

Like other elements of maintenance, repair and overhaul providers of heavy components have consolidated to a small number of major shops. This survey provides a quick reference guide to global MRO suppliers of wheels, brakes, landing gear, APU & thrust reversers.

Global heavy component repair & overhaul survey

A large number independent maintenance providers have emerged or increased their business in recent years with many airlines having sub-contracting a large portion of their maintenance. Airframe and engine shops have attracted much of the industry's attention, but less attention is made to component repair agencies.

There are a large number of component categories, and components have to be sub-divided. This survey provides capability and capacity information on the global facilities which provide maintenance repair and overhaul for the components classified by *Aircraft Commerce* as heavy rotables; wheels, brakes, landing gear, thrust reversers and APUs. This is for jetliner aircraft, and thus includes information relating to components for the DC-9/717/737-200/A318 and larger types up to the 747-400. The Fokker 100 and Avro RJ/BAE 146 are not included, since they are regarded as regional aircraft, although the dividing line is not always clear.

Wheels, tyres & Brakes

The economic importance of wheel and brake maintenance is often overlooked, since they are regarded as components which do not make a large impact on cost and so require little management.

Many carriers have fixed rate per flight hour (FH) or flight cycle (FC) maintenance contracts for tyres, wheels and brakes and leave the management of these parts and focus on other elements of maintenance which have less frequent but higher repair price tags.

Wheels, tyres and brakes are maintenance items which, like line maintenance, have a high frequency. There are also a large number of tyre, wheel and brake units on an aircraft. Small differences in the price of maintenance for these units between vendors can thus multiply to make a large impact on an aircraft's annual maintenance bill for tyres, wheels and brakes.

SAS Component, for example, tracks individual tyres with a serial number. This tracking allows it prove the number of remoulds and total life since new, and is thus able to extend the number of remoulds allowed beyond that permitted for tyres which have not had lives tracked. Many other maintenance providers have this service (*see tables, pages 28 & 30*). Tracking will thus increase number of remoulds between replacement and so reduce overall cost.

Many shops and airlines also do not remould tyres themselves, and sub-contract remoulds to original vendors, and are charged a flat rate per remould according to tyre size. While many shops sub-contract tyre remoulds, they still provide a tracking service and thus a maintenance management service for airlines. There is little room for cost improvement since it is hard to find tyre remoulds charged under time and material contracts.

Wheel inspection capabilities provided by airlines are often related to the types they operate, and a full range of capabilities is usually limited to the largest providers and original vendors. Like tyre remoulds, wheel inspections are often left by airlines on fixed rates per FH, FC or inspection. The rates charged

for this type of service is often based on a degree of error by the provider, and so airlines may pay over the odds. Airlines accept this since wheels are not seen as a high cost item. Time and material contracts, however, mean airlines will pay varying rates for each wheel inspection, but will pay less in the long term. Wheel inspections are required every several wheel removals when tyres have to be remoulded. Wheels only require replacing on condition, and some can almost last an aircraft's entire operational life.

Brake repairs are the most complex and highest cost item of tyre, wheels and brakes. Brakes have either steel or carbon disks. Steel brake units have several disks and there is a minimum weight and thickness of each stack of disks, since this is required to absorb heat released during braking. The pads on steel disks can only be ground twice before being replaced. The disks, or rotors, can have new pads fitted. Rotors can be repaired an indefinite number of times, but have to be replaced if their thickness falls below a minimum. The repair process has to restore thickness and weight of the brake stack to increase capacity to absorb heat. All brake repair shops have the capability to repair steel brakes.

Carbon brakes use carbon disks. These have longer repair intervals. Disks are made of two halves, and are ground to half thickness at repair and two reassembled to make a single disk of original thickness. They can only be repaired once, and so scrapped at the second removal. There are less shops with the capability to grind carbon disks than there are will the ability to repair steel units, but their numbers are increasing.

There are a large number of brake

NORTH AMERICAN AIRLINE & THIRD PARTY WHEEL & BRAKE MRO PROVIDERS

Provider	Tyre retreads	Tyre tracking	Wheel types inspection	Brake types repair	Steel brakes	Carbon brakes
AAR	No	Yes	Most commercial types	Most commercial types	Yes	Yes
Aero Wheel & Brake	Yes	Yes	Commercial aircraft	Commercial aircraft	Yes	Yes
Air Canada	No	Yes	737, 767, 747, DC-9, A300, A310, A320, A330, A340	737, 767, 747, DC-9, A320, A330, A340	Yes	Yes
American Airlines	No	No	No	MD-80, 757, 767, A300 & F.100	Yes	Yes
Aviation Brake User	No	Yes	727, 737, 757, 767, 777 MD-80, DC-9, A300, A320, A330	727, 737, 757, 767, 777 MD-80, DC-9, A300, A320, A330	Yes	Yes
Aviall	Yes	No	All Airbus, Boeing & McDonnell Douglas	All Airbus, Boeing & McDonnell Douglas	Yes	Yes
Dallas Centreline	Yes	Yes	All Boeing, all McDonnell Douglas, A300, A320, A330 A340, L-1011	All Boeing, all McDonnell Douglas, A300, A320, A330 A340, L-1011	Yes	Yes
Delta TechOps	Yes	Yes	727, 737, 757, 767, MD-80, MD-11	727, 737, 757, 767, MD-80, MD-11	Yes	Yes
Goodrich Landing Systems	No	No	All Airbus, Boeing & McDonnell Douglas	All Airbus, Boeing & McDonnell Douglas	Yes	Yes
Honeywell	Yes	Yes	All Airbus, Boeing & McDonnell Douglas	All Airbus, Boeing & McDonnell Douglas	Yes	Yes
Northwest Airlines	No	Yes	DC-9, A320, 727, 757, 747	DC-9, A320, 727, 757, 747	Yes	Yes
United Services	No	No	737, 747-400, 757, 767, 777, A320	737, 747-400, 757, 767, 777, A320	Yes	Yes

EUROPEAN AIRLINE & THIRD PARTY WHEEL & BRAKE MRO PROVIDERS

Provider	Tyre retreads	Tyre tracking	Wheel types inspection	Brake types repair	Steel brakes	Carbon brakes
Air France Industries	Yes	Yes	727, 737, 767, 747, 777, A320, A330 A340, DC-9	N/A	N/A	N/A
Cargolux	No	Yes	737, 747	737, 747	Yes	Yes
Finnair	Yes	Yes	DC-9, MD-80, DC-10, MD-11, 757, A300, A320	DC-9, MD-80, DC-10, MD-11, 757, A300, A320	Yes	Yes
FLS Aerospace	No	No	707, 717, 727, 737, 757, 767, 747, A300, A310, A320, A330, A340,	707, 717, 727, 737, 757, 767, 747, A300, A310, A320, A330, A340, MD-80, DC-10	Yes	Yes
Hellenic Aerospace	No	Yes	737	737, DC-10	Yes	Yes
Iberia	No	Yes	A300, A320, A330, A340, MD-80, 707, 747, 757	A300, A320, A330, A340, MD-80, 707, 747, 757	Yes	Yes
Kearsley Airways	Yes	Yes	Most commercial types	Most commercial types	Yes	Yes
KLM	No	Yes	737, 757, 767, 747, DC-10, MD-11	737, 767, 767, DC-10, MD-11	Yes	Yes
Lufthansa Technik	No	Yes	A320, A310, A340, 737, 757, 767, 777, 747	A320, A310, A340, 737, 757, 767, 777, 747	Yes	Yes
Messier Services	No	No	All Airbus types, MD-80, DC-10, 737, 757	All Airbus types, MD-80, DC-10	Yes	Yes
Olympic Airways	No	Yes	737, A300, A340	737, A300, A340	Yes	Yes
Sabena Technics	No	Yes	A300, A310, A320, A330, A340, 707, 727, 737, 747, 757, 767, DC-10, MD-11	A300, A310, A320, A330, A340, 707, 727, 747, DC-10	Yes	Yes
SAS Component	No	Yes	737, 757, 767, DC-9, MD-80/90, DC-10, A300, A320, A330, A340	737, 757, 767, 777, DC-9, MD-80/90, DC-10, MD-11, A300, A320, A330, A340	Yes	Yes
SR Technics	Yes	Yes	MD-80, DC-10, MD-11 A320, A330,	DC-9, MD-80, MD-11, 747, A320, A310, A340	Yes	Yes
TAP Engineering	No	Yes	707, 727, 737, A310, A320, A330, A340	707, 727, 737, A310, A320, A330, A340	Yes	Yes
TAT Industries	No	Yes	MD-80, DC-10, 737, 747, A320, A330, A340	MD-80, DC-10, 737, 747, A320, A330, A340	Yes	Yes

ASIA PACIFIC AIRLINE & THIRD PARTY WHEEL & BRAKE MRO PROVIDERS

Provider	Tyre retreads	Tyre tracking	Wheel types inspection	Brake types repair	Steel brakes	Carbon brakes
Air New Zealand	No	Yes	727, 737, 767, 747	727, 737, 767, 747	Yes	Yes
Ameco	No	No	All Boeing types & A340	All Boeing types & A340	Yes	Yes
Garuda Maintenance	No	Yes	737, DC-10, 747, A330	737, 747, DC-10, A330	Yes	No
Gameco	No	No	737, 757, 767, 777, A320	737, 757, 767, 777, A320	Yes	Yes
Goodrich Asia	No	No	All Airbus, Boeing & McDonnell Douglas	All Airbus, Boeing & McDonnell Douglas	Yes	Yes
Honeywell Asia	No	Yes	All Airbus, all Boeing, MD-80/90, MD-11	All Airbus, all Boeing, MD-80/90, MD-11	Yes	Yes
Japan Airlines	No	Yes	737, 767, 747, 777, DC-10, MD-11	737, 767, 747, 777, DC-10, MD-11	Yes	Yes
SIA Engineering	No	Yes	737, 747, 777, A310, A320, A340	737, 747, 777, A310, A320, A340	Yes	Yes
Singapore Technologies	No	No	All Airbus, DC-9, DC-10, MD-11 727, 737, 747, 757, 767	All Airbus, DC-9, DC-10, MD-11, 727, 737, 747, 757, 767	Yes	Yes
Thai Airways	No	No	A300, A330, 737, 777, 747, MD-11	A300, A330, 737, 777, 747, MD-11	Yes	Yes

OTHER GLOBAL AIRLINE & THIRD PARTY WHEEL & BRAKE MRO PROVIDERS

Provider	Tyre retreads	Tyre tracking	Wheel types inspection	Brake types repair	Steel brakes	Carbon brakes
Gamco	No	Yes	None	All Airbus & Boeing types, L-1011	Yes	Yes
South African Airways	No	Yes	None	737, 767, 747, A300, A320	Yes	Yes
Varig	No	No	707, 727, 737, 747, 767, 777, DC-10, MD-11	707, 727, 737, 747, 767, 777, DC-10, MD-11		

repair shops. As is the case with wheels, most airline shops concentrate on brakes used on the aircraft types they operate. The larger independent providers have wider capabilities. The majority of these are located in the US. AAR, Aero Wheel and Brake, Aviation Brake User, Aviall, Dallas Centreline, Goodrich Landing Systems and Honeywell have the widest capabilities. Many of these, in particular Goodrich Landing Systems and Honeywell, have the full carbon brake repair capabilities that few airlines and other smaller shops have.

Major European brake repair providers are FLS Aerospace, Kearsley Airways and Messier Services. Several larger European airlines also have extensive brake repair capabilities, and these include SAS Component, Air France Industries, Lufthansa Technik, Sabena Technics, SR Technics and TAP Engineering.

The Asia Pacific has the majority of other independent providers and airlines offering third party tyre, wheel and brake repair services. Goodrich Landing Systems has facilities in Hong Kong and Sydney is one of the largest providers, and offers services for all Airbus, Boeing and McDonnell Douglas types.

Other major wheel and brake repair providers in other areas of the world include Gamco, Bedek Aviation, South African Airways and Varig.

Landing gear

The trend towards sub-contracting of landing gear repair and overhaul by a large number of airlines is due to the eight to 10 year intervals between removals and consequent small number of landing gear repairs each year. The low volume generated by most airlines has led to the consolidation of landing gear repair shops around the globe.

Most landing gear repairs are now paid for on an exchange fee basis. This often has three cost elements of an exchange fee to cover the ownership of the landing gear, a fixed repair cost for the routine items of a shop visit, and a third element to cover the replacement of scrapped parts.

This may appear to provide little room for improvement in cost, but airlines have freedom with removal intervals and should monitor the condition of their gears so as to achieve an optimum removal time that will allow the lowest cost per FC to be achieved.

Less airlines provide landing gear overhaul capabilities than in the past. Those still providing repairs are limited to most of the aircraft types they operate. Airlines with the largest capabilities are Air Canada, American Airlines, Delta TechOps, United Services, Lufthansa Technik, Japan Airlines and Varig.

There are other airlines with landing gear overhaul capability, but these offer services for fewer types.

The landing gear market is dominated by independent providers, and these include AAR, Goodrich Landing Systems, Hawker Pacific, Messier Dowty and Kearsley Airways. Both Messier Dowty and Goodrich Landing Systems have a global presence, with facilities in the US, Europe and Asia Pacific.

One of the world's largest facilities is AAR, which overhauls 600 gears annually, although this includes military and regional aircraft types. Goodrich Landing Systems and Messier Dowty will also have high annual throughputs, and these three providers account for gear overhauls from the majority of airlines. Hawker Pacific is another large independent, with about 450 sets per year for its US and UK shops. Another large provider is TAT Industries, France.

GLOBAL AIRLINE & THIRD PARTY LANDING GEAR MRO PROVIDERS

Provider	Aircraft types for landing gear overhaul	Annual number of overhauls	Annual capacity for landing gear overhauls
North America			
AAR	Commercial aircraft	600	600
Air Canada	737, 767, DC-9, A320,	20	20
American Airlines	A300, MD-80, 767	225	250-275
Delta TechOps	737, 757, 767, MD-80, MD-11	100 legs	60 shipsets
Goodrich Landing Systems	All Boeing types & all McDonnell Douglas types		
Hawker Pacific, CA	727, 737, 747, 757, 767, A300, A310, DC-10, DC-9, MD-80	260	300 plus
Heroux Devtek	DC-10, 707	250	
United Services	727, 737, 747, 757, 767, 777, A320	123	
Europe			
Finnair	DC-9, MD-80	12	18
FLS Aerospace	707, 727, 737, 747, 767, DC-8, A320	65 plus	90
Hawker Pacific	737, 747, 757, 767, 777, DC-10,	200	300 plus
Kearsley Airways	All Boeing types, L-1011	200-250	300-350
Lufthansa Technik	All Airbus types, all Boeing types, DC-9, DC-10, MD-80/90, MD-11, L-1011	600 legs	
Messier Dowty	All Airbus types, 737, 747, 757, 767, 777, MD-80, DC-10, MD-11		
Olympic Airways	737	10	12
Ogma	737		6
Sabena Technics	737, A320	60	75
SAS Component	DC-9, MD-80		
SR Technics	DC-9, MD-80, 717	12	15-20
TAP Engineering	707, 727, 737	12	15
TAT Industries	MD-80, DC-10, 737	150 legs	800 legs
Trinity Aerospace	707, 727, 737	50	50
Asia Pacific			
Air New Zealand	737	10	20
ANA	737, 767, 747		
Ameco Beijing	737, 767, 747	18	26
Garuda	737		
Goodrich Asia	All Airbus, Boeing & McDonnell Douglas		
HAECO	747		
Japan Airlines	737, 767, 747, 777, DC-10, MD-11	100	200
Messier Services Asia	All Airbus, Boeing & McDonnell Douglas types		
SIA Engineering Company	737, 747, 777, A310	24	48
Rest of World			
IAI/Bedek Aviation/SHL	707, 717, 727, 737, DC-9, MD-80 plus developing 757, 767, 747, A320, A310, A300	80 legs	300 legs, with possible increase in capacity
South African Airways	737, 747, A300	20	25
Varig	707, 727, 737, 747, 767, DC-10, MD-11	80	120

SHL, a division of Bedek Aviation, has the largest throughput of independent shops outside of the US and Europe after AAR, Goodrich and Messier.

The largest airline providers are Delta TechOps, United Services, Lufthansa Technik, Japan Airlines SIA Engineering and Varig (*see table, page 32*).

All Nippon Airways (ANA) specialises in offering landing gear maintenance for the Boeing types it operates.

APU repair

The APU repair market has followed the same course as the engine repair market. The high number of annual units required to make a shop viable has forced the market into consolidation. The APU market is now dominated by a small number of major airline and independent providers.

APU maintenance is often charged at either a fixed rate per FH or on a time and material basis. Like other component types, airlines regard APUs as relatively unimportant and pay little attention to maintenance management. This can result in large discrepancies between fixed rate and a time and material deals. Finnair, for example, which changed from a fixed rate to time and material contract saved \$15 per FH on its MD-11 fleet. While this may seem small, it translates into several hundred thousand dollars of saving each year on a few aircraft.

The majority of APU repair and overhaul providers are based in the US and Europe. Airlines offer capability for the types they operate themselves. Thus, Delta TechOps has a wide capability on account of its varied fleet.

The major non-airline providers in the US are Triumph Air Repair, Honeywell and Hamilton Sundstrand. As an original manufacturer, it is not surprising Hamilton Sundstrand has one of the world's highest throughputs, with 1,000 shop visits each year. Standard Aero is another large facility, with 300 shop visits annually. While officially providing third party support, some airlines concentrate on their own fleets.

The European providers are the next largest, but significantly smaller than the US. The largest shop is Lufthansa Technik, which not only has a wide capability but also has one of the world's highest throughputs of about 175 shop visits.

Europe also has some of the largest independent shops. EADS-Revima is one of the biggest, both in terms of capability and annual throughput. It has capability for APUs fitted to most Airbus, Boeing and McDonnell Douglas aircraft types and an annual throughput of 350 shop visits.

H+S APU in the UK is Europe's

GLOBAL AIRLINE & THIRD PARTY APU MRO PROVIDERS

Provider	APU types provide shop visit capability for	Annual number of shop visits
Air Canada	GTCP 85, GTCP 85-129, GTCP 36-300, GTCP 331-200	150
American Airlines	GTCP 131-9B, GTCP 331-500, GTCP 85-98D	50 plus
Delta TechOps	GTCP 85-129, GTCP 331-200, GTCP 331-350, GTCP 85-98D, GTCP 131-9D, GTCP 700-4E	330
GEES	GTCP 36-100, GTCP 36-150, APS 500	
Hamilton Sundstrand	PW401, APS 2000, APS (717), APS 3200,	1,000
Honeywell	All Honeywell types	
Northwest Airlines	GTCP 85, GTCP 85-98D, GTCP 85-129, GTCP 660-4, GTCP 331-200	80
Pratt & Whitney Canada	PW901, APS 3200	
Standard Aero	GTCP 36-100, GTCP 36-150, GTCP 85 series	300
Triumph Air Repair	GTCP 131-9 B/D, GTCP 85, GTCP 331-200/250, GTCP 660, TSCP 700, GTCP 36	
United Services	PW901A, GTCP 331-200, GTCP 331-500	22
Europe		
EADS-Revima	GTCP 85, GTCP 85-129, GTCP 85-98D, GTCP 131-9A, GTCP 331-250, GTCP 331-200, GTCP 660-4, PW901A, GTCP 700-5, GTCP 331-350, GTCP 700-4B, GTCP 700-4E	350
Euravia	ST6L-73 (L-1011)	50
Finnair	GTCP 85, GTCP 85-98D,	40
FLS Aerospace	GTCP 85, GTCP 85-98D, GTCP 85-129, GTCP 36-280, GTCP 660-4, GTCP 331-200, GTCP 331-250	120 plus
Honeywell, Germany	All Honeywell types	
Hellenic Aerospace	GTCP 85-129	20
H + S APU	PW901, GTCP 331-200ER, GTCP 331-250	246
Iberia	GTCP 131-9A, GTCP 36-300, GTCP 85-98	40
Lufthansa Aero	PW901A	20
Lufthansa Technik	APS 2000, APS 3200, GTCP 85-129, GTCP 331-250, GTCP 331-350, GTCP 331-500, GTCP 660, GTCP 700, PW 901	175
Olympic Airways	GTCP 85, GTCP 85-129, GTCP 331-250, GTCP 331-350	25
Sabena Technics	GTCP 331-350, GTCP 85-129, GTCP 660-4	20
TAP Engineering	GTCP 85, GTCP 85-129, GTCP 131-9A	10
Volvo Aero Engine Services	GTCP 85, GTCP 85-98D	40
Asia Pacific & Rest of World		
Air New Zealand	GTCP 85	40
Ameco Beijing	GTCP 85	15
Garuda Maintenance	GTCP 85, GTCP 700	36
Honeywell, Singapore	All Honeywell types	
Japan Airlines	GTCP 85-129, GTCP 331-200, GTCP 660, GTCP 331-500, GTCP 700, PW901	80
SIA Engineering	GTCP 85, GTCP 331-200, GTCP 660-4, GTCP 331-500, GTCP 131-9A, GTCP 331-350, PW901	15
Gamco	GTCP 331-200, GTCP 331-250	30
Varig	GTCP 85, GTCP 85-129, GTCP 660, GTCP 331-200, GTCP 700, GTCP 331-250	200

second largest provider. Although its capability is limited to a few types, it has annual throughput of about 250 shop visits.

FLS is another large provider, with 120 annual shop visits and a capability covering APUs for a large number of Airbus and Boeing aircraft.

Other facilities around the globe are limited mainly to airline shops which cater mainly for their own fleets. Varig

has a large throughout, being one of the largest maintenance providers in South America. Moreover, while Varig's APU capability matches the types it has in its fleet, Varig operates similar types to many other Central and South American carriers, and so has ideal capability.

One problem facing APU repair providers is the increasing reliability of APUs, thus reducing the global annual shop visit requirement.

Thrust reverser

Thrust reversers are increasing in reliability and time between overhauls are rising. The thrust reverser market has consolidated, leaving a few major players. In North America the major airlines are American Airlines, Delta TechOps and United Services (*see table, page 35*), but concentrate on the reversers used in their fleets. Delta TechOps has a large annual

GLOBAL AIRLINE & THIRD PARTY THRUST REVERSER MRO PROVIDERS

Provider	Aircraft or engine types provide thrust repair capability for	Annual number of repaired units
North America		
Airborne Nacelle	A300, A310, A320, A330, 727, 737, 747, 757, 767, DC-8, DC-9, DC-10, MD-80, L-1011	
American Airlines	A300, 757, 767, 777, 737, MD-80, F.100	200 plus
Aviation Equipment	727, 737, 747, 757, 767, DC-8, DC-9, DC-10, MD-80	
Aviation Technologies	All Airbus, Boeing and McDonnell Douglas types plus L-1011	25 units
Delta TechOps	CFM56-3/-7, CF6-80, PW2000, PW4000-94, JT8D-15, JT8D-200, Trent 800, V.2500-D5	500 halves
Hurel Hispano	A320, A330, A340, 737, 767, 747	up to 40
Middle River Aircraft Systems	737, 747, 767, A300, A310, A330, A320, MD-11, DC-10	100
Nordam	CF6-6/-50/-80C2/-80E, CFM56-2/-3/-5/-7, JT8D, JT9D, PW2000, PW4000, RB211-524/-535, V.2500	
United Services	V.2500-A5, CFM56-3, PW2000, PW4000-94, PW4000-112	22
Europe		
Air France	CF6-50/-80C2/-80E, CFM56-2/-3/-5A/-5B/-5C, GE90	200 halves
British Airways Engineering	737, 747, 757, 767, 777	15
Finnair	DC-9, MD-80	15
FLS Aerospace	JT8D, CFM56	20
Hurel Hispano	A320, A330, A340, 737, 767, 747	up to 50
Iberia	JT8D-200, JT9D-7Q/-59/-70A, CFM56-5A/-5B, RB211-535	84
Lufthansa Technik	CF6-50/80, CFM56-3/-5/-7, PW4000, V.2500, Trent 500	450
Olympic Airways	737-200, 737-400, A300-600, A340	14
Sabena Technics	CF6-50/-80, CFM56-3/-5, JT8D, JT9D, PW4000-100	80
SAS Component	A300-600, A310, A330, 737NG, 767, 747	
SR Technics	PW4000-94, PW4000-100, CFM56-5B, CFM56-5C	25
TAP Engineering	707, 727, 737-200, 737-300, A310, A320, A340, L-1011	20
Volvo Aero Engines Services	MD-80	65
Asia Pacific & Rest of World		
Air New Zealand	727, 737, 767, 747	28
Ameco Beijing	737, 767, 747	35
Gamco	A320, A340, 767	20
Garuda	737, 747	
Hurel Hispano, Asia	A320, A330, A340, 737, 767, 747	up to 50
Nordam, Singapore	CF6-6/-50/-80C2/-80E, CFM56-2/-3/-5/-7, JT8D, JT9D, PW2000, PW4000, RB211-524/-535, V.2500	
South African Airways	JT8D, JT9D,	

throughput, with 500 halves of 250 units each year going through its shops.

Major independent providers are Airborne Nacelle, Aviation Equipment, Aviation Technologies, Middle River Aircraft Systems and Nordam. Nordam has capability for thrust reversers on almost every engine type.

Again, Europe has the second largest collection of repair providers. These include the major airlines. Air France Industries and Lufthansa Technik have the largest number of types in their fleets. Air France Industries and Lufthansa Technik have some of the largest volumes of global providers, with about 300 units annually between them.

Other major European providers with an extensive range of capabilities are Sabena Technics, Iberia, SAS Component, SR Technics and TAP Engineering.

Minor European shops concentrate on the types which dominate their fleets, or engine overhaul capabilities. Airlines such as Finnair and Olympic Airways have capabilities for the DC-9, MD-80, 737, A300-600 and A340.

Hurel Hispano is the largest independent provider in Europe, with capabilities for thrust reversers on engines powering all major Airbus and Boeing types.

The largest providers in the Asia Pacific are subsidiaries of the largest

providers in the US and Europe. Nordam has a large facility in Singapore, with the same capabilities as in the US shop. Hurel Hispano has new facilities in the US and Asia. Hurel Hispano plans to build its Asia Pacific facility to a capability of 150 units per year, making it the second largest outside the US and Europe. This and Nordam's Singapore facility overshadow the major airline shops which provide the majority of the capability the rest of the region. These include Ameco Beijing, Air New Zealand, Gamco and South African Airways.

Even large carriers like Japan Airlines, Thai and SIA sub-contract thrust reverser repairs. 