

The cost of acquiring an inventory of rotables and establishing a test and repair facility is prohibitive for many small- and medium-sized airlines. One option is to sub-contract the entire process of supplying, repairing and managing rotables. Narrowbody support providers are examined.

# Narrowbody rotatable inventory support suppliers survey

**G**ood maintenance management involves not just performing maintenance checks, but also ensuring a continued flow and stock of materials, consumables and serviceable rotatable components. This means ensuring that all requested parts can be made available at all locations of an airline's operation whenever required so that aircraft are not delayed when rotables inevitably fail.

## Inventory management

While airframe checks have set intervals, rotables fail at random. A minority of the 2,000 or so items installed on an aircraft are maintained on a hard-time basis, so they are removed

for maintenance and repair during airframe checks. Most parts, however, are maintained on an on-condition basis so they are allowed to remain in operation until they fail or start to develop operational problems. These components are often subject to functional tests during airframe checks, which may reveal reliability or operational problems that force a removal for repair at this stage.

These rotatable items are major system components. While they are often duplicated or triplicated, the aircraft cannot function if one or two of the components fail. Operation of the aircraft therefore has to be suspended until they are repaired or replaced with serviceable items. Many parts are replaced during line maintenance, so these rotatable

components are often referred to as line replaceable units (LRUs).

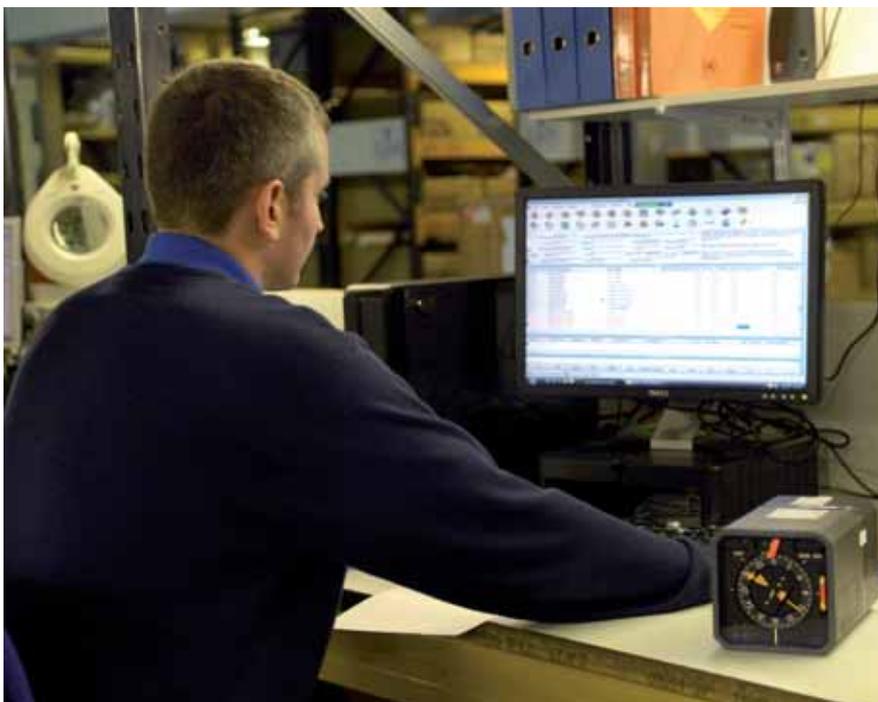
An inventory of serviceable items is therefore required at the operator's main base, with some parts perhaps held at outstations, so that failed rotables can be replaced in the shortest possible time to avoid disrupting an airline's operation.

The first major challenge in ensuring availability of serviceable rotables and LRUs to replace failed items is to assess the number of components that are required in an inventory at the operator's main bases and outstations for a particular aircraft type. This starts with assessing the aircraft's minimum equipment list (MEL). Failed parts are divided between MEL items and no-go items. No-go items account for a minimum number of parts, and prevent the operation of the aircraft until they are replaced. Most of these are safety-critical parts. The MEL is a list of items that can remain on the aircraft and whose repair or replacement can be deferred for a specified period. There are different lengths of time a defective part can be deferred for. These are one, three, 10 or 120 days. A list of defects is maintained in the aircraft's technical log.

Assessing the size of inventory needed next involves obtaining reliable data on the average failure intervals of each part,

---

*The initial capital outlay for aircraft rotables is in the order of \$1-3 million per aircraft. More airlines are seeking ways to avoid this investment, and more providers are offering turnkey solutions to airlines.*



## EUROPEAN ROTABLE SUPPORT PROVIDERS SERVICES

Company	Package offered	Types supported	Stocks & location	Extras offered	Engine types supported	Additional services	Service levels	Main customers
Air France Industries / KLM	- Fee / Flt Hr - Lease of stock - Pool Access	A320 & 737	CDG & AMS +15 pools	- Engine LRUs - Wheels & Brakes - APU	- CFM56-3 - CFM56-5A - CFM56-5B - CFM56-7	- Component repair - Engineering - Warranties	3 hours	- South African - Airways - Thomas Cook - Oman Air
Avtrade	- Fee/ Flt Hr - Lease of stock	737, 757 A320 BAE 146	35 lease pools for each aircraft - global	- Engine LRUs - Wheels & brakes - APU	Support for aircraft supported	- Initial provision - MRO support - Document management	-AOG 4hrs -Urgent 24hrs -Routine 7days 99-100%	- Singapore Airlines - Air Baltic - Futura
Cimber Air Support	- Lease of stock - Pool access	ATR	3 stocks	- Engine LRUs - Wheels & Brakes	PW120	MRO Support	Dependant on price	
Finnair	- Fee / Flt Hr - Lease of Stock - Pool access	A320 Embraer E-Jets 757	Helsinki	- Engine LRUs - Wheels & brakes - APU	CFM56-5B CF34-8/-10 PW2000	- Document mgt - Component repair	90-98%	Finnair Aeroflot Cargo
Fokker Services	- Fixed fees - Lease of stock - Pool access	F 50/70/100 Q100/200/300	Atlanta, USA Amsterdam Singapore	- Engine LRUs - Wheels & Brakes - APU	PWC 123 PWC 125 PWC 127	All services available for Fokker a/c	4-48hrs up to 98%	
Iberia	Fee / Flt Hr / Month - Lease of stock - Pool access	MD80 A320 757	Madrid plus others globally	- Engine LRUs - Wheels & Brakes - APU	JT8D RB211-535C/E4 CFM56-5A/B	- Component repair	- 4hrs-72hrs 92-100%	
Lufthansa Technik	- Fee / Flt Hr - Pool access - Lease of stock	A320, 737 CRJ, E-Jets Q400	FRA, BLR FLL, SZX	- Engine LRUs - Wheels & Brakes - APU		Engineering Life monitoring Reliability	20mins-10days 90-97%	Lufthansa Austrian
Monarch Aircraft Engineering	- Fee / Flt Hr - Lease of stock - Pool access	A320/321 757		- Engine LRUs - Wheels & Brakes - APU	V2500 CFM56 RB211	- Repair - Re-certification - Warranties		
SR Techniks	- Fee / Flt hr - Lease of Stock - Pool access	A320, 737 757, MD11	Zurich +60 global	- Engine LRUs - Wheels & Brakes - APU	CFM56-3/-5/-7 RB211 V2500	- Warranties - Documents	2-4hrs 90-95%	
TAP Air Portugal	-Fee / Flt Hr -Pool Access	A320 family	Lisbon	-Engine LRUs -Wheels & Brakes - APU	CFM56-3/-5/-7 JT8D	-Repair - Re-certification	up to 95%	TAP Air Portugal SATA

and the statistical spread of failure intervals. This information is constantly updated and monitored by the airline's maintenance and engineering department during operation so that inventory levels can be modified.

An inventory of serviceable no-go parts should always be available at the main base or outstations, unless a particular part is known to have long failure intervals and a high price, or can easily be accessed from another operator if they have larger operations and their own inventories of no-go items at some outstations of an airline's operation.

Airlines that do not have enough stock of no-go items at every point on their route networks risk a possible aircraft-on-the-ground (AOG) situation. This technical delay can only be overcome by accessing the correct part and making arrangements for its replacement. This inevitably causes delays.

The inventories of the other MEL

items do not have to be so extensive. This is especially the case when a rotatable part fails at an outstation, since it can be deferred and replaced when the aircraft is at its home base and there has been enough time to source its replacement. The inventory of MEL items kept at the operator's base can also be minimised, since they do not have to be replaced immediately after failure. Significant stocks of MEL items are held only if they have high failure rates.

An operator's stock of items at its homebase, for each aircraft type, will therefore be no-go items plus other parts with high failure rates. This stock of parts involves a sizeable investment of several millions of dollars. However, the larger the fleet, the fewer parts are required per aircraft and the lower the investment per aircraft. This is because the failure rates of most parts and the probability of a part failing often means that a spare item of one particular part is required for one, two or three aircraft. Investment in stocks

can be \$1-3 million per aircraft.

Other parts can be exchanged with serviceable items with specialist providers, or accessed from a larger pool of parts that is shared between several operators.

The large investment required for inventory puts small operators at a disadvantage. Investing in an inventory of rotatables can be a huge part of their costs.

## Repair and management

In addition to investing in these parts, airlines have to repair and manage items. Failed parts are removed during aircraft operation and line checks, and sent for testing and repair. Test and repair facilities have to be staffed with large numbers of highly qualified engineers, but the high level of investment required can only be justified by large airlines with large fleets and therefore a large volume of rotatable and LRU testing and repair.

Repaired parts then require

## NORTH AMERICAN ROTABLE SUPPORT PROVIDERS SERVICES

Company	Package offered	Types supported	Stocks & location	Extras offered	Engine types supported	Additional services	Service levels	Main customers
AAR Corp.	- Fee / FH - Lease of stock - Pool access	CRJ, ERJ, E-Jets 737, 757 MD80, A320	N. America Europe, Asia Australasia	- Engine LRUs - Wheels & Brakes - APU		- Repair - Engineering	mins-weeks up to 99%	Delta, MTU Air France HAECO
Delta TechOps	- Fee / FH - Pool access	737, 757 MD-88	Multi US +150 global	- Engine LRUs - Wheels & Brakes - APU	PW2000 CFM56 JT8D	- Documents - Repair - Warranties		Hawaiian Comair World Airways
Goodrich	- Fee / FH - Pool access	All	Global + London, DXB, SIN	- Engine LRUs - Wheels & Brakes - APU	CFM56 V2500	- Repair - Warranties	4hrs-5days 95-100%	Many
Sargent Avborne	- Fee / FH - Pool access	737, 757 A320, MD80	1 main	- Engine LRUs - Wheels & Brakes - APU		- Inventory optimisation	4hrs	

documentation certifying the repairs that have been carried out and their airworthiness. These have to be issued and records kept. Serviceable items then have to be transported and kept in the relevant inventories until required. Parts also have to be tracked throughout the removal, repair and replacement cycle. This is referred to as inventory management, and is another high expense that can generally be justified only by larger airlines on an in-house basis.

However, by sourcing specialist third-party providers, airlines can avoid having to invest in stock, repair and testing facilities, staff and IT systems for inventory management.

### Sub-contracted services

There are many IT systems and packages to assist with managing and tracking inventory stocks. A specialised system tracks and monitors each part so that its failure intervals, the time taken for testing and repair, and locating where it is in the removal-repair-replacement cycle can be followed. These data can then be used to fine tune the numbers held for each part, as well as to identify surplus stock so that it can be sold.

Many specialist parts, rotables and inventory logistic providers offer services that manage airlines' rotatable inventories and stocks for them. The leaders in this area are AAR, ST Aerospace, AJ Walter, Avtrade and Lufthansa Technik.

These services allow airlines to divest their rotatable inventories and facilities, or avoid having to make the initial investment. Airlines can also reduce their management workload. Even large airlines, with their economies of scale,

can benefit from these types of services if they have a small fleet of a certain aircraft type.

### Types of service

There are a few different access and payment systems offered by the different providers, but essentially they offer four types of programme. These are then adapted to suit the needs of each operator, although it is normal for an operator to utilise at least two of the four options. Examples are a monthly fee for pool access or lease of a homebase stock, and a pool access and payment per flight hour (FH).

1. Payment per FH (power by the hour (PBH)), or per flight cycle (FC). The amount paid being dependent on the number of items or amount of access.
2. Pool access.
3. Lease of a homebase stock.
4. Payment by monthly fee.

Another benefit to leasing rotatable stocks is that someone else deals with the history of an item, the warranty claims and the documentation. The provider has to manage the repair of the stock. The process of supplying, repairing and maintaining inventory, therefore, requires a large management activity.

Inventory management companies will have experience of an aircraft and its failure rates, which is helpful to an operator starting with a type. The forecasting to optimise inventory levels has already been generally done, and just the airline's specific details are required. This includes what the airline needs in its homebase stock and what it is happy to

access from a pool. This is affected by an airline's unique failure rates and its MEL. Typically, an airline can have 80% of its LRUs within a pool, with only 20% actually held at base.

The service providers' offer can be extensive and removes the need for an airline to have engineering input into the process of inventory management. A parts provider can offer an initial provisioning (IP) service, which determines the amount of inventory required and decides the split between homebase stock and stock accessed from a pool.

Airlines also like to carry out reliability programmes to identify the main causes of poor reliability. This is more commonly done in parallel with component tracking. Each part can be tracked with IT systems, so that failure intervals are followed. These services are now offered by an increasing number of inventory management companies.

### Benefits

An operator that transfers its inventory management to a specialist company will receive many benefits.

Finance departments can see clearly where money is being spent, and regular payments make it easier to budget. There are also savings from not having to employ as many personnel to manage the inventory and staff the stores. There is less need for an airline to have its own IT system to manage the stock. Avtrade even has an intranet system to allow its customers to check costs and stock in a paperless manner. Introducing an effective computer system also means that a constant monitoring and re-calculation

## ASIA PACIFIC ROTABLE SUPPORT PROVIDERS SERVICES

Company	Package offered	Types supported	Stocks & location	Extras offered	Engine types supported	Additional services	Service levels	Main customers
Ameco Beijing	- Lease of stock - Pool access	737, A320	Beijing	-Engine LRUs	CFM56	- Documents - Repair - Re-certification	Immediately -30 days 90%	More than 70
EGAT	- Fee / FH - Lease of stock - Pool access	737NG	Taiwan	-Wheels & Brakes - APU	V2500	- Reliability - Repair	85-95%	Vietnam Airlines
HAECO	- Fee / FH - Lease of stock - Pool access	A320	Middle East USA	-Engine LRUs UKWheels & Brakes - APU	CFM56	- Documents - Repair - Re-certification	immediately -30 days 92-95%	Bahrain Air
ST Aerospace	- Fee / FH - Lease of stock - Pool access	MD80, 737 A320	Europe USA Asia	- Engine LRUs Wheels & Brakes - APU	CFM56-3/-5/-7	- Warranties - Warehousing	Within 1 hour over 90%	Air Asia Jetstar Asia Flybe

of stock and individual part levels can be done. This is important, because aircraft parts have changing failure rates as the aircraft ages or undertakes different styles of mission.

For the operational department, there should be a reduced likelihood of schedule disruption, meaning every day is easier to plan for. The experiences of other operators can be brought together by the service provider for the benefit of all its clients.

## Service providers

Rotable inventory management for narrowbody aircraft is offered by several companies, but true total support is offered by few globally. The tables (see pages 50, 52 & 53) show providers that offer the service and the basics of their programmes.

The main players globally are located in America and Europe. The majority are in Europe, but those that are headquartered in America operate worldwide and have an extensive programme. The majority of service providers have total, or very nearly, worldwide support. Again, most providers have more than one pool stock location (not necessarily including a specific smaller customer homebase stock). Those that do not have the global coverage and/or only one pool stock tend to be those connected to airlines and therefore more locally orientated.

The exception to this is Ameco Beijing, which offers a basic rotatable inventory management programme. In essence it just supports its customers when they are undergoing maintenance in China.

The providers of an inventory

management service have often started the service because they have a large stock of items themselves. These can be airlines, maintenance, repair and overhaul (MRO) or specialist parts providers that have developed their AOG and logistics support to include inventory management.

## Additional services

The companies that offer these programmes do not just offer rotatable inventory management. There are some associated services that they also have to offer. These include AOG and logistics support, which go together and assist the facilitation and delivery of a customer's needs.

Then there are the services that are generally offered by most service providers. These assist in the smooth running of the inventory programme and further simplify the process for the operators. These can sometimes be automatically included, but at other times they will be additional services offered on a one-on-one basis for an additional cost. This is often the case for LRU/accessory rotatables, wheels and brakes, APUs, warranty management and documentation management.

Since many of the providers are airline maintenance departments and MROs, it is easy for them to integrate engineering services. Those that have the space and capability can offer component repair, re-certification and reliability management along with warehousing for the many homebase and pool stocks.

## European providers

The majority of specialist inventory

management providers are based in Europe. Taking into account the number of aircraft they support and the different types, the main companies, which are mentioned in the survey, are AAR, Avtrade, AJ Walter, Air France/KLM, Fokker Services, Lufthansa Technik, SR Technics and ST Aerospace.

Although Fokker Services does not seem to have a high value in inventory, it supports over 200 aircraft and offers all services for all Fokker aircraft types. This is in addition to developing its capabilities for the Bombardier Q series. Fokker has concentrated on the smaller regional aircraft.

SRTechnics and Air France/KLM on the other hand have concentrated their abilities on the larger and more common narrowbodies, such as the 737 and A320 families. These each support a massive 500 and 600 aircraft.

Europe-based providers are airline maintenance departments, except for five companies. These are AAR, AJ Walter, Avtrade, ST Aerospace and SR Technics.

With regard to service levels for parts delivery, minimum times can be as low as minutes. This would be if the specific part was available at the aircraft's location.

A more realistic time of four hours has been given by most companies as their minimum delivery time. As Miguel Povedano at Iberia has commented, 'regardless of level, a part will be ready for delivery immediately it is sourced'. All companies that have provided availability data, have at least 90% success, with some even claiming 100% if given enough time.

The exception is TAP, which says that while it generally has a success rate of more than 90%, if an item is not urgent (i.e. the aircraft can fly for a while



without it) its success rate can fall to 85%. The success rate ultimately depends on the contract in place and the prices agreed. As Cimber Air Support say, service levels for parts delivery can be up to 100%, it just depends on the price.

### North American providers

The three inventory management companies that have submitted data for this survey are AAR Corp, Aviall, Delta TechOps and Goodrich. All four are large providers with many clients. Delta TechOps is an airline MRO, and AAR and Goodrich are independent parts and services companies. While Goodrich and AAR were unable to say exactly how many aircraft they support, this is likely to be several hundred aircraft each, in part due to the sheer number of clients they have and the different types of aircraft they service. In fact Goodrich confidently says it can support all narrowbody aircraft and AAR is not far behind. The aircraft types supported by each provider are listed (see table, page 52).

Goodrich says it supports LRUs for most engine types, while Delta TechOps is restricted to the engine types that power the airframes it supports. AAR provides little support for engine LRUs.

All three companies have a global support network with, in some cases, more than a hundred pools of stock worldwide.

Service levels for parts delivery are generally very high for the American companies. Goodrich, for example, has levels of 95-100%. Again four hours is the accepted minimum delivery time, but AAR is sometimes able to get that down

to minutes. This is only possible when the part is a common item, sitting on the shelf at the aircraft's location.

### Asia Pacific providers

As in America, there are three main providers of inventory management services. All three are independently-run MRO facilities: Ameco Beijing, HAECO and ST Aerospace. In addition, Evergreen Aviation Tech Corp (EGAT) is currently developing its widebody service, but is also a prospective provider for the 737NG. As EGAT shows, narrowbody servicing is a developing market in the Asia Pacific. As the MRO facilities grow in the area, so too will the services they offer, inventory management being one of them.

The range of narrowbodies covered is limited to the A320 and 737, with the exception of ST Aerospace which also supports the Q400, MD-80 and MD-90.

The support locations are also quite limited. Ameco Beijing and EGAT both limit their support to China and the Asia Pacific, and both have just the one pool stock at their main base. Although, Ameco supports 100 aircraft and has clients from all over the world, the service is essentially for those coming to them for maintenance.

HAECO, based in Hong Kong, supports just one client in the Middle East. With the growth of HAECO in the Asia Pacific and the Middle East, its number of clients is likely to grow.

ST Aerospace is a major player in the Asia Pacific MRO market, but is also very prolific in inventory management in Europe. It supports over 600 aircraft and has a global support network and many

*One key issue in inventory management is tracking of parts to modify inventory requirements, and also to identify surplus stock so that it can be sold to reduce investment.*

pool stocks. These levels have been bolstered by ST Aero's acquisition of Aircraft Rotables Leasing (ARL), based in the UK, and of SAS Component in Denmark.

Although the four providers only acknowledge service levels of 90-95%, ST Aero has a minimum time of one hour.

Engine LRU support is low for the Asia Pacific providers, with Ameco supporting no engine types and the others only doing one or two types. Since the providers are MROs, the additional services are vast. The main ones are listed (see table, page 53).

### The future

The future of sub-contracted inventory management is looking good. This part of MRO and technical support is growing about twice as fast as the aviation industry in general. EGAT has had success with its widebody inventory management scheme, and is now developing it to include narrowbody stocks.

As already mentioned, the aviation industry is looking for more ways to cut costs. Ramon Sosa at Delta TechOps sales and marketing says that 'the core competence of an airline is to transport passengers, not repair or manage piece-part inventory. Therefore the gain from our service is the ability to focus their business in their core competency of moving passengers from point A to point B'. The benefit of this is an improvement in maintenance, resulting in fewer delays, a reduction in costs, and boosting the public's perception of a carrier.

It is quite likely that as airlines look for more ways to reduce costs at the same time as keep maintenance levels static or even improve, they will be attracted by the services offered by the large MRO facilities. Both the independent and airline connected facilities are able to offer more services, meaning lower costs for the operator. Total support is becoming exactly that. The big question next is whether the parts companies can compete. They have stock levels that the MROs would struggle to compete with and would require massive investment to match. **AC**

To download 100s of articles like this, visit:  
[www.aircraft-commerce.com](http://www.aircraft-commerce.com)