y	Y	Y	Y	Y
Malaysia Airlines E&M	Y		Y	Y	Y	Y	Y	Y
Mexicana MRO Services			Y	Y	Y	Y	Y	Y
MNG Technic	Y	Y	Y	Y	Y			Y
MTU Maintenance	Y*	Y	Y*	Y*	Y*	Y*	Y*	
MyTechnic	Y		Y	Y	Y	Y	Y	Y
OGMA			Y	Y			Y	Y
P&W Engine Services					Y*	Y*	Y*	
Sabena Technics	Y	Y	Y	Y	Y	Y	Y	Y
Snecma Services	Y*	Supported	Y via CFMI	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
Storm Aviation	Y							
TAP M&E	Y	Y	Y	Y	Y	Y	Y	Y
TIMCO Aviation Services	Y	Y	Y	Y	Y	Y	Y	Y
Turkish Airlines Technic	Y	Y	Y	Y	Y	Y	Y	Y
United Services	Y	Y	Y	Y	Y	Y	Y	Y

*Engines only

Maintenance Provider	Aircraft config & IPC	Total tech support	Engine trend monitor	Flight data monitor	Aircraft accept & return	Continuing airworthiness approval	Approvals held
AAR Corp	Y	Y			Y	Y	FAA/EASA
Adria Airways			Y	Y	Y	Y	EASA + 1
Aeroman					Y		FAA/EASA + 7
Air France Industries/KLM M&E	Y	Y	Y	Y	Y	Y	FAA/EASA + various
ATC Lasham	Y						FAA/EASA + 12
Austrian Airlines/ Technik	Y	Y	Y	Y	Y	Y	FAA/EASA + various
Aveos	Y	Y	Y	Y	Y	Y	FAA/EASA + 2
Bedek Aviation	Y	Y		Y	Y	Y	FAA/EASA + 4-6
Egyptair Maintenance & Engineering	Y	Y	Y				EASA + 10 others
Europe Aviation	Y	Y	Y	Y	Y	Y	EASA + 3
Finnair Technical Services	Y	Y	Y	Y	Y	Y	FAA/EASA + 2
GE Engine Services	Y*	Y*	Y*		Y*	Y*	FAA/EASA + 30/40
Goodrich	Y	Y	Y	Y	Y	Y	FAA/EASA + various
Iberia Maintenance	Y	Y	Y	Y	Y	Y	FAA/EASA + 16
Lufthansa Technik	Y	Y	Y	Y	Y	Y	FAA/EASA+39 countries
Malaysia Airlines E&M	Y	Y	Y	Y	Y	Y	FAA/EASA + 30 plus
Mexicana MRO Services	Y	Y	Y	Y	Y	Y	FAA/EASA + 4
MNG Technic		Y			Y		FAA/EASA + 2
MTU Maintenance		Y*	Y				FAA/EASA + 17
MyTechnic	Y	Y	Y	Y	Y		EASA + 4 (FAA due 2009)
OGMA						Y	
P&W Engine Services			Y		Y*		FAA/EASA + various
Sabena Technics	Y	Y	Y	Y	Y	Y	FAA/EASA + various
Snecma Services	Y*		Y via CFMI	Y*	Y*	Y	FAA/EASA + 14
SR Technics	Y	Y	Y	Y	Y	Y	FAA/EASA
ST Aerospace	Y	Y	Y	Y	Y	Y	FAA/EASA + various
Storm Aviation					Y		FAA/EASA
TAP M&E	Y	Y	Y	Y	Y	Y	FAA/EASA + 7
TIMCO Aviation Services	Y	Y					FAA/EASA + 3
Turkish Airlines Technic	Y	Y	Y	Y	Y	Y	FAA/EASA + 18
United Services	Y	Y	Y	Y	Y	Y	FAA/EASA + 4

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 Corp		Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA
Adria Airways	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	EASA+1
ADAT (GAMCO)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA + various
Aeroman	Y		Y	Y	Y	Y	Y	Y	Y		FAA/EASA + 7
Air France Industries/KLM M&E	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA + others
All Nippon Airways *			Y	Y							FAA/EASA + 2
AMECO Beijing	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Various
ATC Lasham				Y	Y	Y	Y	Y	Y		FAA/EASA + 12
Austrian Airlines / Technik	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA + 4
Bedek Aviation	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA + 4-6
Coopesa			Y								FAA/EASA
Europe Aviation	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	EASA + 3
Evergreen (EGAT)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA + 6
Finnair Technical Services	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA + 2
GAMECO *				Y							FAA/EASA + 7
GE Engine Services					Y	Y					FAA/EASA + 30/40
Iberia Maintenance	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA + 16
Lufthansa Technik	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA + 39
Malaysia Airlines E&M	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA + 30+
Messier Services							Y				FAA/EASA + 1
Mexicana MRO Services	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA + 4
MNG Technic			Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA + 2
MTU Maintenance		Y*1			Y						FAA/EASA + 17
MyTechnic	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	EASA +4 (FAA due '09)
OGMA				Y	Y	Y	Y	Y	Y		
P&W Engine Services					Y						FAA/EASA + various
Sabena Technics	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA + various
Shannon Aerospace *				Y	Y	Y	Y	Y	Y		FAA/EASA + various
Snecma Services	Assistance	Y*1			Y*1	Y			Y		FAA/EASA + 14
South African Technical *				Y							FAA/EASA + 3
SR Technics	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA
ST Aerospace	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA+various
Storm Aviation	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA
TAP M&E	Y	Y	Y	Y	Y	Y	Y	Y	Y		FAA/EASA + 7
TIMCO Aviation Services	Y	Y	Y	Y	Y	Y	Y	Y	Y		FAA/EASA
Turkish Airlines Technic	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA + 18
United Services	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA + 14

* Based on *Aircraft Commerce* research, not survey response

*1 Engines only

Airbus Freighter Conversion (AFC) joint venture, which brings together Airbus and EADS EFW with Russia's UAC (United Aircraft Corporation) aerospace holding and the Russian Irkut company.

A320 MRO market

The consultancy Aerostrategy, which has extensive experience in the MRO sector, forecasts that by 2017 the A320 family will account for 26% of the commercial airliner fleet. Together with the 737, the A320 family will account for almost half of this total fleet.

In terms of revenue generation for MRO suppliers, the A320's dominance is somewhat diluted because of the higher workloads associated with widebody aircraft. Many airframe MRO providers, however, favour the single-aisle families, because of the increased flexibility they allow in terms of aircraft throughput.

The forecast MRO revenues from A320 maintenance are significant. Aerostrategy estimates that the A320 MRO market will be worth about $6.3 billion in 2009, and $11.4 billion by 2018. The largest proportion of this will be for engine repair and maintenance, which will be 34% of the total in 2009.

The higher rates of growth in MRO revenues are associated with the airframe market. The predicted 2009 spend on heavy maintenance is $732 million, but is forecast to more than double by 2018.

According to the Aerostrategy figures, the growth rate in modification work is forecast to be even greater. The spend in this field, the smallest part of the MRO expenditure at 2%-4% of the total, is forecast to rise from $186 million to $474 million over the same period. This trend in airframe-related work is to some extent a reflection that towards the latter end of the forecast the average age of the fleet will have increased from its current level. Maintenance and modification requirements will therefore increase as a result.

Lessors' influence

Set against these long-term growth prospects, there is no doubt that the current economic environment is having an impact on the MRO market, with most airlines reducing their activity and many going out of business completely. Airlines are failing at an unprecedented rate. John Trevett, of the UK consultancy Flightsafe, says that in 2008 43 went out of business. In 2009 the casualties have continued, with a further five airlines ceasing to operate in January. Trevett adds that in addition to the confirmed casualties there are several airlines cutting back their activities.

The problem of this recession is that it appears to be affecting all regions. Even China's civil aviation transportation market, which has in past years been growing continuously, has been affected by the financial crisis. According to the Chinese consultancy CCID, however, the associated MRO market maintained its

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 Corp	Y	Y	Y	Y	Extensive	25	2,000+	3	Y	Approx 100	
ADAT	Y	Y			Composites & others						FAA/EASA + various
Adria Airways	Y	Y	Y		Composite/Interior/ Sheetmetal/NDT/ Avionics/Oxygen & others	2	120	2	On req.	230,000MH	EASA + 1
Aeroman	Y	Y	Y	Y	Full	6	855	3	Y	150	FAA/EASA + 7 others
Aeroframe Services *	Y	Y	Y	Y	Various					450,000MH	FAA/EASA + 1other
Aerotechnology					Avionics/Instruments	6		3			FAA/EASA
Air Berlin Technik *	Y	Y	Y	Y							
Air France Industries/ KLM M&E	Y	Y	Y	Y	Extensive	TLS: 50 Paris: 2					FAA/EASA + 23 others
ANZES *	Y	Y	Y	Y	Various	19		24hr			FAA/EASA + 7 others
All Nippon Airways *			Y	Y	Various			2			FAA/EASA + 2
ATC Lasham	Y	Y	Y	Y	Interiors/Machining/ Composites	Y	110	2	1		FAA/EASA + 12 others
Austrian Airlines/Technik	Y	Y	Y		Sheetmetal/Electrics/ Paint/Mechanical/ Emergency/Composite Interior & others	2	105	2	On req.	205,000MH	FAA/EASA
Aveos	Y	Y	Y	Partial	Composite/Process/ Seats/Machining/ TNF/Sheetmetal	Montreal Winnipeg Vancouver	750	24/7	Y	35 H-checks 165 C-checks	FAA/EASA + 2 others
Bedek Aviation	Y	Y	Y	Y	Yes	9-12	300-350	3	2	20-60	FAA/EASA + 4-6 others
Egyptair M&E	Y	Y	Y	Y	Various	CAI: 4	700	2	On req	150	EASA + 10 others
Europe Aviation	Y	Y	Y	Y	Structure/Cabin	ORY: 3 CHR: 2	80	2	On req.		EASA + 3
Evergreen (EGAT)	Y	Y	Y	Y	Various	8	800	2	2	120	FAA/EASA + 6 others
Finnair Technical Services	Y	Y	Y	Y	Sheetmetal/Mechanical/ Structures/Composite & others	5	290	Y	On req.	Approx 100	FAA/EASA + 2 others
GAMECO *	Y	Y	Y	Y	Various	12		24hr			FAA/EASA + 7
HAECO *	Y	Y	Y	Y	Various			3			FAA/EASA + others
Iberia Maintenance	Y	Y	Y	Y	Various	12	1,050	3	3	800,000MH	FAA/EASA + 16 others
JorAMco *	Y	Y	Y	Y	Various			3			FAA/EASA + others
Lufthansa Technik	Y	Y	Y	Y	Full	12 worldwide		2	Yes		FAA/EASA + 39 others
Malaysia Airlines E&M	Y	Y	Y	Y	Full avionics/Mechanical	11	1,500	Y	Y	In line with no of bays.	FAA/EASA + 30 others
Mexicana MRO Services	Y	Y	Y	Y	Extensive cap.	10	726	3	2	1.2million MH	FAA/EASA + 4 others
MNG Technic	Y	Y	Y	Y		4		1	1	70	FAA/EASA + 2
MyTechnic	Y	Y	Y		Structural/NDT/ Hydraulic/Electrics/ Pneumatic/Avionics	SAW: 12	200+	2 by yr end	Y	80	EASA + 4 (FAA due'09)
OGMA	Y	Y	Y	Y		2		2			FAA/EASA + 1
PEMCO *	Y	Y	Y	Y	Various			2			FAA/EASA
Sabena Technics	Y	Y	Y	Y	Hydraulics/Avionics/ Composite/Pneumatic & others	25	1,200	2/3	On req.	700	FAA/EASA + others
Shannon Aerospace*	Y	Y	Y	Y	Extensive	5					FAA/ESA + 1
SIAEC *	Y	Y	Y	Y	Various			2			FAA/EASA
South African Technical *	Y	Y	Y	Y	Various	6		24hr			FAA/EASA + 3 others
SR Technics	Y	Y	Y	Y	Extensive	6:ZRH	824	2/3	2/3		FAA/EASA + others
ST Aerospace	Y	Y	Y	Y	Interiors/Finishing/ Composite/Battery/ Structures/Avionics	30+	3,000+	2	Y	Varies	FAA/EASA + others
TAP M&E	Y	Y	Y	Y	Sheetmetal/Interiors/ Machining/Composites/ Emergency	3	360	2	on req.	30-50	FAA/EASA + 7 others
TIMCO Aviation Services	Y	Y	Y	Y	Full capability to support MRO	Greensboro: 12 Lake City: 11 Macon: 3	1,500	Y	Y	Varies	FAA/EASA + 3 others
Turkish Airlines Technic	Y	Y	Y	Y	Various		1,920	3	Y	213	FAA/EASA + 18 others
United Services	Y	Y	Y	Y	Sheetmetal/Avionics/NDT/ Pumps&valves/Machining	8	3,834	3		8	FAA/EASA + 4 other

* Based on *Aircraft Commerce* research, not survey response

ENGINE MAINTENANCE

Maintenance Provider	Engine maint mgt	Scheduled on-wing engine maint.	Unscheduled on-wing maint.	Engine shop visits	Parts repair schemes	Total Care Packages	Level of test cell capabilities	Aviation Authority Approvals
AAR Corp		Y	Y					
Adria Airways	Y	Y	Limited					EASA + 1
Aeroman		Y	Y					FAA/EASA + 7
Air France Industries/KLM M&E	Y	Y	Y	CFM56	via CRMA subsidiary	Y	All ratings	FAA/EASA + others
Airfoil Technologies					Fan & HPC blades V2500			FAA/EASA + others
All Nippon Airways *				V2500	Various			FAA/EASA + 2
ATC Lasham		Y	Y				None	FAA/EASA + 12
Austrian Airlines/Technik	Y	Y						FAA/EASA
Aveos	Y	Y	Y	CFM56	Y	Y	Full	FAA/EASA + 2
Bedek Aviation	Capability to be completed and fully implemented by 4thQ 2009. FAA/EASA approval expected 2010							
Chromalloy	Y				CFM56			
Egyptair M&E	Y	Y	Y	V2500	Simple repairs	Y	100,000lbs	EASA + ECAA
Europe Aviation	Y	Y	Y					EASA + 3
Evergreen (EGAT)	Y	Y	Y	V2500	Y	Y	120,000 lbs	FAA/EASA + 6
Finnair Technical Services	Y	Y	Y	CFM56-5B	Y	Y	Full	FAA/EASA
GE Engine Services	Y	Y	Y	CFM56 & V2500	Y	Y	Full	FAA/EASA + 30/40
Goodrich					Y			FAA/EASA + 2
Iberia Maintenance		Y	Y	CFM56	Y	Y	100,000lbs	FAA/EASA + 16 others
Lufthansa Technik	Y	Y	Y	CFM56 & V2500	Y	Y	6 up to 100,000 lbs	FAA/EASA + 39 others
Malaysia Airlines E&M	Y	Y	Y	CFM56	Y	Y	Full capability	FAA/EASA + 30 plus
Mexicana MRO Services	Y	Y	Y					FAA/EASA + 4
MNG Technic		Y						FAA/EASA + 2
MTU Maintenance	Y	Y	Y	CFM56 & V2500	Y	Y	150,00 lbs	FAA/EASA + 17 others
PAS Technologies					CFM56-5B			FAA/EASA + various
OGMA		Y	Y					
Sabena Technics	Y	Y	Y	Managed	Managed			FAA/EASA + various
Snecma Services	Y	Y*	Y	CFM56	Y	Y	All CFMI engines	FAA/EASA + 14 others
SR Technics	Y	Y	Y	CFM56	Y	Y	Full	FAA/EASA + others
ST Aerospace	Y	Y	Y	CFM56	Y	Y	Full	FAA/EASA + others
TAP M&E	Y	Y	Y	CFM56	Y	Y	All CFMI engines	FAA/EASA + 7
TIMCO Aviation Services		Y						FAA/EASA
Turkish Airlines Technic	Y	Y	Y	CFM56	Y	Y	Full capability	FAA/EASA + 18
United Services	Y	Y	Y	V2500	Y	Y	Full capability	FAA/EASA + 4

* Based on *Aircraft Commerce* research, not survey response

strong growth momentum in 2008. Of particular significance to the A320 market was the establishment in 2008 of Taikoo Sichuan Aircraft Engineering Services, which is the first MRO company in the country to specialise in Airbus aircraft.

Another good sign for the A320 MRO market is that the family appears to be less badly hit than some other types, although the Alitalia and Skybus problems are bound to have some impact. According to industry sources, only 33 aircraft were advertised as available in January (seven A319s and 26 A320s). In any case things are perhaps not quite as bad for the MRO industry as the headline figures might suggest. Matko Dadic, sales manager for Europe Aviation, points to a silver lining. He says the general economic slowdown has impacted on business, but aircraft lessors have taken up some of the spare capacity. The number of aircraft coming off-lease or being repossessed has increased, which has resulted in a demand for capacity to refurbish aircraft interiors and bring them into a condition where they can be re-marketed or transferred to another region of the world. Dadic adds that, because this type of business is intrinsically more difficult to plan for, the MRO providers need to be flexible in dealing with the lessors. "We keep one slot dedicated for lessors," he explains.

Engineering management

This trend for smaller fleet sizes has led to increased outsourcing of maintenance functions by the airlines. In turn this has led to many of the large independent MRO providers offering engineering management services.

Line & light maintenance

As for most aircraft types, line and light maintenance is one of the least likely functions to be completely outsourced, with many airlines choosing to look after all, or at least most of, their own requirements. Many such airlines try to leverage this requirement by offering third-party services on their networks. The size and operator base of the A320 fleet means that there is a large number of light maintenance providers, and this survey does not attempt to cover all such providers unless they offer either services for the A320 family.

Although line activity accounts for a quarter of the total maintenance generated by the fleet, the third-party market is relatively small. David Stewart, founding partner at Aerostrategy, estimates that 10-12% of line maintenance is outsourced by airlines.

Base maintenance

The A320 family is well served by providers of heavy maintenance across the various regions.

The A320 base maintenance market

SPARE ENGINE SUPPORT

Maintenance Provider	Engine type	AOG Services	Short-term leases	Medium /long-term leases	Engine pooling
AAR Corp	CFM56 & V2500	Y	Y	Y	Y
AerCap	CFM56 & V2500	Y	Y	Y	
Air France Industries/KLM M&E	CFM56	Y	Y	Y	Y
AJ Walter	CFM56 & V2500	Y	Y	Y	Y
Aveos	CFM56	Y	Y	Y	
ELFC *	CFM56 & V2500	Y	Y	Y	Y
Finnair Technical Services	CFM56	Y	Y	Y	Y
GE Engine Services	CFM56 & V2500	Y	Y	Y	Y
Goodrich	CFM56 & V2500	Y	Y	Y	Y
Iberia Maintenance	CFM56 & V2500	Y	Y	Y	Y
Lufthansa Technik	CFM56 & V2500	Y	Y	Y	Y
Malaysia Airlines E&M	CFM56	Y			
Macquarie Aviation Capital *	CFM56 & V2500			Y	
MTU Maintenance	CFM56 & V2500	Y	Y	Y	Y
P&W Engine Services	CFM56 & V2500	Y	Y	Y	Y
SES	CFM56	Y	Y	Y	Y
SR Technics	CFM56	Y	Y	Y	Y
ST Aerospace (CFM only)	CFM56	Y	Y	Y	
TAP M&E	CFM56	Y	Y	Y	Y
Turkish Airlines Technic	CFM56	Y	Y	Y	
United Services	V2500	Y	Y	Y	
Willis Lease Finance *	CFM56 & V2500	Y	Y	Y	Y

* Based on *Aircraft Commerce* research, not survey response

services the current fleet of more than 3,700 aircraft. The type's maintenance programme has a system of eight checks which have an interval of up to 18 months. On the basis that actual check intervals for most aircraft will be 14-16 months, the fleet will require about 3,000 base checks each year. The system of eight checks includes a heavy check every fourth and eighth visit. About 750 of the annual base checks will therefore be heavy visits.

About 900 aircraft have their base checks performed in-house by airline maintenance and engineering departments. The largest known players in the third-party market by the number of aircraft they have contracted to them are Aeroman (294 aircraft), Lufthansa Technik (264), SR Technics (198), United Services (152), ST Aerospace (139)Air France Industries (138), Gameco (132) and Aveos (123).

Base maintenance providers with medium-sized contracts include Sabena Technics, Turkish Technic, TAP Maintenance & Engineering, Air Berlin Technik, Iberia Maintenance, and Abu Dhabi Aircraft Technologies(ADAT).

As might be expected given the fleet distribution, Europe is particularly well represented. The leading integrators, which include ATC Lasham, Lufthansa Technik, Finnair Technical Services, Iberia Maintenance, SR Technics, Sabena Technics, and TAP Maintenance & Engineering, all offer significant capacity. Air France Industries/KLM M&E also offers a major capability via its French facilities.

Several smaller independent facilities and airline engineering divisions also offer heavy maintenance to third parties. Even some airlines with relatively small A320 fleets actively market third-party capabilities. Airlines such as Adria Airways fall into this category, although they typically do not have such a broad range of back-shop support as the larger European MRO providers.

One new independent MRO provider is Turkish company MyTechnic. Based at Istanbul's second major airport Sabhia Gokcen, MyTechnic has an all-new facility that was opened in late 2008. It has a large hangar that can accommodate up to 12 narrowbody aircraft. In addition to base checks, MyTechnic has an engine shop and component repair capability.

The US has a good range of MRO facilities for the A320 family. Major independent providers include AAR Corp, Mobile Aerospace and TIMCO. United Services, the maintenance and engineering division of United Airlines, also offers base maintenance. The North American capability is augmented by the presence of Aveos (the former Air Canada Technical Services). There is also Louisiana-based Aeroframe Services, an Airbus maintenance specialist provider.

The Aveos group also has a Latin American presence via its San-Salvador-based subsidiary Aeroman. Other providers of heavy maintenance in Latin America include Mexicana's engineering facility, which also has a broad range of back-shop support. There is also Coopesa, based at San Jose, Costa Rica.

The Asia Pacific market is served by major providers such as ST Aerospace, SIAEC, Ameco Beijing, Gameco, Evergreen and Air New Zealand Engineering Services (ANZES), which offers base maintenance as part of its comprehensive offering for the A320 family. Evergreen in Taiwan also offers heavy maintenance among its range of services, although it does not offer outsourced engineering management.

The A320 also has a significant presence in Africa and the Middle East. Major MRO providers for the A320 family in the Middle East include Bedek Aviation, JorAMco or Jordan, Egyptair Maintenance & Engineering, ADAT (formerly GAMCO), and South African Airways Technical.

Egyptair Maintenance & Engineering is a newcomer to the third-party MRO market, having acquired EASA part 145 approval in 2006. "We are the only maintenance provider at all major Egyptian airports," says Abdel Aziz Fadel, chief executive officer at Egyptair Maintenance & Engineering. "A large number of different airlines fly to Egypt, and we started our third-party MRO business through offering line maintenance. We now have a large number of European airlines using our base maintenance facility at Cairo. We have a dedicated Airbus aircraft hangar at Cairo which can accommodate four A320 family members at any one time. We have a total of 77 customers. Those using us for A320 maintenance include Air Cairo, Coral Blue, Jordan Aviation, Thomas Cook Airlines, British Midland and Iberworld." In addition to base and line maintenance, Egyptair is proposing a total care package that will include engineering management, component maintenance, rotable support and management, and engine management and maintenance.

Engine market

The competition between engines differentiates the A320 from the 737 market. The two principal manufacturers of engines for the A320 are CFM International and the International Aero Engines Corporation (IAE), which produce the CFM56-5A/-5B and V2500-A1/-A5 respectively.

Both companies are consortiums of leading engine manufacturers. CFM is a joint venture between Snecma of France and US company General Electric. IAE's shareholders comprise Pratt & Whitney (PW) of the US, the UK's Rolls-Royce (RR), Japanese Aero Engines Corporation and MTU Aero Engines of Germany. PW developed the PW6000 for the A318 separately from the IAE consortium, but the engine has made very little impact on the market.

Both main manufacturers are adept at presenting market share figures that show their respective engines in a favourable

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 Corp	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA
Aeroman		Y		Y		Y	Y		FAA/EASA + 7
Air France Industries/ KLM M&E	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA + 30
AJ Walter	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA +
Aveos		Y	Y		Y	Y	Y	Y	FAA/EASA + 2
Bedek Aviation	Y	Y	Limited	Y	Y	Y	Y	Y	FAA/EASA + 4-6 others
Egyptair M&E	Y			Y	Y	Y	Y		EASA + 10 others
Europe Aviation				Y	Y	Y			EASA + 3
Evergreen (EGAT)	Y	Y	Y	Y	Y	Y	Y		FAA/EASA + 6
Finnair Technical Services	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA
Goodrich	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA +
Iberia Maintenance		Y	Y	Y	Y	Y	Y	Y	FAA/EASA + 16
Lufthansa Technik				Y	Y	Y	Y		FAA/EASA + 39 countries
Malaysia Airlines E&M	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA + 30 plus
Messier Services		Y	Y				Y		FAA/EASA + 1
Mexicana MRO Services	Y				Y	Y	Y		FAA/EASA + 4
MTU Maintenance	Y*	Y*	Y*	Y*	Y*	Y*	Y*	Y*	FAA/EASA + 17
MyTechnic	Y	If reqd.		Y	Y	Y	Y	Y	EASA + 4 (FAA due `09)
OGMA				Y					FAA/EASA + 1
Sabena Technics	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA + others
SR Technics	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA + others
ST Aerospace	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA + others
TAP M&E	Y		On PBH basis	Y	Y	Y	Y	Y	FAA/EASA + 7
Turkish Airlines Technic	Y	Y	Y	Y	Y	Y	Y	Y	FAA/EASA + 18
United Services	Y	Y	Y		Y	Y	Y	Y	FAA/EASA + 4

* Engines only

light, but there is undoubtedly healthy competition. The ACAS database shows that the IAE V2500 powers 42% of the current fleet. Ignoring the small impact of the PW6000, the CFM56 powers the remaining 58%. This market share, taken together with the CFM56's presence on the 737NG and Classic, means that the CFM56's market is significantly larger. This partially explains the larger number of independent overhaul facilities for the CFM56 compared to the V2500. But in both cases the OEMs have a strong presence. The biggest three OEMs are GE Engine Services (GEES), Pratt & Whitney Engine Services (PWES) and Snecma Services.

Even in the case of independent engine overhaul facilities, the OEMs are often involved by way of a joint venture. The manufacturers say that their expansion in the aftersales market is, in part, due to the changing nature of the typical customer and the smaller fleet sizes cited above.

MTU Maintenance is one major independent engine shop, and is one of the few providers to have capability for both engines.

Besides OEMs and independent shops, airline technical departments also play a role in the engine MRO market. The largest are: Lufthansa Technik (which overhauls the CFM56 and V2500); Air France Industries (CFM56); Finnair Technical Services (CFM56); Iberia Maintenance (CFM56); TAP Maintenance & Engineering (CFM56); and United Services (V2500).

Actual engine MRO capability varies between shops. The most basic capabilities are disassembly into modules, reassembly and engine testing. Further capabilities are module disassembly, simple parts and component repairs, and hi-tech parts repairs. Egyptair Maintenance & Engineering has capability for the V2500, which is limited to engine disassembly, refurbishment of the hot section, basic blade and vane repairs in the hot section, and engine reassembly. However, it plans to add fan and low pressure compressor (LPC) refurbishment capability in 2010. It sub-contracts hi-tech parts repairs to specialist repair shops.

Companies specialising in hi-tech component repairs for the CFM56-5A/-5B are CRMA, PA Technologies and Chromalloy. Airfoil Technologies repairs fan and high pressure compressor blades for the V2500.

With engine shop-visit intervals ranging from 10,000 engine flight hours (EFH) to 20,000EFH, engine removals are once every four to seven years. There are now more than 7,000 CFM56 and V2500 engines in service with the A320 family, generating 1,200 shop visits per year. Snecma Services has the largest share, with 1,100 engines under contract, followed by MTU Maintenance with a similar number. GEES, PWES and Lufthansa Technik are the other big players in the top five for the CFM56 and V2500 market, accounting for another 2,200 engines. About 400 engines are maintained in-house by airline shops.

Shops managing a medium number of engines are Aveos, SR Technics, Alitalia, Iberia Maintenance, TAP Maintenance & Engineering, and Turkish Technic.

Spare engine support

Industry estimates suggest that an additional 15% of spare engines is

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 Corp	Y				Y	Y	FAA/EASA
Adria Airways	Y						EASA + 1
Aeroman	Y					Y	FAA/EASA + 7
Air France Industries/KLM M&E	Y			Y			FAA/EASA +
All Nippon Airways *			Y				FAA/EASA + 2
AMECO Beijing	Y	Y			Y	Y	Various
ANZES *	Y				Y		FAA/EASA + 7
Aveos	Y		Y		Y	Y	FAA/EASA + 2
Avtrade	Y	Y	Y	Y	Y	Y	FAA/EASA +
Bedek Aviation	Y		Y	Y	Y	Y	FAA/EASA + 4-6
Egyptair M&E	Y					Y	EASA + 10 others
Evergreen (EGAT)	Y			Y			FAA/EASA + 6
Finnair Technical Services	Y	Y	Y	Y	Y	Y	FAA/EASA
Fokker Services					Y		FAA/EASA
Goodrich	Y	Y	Y	Y	Y		FAA/EASA +
Iberia Maintenance	Y	Y	Y	Y	via Madrid Aerospace	Y	FAA/EASA + 16
JorAMco *					Y		FAA/EASA + others
Lufthansa Technik	Y	Y	Y	Y	Y	Y	FAA/EASA + 39 others
Malaysia Airlines E&M	Y						FAA/EASA & 30+
Messier Services	Y				Y	Y	FAA/EASA + 1
Mexicana MRO Services	Y			Y			FAA/EASA + 4
MNG Technic	Y						FAA/EASA + 2
Mytechnic	Y					Y	EASA + 4 (FAA due '09)
Sabena Technics	Y	Y	Y	Y	Y	Y	FAA/EASA + others
South African Technical *	Y				Y		FAA/EASA + 3
SR Technics	Y		Y	Y	Y	Y	FAA/EASA + others
ST Aerospace	Y	Y			Y	Y	FAA/EASA + others
TAP M&E	Y		Y	Y			FAA/EASA + 7
Turkish Airlines Technic	Y	Y	Y	Y	Y	Y	FAA/EASA + 18
United Services	Y		Y	Y	Y		FAA/EASA + 4

* Based on *Aircraft Commerce* research, not survey response

required to support the installed fleet. This implies in excess of 1,000 spare engines for the A320 family. About 200 of these engines 20% are leased separately from aircraft.

A large proportion of the demand arises from maintenance and overhaul requirements. Industry sources indicate that 25% of all current leases are associated with MRO requirements, and this proportion is set to grow. It is therefore not surprising that the major engine MRO providers offer spare engine support in one form or another.

The size of the market has led to a number of specialist companies entering the field, notably Willis Lease Finance, Engine Lease Finance (ELF) and Macquarie Aviation Capital. There are several other companies entering the specialist engine leasing business. CFM has a subsidiary, Shannon Engine Support, which specialises in the sector.

Rotables & logistics

The high cost of the repair facilities and management infrastructure that an airline incurs in order to have in-house capability for line replaceable unit (LRU) and rotable component support has resulted in an increased amount of outsourcing of this activity by airlines in recent years. This has prompted the growth of a number of specialist suppliers, as well as forming part of the offerings of the major MRO integrators.

The LRU and rotable logistics support sector now offers services such as: rotable component provisioning; inventory and logistics management; and repair and overhaul services. Leaders in this field include specialists such as A J Walter and AvTrade, as well as the major MRO providers and integrators.

Boris Wolstenholme, commercial director at A J Walter, says that in the current economic climate the outsourcing of rotables and logistics is particularly relevant. "Airlines which historically had a self-sufficient stocking policy are now realising that power-by-the hour (PBH) support contracts not only offer a pooling solution which reduces their on-site inventory requirement, but also adds expertise to the organisation. In current market conditions, operators want to realise cash from inventory, but surplus package values are very low. Inventory management solutions like A J Walter's model overcome this problem," says Wolstenholme.

Heavy components

Heavy components include: wheels, tyres and brakes; landing gears; thrust reversers; and auxiliary power units (APUs). It is rare for airlines to have the capability to maintain all of these components in-house, unless they have fleets that are large enough to justify the substantial investment in facilities, tooling and equipment. Finnair, Iberia, Lufthansa, Sabena, Swissair and Turkish Airlines have or have had large fleets, so Finnair Technical Services, Iberia Maintenance, Lufthansa Technik, Sabena Technics, SR Technics and Turkish Technic all now have full capability for repairing and overhauling these heavy components. Goodrich is an independent provider with capability for wheels and brakes, APUs, thrust reversers and landing gears.

Repair and overhaul for landing gears, thrust reversers and APUs are generally handled by specialist companies. Examples are Messier Services, which specialises in wheels and brakes, and landing gear overhaul.

The OEMs of the respective components tend to dominate the overhaul market for their respective products. Another characteristic of this market, particularly landing gear, is the requirement to provide an exchange service. AC