

PW4000-94 technical support providers

There are about 2,200 PW4000-94s in service with more than 700 aircraft. A global survey of six major levels of support identifies the major providers.

This survey summarises the major aftermarket and technical support service providers for the Pratt & Whitney (PW) PW4000 94-inch turbofan series.

It is grouped into six sections covering the categories of technical support offered by each of the providers:

1. Line maintenance and in-service operational support (see table, page this page);
2. Engine management (see table, page 30);
3. Engine provisioning (see table, page 30);
4. Engine components (see table, page 30);
5. Shop visit maintenance (see table, page 31);
6. Specialist repairs (see table, page 31).

Those companies that are listed in most or all of the six sections can loosely be called one-stop-shop service providers for the PW4000 94-inch family. This means that they provide most, if not all, the technical support services that a third-party customer would require. The survey tables show that the providers capable of offering a complete range of services for the PW4000-94 include: Delta TechOps; Lufthansa Technik; SR Technics; and, of course, the original equipment manufacturer (OEM), Pratt & Whitney Engine Services (PWES). Notably, United Parcel Services (UPS) and FedEx are among the OEM's largest engine overhaul customers. FedEx sends its A300/A310 and MD-11 engines to PWES's Cheshire Engine Center, while UPS sends similar powerplants to PWES's Eagle Services Asia. Martinair is another big outsourcing customer, sending its engines to both Eagle Services Asia and SR Technics.

Market share analysis

In terms of the major portion of PW4000-94 engine overhauls, the largest provider of full overhauls is the OEM

itself. According to ACAS, which records actual maintenance contracts, PWES performs about half of all PW4000-94 engine shop visits. In the US, PWES's Engine Center, based in Cheshire, CT, accounts for 21% of total PW4000-94 worldwide engine shop visits, while its Eagle Services Asia venture with SIA Engineering Company (SIAEC) in Singapore performs 20%. ACAS also lists Pratt & Whitney as carrying out 6.2% of total worldwide engine shop visits for the PW4000-94.

The next biggest slice of the pie, 14.2%, is undertaken by airlines' own in-house overhaul facilities. One of these, United Services, offers third-party full-engine overhaul services to customers, accounting for 9.7% of the world total. The remainder include: Delta TechOps (5.4%), of which World Airways is a big customer; Lufthansa Technik (4.7%); Ameco Beijing (3.8%), a venture with Lufthansa Technik, primarily servicing Air China's fleet - together LHT and Ameco account for 8.5% of the worldwide PW4000-95 maintenance, repair and overhaul (MRO) market; SR Technics (3.6%); GE Engine Services (2.9%); Mitsubishi Heavy Industries

(1.2%); Biman Bangladesh Airlines (0.6%); SAS Technical Services (0.4%); and Air India (0.29%).

Aftermarket perspectives

According to Robin Salisbury at PW, the PW4000-94 fleet is now experiencing 'unprecedented levels of reliability and on-wing durability', which PW 'expects to continue going forward'. This will reduce operators' maintenance costs, and ensure that overhaul shop capacity with existing suppliers will be more than adequate.

"PWES intends to continue to seek MRO volume as more operators outsource overhaul capability," notes Salisbury. "We are working with our customers to expand the scope of our offerings in engine health monitoring, defined-cost arrangements (flight-hour-based cost of maintenance), fleet management, and line maintenance services such as 'EcoPower', which is an environmentally neutral engine wash system that increases an engine's on-wing time by restoring exhaust gas temperature (EGT) margin, and improving fuel burn and CO2 emissions."

PWES, working with its 'global service partners', provides a full suite of engine overhaul, parts repair and replacement solutions, line maintenance and lease engines to support all models of the PW4000. These engines are overhauled at the company's two centres in Cheshire, CT, USA and in Singapore, which are supported by a worldwide network of 18 part-repair facilities. PWES also repairs composite material components, particularly for nacelle inlets and thrust reversers with exchange material available to support operators' needs.

In February 2006, FedEx chose PWES to provide an off-wing Fleet Management Program (FMP) as part of a 20-year

PW4000-94 LINE MAINTENANCE & IN-SERVICE OPERATIONAL SUPPORT

	On-wing maintenance	Line maintenance	Hospital repair/ Quick turn repairs	On-wing support	AOG/field services	Borescope inspection
Air India	Yes	Yes	Yes	Yes	Yes	Yes
AMECO Beijing	Yes	Yes	Yes	Yes	Yes	Yes
Delta TechOps	Yes	Yes	Yes	Yes	Yes	Yes
Egyptair E&M	Yes	Yes	Yes	Yes	Yes	Yes
Korean Air	Yes	Yes	Yes	Yes	Yes	Yes
Lufthansa Technik	Yes	Yes	Yes	Yes	Yes	Yes
Pratt & Whitney Engine Services	Yes	Yes	Yes	Yes	Yes	Yes
SIA Engineering (SIAEC)	Yes	Yes	Yes	Yes	Yes	Yes
SR Technics	Yes	Yes	Yes	Yes	Yes	Yes
United Services	Yes	Yes	Yes	Yes	Yes	Yes
VEM	Yes	Yes	Yes	Yes	Yes	Yes

PW4000-94 ENGINE MANAGEMENT

	Maintenance management & check planning	ADs/SBs management	Documentation management	Health/condition monitoring
Air India	Yes	Yes	Yes	Yes
AMECO Beijing	Yes	Yes	Yes	Yes
Chromalloy	Yes	Yes	Yes	Yes
Delta TechOps	Yes	Yes	Yes	Yes
Egyptair E&M	Yes	Yes	Yes	Yes
GA Telesis	Yes	Yes	Yes	Yes
IASG	Yes	Yes	Yes	Yes
Korean Air Maintenance	Yes	Yes	Yes	Yes
Lufthansa Technik	Yes	Yes	Yes	Yes
Pratt & Whitney	Yes	Yes	Yes	Yes
SIA Engineering (SIAEC)	Yes	Yes	Yes	Yes
SR Technics	Yes	Yes	Yes	Yes
Total Engine Support UK	Yes	Yes	Yes	Yes
United Services	Yes	Yes	Yes	Yes
Varig VEM	Yes	Yes	Yes	Yes

PW4000-94 ENGINE PROVISIONING

	Short-term leasing	Medium- & long-term leasing	Engine pooling	Sale & leasebacks
Chromalloy	Yes	Yes	~	~
Delta TechOps	Yes	Yes	Yes	~
Engine Lease Finance Corp (ELFC)	Yes	Yes	~	Yes
Lufthansa Technik	Yes	Yes	Yes	Yes
Pratt & Whitney	Yes	Yes	~	Yes
SR Technics	Yes	Yes	Yes	Yes
Willis Lease	Yes	Yes	Yes	Yes

PW4000-94 ENGINE COMPONENTS

	QEC repair	QEC build-up & engine dressing	LRU repair	LRU pooling & logistics
Delta TechOps	Yes	Yes	Yes	Yes
GKN Aerospace	Yes	~	~	~
Korean Air Maintenance	Yes	Yes	Yes	Yes
Lufthansa Technik	Yes	Yes	Yes	Yes
TCI International	Yes	~	Yes	Yes
Pratt & Whitney	Yes	Yes	Yes	Yes
SR Technics	Yes	Yes	Yes	Yes

exclusive contract for the operator's fleet of PW4000-94 engines. The agreement includes the overhaul and repair of 135 PW4000 engines operating on FedEx's fleet of MD-11s, A300-600s and A310s, with the option to include any PW4000-94-equipped aircraft added to its fleet throughout the lifetime of the contract. The engines will be maintained within PWES's global service partners' restoration and repair network. PWES will manage the performance of FedEx's PW4000 fleet using its advanced

diagnostics and engine management (ADEM) system, which is a web-based, automated tool.

Europe is host to some significant providers of PW4000-94 aftermarket services. Of these, SR Technics (SRT) has refurbished more than 1,650 PW4000-94s at its engine overhaul facility in Zurich. A notable recent contract was with Air Macau, which signed a five-year contract in 2006 with SR Technics for engine maintenance and support for the PW4158 engines on the airline's A300-

600 aircraft. Other PW4000-94 MRO customers include: Martinair Holland (MD-11F, 747-400F and 767-300); Aeromexico (767-200 & -300); Belair (767-300); Tarom (A310-300); Transmile Air Services (MD-11F); and XL Airways (767-300).

The company offers what it calls 'integrated engine solutions' (IES), which include field team availability, engineering support, and removal planning throughout the engine's lifecycle. SRT provides PW4000 engine services to more than 60 different airlines or leasing companies, including non-exclusive contracts.

According to Vivienne Burch, marketing spokesperson at SRT, the competition for the MRO work on the PW4000 engine is strong. This depends largely on technical support providers; having sufficient shop capacity and access to available parts coming from the aftermarket. Moreover, on the PW4000-94 in particular, Burch reports that SRT is seeing increasing business from non-exclusive contracts. SRT is also actively following-up the re-entry of aircraft such as the 747-400.

"This situation has arisen because of delays on both the Airbus A380 and the 787," notes Burch. "The result of these delays is that leasing companies and other parties are offering older 747-400s (and other types) as an alternative until the new generation of large aircraft enters service. This therefore provides SRT with the opportunity for many shop visits and ring case modifications for PW4000 engines."

Burch observes that the PW4000-94, which is still in production, will be in operation for 'quite some time'. This is because many aircraft, including the A300, 767, MD-11, and 747-400 will be converted to freighters, which are expected to reach an age of 30 years.

On the provider side of the market, Burch believes that the OEM will aggressively try to increase its market share by offering spare engines and low shop visit rates. "The risk for airlines is that PWES will gain market domination and increase its prices to recover the losses made during its quest for market share," she notes. "A general consolidation in the PW4000 overhaul market is also expected. Volvo has already left, and other providers might change their capabilities when the aircraft leave the fleet of their main customer."

Another big player, Lufthansa Technik, performs most of its PW4000-94 overhauls in Hamburg, but also has capabilities at its joint venture partner Ameco Beijing. Together they account for more than 8% of the PW4000-94 overhaul market. Customers include: Aerolineas Argentinas, Air Madagascar, Cathay Pacific Airways, China Southern,

PW4000-94 SHOP VISIT MAINTENANCE

	Hot-section inspection	Module change	Module overhaul	Full overhaul	No of annual shop visits	Mods & upgrades	Disassembly/build-up	On-site test cell	Specialist processes (HVOF/plasma)
Air India	Yes	Yes	Yes	Yes	n/s	Yes	Yes	Yes	Yes
AMECO Beijing	Yes	Yes	Yes	Yes	n/s	Yes	Yes	Yes	~
Delta TechOps	Yes	Yes	Yes	Yes	→65	Yes	Yes	Yes	Yes
Egyptair E&M	Yes	Yes	Yes	Yes	n/s	Yes	Yes	~	~
Lufthansa Technik	Yes	Yes	Yes	Yes	40-50	Yes	Yes	Yes	Yes
Korean Air Maintenance	Yes	Yes	Yes	Yes	n/s	Yes	Yes	Yes	Yes
Pratt & Whitney	Yes	Yes	Yes	Yes	→250	Yes	Yes	Yes	Yes
SIA Engineering (SIAEC)	Yes	Yes	Yes	Yes	n/s	Yes	Yes	Yes	Yes
SR Technics	Yes	Yes	Yes	Yes	→120	Yes	Yes	Yes	Yes
United Services	Yes	Yes	Yes	Yes	n/s	Yes	Yes	Yes	Yes

PW4000-94 SPECIALIST REPAIRS

	Fan blade repair	Vanes & stator repair	Compressor blade repair	Turbine blade repair	Combustor repair	Casing repair	Seals repair	On-site DER authority	PMA parts approved
Asian Compressor Technology services	~	Yes	~	~	~	~	Yes	~	~
Asian Surface Technologies/ Praxair	Yes	~	~	~	~	~	~	~	~
Barnes Aerospace Windsor Airmotive	~	~	~	~	~	Yes	Yes	Yes	~
Chromalloy	~	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Delta TechOps	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GKN Aerospace	Yes	~	~	~	~	Yes	~	~	~
Lufthansa Technik	Yes	Yes	Yes	~	Yes	Yes	Yes	Yes	Yes
Pratt & Whitney Engine Services	Yes	Yes	Yes	~	Yes	Yes	Yes	Yes	Yes
PWA International	~	~	~	~	~	Yes	~	~	~
SR Technics	~	Yes	Yes	Yes	Yes	Yes	Yes	Yes	~

Condor Flugdienst, Corsairfly, Czech Airlines, LAN Airlines, and Lauda Air.

Klaus Mueller, marketing research manager at LHT, notes: "Of course the engine is ageing, and many shop visits are in their second or third life.

Consequently, the age of the PW4000 will play a role in the cost per event, which is increasing. The ring case modification is a market driver, but airlines and operators are tending to include that modification programme in a regular shop visit."

Mueller observes that in 2007, the total number of shop visits (for the worldwide market) on the PW4000 increased sharply. "The global average of 300 shop visits for the past two years has risen to 550," he notes. "Many engines from the mid-to-late 1990s are coming into their third lives, so I expect the average number of shop visits for the next four or five years to stabilise at 500 engines per year."

Specialist repairs

GKN Aerospace Engine Products has full repair and overhaul capability for the

94-inch fan PW4000 engine on both the Phase I and Phase III fan blades, as well as the exhaust sleeve. Its fan blade business is located in El Cajon, CA, while its PW4000 exhaust sleeve repairs are undertaken at its facility in Santa Ana. According to Steve Pearl, marketing spokesperson at GKN's Chem-Tronics division, the company has several approved OEM repairs available, as well as extended designated engineering representative (DER) repairs.

Another PW4000-94 component repair and modification specialist is Barnes Aerospace/Windsor Airmotive Division, which offers alternative DER repairs on many PW4000 engine components. Its facilities in Connecticut, Ohio and Singapore perform P&W-approved repairs and modifications on a variety of parts, including: casings and frames; rotating parts such as disks, drums and low pressure turbine (LPT) rotating air seals; honeycomb seal repair; high pressure solid turbine shroud; and other major turbine engine components. Windsor Airmotive also provides DER repairs on PW4000-94s, and other engine

types.

William Gonet, vice president of sales and marketing at Barnes Aerospace, believes that the overhaul market remains strong for the PW4000-94 engine for the foreseeable future. "Windsor Airmotive will continue to invest in new processes and equipment to meet the needs of the PW4000-94 overhaul market, along with the other large commercial turbine engines. One of our key strengths is our ability to work effectively with the OEMs to provide them with valuable repair solutions."

Another specialist provider, Asian Compressor Technology Services (ACT), Taiwan, repairs and overhauls high pressure compressor (HPC) stators and variable vane inner shrouds (VVIS) on the PW4000-94. Its customers for these repairs include China Airlines and SIA, as well as other regional carriers. ACT was ISO14000 certified in 2003. [AC](#)

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