

Spares inventory management is a process that involves several complex steps. The various technical and logistical issues of tracking, determining inventory & stock levels, accessing stocks, and dispatching & transporting consignments of repairable & rotatable components are examined.

Spares inventory management & logistics

On-time departure and schedule reliability is crucial to airlines. The major risk to flights leaving on time is technical delay. When rotatable components need to be available at short notice, airlines and operators often position the most common 'no-go' items that prevent the aircraft from departing according to the minimum equipment list (MEL), at major hubs and remote line stations.

These rotatables are usually suggested by the original equipment manufacturer (OEM). Other sources, such as the airline's own maintenance & engineering (M&E) IT or enterprise resource planning (ERP) system, can produce important statistical data in the form of fleetwide component reliability reporting to aid the process of assessing the quantity of rotatable inventory required.

This article will look at how airlines can protect their investment and get the most life out of aircraft components, while ensuring that they are not spending money needlessly.

Repairables & rotatables

A repairable or rotatable component can be economically restored to a serviceable condition. A repairable can only be made serviceable a limited number of times. A rotatable can undergo unlimited repairs, over a period similar to the operational life of the aircraft on which it is installed. A rotatable's maintenance interval can also be scheduled separately, or out-of-phase, to

the aircraft's maintenance check intervals. Repairable and rotatable parts always use serial numbers.

Operators and maintenance, repair & overhaul (MRO) personnel either opt for OEM-defined identification, normally called a manufacturer part number (P/N or MPN), or internal codified identification. Identified parts are linked with interchangeable spares, or alternative part numbers, and classified in-line with industry standards.

Tracking rotatables

Repairable and rotatable components must be tracked when they are installed on the aircraft and removed from it; and during the transport, testing, repair and storage cycle.

This tracking functionality is used to generate removal interval and reliability

data, monitor aircraft configuration, optimise inventory as a by-product of the reliability reporting, and ensure any warranties on removed items are claimed for and managed appropriately. A related function is to track and indicate the location, serviceability status and ownership of each component at any time.

Assets that can be monitored by an M&E system's asset management module include: engines; rotatable and repairable components; vehicles; tools; equipment; aircraft jacks and gantries; and facilities.

Parts are physically tracked by entering the component's part and serial number at each major event. These include: installation; removal; testing; repair; being put into transit; and being placed into stores. In some cases the part and serial numbers are keyed into the M&E system manually. Some M&E



An increasing number of airlines are divesting their rotatable inventories and seeking provisioning packages from specialist suppliers. Many packages provide airlines with a homebase stock, and access to the remainder of components is via the provider's pool stock.

systems have the functionality to track components by scanning barcodes, while the most advanced system uses radio frequency identification (RFID) tags.

Ramco has added a new functionality to its Ramco Aviation Software M&E system. Using the technologies of geospatial intelligence, Google Maps and Google glasses, and combining them with other technologies and Ramco's component tracking functionality, it has developed a product that allows line mechanics to locate a particular part or component in the user's various stores. Google glasses will present the user with all the different locations where the requested part is stored, how far away each location is, the number available at each store, and the transit time it would take to reach the mechanic's location once ordered or requested. Once ordered, all the dispatch documents are sent automatically in pdf format.

A prime requirement of an M&E system is to determine the correct level of inventory that an airline needs to stock. Moreover, fine tuning the airline's repairable and rotatable inventory includes determining how many of each part number must be held at each operating base and outstation.

Another function of tracking assets is to determine book depreciation schedules for parts, components, tools, equipment

and vehicles. A record of the purchase price and residual value at disposal is also kept.

The tracking process starts with a register of all major fixed assets. Each asset is entered into the database when purchased and delivered to the user. A database of parts is then kept in the system, with details that include the asset's unique serial number, its part number, and the date of purchase.

The system will be programmed with pre-defined depreciation rates for the different asset categories if the system's financial functionalities are being used. These can be standard depreciation models, or defined by the user.

Many M&E systems have the functionality to evaluate the total stock of rotatable and repairable components and parts held by the user. M&E systems can also distinguish between components that are owned, borrowed or on exchange from other operators.

"The value of stock held by the airline or MRO user at any one time will be calculated based on components that are not installed on aircraft," explains Ronald Schaufele, chief executive officer at Swiss Aviation Software. "It therefore includes parts that are in store and inventory, in repair and in transit, or are unserviceable. AMOS can break down the information on total asset value

further, by listing the value of inventory held by different aircraft and engine types, or at each base and outstation. The user can further drill down to see what part numbers are held at each outstation, as well as sub-dividing inventory by owner and ATA chapter."

M&E systems can provide a lot of detailed information on each asset, and the user can drill down the data to retrieve this. An example is the assembly tree of an aircraft structure or a complex sub-assembly. The structure can be viewed on screen by ATA chapter and sub-chapter, and the individual components in each part of the structure listed by part and serial numbers. This is possible through the rotatable-component tracking functionality.

The complexity of rotatable management is illustrated by the fact that some airlines have reduced their stock holdings by up to 25% when they have made dedicated efforts to improve inventory management efficiency.

Ensuring the right amount of stock is held by an airline at all its maintenance and operations locations requires the module to identify that the correct part and dash numbers are held, accurate removal and repair interval data are used, and that borrowed and exchanged parts are returned within time limits.

Inventory requirements have to be



A. Man aspires.



B. Man constructs.



C. Man soars.

FIG. 1 Building on where we came from to help you move forward.

MAGELLAN
AVIATION GROUP

North America +1 704 504 9204
salesusa@magellangroup.net

magellangroup.net

Europe +353 61 474800
sales@magellangroup.net

fine-tuned at many levels. The starting point is the serviceability policy the airline follows. This is the percentage of occasions that a part is available in stock when required. Most airlines have a minimum serviceability level of 90%. A higher serviceability level will increase the amount of stock that has to be held.

“Most M&E and ERP systems have component data, but they do not have the algorithms to calculate the inventory required,” says Michael Armstrong, chief executive officer at ARMAC. “Some M&E and ERP systems tend to calculate inventory stock on a re-order stock level, by calculating how much to purchase to keep stock levels more or less constant. This is more appropriate for a system where items are consumed, not rotated.

“Determining the inventory of rotables and repairables that are not consumed, but get repaired and re-used requires the use of a specialist or point solution,” continues Armstrong.

“The main issue is that the failures of rotatable and repairable components are uncertain, but not random. An airline needs to hold an inventory of thousands of P/Ns, and calculating the optimal amount of stock for each one is a giant mathematical problem, that can only be solved using a specialist algorithm such as the one on our system.”

SR Technics is one of the world's leading independent providers of technical services for the civil aviation sector. The company has recently announced a strategic investment in Armac Systems. The investment will result in a close strategic partnership between the two companies, enabling customers to benefit from a turn-key planning solution that will continuously optimise component inventory asset investment and maximise component availability.

SR Technics and Armac Systems have collaborated for several years, and combining both companies' core competencies will allow SR Technics to continue delivering enhanced inventory management and optimisation solutions to its customers.

Float level

The number of repairables and rotables needed to support fleet availability is known as the float level.

Optimising aircraft spares inventory through float management is a key task for airline material planners, who use IT systems to ensure that enough rotables of the appropriate P/Ns are available at the right location and in the right quantity.

Assigning proper nomenclature and classifying the spares is a fundamental step for material planning.

Float requirement is the quantity of spares maintained to meet the desired

service levels when there is an unexpected increase in demand or procurement lead time. Multiple factors affect the float requirement, including: number of aircraft; parts per aircraft; mean time between events (MTBE); line unscheduled removals; average utilisation; turnaround time (TAT) for repair and purchases; expected service levels; scrap rates; and scheduled repairs based on the maintenance programme.

While the OEM gives an original float recommendation in the

recommended spare parts listing (RSPL), the requirements can change over time, depending on the number of aircraft in operation, aircraft age and actual scrap rates, utilisation of aircraft and engines, and component repair TAT.

Proper classification and accurate float requirement helps in optimising and positioning spares. For short-term float requirements, such as items that will be in the repair loop and returned to stock quickly, the preferred option would be taking an item on loan or pool.

AJW

Redefining world class

The AJW Group is a world leading specialist in the supply, exchange, repair and lease of commercial aircraft spare parts.

With a focus on quality that permeates every aspect of the business and the customer experience, AJW is justifiably proud of the reputation it has built for providing the resources, in terms of expertise and inventory, which support more than 1,000 airlines in 115 countries, with nearly 500 aircraft under contract.



24/7

www.ajw-group.com


Strategic Partner

AJW engines

engines@ajw-aviation.com

+44 1685 352781

AJW aviation

sales@ajw-aviation.com

+ 44 1403 798000

AJW technique

sales@ajw-technique.com

+ 1 514 339 5100

Please visit us: Stand 266, MRO Europe 2014, 7-9 October, IFEMA Madrid, Spain

For long-term requirements, airlines can source inventory through power-by-the-hour (PBH) programmes. If the item is categorised as no-go, PBH items are stocked in the operator's or MRO warehouse, generally referred to as homebase. If it is categorised as a 'go-if' or a 'go' item, then it can be accessed from the PBH vendor's stocking location, generally referred to as pool access.

As an example of M&E system functionality related to rotatable component management, Ramco Aviation Suite's M&E solution has an integrated material planning module that covers Float Management, Scrap Management, PBH Management, and Part-RSPL Data Management. This helps to increase the service levels for the spare parts with optimised inventory costs.

Secure tracking

In cargo logistics, a customer's need to monitor, track and trace parts being shipped is now almost a prerequisite.

This presents air cargo and AOG parts supply companies with a number of challenges. Cargo processes need to become faster and more transparent, yet also need to be more secure.

On one hand the key objective is to protect against theft, prevent delay in an AOG situation, prevent temporary loss

of consignments, and ensure compliance with increasingly strict international security measures.

On the other hand the logistics processes themselves are subject to continuous optimisation with the aim of improving quality. Systems that allow up-to-the-minute monitoring of consignments and a quick response in the case of any deviation from the planned schedule or loss of the cargo are central to this process. Any transport delays can incur high costs for both the intended recipient and the carrier if guarantees have been made in respect of the delivery schedule.

Transport networks are finely tuned machines allowing the flow of time-critical items. The flow of components is of paramount importance. As with any airline, cargo operators are not immune to the pressures of reducing the costs in the logistics processes. Central Global Cargo and ALN have developed the Airsecure solution to monitor cargo consignments. This will function anywhere in the world, and only requires their tracking device and access to a web browser.

Airsecure is a small box that contains a GPS/Galileo receiver, a processor, a GSM modem, and various other sensors together with a rechargeable power supply. The sensors include

accelerometers to monitor and record any shock loading, and also to disable and enable the GSM modem when in flight.

The system also takes into account difficult operating conditions, such as poor satellite reception while unloading aircraft in hangars or consignment facilities. If, for example, after a landing is confirmed no GSM signal can be established, any data are stored internally and are later transmitted when a signal becomes available.

The GPS data from the tracking module are transmitted via the GSM network to a server and then to the MapCenter database. The data are accessed via an internet browser, eliminating the need for any software to be held on the operator's computers. Naturally this is password-protected and encrypted, ensuring that the tracker is accessed only by the relevant people.

Any software updates are carried out wirelessly through the GSM network, eliminating the need for physical technical support of the item. The typical cost of these units is £20,000 (\$33,000) for three units, although these can be purchased or rented/leased from ALN on an ad-hoc basis. With a \$250,000 component missing in a remote corner of the world in an AOG situation, the peace of mind that this system offers by



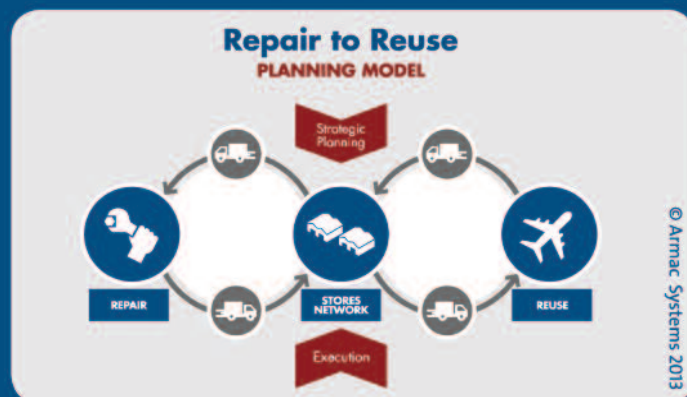
How do you plan your MRO inventory?

Armac's inventory planning and optimization solution has been designed specifically to address the requirements of MRO inventory planning within a "Repair to Reuse" model. Integrating with your existing ERP/MRO IT system, it provides decision support for determining optimal asset management strategy, while our unique Inventory Planner's Workbench supports the execution of optimal policy through daily prioritised tasks. The solution provides critical management control over the inventory planning process as well as improved cashflow and profitability to the organisation.

www.armacsystems.com

Applying the "Repair to Reuse" model to MRO inventory planning

- Reduce inventory investment by up to 40%
- Reduce annual inventory spend by up to 25%
- Improve service levels
- Management control delivered



For more information take a look at our videos on the "Repair to Reuse" model for inventory planning and optimizing MRO inventory at www.armacsystems.com.

Visit us at MRO Europe Madrid, 8-9 October 2014, booth 188

www.armacsystems.com | info@armacsystems.com | T. +353 41 9877480

tracking components in real time without relying on the carrier that cannot find its infrastructure, is a powerful tool for an airline to have at their disposal.

Global providers

Third-party rotatable providers have been in business since the early 1980s, providing component support options, including: PBH support; inventory and engine leasing; component MRO; and

ad-hoc trading in the form of sales, loans and exchanges.

The cost of supporting a 10-aircraft fleet of A320s may not be as high as first thought. Third-party companies can support an operator's aircraft in many ways, but many considerations have to be taken into account. First, where is the operator based? Where does it operate from, and what is its proximity to major transport hubs? Is it a lean operation, with only one aircraft flying on one route

permanently, or do several aircraft operate on the same route? What is the age of the fleet and its reliability?

In these situations, an operator should hold as much stock as it can afford to minimise the risk to its operation. Due to the fiscal restrictions associated with operating a modern airline, however, it is not always possible.

A typical base provisioning kit containing the absolute 'no-go' items according to the MEL comprises about 20 items, and would typically cost \$4-5 million. They would be stored at the operator's main operating base.

If the operator cannot afford to buy the kit outright it may buy \$2 million of the homebase kit. They then might lease the balance of stock at a monthly rate. If the operator is close to a large transport hub, such as Dubai or Miami, this could be reduced, and the operator would rely on the provider's pooling ability and its spares network to deliver on an AOG basis. This strategic placement is not locked into a consignment stock for the sole use of the operator, and is available on a first-come-first-served basis to other operators that may use the services.

Mixed fleets are managed in the same way. The absolute no-go parts, or 'stoppers', must be held on site or strategically positioned as needed. This can be double the cost of a single fleet.

One such company is Avtrade, based near London Gatwick airport, and founded in 1985. It initially worked with Boeing inventory, but has grown into a large multinational corporation with a large inventory strategically located worldwide.

Commercial director Jamie Brooks explained how Avtrade supports a Middle Eastern operator that flies into Dubai. "We have to consider what happens if this operator goes AOG down route. If we were to support them from the UK, there would be a likely delay of up to 20 hours, from shipping in the UK to the part arriving at the aircraft, having passed through the operator's base in Dubai. We strategically position stores at our base to minimise downtimes to an average of seven hours. By operating out of five strategic locations, we can cover the entire world, ensuring our components are available as soon as possible to anyone who needs them."

OEM competition

The OEMs have tried to control the aftermarket sale of components and rotatables in the past, through the direct refusal of either parts sales over and above necessary stock quantities to airlines in agreements with third-party parts suppliers, or of aftermarket sales in a historic capacity.

In an attempt to gain market share in



Custom Cable-Harness Assemblies • Temperature Sensors

Superior Performing MRO Solutions when Cost, Reliability and TAT are critical

HARCO has been a global leader in OEM and Aftermarket for over 60 years, offering repair and replacement solutions for airframe, engine, landing gear and all aircraft systems. All work performed is to OEM standards and our team of experienced technical professionals are dedicated to developing cost effective, highly reliable solutions for repair, overhaul or replacement hardware.



FAA and EASA approved Repair Station.

203.483.3700 • harcolabs.com

Innovative Solutions. Proven Performance®.

this sector of the business, Airbus has its managed inventory system and its flying hour services (FHS) platform. This offers cost-effective maintenance outsourcing options aimed at securing aircraft technical performance with minimal risk and investment. Airbus delivers customised outsourcing solutions for maintenance to meet the unique business model of each airline.

Airbus FHS offers guaranteed solutions, including component supply and repair, and MRO facilities and manpower. Airbus's main draw is its guaranteed availability of all primary line replaceable unit (LRU) spare parts through exclusive on-site stocks and pool access services, and state-of-the-art repair services that minimise rotatable TATs.

Boeing recently announced it has signed an agreement with GA Telesis LLC to expand Boeing's aftermarket parts portfolio to include serviceable commercial airplane parts. Boeing is now making new surplus, repairable and overhauled parts available to customers through a new marketplace section of the Boeing part analysis and requirements tracking (PART) website page.

The Boeing PART page, available to customers, is one of the most frequented e-commerce sites in the aerospace industry. More than 43,000 users log

over 40,000 interactions there daily.

"At Boeing, we want to be the one place our customers can come for almost any kind of airplane part they need, whether new or serviceable," says Tim Copes, vice president of material services, the parts business at Boeing. "We are extending our offering of serviceable parts to include non-Boeing aircraft."

Serviceable parts are a fast-growing segment of the aviation parts market, outpacing new part sales. The serviceable parts market is worth more than \$3 billion annually.

"Our customers want more options in maintaining their airplanes, and they tell us they want to get their parts, new or not, from Boeing," said Copes. "We are pleased to be joining GA Telesis in giving our customers a reliable and cost-effective alternative to new parts."

GA Telesis, headquartered in Fort Lauderdale, is the only replacement parts supplier with distribution centers in the US, the UK and mainland China. GA Telesis also offers aircraft and engine leasing, asset management, and engine and component overhaul and repair.

"By combining GA Telesis's expertise in the used serviceable market with the customer-centric Boeing PART Page, we have created a first-of-its-kind e-commerce platform in the commercial

aftermarket," said Chris Rauch, senior vice president of Global Sales at GA Telesis. "The PART Page Marketplace is an efficient solution for end-users that also simplifies their sourcing strategies."

All overhauled and repairable parts offered through the Boeing PART Page Marketplace have been repaired or tested by Boeing-approved repair providers.

The initial offering of serviceable parts from GA Telesis includes airframe and component parts, such as: hydraulic actuation systems; pneumatic systems; line replaceable units (LRUs); and flight control surfaces, that are mainly manufactured by companies other than Boeing. Serviceable engine parts will be made available at a later date. Through PART Page Marketplace, traceability, certification and repair records can be reviewed on demand. Each part sold has a one-year warranty.

Rotable PMAs

A key means of reducing component-related costs comes through the Federal Aviation Administration (FAA) parts manufacturer approval (PMA) process. This allows private vendors to reverse-engineer OEM parts and sell them at a significant discount. In 2006 the global market for PMA parts reached \$38

Spares & Engines

FALCO

Airbus A320 spares available

Any time, any place, any spare!

Airbus A320 Spares immediately available

Extensive BAe146 / Avro RJ stock

ALF502 and LF507 engines and spare parts

Sundstrand / Garrett APUs

A fully reactive service to support your operation

Rotable exchange programmes available

Certified components

Worldwide logistics

HIGHLY COMPETITIVE PRICES!

E falkospares@falko.com

T +44 (0) 1707 271777

W www.falko.com

Falko Regional Aircraft Limited

1 Bishop Square • St. Albans Rd West • Hatfield • AL10 9NE • UK

billion, with engine components alone at \$200 million. By 2015, the total PMA market could reach \$55-60 billion.

Obviously OEMs have some resistance to PMA parts in terms of ultimate liability and recouping their own original research and development costs. There also remain some myths about PMA parts, such as less stringent production processes or even counterfeiting. The FAA, however, sees the parts as the same if the PMA holder meets the stringent design, production and testing process. This takes a year or more on average, and can cost \$15,000-300,000.

Many airlines have already disproved the myths by accepting PMA parts as equal to or better than OEM parts. Nathan Dalton, vice president for corporate business development at the Wencor Group, informed *Aircraft Commerce* that just one of Wencor's airline customers should save \$3.2 million this year by using PMA parts. He points out that: "OEMs rarely have interest in solving problems in legacy aircraft types." Wencor includes many improvements in its PMA parts for those aircraft, offering about 5,000 line items. "Our customers expect to save 30-50% on the normal price of OEM parts."

Robb Baumann, president of the nine-unit Parts Group for HEICO Aerospace, reports that his group has saved airline customers an estimated \$700 million through PMA parts since 1972. The group ships 2.7 million PMA parts per year. One customer is directly saving \$20 million a year.

"In any industry, the alternative parts market will offer consumers a choice," says Baumann. "Parts are more than just parts. They offer efficiency and bottom-line leverage through warranty terms, maintenance support, and long-term, sustainable cost savings. On every PMA part we make, we use in-house material science staff and on most of our parts, we use a finite element analysis model. Our testing and computation process allows us to consider more than a part's geometry, but also what forces may affect this part and what forces from this part may affect other parts. We ultimately create a more robust design, can offer better technical support for the product, enhance an aircraft's repairability and lifetime, and also provide potential for new products."

PMA parts can offer obvious and immediate cost reductions, so some independent MROs are gearing up to offer PMA capability in-house. This puts another player in the PMA game. In response, OEMs are attaching 'PBH' and total care type programmes as part of an aircraft customer's purchase package. Such programmes ensure fixed maintenance costs over an extended

period of time, or on shorter contracts based on customer requirements.

Summary

Ensuring the correct stock levels is complex, and requires accurate parts tracking.

Ultimately, surplus and obsolete stock can be sold, realising some of the largest efficiency gains and savings that M&E

systems can provide, while improved warranty management can make further savings. Core M&E systems have the functionality for inventory management, but its specialised nature has led to the creation of point solutions which are slowly being incorporated within M&E systems.

To download of articles like this, visit:
www.aircraft-commerce.com

THINK BIGGER

We did. We focused on the 757-200 conversion for over a decade. Now, we offer more. From structures to systems, kitting to conversions, inside the plane or out — if it can be done, Precision can do it.



PRECISION
AIRCRAFT SOLUTIONS

precisionaircraft.com