Some airlines have opted for total support packages, where MRO services are vertically integrated with M&E systems. These are attractive to small or start-up airlines; minimising their investment in facilities and IT systems. There are several pitfalls, and these should be appreciated.

The packaging of MRO services and M&E systems

A small number of maintenance repair & overhaul (MRO) providers have combined their services with maintenance & engineering (M&E) information technology (IT) systems to provide a vertically integrated, total care service. Their main aim is to offer a one-stop service that meets almost all of an airline's engineering management, maintenance and M&E system requirements. With few airlines opting for these combined services, what are their advantages and disadvantages?

Total care service

A vertically integrated, one-stop MRO and M&E total care service is intended to meet airlines' complete needs, so that they only have to carry out the legal minimum requirements.

"An M&E system is needed more for all the engineering management functions than to perform any maintenance," says Ronald Schauffele, chief executive officer at Swiss Aviation Software. "An airline that does all its engineering management in-house will use an M&E system to produce all the job cards for an airframe check, and give them and the aircraft to the MRO provider, who does not actually need an M&E system to perform the check." It would be a bonus if the MRO provider did have an M&E system, since it could produce e-task cards, electronically record shop data inputs, and monitor the progress of the check.

Engineering functions

The engineering functions the airline is legally required to perform involve keeping: maintenance records for the aircraft it owns; flight hour (FH), flight cycle (FC) and calendar time utilisation data; a record of technical defects and the aircraft technical logs; and a record of component removals. An airline must also keep an up-to-date library of maintenance manuals, and maintain a maintenance programme for each type in its fleet.

Some of the engineering management functions would also be performed by the MRO provider, so there is an overlap of functions by the two parties. This can clearly lead to duplication of cost.

Following aircraft utilisation and technical log and defect data feed from the airline, the MRO provider has to perform virtually all engineering functions, starting with maintenance of all relevant manuals and a technical library, even though this also has to be kept by the airline.

The MRO provider will manage each fleet's maintenance programme, which involves: maintenance planning document (MPD) data input; MPD revision; and managing the airline's approved maintenance programme data, the corrosion prevention and control programme (CPCP) and the sampling programme.

Data relating to airworthiness directives (ADs) and service bulletins (SBs) also have to be incorporated into the M&E system. The ADs and SBs must be managed, to ensure they are complied with and planned into relevant airframe and maintenance checks.

The MRO provider also has to create a minimum equipment list (MEL), and maintain the component configuration of each aircraft. That is, all the relevant data with respect to installed components, as well as which component part and dash numbers are compatible with each other and with which aircraft.

The maintenance status has to be monitored. This involves: tracking maintenance tasks in relation to FH and FC data; monitoring the status of FH and FC data for all installed rotable components, and their removal data; ensuring compliance with relevant ADs and SBs; and writing the engineering orders (EOs) for the aircraft (a function normally performed by an operator's engineering department).

Another engineering function is powerplant management. For most airlines and M&E systems this includes collecting, analysing and storing engine health and condition monitoring data. M&E systems can track the status of life-limited parts (LLPs) and on-condition rotables and accessory components. Few M&E systems can plan engine removals and maintenance shop-visit (SV) workscopes, or estimate the cost of SV inputs. This is done manually by many engineering departments, and resulting engine maintenance costs are recorded in the M&E systems. While engine removal and SV workscope planning is not needed by airlines with power-by-the-hour (PBH) engine maintenance contracts, AerData's EFPAC solution specifically deals with planning removals for an engine fleet. It also plans engine SV workscopes, estimates SV costs and aims to minimise overall engine maintenance costs.

Other engineering functions and activities include: maintenance planning; job card production; maintenance execution monitoring; regulatory compliance; compiling and filing reliability reports; keeping technical records; managing the content management system (CMS), which involves importing technical documents into the M&E system; and managing this library, so that the documents are distributed to all relevant departments of the engineering function and to all workstations as required.

Maintenance execution

Few, if any, MROs provide absolutely all levels of airframe, engine and component maintenance for all possible

airframes, engines, airframe and engine components, and existing airframe-engine combinations that a customer might operate.

The MRO provider will inevitably need to outsource some of the maintenance it manages for its customers to several other providers, especially in the case of the large variety of rotable components on aircraft and engines, many of which are repaired by only a few specialists around the world. This means an increased engineering function for the MRO provider, including: issuing repair and work orders; associated logistics; recording all relevant financial data and information; managing all documentation; and keeping repair and technical records of the outsourced items. "Using a large number of different maintenance providers means that several M&E systems will be used," says Chris Reed, managing director of Trax. "This complicates the issue for the MRO provider, since there is no standard language format for M&E systems. The MRO provider therefore has to send data to a large number of different M&E systems, and receive data back. Systems such as Aeroexchange act as a data exchange hub between a lot of different systems, when component maintenance is performed by many different vendors."

Sub-contracting component maintenance to a large number of vendors leads to the duplication of engine maintenance, heavy component repair, some airframe checks, and line maintenance at many outstations. Line maintenance in particular will be carried out by a large number of providers, and even by the airline customer itself at its homebase and some destinations to which it operates. Managing all the data going to and from these vendors and sub-contractors is another management function for the MRO provider, with respect to data flows between a large number of M&E systems in particular.

Although the MRO provider will sub-contract a lot of maintenance functions to several specialist vendors, the MRO provider relieves the airline customer of the majority of the engineering management functions and maintenance execution. This is particularly attractive to start-ups and airlines with small fleets.

One-stop providers

There are few providers of true one-stop, vertically integrated MRO & M&E system services. One of these is Lufthansa Technik, which offers maintenance support from its Hamburg base, and a large variety of capabilities through its network of other facilities, subsidiaries and partners worldwide. It has created Manage M: a suite of up to 100 different M&E IT systems, centred around SAP and SAP's iMRO systems. Manage M has as many as 20 different functions to control the technical life of customers' fleets. SAP's iMRO was developed by HCL-Axon, after SAP outsourced it. Lufthansa Technik also offers a vertically integrated product with Swiss AMOS, but prefers to offer Trax as a system for customers that use Lufthansa Technik Philippines.

Another provider is SR Technics, which uses SAP for its own purposes, but uses other M&E Systems for its customers. One was Swiss, which had to emerge fast from the collapse of Swissair in 2002. Another is easyJet, which started operations in 1995 with two wet-leased 737-200s and served only two destinations from London.

An integrated service met the needs of both airlines. Swiss had to get operations running as soon as possible, and did not have the time or resources to start its own engineering department. Like many other low-cost carriers (LCCs), an integrated service suited easyJet's needs since it was able to avoid having to invest in an engineering department of its own, which would have been difficult to justify with a wet-leased fleet of two aircraft.

Other examples of an integrated service provider are Delta Tech Ops'

Program Integrator total care product. Boeing is introducing this type of one-stop service for just the 787 with its GoldCare program. This uses the MXi's Maintenix system as the IT solution.

Egyptair Maintenance & Engineering is also planning to offer a one-stop total care technical service, and is in the process of selecting M&E systems.

Airline requirements

When outsourcing the engineering management functions to an MRO provider, an airline's first requirement is to have full-time access to the MRO's M&E system, so that it can monitor the airworthiness and maintenance status of its aircraft. "The airline will ideally have web-based access to the M&E system used by the MRO provider. This raises some security issues, such as ensuring the airline only has access to the data for its own aircraft," says John Stone, director of product market management at Ramco. "This access is a legal requirement, since the airline has to continuously know the maintenance status of its fleet. The airline needs web-access because it has to feed in aircraft utilisation data, technical defects and technical log information, component removals, line maintenance actions, and other data. The overall objective is to have a seamless service for the airline."

Another important requirement is for the airline to have access to maintenance and technical records. Most aviation authorities and regulators do not permit electronic records on their own, so traditional paper records are required as a back-up.

"The MRO provider is legally bound to provide the airline with paper records," says Reed. "Keeping electronic records in parallel is advisable when the airline's future requirements are considered. The issue is complicated by the fact that the engineering company legally owns the maintenance task cards, so this must be addressed in the initial service agreement and contract between the airline and MRO provider."

A further requirement an airline may have is access to the man-hour (MH) and material cost inputs used by the maintenance provider. "This will be hard for the airline to obtain, particularly in the case of fixed-cost-per-FH contracts," says Reed. "The original terms of the contract have to be considered carefully."

Advantages

These vertically integrated services offer several clear advantages to airlines. "They clearly suit airlines that are starting operations, or have small fleets," says Sharhabeel Lone, partner global business strategy at Saks Consulting. "An airline can almost completely avoid the cost of establishing its own engineering department, which is a large investment that cannot be justified for a small fleet. This changes, however, as the fleet gets larger.

"An airline is only legally required to: keep technical and maintenance records; monitor the airworthiness of its fleet; get full visibility of what the MRO provider is doing; employ a technical director and quality control director; and feed in utilisation and technical defect data," continues Lone. "After a short amount of time and growth in the operation the airline can perform some of the line maintenance functions and grow the capability of its engineering department accordingly."

The airline can also offload the full responsibility of executing all maintenance to the MRO provider. "This means that the MRO provider has to determine what maintenance it will do itself, and what it will outsource," says Stone. "The MRO provider therefore has to deal with other maintenance providers in terms of data flows and formats and the IT systems."

Total care packages only work and make sense when an airline sub-contracts all its maintenance to a single provider. An airline has to consider how it can extricate itself from a total care contract when it starts to operate a larger fleet, perform some of its own line maintenance, starts using its own M&E system, and sub-contracts some maintenance to other providers.

The overall benefit is that the airline does not have to worry about maintaining its fleet. "These services are cost-effective for small and start-up operators, but the main attraction is control rather than cost," says Lone. "For seamless integration, the airline must commit to a true one-stop service, under a long-term contract, because it will complicate things if it starts to sub-contract maintenance to other providers. It will need first to operate an engineering department to manage the M&E system, and deal with the problem of managing data flows between all its maintenance providers and related M&E systems. All of these requirements clearly defeat the objective of a fully integrated service.

"An advantage of an integrated service is that it avoids the large investment in acquiring, implementing and operating a M&E system," continues Lone. "These savings are considerable when they are coupled with the saving an airline makes from not developing its own engineering department."

The true one-stop shop is therefore ideal for small airlines, which have limited start-up capital and lack the economies of scale possible from investing a lot in M&E capability and IT systems. An MRO provider will charge for the IT system in the package on a flat-rate basis, and the airline can sometimes get these M&E systems supplied at almost a token cost. The airline also only needs to employ one or two senior people in its own engineering department. "These cost benefits shrink as the fleet and operation grow," says Schauffele. "It gets to the point when it becomes economic for an airline to develop its own engineering department and do more line maintenance in-house."

Hazards and pitfalls

Airlines need to be aware of several potential pitfalls when considering total support contracts. The key issue is that airlines need to think how they can extricate themselves from such contracts before actually entering them. There are several, interlinked, reasons for this.

The first is how the airline can leave the contract when it grows its operation and its own capabilities. Line maintenance is the first issue an airline will want to address as its network, fleet and operation grow. Outsourcing the majority of line maintenance to a third party will no longer be economic once the fleet grows beyond only 10 aircraft.

It then becomes increasingly uneconomic to leave all engineering management to the MRO provider as the fleet and operation grow, so it makes more sense for an airline to carry out its own engineering management functions.

An airline will also find it more economic to perform some of the simpler elements of maintenance that require little investment in expensive facilities and tooling. An example is having its own tyre, wheel and brake shop.

As an airline becomes more self-sufficient in M&E, it will need to acquire and implement its own M&E system. This can cause a huge logistical problem because the airline will not be able to populate all the data in its new M&E system from its MRO provider's system overnight. The process will take several months at best. In turn, having an in-house M&E system means the airline will need to regain more of its engineering functions to justify having it.

One of the biggest issues relates to technical and maintenance records. As described, maintenance records have to be kept by the airline, and most authorities and regulators only permit paper records. "While the MRO will be legally obliged to provide the airline with these paper records, it is in the airline's interest to have the technical records in a structured electronic format, such as XML, so that the data can be used to populate the airline's or another MRO provider's M&E system," advises Schauffele. "There are several reasons for this: the airline's contract with the total care provider may be due to expire; the airline may decide the total care contract is no longer economic; or it may wish to perform some of its maintenance in-house. Whatever the reason, a smooth transition from one maintenance provider to another cannot take place unless the technical records, aircraft configuration, aircraft utilisation, and all maintenance data are migrated to the new maintenance provider's M&E system.

"This process takes a minimum of several months. It is also very expensive, because M&E systems do not have a standard data format," continues Schauffele. "The cost of manually inputting data taken from paper records can run into millions of dollars."

The issue of data migration and portability between M&E systems is one of the greatest risks with total care service contracts. "It is underestimated by most operators, whether or not they use total care services," says Stone. "The problem is that many M&E systems like SAP and IFS are customised, which prevents data migration between the different versions."

Lone warns that airlines should ensure they enforce the clause in the contract that covers keeping technical records in a structured and transferable electronic format. Records should be kept properly, so they should be overseen by the airline's quality department on a regular basis. This reinforces the need for airlines to have web-based access to the MRO's M&E system.

The worst case scenario is when the airline switches maintenance provider, and does not have any agreement in place for the MRO to provide the airline with electronic records that can easily be transferred to another M&E system. Airlines have been provided only with

paper maintenance records in these scenarios. It takes several months to manually input all the data into a new M&E system, and means the aircraft's maintenance status, configuration and FH and FC data are unknown. This kind of mistake can take months to sort out, ground aircraft, and cost millions of dollars for unproductive downtime, labour to go through maintenance records and duplicated maintenance.

Although the airline is legally bound to keep paper maintenance records, the MRO provider may actually have them. In this case the paper records should be scanned so that the airline can have copies to provide to its regulator.

Further problems arise in relation to technical records with leased aircraft. Lessors have legal title over maintenance records for aircraft they own. The lessees, however, keep maintenance records during operation, and have to give these to the lessor when returning the aircraft at lease end. Again, if not being given electronic technical records by the MRO provider has not been anticipated, airlines can run into difficulties, especially where little is known about the aircraft's maintenance status. Airlines will have to ground aircraft, while continuing to pay lease rentals, as paper records are analysed, and input into an M&E system.

Evolution & extrication

Even if the airline anticipates and prepares for all the hazards of total care contracts, several issues still need to be addressed to ensure a smooth transition when cancelling or withdrawing.

"A contract cannot be terminated by the airline overnight," says Schauffele. "It will have to gradually extricate itself from such services. For example, Swiss started to insource its engineering management functions, implemented its own Swiss AMOS M&E system, and started to import data from SR Technics' system for the fleet of 40 aircraft that SR Technics was managing. Swiss also insourced light maintenance, but it still outsources heavy airframe maintenance, engine shop visits and component repairs to various providers. This is only possible if the airline first has its own M&E system. The maintenance data still have to be kept on the MRO provider's system, since data migration to the airline's system takes several months. The data on the airline's M&E system will have to build up, and will be the same as on the MRO's system.

"The airline will also need to implement its own M&E system if, for example, it introduces a new fleet type," continues Schauffele. "It makes sense at this stage to source several maintenance providers and develop its engineering management capabilities, and so acquire an M&E system. Data for a new fleet can be imported directly, rather than be migrated from another system."

Swiss AMOS has recently integrated with Lufthansa Technik's Manage M suite of IT systems. "This partnership started in October 2007, and allows Lufthansa Technik's total care customers to gain some freedom, use other maintenance providers and transfer data to Swiss AMOS, which can be used as their own M&E system," explains Schauffele. "Swiss AMOS interfaces with Manage M so that customers can continue to use Lufthansa Technik's engineering management services. This gives them time to develop their own engineering management capabilities, and migrate data into Swiss AMOS after it has been implemented. The data in AMOS and the Manage M suite are synchronised. The engineering data for any new aircraft introduced after AMOS is implemented would not be duplicated. Data for the original fleet can still be viewed in Manage M through Swiss AMOS." AC