

With airlines seeking to outsource an increasing amount of technical support activity, more engine maintenance providers are offering more comprehensive engine support services. This survey provides a brief description of services provided by major North American & European providers.

# Engine support services survey

**S**ourcing more engine services is becoming increasingly important for small and start-up airlines. An engineering department for engines is part of their infrastructure that airlines are now trying to outsource at whatever level possible.

## Engine Services

Besides engine maintenance, airlines require a variety of services including: engine fleet management; on-wing support; training of engineers and mechanics, tooling; spare engines; and inventories of line replaceable units (LRUs).

Engine fleet management is a core function of the traditional airline's engineering department. Engines have to be condition monitored, and various parameters of engine performance and physical operation followed, and the data stored. Deviations from trends and safe parameters indicate an engine should be removed for maintenance. Sophisticated engine condition monitoring systems have evolved, which can monitor engines on a real-time basis, transmit data via satellite, and monitor a larger number of parameters. This alone requires highly qualified engineers with experience in engine removal decision making and maintenance management. It also requires a large investment in engine health monitoring apparatus. An engineering team is also required for engine fleet management. This is responsible for engine maintenance management; engine removal timing; shop visit workscoping and costs; life limited parts (LLPs) management; lease return conditions; and considering spare engine requirements to minimise overall engine-related costs.

This team is also responsible for monitoring engine maintenance condition, deciding which airworthiness directives (ADs) and service bulletins (SBs) to incorporate, and keeping all

maintenance records up to date.

Besides shop visit maintenance, lighter maintenance is required during an airline's operation involving on-wing support and line maintenance and on-wing support. Line maintenance requires both the appropriate personnel, inventory of LRUs and parts and tooling.

On-wing support requires infrastructure to allow airlines to make engine changes, and deal with problems as they arise. Examples are troubleshooting, changing fan blades and major accessories, or even blending of compressor blades via borescope ports while the engine is on-wing. On-wing support also involves borescope inspections, and dealing with technical problems or aircraft-on-ground (AOG) situations. This all requires extensive tooling and spare parts, and experienced mechanics and engineers.

Supply and availability of tooling is a costly requirement for an airline, since complete engine stands and engine change rigs are large and expensive pieces of equipment. Other tooling is required for line maintenance and LRU changes, and an array of tools for engine shop visits.

Airlines also require training for their line and shop visit mechanics, as well as their engine management staff. This requires training on actual engines and engine modules and parts, although the most advanced systems use virtual reality. Mechanics also require experience in line maintenance and the shop, and overall all staff need on-the-job training and experience. Large airlines have the established infrastructure for this, but it is a large investment for smaller carriers.

LRU and rotatable inventories are a further ingredient of a reliable operation, which starts with initial provisioning requirements and acquisition of these components. This is a high investment for small airlines, especially since investment per engine is high on smaller fleets.

Spare engine access is one of the highest investments, since a fleet of 10-20

modern generation narrowbodies will require an inventory of two or three spare engines with a market value in the region of \$5 million each. This is the first area where airlines have sought to divest, and there has been a high growth in engine leasing in the past 10 years.

Airlines have divested themselves of these services and activities, or avoided acquiring them, and instead sought them from specialised engine services providers. Some airlines have used a range of suppliers, but it is often simpler for airlines to acquire all these services from the same source.

## Service providers

There are a number of specialist service providers, and the services of some of the major providers in North America and Western Europe are examined here. Original Equipment Manufacturers (OEMs) have developed their capability for offering these services in parallel to engine maintenance over the past 10-15 years. Airlines which sell third party maintenance facilities, however, have developed and evolved these capabilities for their own requirements over several decades, and are now offering these in addition to engine maintenance.

## OEMs

General Electric (GE) is one of the biggest third party engine service providers. The number of its engine maintenance shops is well known, and it has capability not only for the entire CFM56, CF6, CF34 and GE90 families, but also for the PW4000 and RB211.

"We have several on-wing support centres across our network to offer light maintenance to prevent the need for a shop visit," says Russ Shelton, general manager of maintenance repair and overhaul marketing at General Electric aircraft engines. "We can provide small

repairs, assistance for foreign object damage (FOD) incidents, and warranty claims in support of the maintenance cost per hour (MCPH) agreements we have with our engine maintenance customers. This is an intermediary between line maintenance and shop visits. We also have dispatch teams that are available 24 hours per day to help airlines with engine changes and small engine repairs for our customers around the world." GE offers technical support free to all customers of GE engines.

GE provides condition monitoring for 15% of the world's engine fleet on its remote diagnostics system. Data are collected in real time and customers can be given any level of monitoring they require. "MCPH customers get this service for free," says Shelton. "Another service we offer is E-Trend, where we collect data for airlines, which are sent to their engineering department for them to analyse and make their own management decisions. We also have engine management services to help all airlines with their engine management, and offer consultative services."

GE also has a training school to assist airlines with line maintenance, shop visit maintenance, and engineering training for engine management. GE offers inventories of engine LRUs and

accessories for airlines, and offers component exchanges and offers provisioning guarantees. GE Engine Leasing has a portfolio of 400 engines, and can provide spare engines to maintenance customers as part of its MCPH agreements, or can offer them separately.

### Pratt & Whitney

Pratt & Whitney (PW) offers a wide range of services similar to that offered by GE. PW Engine Services has capability for the JT8D family, JT9D, PW2000, PW4000, V.2500 and CFM56-3/-5B/-7.

"We have dispatch teams available 24 hours a day for on-wing support. These provide borescoping, blade blending on-wing, on-wing repairs, and external maintenance and LRU changes," explains Chris Ramm, vice president of customer services at Pratt & Whitney. "We are further interested in expanding our suite of services, and we can train our customers to do these on-wing services. We also offer engine management support, which can be on a fixed rate per hour basis. We offer complete maintenance and engine management, and also a material management programme, which is supply of material for shop visits at a fixed rate per hour. All

engines under a maintenance contract receive condition monitoring, which we provide on a real-time basis. We have two facilities for training customers, at East Hartford, Connecticut and Beijing, China. These provide training in line maintenance, module breakdown, and maintenance management. We now have a virtual reality training facility, so airlines can train at their home base rather than travel to the training school."

PW Engine Leasing has a portfolio of 120 engines, including competitor engines, provides short/medium/long-term leases to customers, and also offers engine purchase and leasebacks. "We do not yet offer LRU inventories, but are examining into this area," says Ramm.

### Snecma Services

Snecma Services is one of the fastest growing engine service providers. Its shops offer maintenance for the CFM56 family, the GE90, JT8D and JT9D. "We have several on-wing support facilities, including those in France, Belgium, Morocco and two in the US, which we added at the end of 2003," says Pierre Gires, vice president of customer operations at Snecma Services. "These provide staff, tooling and parts. We also offer remote diagnostics 24 hours per day

# Engine Lease Finance Corporation

Engine Lease Finance Corporation is one of the world's leading engine financing and leasing **technical expertise** companies specialising in the provision of individually tailored, flexible spare engine **and financing power for world-wide** support packages to the airline industry. We are a team of highly **spare engine support** experienced aviation industry professionals who together with our extensive financial resources provide an optimum blend of technical expertise and financing power to meet the operational demands of airlines world-wide.

Operating Leases	CFM56-3/-5/-7	CF6-50/-80
Sale & Leaseback	V2500-A1/-A5	RB211
Engine Acquisitions & Re-marketing	JT8D-217/9	PW2000/4000
Management of Engine Assets	AE3007/CF34	ALF502/LF507

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*Most engine service providers have on-wing dispatch teams that are available 24 hours per day, 7 days per week.*

and full fleet management services. This includes removal timing, shop visit workscoping and LLP management. These are offered on a power-by-the-hour (PBH) basis. This is a full service and so allows airlines to dispense with their engineering departments. One contract we have for complete management is Northwest's CFM56 engines for its A319/20 fleet.

"Training is also a growing activity we offer. All mechanics require JAR 147 training, and we were the first to offer this. We are also now selling software for training. Training covers line maintenance, borescope inspections and shop visit work. We have also entered into tooling supply for our customers. This is tooling for line maintenance, shop visit work and changing engines. We also lease engines to customers via our partner Shannon Engine Support (SES)." SES has a portfolio of 120 CFM56 engines, about half of which are used for long-term leasing. Snecma Services also provides LRU inventories on a PBH basis.

## Rolls-Royce

Rolls-Royce has a number of engine shops and offers maintenance for all its commercial engine products. Rolls-Royce provides all types of support and engine services as part of a total care menu, and each item can be added to a fixed hourly rate. "We can effectively take over the entire technical management for an airline," explains Ian Lloyd, director of services at Rolls-Royce. "We are just moving into on-wing support to provide ad-hoc repairs, but we have staff located with all our customers. We can provide a complete engineering service so that airlines do not require any staff, and we can also have our staff located at an airline. We also offer training through a special facility, at our Derby headquarters, for line maintenance and management engineers. Spare engines are provided by Rolls-Royce Engine Leasing, which has a portfolio of about 130."

## MTU

MTU Maintenance is a major independent maintenance provider, and has several shops providing capability for the CF6-50/-80, CFM56-3/-5/-7, V.2500 and CF34. MTU now offers additional support services complimentary. "We offer AOG support on a 24-hour basis for our customers, and can help them worldwide. We send teams of mechanics,



and can remove engines, although we are not certified for re-installation," says Stefan Heinsohn, manager total engine care at MTU Maintenance Hannover. "We offer this mainly for our engine maintenance customers. We also provide most activities in engineering support, especially to small airlines which do not have their own full engineering departments. We are now setting up an internet condition monitoring product, so that customers can find all the information about their engines on the web. We also have a training school for line mechanics, borescoping and engine management. We have also offered spare engines via our "Engine Pool Services" for the past three years, but only for our engine maintenance customers. We also do purchase and leasebacks, and can guarantee customers' engines for a pool access fee, lease payment and maintenance reserves."

## VAES

Volvo Aero Engine Services has an engine shop in Bromma, Sweden and has capability for the JT8D-200, JT9D and PW4000-94. The Volvo Aero Group also includes Volvo Aero Leasing which has a portfolio of about 130 engines. "We offer on-wing support for the engine types we have maintenance capability for, which includes borescoping, fan changes, special inspections, and field services for teams to perform repairs. We do not offer engine changes, but can arrange for this to be done for our customers," says Goran Norden, vice president of marketing at VAES. "We offer condition monitoring and fleet management, although most of our customers like to do this themselves. We do offer training for fleet management

aspects, such as removal timing and workscope development, but do not offer training for line and shop maintenance. We have seen a trend to more leasing of engines, and we can advise on the number of spare parts needed and can support maintenance customers from our own inventory, one example being MD-80 operator Lion Air in Indonesia. We also offer engine purchase and leaseback."

## Total Engine Support

Total Engine Support (TES) specialises in engine management for airlines, and offers remote condition monitoring with real-time analysis, and provides bi-monthly reports to its airline customers as well as data interpretation for its customers. Fleet management is TES's core product, and offers the full range of services including shop visit planning, shop contracting negotiations, engine lease negotiations, LLP management, engine management and a reliability management programme. Although it is not a lessor, TES does have agreements with finance companies and lessors to locate spares for customers, and can make recommendations to airlines about their spare engine requirements.

## Airlines

## United Services

United Services offers engine maintenance for the PW4000-94/-112, PW2000 and CFM56-3. In parallel to this United provides dispatch teams to support its customers in engine borescopes, engine changes and light maintenance, and a variety of other on-



wing support functions. United also provides all types of engine management services for the relevant engine types, and provides training for line mechanics, shop visit maintenance and engine management. United can offer its maintenance customers spare engines on short-term leases and access to a pool of LRU components. It can also offer inventory provisioning estimates.

### Delta TechOps

Brandice Bosley, manager of technical sales and marketing at Delta TechOps, explains that it offers on-wing support, with dispatch teams for repairs, and engine fleet management services for its engine maintenance clients. "We use Smart signal for condition monitoring, and analyse data for customers. Our engineering service is extensive enough for airlines to totally sub-contract their engine management to us," explains Bosley. "We also offer training in compliance with the JAA and FAA for line mechanics. We do offer long-term lease support contracts, but this is tied to engine maintenance contracts. We also provide LRU inventories on a PBH basis, in conjunction with supply guarantees."

### Lufthansa Technik

Lufthansa Technik has maintenance for the CFM56-3/-5/-7, V.2500, JT8D, JT9D, PW4000 and CF6-50/-80. It offers a wide range of support services in parallel. "For our engine maintenance customers we have airline support teams which can provide a wide variety of on-wing support activities, and also offer full engine management support," says Wolfgang Weynell, director of customer

support engine services at Lufthansa Technik. "We also have JAR 147 approval for line maintenance, engine management and shop visit training. We have a portfolio of 70 spare engines, which includes the main types we offer maintenance for. We provide our customers packages of maintenance and spare engines. We also consult on LRU inventory requirements and provide spares on lease or via a pool."

### Air France

Air France Industries provides maintenance for the CF6-50/-80, CFM56-3/-5 and GE90. "We do provide on-wing support for customers, although it is not a main activity, but intend to expand this service. We can offer engine management support at a level which allows our maintenance customers to fully sub-contract this activity," says Didier Verte, product manager GE engines at Air France Industries. "We offer some on the job training for shop visit work, but other types of training can be offered. We offer engines on short-term leases for our maintenance contract customers, and they have access to an engine pool. We also provide LRU pools, but also lease them if required."

### SR Technics

SR Technics has engine maintenance for the CFM56-5B/C/-7, JT8D-200 and PW4000. It provides full on-wing and engineering support to its engine maintenance customers that allows them to completely sub-contract this activity. "We provide line and shop visit and engine management training for our customers, as well as engine pooling and

*Teams to handle items such as engine changes are an expensive overhead for small airlines absorb, and so it is more economic for them to outsource these and other engine management functions.*

leasing for the PW4000-94/-100, CFM56-5B and JT8D-200," says Frank Spothelfer, division manager commercial services at SR Technics. "We combine long-term leases with maintenance contracts, and provide LRUs via our component business unit."

### Iberia

Iberia offers maintenance for the CFM56-5A/B/C, JT8D-200, JT9D and RB211-535E4. "We naturally have on-wing support capability that has been developed for Iberia Airlines, and so can offer this to maintenance customers," explains Jose Quiros, powerplant overhaul director, maintenance & engineering division at Iberia. "We offer engine management to our long-term maintenance customers for the engines we have maintenance capability for, but can offer on-wing support for additional engine types. We also offer engines and LRU inventories on lease to customers with long-term maintenance agreements."

### KLM Engineering & Maintenance

KLM has maintenance capability for the CF6-50/-80 and offers on-wing support and engine management for these types in parallel. KLM also places spare engines at its customers' home bases or can provide them with access to an engine pool with guarantees for availability; this includes the CFM56-7. "We combine maintenance contracts and pooling, and can also provide spare engines on their own for leases. We can also provide LRU inventories and combine these with line mechanics if a customer requires. We can also help with initial provisioning and parts exchanges," says Paul Vonk, marketing manager at KLM Engineering & Maintenance.

### Finnair

Finnair has maintenance capability for the CF6-50/-80, JT8D-200, PW2000 and CFM56-5B. "We can provide support teams in addition to maintenance contracts, but not yet for the CFM56-5B," says Heikki Kurikka, manager of large engines at Finnair. "We also provide guaranteed spare engines and engine management in conjunction with long-term maintenance contracts. We can offer training courses for line and shop mechanics and inventories of LRUs if airlines require them." **AC**