An airline or maintenance facility has many requirements for its maintenance IT systems. These requirements can depend on an airline's fleet size, or the number and depth of maintenance events carried out by a maintenance facility. This article highlights the considerations undertaken by IT system users via a series of case studies.

M&E & CMS system configuration case studies

Sophistication is required from the software that becomes an airline's or a maintenance facility's central 'hub'. This will be a system that correctly feeds and filters all information entered manually, or automatically via an electronic techlog (ETL). Fully paperless processes are increasingly possible, as regulatory authorities such as the Federal Aviation Administration (FAA) and Civil Aviation Authority (CAA) are recognising the benefits that a Maintenance IT system can bring to a customer.

Airlines and maintenance repair organisations (MROs) choosing their first Maintenance IT system, or upgrading have to understand the system they need. They also need to understand the importance of data standards, and the complexities of data migration. Transferring a client's entire backlog of paper records (manuals, task cards and logbook entries) varies in complexity between users. This depends on whether they already have electronic versions.

The most recognised types of Maintenance software are narrowed to three main streams, each with its own functionalities: M&E systems; content management systems (CMS); and enterprise resource planning (ERP) systems. The customer has to determine which system best meets its needs, or best achieves its aims. This could be to become paperless, improve its reporting processes, or cut down on manpower. It is not unusual for a user to tailor its IT systems to its own operations because it needs more than one solution.

Maintenance and engineering (M&E) systems solutions perform functions to support engineering management and maintenance tasks, including: managing maintenance programmes and planning maintenance events; job card production; creating minimum equipment lists (MELs) for each fleet; monitoring aircraft utilisation; and maintaining the user's regulatory compliance.

A pureplay M&E system may also accommodate unscheduled elements of engineering management, such as defect analysis, repair design and approval, and diagnosis and correction. Some business-related functions, such as invoicing or accounting capabilities, or employee planning, may be limited in M&E software. The wider capabilities of an ERP system or Point Solution may, therefore, be interfaced to expand the scope of the user's IT systems.

ERP systems are business management solutions, comprising several applications. Business activities that benefit from ERP systems include inventory management, overall cost and financial management, personnel management, and purchasing. ERP systems have been developed to incorporate maintenance and engineering processes for industry use. It is common for a business using MRO IT software to have an ERP system interfaced.

A CMS allows different types of content formats to be published, edited and modified. It enables users to manage workflow in an environment of frequent changes, edits and updates. In an aviation environment, this will include: manual and document revisions and upgrades; task card development; and part number changes. These procedures can be performed manually, or can be an automated cascade in more advanced CMSs. Most CMSs perform document management functions that include: web-based publishing; format management; revision control (version control); and indexing, search and retrieval.

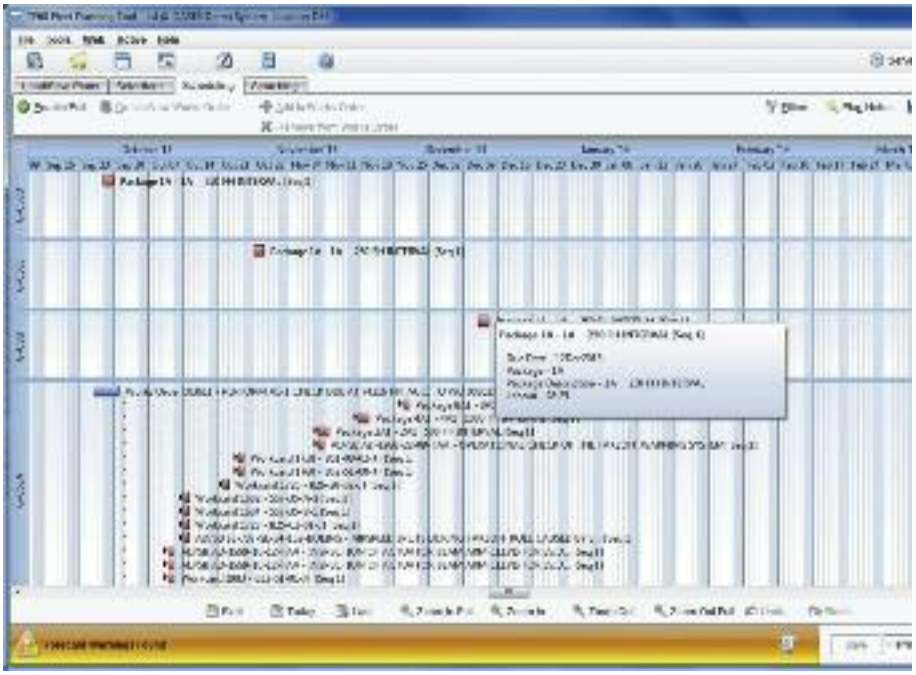
Data standards & formats

Data standards a company adheres to will affect how a system is implemented. Data standards are not mandatory, so customers implementing new software usually encounter difficulties.

Electronic data can be presented in several formats. This affects how M&E systems are interfaced, since data can come from various sources. Original equipment manufacturers (OEMs), for example, supply aircraft and engine maintenance manuals (AMMs and EMMs), component maintenance manuals (CMMs), illustrated parts catalogues (IPCs) and other manufacturer-based information to the aircraft operator in one format. The aircraft operator will supply flight hour (FH) and flight cycle (FC) utilisation data. Such data need to be interactive with the aircraft's maintenance programme, in order to update criteria including the status of life-limited parts (LLPs), or the proximity to maintenance events.

An MRO provider will respond to these data by supplying workpack documentation, task cards, release-to-service certificates and modification information relating to the replacement or repair of parts as and when required.

To fully integrate with an MRO IT



Commsoft's OASES system enables workscope planning; production and inventory management; technical records management; and the management of engineering functions.

system, all aircraft-related documents, such as the maintenance planning document (MPD), AMM, EMM and IPC, must be stored digitally to make accessing information possible at any time.

Regulatory authorities will supply approvals and airworthiness directives (ADs) relating to aircraft types, which have to be interfaced with an M&E IT system to update system records.

Data come in several forms, including standard generalised markup language (SGML), hypertext markup language (HTML), portable document format (PDF), and extensible markup language (XML) formats. Both SGML and XML formats are entirely written in code. The code needs to be rendered and presented in an understandable viewable format.

M&E systems have different database structures, which makes integrating two systems difficult. An airline's and an MRO's systems will have different ways of storing and displaying data in CMSs. Reference numbers also vary in character length between OEMs. Synchronising these data is complicated.

Data standards were created to align data between OEMs and aircraft types, and allow simplified data transfer. While industry demand has meant that most providers at least pay attention to the standards, they are not always followed.

iSpec2200 provides specifications and models for transferring and exchanging data. Most older aircraft conform to iSpec2200 standards. S1000D is used by the latest generation aircraft. Other examples of standards include ATA Spec 2300, DITA and ATA Spec 2000.

For an airline with a mixed fleet, or an MRO with different maintenance programmes in its capability, data integration can be more complicated.

Flatirons Solutions has developed CORENA Suite, a software that incorporates a CMS, interactive electronic technical publications (IETP), business process management engine, and tablet applications to manage the full content lifecycle of technical documents from authoring to consumption. "Non-adherence to data standards is common, and working around it wastes a lot of time and cost when reconfiguring a customer's IT system to accommodate a new software," explains Paul Saunders, solutions manager at Flatirons. "Customers can sometimes deviate from the standards with the best intentions, but are unaware of the impact this will have for system implementation and integration later. When it comes down to migrating these data, however, the cost will almost always outweigh the benefits they may have previously experienced."

Integration & migration

Transferring and interfacing existing data formats with a new system may vary with the format and volume of the data concerned. It can also depend on whether the customer already has an IT system in place, or is mostly paper reliant. "A start-up, or paper-reliant operation, can be 'live' entering techlogs, recording component changes and monitoring reliability within three weeks of signing a contract," explains Nick Godwin, managing director at Commsoft. "Software can be implemented in phases, with purchasing and inventory being handled in a week, independently of continued airworthiness activities.

"Techlogs, component changes and reliability can start almost immediately. The development of aircraft build, including components, life limited parts (LLPs), on-condition condition monitoring (OCCM), main assemblies such as nose landing gear (NLG), main landing gear (MLG), auxiliary power unit (APU), and engines can require more time. This depends on the validation of paper-based data, such as ADs/SBs for instance," continues Godwin. "Ultimately, total implementation time will depend on the number of fleet approved maintenance programmes (AMPs), age of the aircraft, quality of the data, and the history required for implementation," says Godwin. "An important factor is strong project management processes. Commsoft has demonstrated that a fleet of 10 A320s or 737NGs can be implemented in 8-14 weeks from contract signature." For a customer that has a type of maintenance software already in place, one can expect a shorter time to implement a replacement system. "This depends on the availability of reasonable data in convertible electronic formats. The time to implement can sometimes be shortened by 20-30%," confirms Godwin. "Even if these data are sourced from different systems or MS Excel or Access, it can be codified, analysed and sorted using data migration and validation tools."

Data migration process is key when implementing systems. "This is the most critical part of the overall project," says Chris Reed, managing director at Trax. "It can take up to six months to migrate the data an airline or an MRO requires. It can be 12 months for a large customer.

"This is because there are many variables that one must check to validate components," continues Reed. "A fleet of 30 aircraft, for example, may have about 100,000 records to cross-check and refer. Assuming a validation rate of 100 records an hour, translating to 1,000 man-hours, the first migration and validation process can take weeks. It is rare for migration to work 100% correctly, so the process of cross referral is repeated until verified."

It is easiest to migrate new data, that is, when an airline adds a new aircraft or fleet. "It is all digital now, and can be implemented easily into systems without the need for cross-referral with the old systems," confirms Reed. "It is rare for users to have purely paper manuals and records. It is possible in this event, however, to scan the paper records and analyse the data via a PDF file before migrating into Trax.

"The OEM obviously provides the best baseline on which to compare a customer's data before migration," adds Reed. "If we can locate a digital version

of the IPC, for example, we can overlay the data against the customer's data and highlight any changes, and so optimise data integrity." Customers may also choose sample validations, from 100% checks, to 50% and then 20% overviews.

Typical interfacing techniques include XML data transfer, web services, Java, J2EE and .NET technologies. These typically narrow down to give customers two main integration choices: access to software via applications; or sending business transactions, documentation and data between systems, to and from customers and suppliers via the IT vendor. "There are a couple of potential integration points for our system during production and implementation," explains Saunders at Flatirons. "The most common is the integration between our system and the MRO/ERP system.

"An airline will usually use an MRO system to track aircraft technical records and plan maintenance. The two functions allow them to forecast and schedule maintenance," he adds. "The MRO system pulls together all due items and tasks, with an MPD or similar unique reference for each task. Integration with our system allows the MRO system to call the relevant data for each task from our CMS, and return the latest content.

"This provides efficiencies for our customers when compared to legacy processes. Without a CMS, the tasks would have to be replicated in the MRO/ERP system. Reconciliation with OEM updates is a significant effort, sometimes taking 30-90 days," continues Saunders. "Either that, or the tasks would be a simple referral to the AMM. This means that mechanics, inspectors and other stakeholders in compliance would have to cross-refer between task and the associated source."

There are a number of data generation opportunities that utilise integration during system implementation or during fleet or aircraft adoption. "The task of populating an MRO or ERP system's planning data relating to the maintenance programme, for example, would be accomplished by our system and migrated into the MRO/ERP system. We do this by converting the content of the MPD into tasks, and then integrating it with the relevant destinations in the customer's ERP systems," says Saunders. "This can be achieved for MPDs in whatever format, even PDF. The same concept allows us to extract part number and configuration data from IPCs."

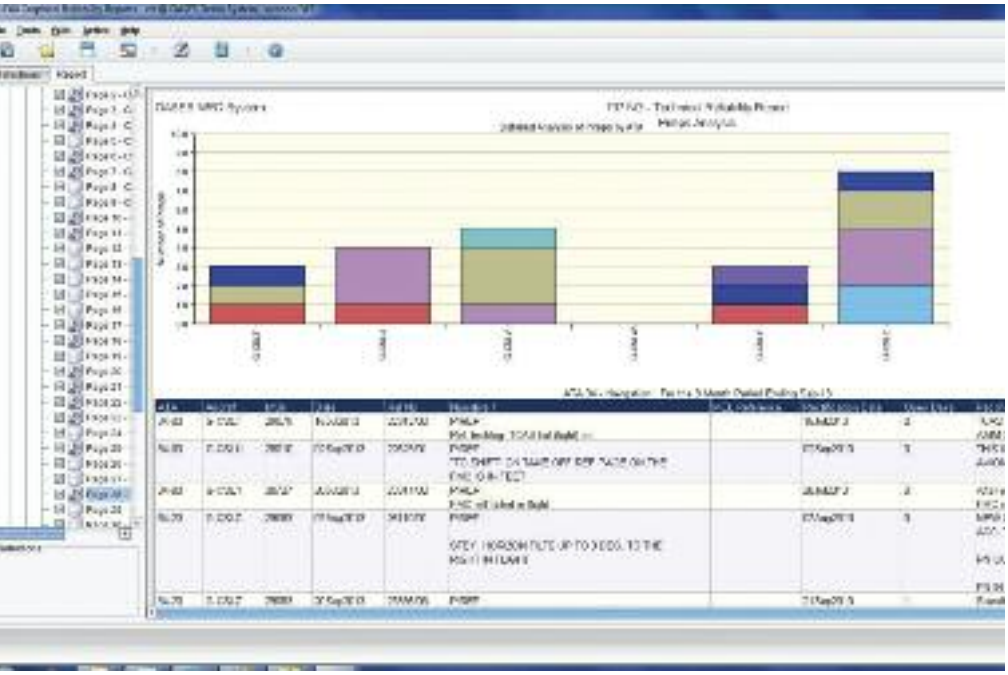
Cathay Pacific Airways

Cathay Pacific, with a mixed fleet, has used Ultramain systems since 2001, so almost all its maintenance activities are supported by this system. "In terms of M&E systems, we use Ultramain version 8 (V8)," explains Robert Saunders, head of engineering business improvement at Cathay Pacific. "New enhancements and modules are being introduced in Ultramain V9. The scope of Ultramain extends to all aspects of fleet and inventory management, with the exception of document management and authoring." Paper records are currently scanned and indexed via FlyDocs.

"In terms of CMS, for general documents we use a centralised drive file structure," continues Saunders. "Cathay is installing an enterprise-wide CMS (which is based on Filenet). Our Technical Documents Approvals are managed in an in-house Sharepoint development called TDM.

"SGML content for Work Card production is in ADOC for all fleets. This is integrated back to Ultramain Job Card Production for control," says Saunders.

Ultramain is also used for forecasting engineering activities. Cathay does not have an ERP for overall management of the business. "SAP is being installed for finance and procurement functions," continues Saunders. "SAP and Ultramain will also be integrated for finance and accounting transactions, but the maintenance forecasting and compliance will remain with Ultramain."



The OASES suite also collates technical reports for use during audits and other inspections.

Prior to Ultramain, Cathay used EMPACS, an in-house system that is currently only accessed for aircraft disposal or lease returns."

Cathay uses SGML for OEM manuals, PDF for scanned and filed copies such as technical records, HTML for web-distributed procedures manuals, and Word as a document format.

Cathay has configured its systems to operate in a modular fashion. That is, while its M&E and ERP systems provide core capabilities across most functions, other in-house programmes are interfaced for certain applications as needed.

Ultramain Tech Log has managed technical defect management and reliability from paper-scanned records stored in FlyDoc. Cathay is moving to Ultramain efbTechLog (e-Log) , phasing it in through its 777s. The first A350 will be delivered in February 2016, and will have e-Log from entry into service (EIS).

Cathay uses the Ultramain AHRM module in V9 for airframe health and reliability monitoring and will continue to run spreadsheets and databases in parallel. Cathay outsources its base maintenance and repair, primarily to HAECO and TAECO. "They use in-house developed systems," says Saunders. "HAECO is installing Ultramain Mobile Mechanic for light maintenance e-Work Cards and production."

Engineering management functions are divided between Ultramain and TDM. ADs and SBs are managed via the sharepoint system, whereas Ultramain manages the EOs. Other modules managed by Ultramain include warranty management (via Ultramain Warranty) and defect tracking (including MEL). "Repetitive defects and CMC alerts are in Ultramain, with an integration into Net Line Ops for performance-related defect alerts," continues Saunders. The e-Log is key to providing accurate and 'clean' information to get the best from the defect management modules. "We expect operational approval for paperless line operations in Dec 2015."

Cathay relies on manual, paper and e-mail-based procedures for its commercial management demands, including invoicing and bid management. "We expect to eventually migrate these processes onto SAP," says Saunders.

Cathay now has a system in place that is significantly IT-, rather than paper-reliant. "If we experienced system failure, we could operate without IT for up to a week, reverting temporarily back to paper. Data recovery of backlogs would be a significant challenge, however, and would take a long time," says Saunders. "For example, the impact to stores and logistics/configuration management would be particularly challenging.

"Although we have paperless technical records that are scanned copies, e-Log, once implemented, is the first truly electronic record that we will use. We anticipate work cards will follow in 2016 via Mobile Mechanic," says Saunders.

Cathay's approach in configuring its systems has given multiple benefits to its operations. "Since completing our data integrity project (zero tolerance policy) and introducing FlyDocs for electronic access to Tech Records, we have not had a late lease return or aircraft sale," highlights Saunders. "We also no longer need to replace expensive components due to records discrepancies. Overall, we are saving millions of dollars.

"With fleet growth and increased leasing activities we estimate that we would have had to increase headcount in Tech Records by about 10 people (50%) at the peak. We have instead reduced headcount by one, to put the issue into context," continues Saunders. "Alongside this, accurate configuration control and accomplishment records in Ultramain have meant that task overruns (MPD and mandatory) are rare, while successful warranty recoveries have improved."

In terms of improvements, Saunders sees that following Spec standards is key. "With a highly integrated system, a transaction propagates to many areas that the user is unaware of. It is a challenge to get people to use the software as designed, particularly when first introduced," explains Saunders.

"More generically, just about every MRO system will need to talk to other systems whether OEM, Flight Operations or other MROs," continues Saunders. "This can affect processes. If Specs are followed, such as Spec 2000 chapt 11 and 17, then it helps, but is by no means a complete solution. The industry needs standards for MRO packages and accomplishment; topics that are now under investigation by IATA."

Commsoft and Jet Time

Headquartered in Tiptree UK, Commsoft produces the OASES MRO IT system ('M&E'). OASES covers all key areas of technical records, planning, reliability, engineering, line maintenance, base maintenance, forecasting, cost control in aviation engineering for network, low-cost and regional airlines, third-party MROs, parts suppliers, and corporate aviation, among others.

Commsoft has about 60 direct customers for OASES, the majority of which are divided between airline, MRO and continuing airworthiness management organisations (CAMO), or engineering management organisations.

When discussing integration of its software with a new customer, phasing is key. "It is far better to agree a phased implementation by functionality, or by fleet and then individual aircraft, because this builds engagement with the user, OASES and Commsoft," explains Godwin. "Since the structure of OASES is modular, it is much easier to phase in accordingly, while also allowing flexibility when pricing to the customer."

Commsoft's OASES is live on Jet Time Air Service's (A/S) operational systems. Based in Kastrup, Denmark, Jet Time is an airline with its own MRO

The IFS application is able to group work orders by status, assignment requirements and priority.

facility. Its fleet includes 737-400s, seven 737-300s, five 737-700s and 13 ATR72s. In terms of maintenance activity, Jet Time performs about 500 maintenance inputs per year, based on an average of 1.5 inputs per aircraft, per month.

Jet Time operates a variety of systems, including those supplied by OEMs. Jet Time uses OASES for M&E, and is continually being upgraded to align with Jet Time's on-going needs. "We implemented the OASES inventory control, airworthiness, and production and planning modules. We have gradually added other modules and functionality as required, or as Commsoft has developed additional facilities," explains Nicolai Ronnow, planning manager at Jet Time A/S. "We also use the Boeing Toolbox and ATR Doc CMS, alongside Dynamics AX as an ERP. We initially implemented the General Ledger and Finance modules for Dynamics, but have just gone live with Payroll and are now implementing the HR module using OASES."

Commsoft required all electronic source materials that Jet Time had access to start integration with OASES. Jet Time has ensured a consistency in its technical document management, and the data standards it adheres to. This means the transfer of live flight data and the implementation process when interfacing with the OASES software was simplified as much as possible. This allows both customer and software vendor to mitigate against data transfer discrepancies. "We primarily use pdf for documentation, and XML for systems interfaces," says Ronnow. "For example, the transfer of live data between the OASES M&E system and the PDC operations system."

In terms of data standards, ATA100 standard formats are deployed.

Jet Time is now using the OASES system for the vast majority of day-to-day tasks, including: workscope planning; production and inventory management; technical records management; and the management of engineering functions such as ADs and SBs. The OASES system also manages job instruction cards, while the manuals such as IPC, AMM and MEL are accessed through the Toolbox and ATR Doc CMS. For future planning, Jet Time and Commsoft are working together to incorporate commercial management such as invoicing and bid management, warranty management, and manpower planning throughout 2016 and the early part of 2017.

In terms of implementing the OASES software, Jet Time commenced trialling the system during a period of growth. "We have increased our fleet size by more than 200% since we implemented OASES, so implementation took place in a challenging operational context," says Ronnow. "We used a joint project approach to control the implementation, and have had the active interest and participation of senior technical managers throughout the process.

"We have visibility of all open implementation and support issues through Commsoft's online service desk, and this gives all involved a clear view of tasks to be completed. This is supplemented with regular meetings (remote and on-site) with the Commsoft customer manager who provides day-to-day support and continuity," continues Ronnow. "In all, it took about six months from starting the OASES implementation to switching off the AMICOS legacy system," says Ronnow.

Jet Time and Commsoft are further working to streamline Jet Time's processes. This will include electronic sign-off for task cards and aircraft release certifications, one of the main hurdles operators experience in their drive to become fully paperless. Overall, Jet Time has experienced substantial operational benefits since implementing the OASES software. "We have greatly improved maintenance control using OASES, which has allowed us to better adapt to our rapid growth as a company,"says Ronnow.

"For the future, we have identified radio frequency identification (RFID) tooling control as important to our operations. We are working with Commsoft to develop automatic logging and control of tooling using RFID," adds Ronnow.

Blue Air

Blue Air is another OASES user. Blue Air operates a fleet of 15 737s, operating on two basic AMPs for 737 'Classic' and 737NG families. Blue Air is positioning itself for growth to a fleet of 20-25 aircraft. It continually works with Commsoft to adapt and upgrade its systems. "We implemented a new AMP management and AD/SB control functionality in 2014/15," explains Aurelian Bobei, CAMO director at Blue Air. "We are also going 'live' with the Blue 1 operations system interface, which is integrated with OASES. In 2014 we also deployed major new production module improvements in our Part 145 hangar operation, which handles heavy checks for our fleet and has been/will be offered to third-party customers."

Blue Air uses SharePoint online as a CMS, together with file-sharing servers. It adheres to XML for data transfer to interface between OASES and financial and operational systems. "Blue Air also used Commsoft's services to electronically migrate data from Excel and other sources. This is backed up by extensive manual and electronic re-verification. We mainly use PDF for file formats in OASES, and adopt ATA100 standards for our data to aid integration," says Bobei.

The M&E functions performed by OASES include: production and inventory management; engineering management functions; and technical records and logs including defect management and workscope planning for maintenance packages.

Commercial management, human resources and warranty management modules are in the pipeline, and are due to be rolled out in 2016. In terms of

accounting, Blue Air adopts an ERP via Navision, which is also interfaced with OASES. "This was a multi-workflow integration project between Navision and OASES. It went live in 2015," says Bobei.

Blue Air is looking to strengthen its line maintenance module. It includes MEL access and deferred defects, which are also due to roll out live in 2016. Other than this, quality control is the remaining module that Blue Air is waiting to implement via OASES, having relied on SharePoint to provide this.

The next large project being considered by Blue Air and Commsoft is integration of ETLs into the operational and line maintenance systems. "We are watching developments, because OASES is integrated with NVable and Conduce from other live customers," says Bobei.

Finnair

Finnair has a mixed fleet and will start A350 operations in 2016.

Finnair technical operations line maintenance scope includes hangar and apron maintenance from daily checks up to hangar A checks. This is about 6,000 maintenance inputs. Base maintenance is mainly outsourced, being 40-50 checks.

Finnair implemented Swiss Aviation Software's AMOS in 2012. AMOS performs M&E, CMS, resource planning along with Oracle Primavera, and logistics and finance functional criteria for the airline. Finnair has also updated AMOS from version 9.70 to 10.70.

Prior to AMOS, Finnair had developed its own M&E legacy 'TEKO' system in-house and implemented an ERP system to logistics, HR and finance. A CMS was also accomplished via a company-specific publication management system.

Finnair has a clear procedural format for document management and data standards. "Finnair Technical Operations has used SGML-structured documentation since 1999," outlines Jari Huhtinen, head of technical operations at Finnair. "The main reason is for easy integration into our maintenance IT systems (MIS). All the OEMs' AMM tasks and our own customised AMM tasks, for example, are written in SGML, and the information automatically converts into work packages."

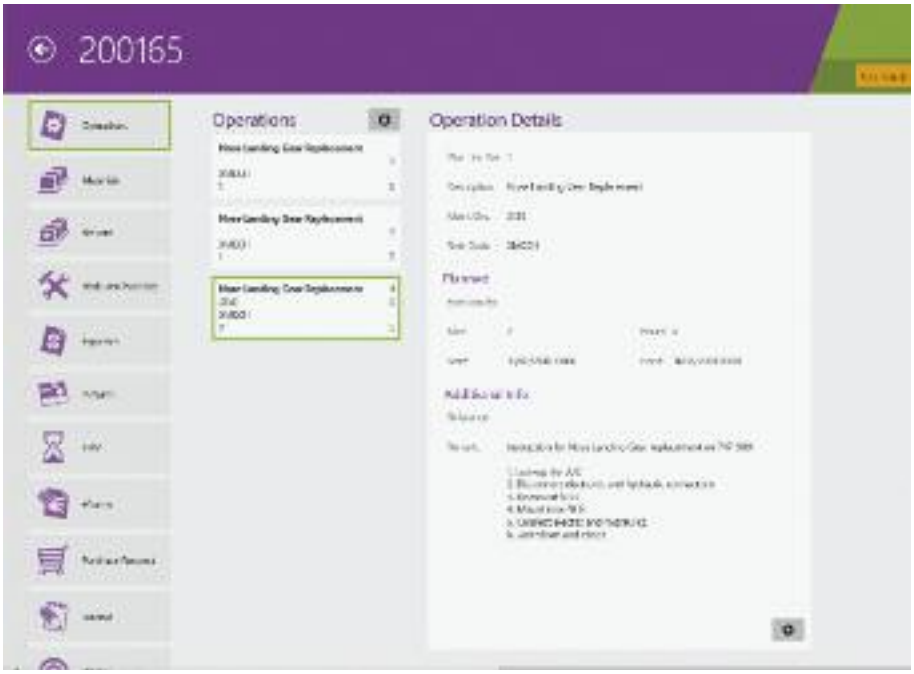
Finnair Technical Operations previously used an Opentext Content Server as a document management system, which had a tailor made process to support SGML-format manuals and customised AMM tasks. This had been integrated with its TEKO system.

"The AMM, IPC, EMM, NDT and TSM can be stored in SGML format in AMOS," confirms Huhtinen. "These manuals can be downloaded to the OEM Documents Library in AMOS. The user can then create links from Work Orders and Task Cards to AMM tasks, which are printed with the work package.

"Outstanding AMM tasks are filtered by using the effectivity tags," continues Huhtinen. A320 family, A330, A340, E-170 and E-190 manuals are stored in this in SGML format. These manuals adhere to the iSpec2200 standard.

Finnair Technical Operations also has a database of SGML- and XML-formatted aircraft technical data for the use of 'data mining'. The SGML-formatted IPC, for example, which holds information such as parts numbers and spares information, is used for a regular cross check against the M&E system. This helps reduce the manual work needed when reconfiguring Finnair's systems. A recent case of data importation for Finnair has been A350 data, which is in raw XML format that follows S1000D standards.

"We have been able to transfer fundamental information such as the list of aircraft structure zones, functional item numbers, access panels, suppliers and parts information," adds Huhtinen. "We were able to import applicability, IPC references, and map out aircraft positions for parts in AMOS's Part Administration module. We are also able



IFS's programme also allows for operational details such as man-hours required to perform tasks.

to show information, such as the various consumables required for maintenance procedures that will occur during the first three years of A350 operation."

AMOS is obviously the predominant solution for Finnair for core M&E, CMS and ERP tasks. Finnair's technical operations department also uses AirVault (Critical Technologies) for technical records management. This scans and analyses its paper-produced records when received from an MRO vendor. AirVault is a cloud-based document management software service, which is fully integrated with AMOS. It also has a programme, AVRAD, used for lease returns; which still often requires the use of paper records. AirVault will recognise barcodes or process optical character recognition (OCR) from scanned MRO records, and update the AMOS system via links and indexing. It will also publish the record on its own system. Full configuration and integration of AMOS took about 18 months. Finnair anticipates it will become fully paperless within two years.

IFS and TAE

IFS Applications™ is an enterprise asset management (EAM) and ERP software with more than 2,400 customers and over 1,000,000 global users across 11 industries. IFS focuses on the Aviation and Defence industry including OEM, airport, airline and MRO functions of the civil aviation sector. It supports heavy, complex, and component MRO for civil aviation, as well as line maintenance support. The software, IFS Applications, also provides solutions to support core enterprise functions for managing finance, inventory and human resources.

IFS supports more than 100 diverse aviation customers.

The three key civil aviation MRO customer segments are airlines, MRO customers and airline customers with their own MRO facilities.

A user's data must be input into the new system ahead of implementing a new M&E system. "For most airlines, the information required to implement any software application is readily to hand, either already in electronic format or in manuals," explains Tony Louw, maintenance and logistic consultant at IFS Aerospace & Defence. "If the airline has to rely on manuals, the common source of information would be the IPC, both for the aircraft itself and any assemblies/sub-assemblies that it maintains. If the data are available in electronic format then it is a simple case of performing data mapping between the source data attributes and the required target data."

In addition, the following is also required in IFS's experience:

- Aircraft assembly and sub-assembly configuration information, specifically in respect of maintenance and configuration-significant items. The identification of LLPs is critical.
- Maintenance planning document (MPD) or continuous airworthiness maintenance programme (CAMP).
- Task code and task card templates and contents.
- MMEL and the airline's dispatch deviations guide (DDG), which would be a combination of the MEL and CDL.
- Configuration and engineering control responsibilities and organisation structure.
- Personnel information on engineers/technicians and their qualifications and licences.
- Details of the various locations where aircraft would be supported.
- Fault modes, codes and categories to aid the recording and capture of system malfunctions or discrepancies.

"With any implementation there are also a number of additional items which can ensure success," summarises Louw. "These are namely:

A. Consistent business processes. "The customer should come to the table with a strong sense of where they are and where they are going," explains Louw. "They should already have an informed sense of how they would like to operate in the future".

B. Quality management system (QMS) details. "Internal requirements, as well as linkage to associated standards (That is ISO9000, AS9100, CMMI, FAA, IATA, EASA, ATA, ASD) should be supplied," advises Louw.

C. Supportability analysis. "This can include maintenance task analyses, reliability/maintainability analyses and operational objectives. If the team enters the implementation with a good sense of report requirements they are well positioned to architect the RDBMS, and therefore the data attributes correctly.

"Not all of the information is required prior to go-live," says Louw. "If the source data and 'generic basic data' has been captured and is used by both operational and support personnel at the start of the implementation, then more accurate recording occurs when maintenance and corrective actions are initiated," says Louw.

One of IFS's most recent customers is TAE. Headquartered in Amberley, Queensland Australia, TAE is a maintenance facility. Its annual activity is mainly turbine engine MRO and wheel and brake MRO for civil and military customers. Activity includes 350 turbofan, turboprop and APU engine events, and 2,500 aircraft wheel events (A380 to Dash 8).

IFS and TAE work together to implement a new ERP system into TAE's operations. "The ERP replacement project will replace an existing SAP ERP system for two-thirds of the business, and an existing Russell Adams system for the other third," explains Andrew Sanderson, chief executive officer (CEO) at TAE. "IFS will provide a single ERP system to streamline efficiencies". The majority of technical documentation is in PDF format. Because TAE mainly uses customers' data, no formal data

Finnair is due to start A350 XWB operations in 2016.

standards are followed in its processes.

TAE already used the SAP and Russell Adams ERP systems to accommodate a range of functionalities. TAE therefore configured IFS to accommodate a variety of modules including: technical logs; defect management & reliability; technical records management; maintenance package & workscope planning; production management (including work in progress, and shop floor data collection); inventory management (stock control, sales orders); several engineering management functions; commercial management (bid management; warranty management; document management; human resources & scheduling; and native finance & accounting. There was a substantial technical infrastructure to replace and interface with the IFS software.

"Typical implementations take 6-24 months," says Louw. "Duration depends on the breadth of the modules implemented, and the complexities introduced with multi-site and international multi-region roll-outs of the software.

"The time to implement IFS varies because of the solution's modular structure. A customer's business scope complexity may also affect the time required," continues Louw. "The maturity, experience, and resources the customer can deploy to support transformation will also influence implementation. The issue is whether the company, that has been repairing aircraft for 25 years, is replacing an existing complex assembly, or it is a new business that is still growing."

TAE's implementation sequence was planned accordingly: "We had a pre-scoping study to understand if IFS was the right fit for the business. We developed a high level scoping document and project plan to ensure implementation could meet our expectations in terms of capability and the implementation time line. This took about six weeks," explains Sanderson. "We then commenced solution prototyping and definition to prepare the initial system, which lasted about 12 weeks. Establishing solutions to overcome any gaps that the initial system showed was another six weeks. We also started to train staff that would be using the software. We plan to start implementation and go-live at one site before continuing onto the others. We anticipate initial implementation and going live at site one will take a further six weeks, while rolling out among the other sites will take more than 12 weeks," continues Sanderson.

No regulatory sign-off is needed before progressing between stages to implement its new ERP system, so it can set out a fairly aggressive rate to go live. "The implementation has been fast paced," confirms Sanderson. "We plan for full implementation across the two-thirds of the business by March 2016. The remaining third will follow within three months by June 2016."

TAE anticipates that it has some way to go before becoming paperless across its entire business. "I estimate we are now 20% paperless," says Sanderson. "The IFS platform provides us with the best basis to achieve this. The major limitation I can foresee is obtaining FAA/EASA/CASA approval for electronic signatures."

While TAE has experienced no changes to the frequency or depth of any regulatory audits, it expects that there will be some scrutiny once electronic signatures start being rolled out.

Lufthansa Technik AG and Lufthansa Systems

Lufthansa Technik (LHT) has more than 60 office locations worldwide, including about 30 subsidiaries. It has a large base of 795 customers, and nearly 3,300 aircraft under exclusive contracts for maintenance. Its IT systems need to be fully integrated with its sister airline, alongside its customer systems to record the thousands of checks, modifications and overhauls involved.

"LHT has developed an in-house M&E system for its maintenance activity," explains Jamila Jadran, product manager MRO IT solutions. LHT/LH Systems made the complete development and the implementation processes.

"Our MRO IT system, the Technical Operations WebSuite manage/m®, supports a web-based management of all core functions in technical operations. It keeps the operator and the MRO supplier connected and in full loop with active control of all aircraft maintenance related information," continues Jadran. Its Manage/m® suite consists of 15 modules. These perform different maintenance tasks, and are all interlinked. Manage/m was first integrated in 2006.

"The WebSuite combines all relevant maintenance processes within one system. These had been running in several individual systems before it was implemented," adds Jadran. LHT uses a variety of formats including PDF, SGML, XML documents, and these comply with S1000D standards and further standardised formats such as Spec2000. These are the standards best to integrate with the manage/m® modules.

The majority of complete maintenance processes are administered by the manage/m modules. This includes technical records management and defect reliability, production management, quality control, and engineering functions that include AD and SB updates.

Integrating its software with customers' systems is made relatively simple by the web-based nature of manage/m. "It can be used anywhere without the need for software installation," says Jadran. "All a customer needs is access to the internet. We have extensive and direct customer support (on- and off-site) throughout the integration phases."

The time to implement the systems

Lufthansa Technik's in-house manage/m system is web-based, and so can be accessed and used anywhere without the need for local software installation.

depends on the scope of contract with Lufthansa Technik. The use of the manage/m® WebSuite and the corresponding modules are included in a user's agreement with Lufthansa Technik. If the Technical Log Book module is included, for example, aviation authorities have to sign the phase off before the customer can go live. Overall, implementing via the web-based systems can take one to four months.

LHT is currently aiming to replace more than 90% of the existing paper documentation with electronic applications, and is positioned to do so via its in-house software.

Trax and Transavia Airlines

Trax is a pureplay M&E system with customers that include airlines and MRO facilities. One of its customers is Transavia Airlines CV, an airline based at Schiphol Airport, Amsterdam. Transavia has eight 737-700s and 25 737-800s.

Having previously used PMI to perform most of the processes, Transavia switched software systems in 2007. The data standards followed by Transavia include PDF and Word .doc files for document management, and XML for data import and transfer. The data follow ATA Spec 2000 standards.

Trax is interfaced with Transavia's operations accordingly. "We have a set of standard 'Web Services' that can connect other systems, via XML data transfer," explains Reed at Trax. "A flight operations system, for example, will send us the aircraft flight schedule via the web services. Once each flight has completed, the system will send us the completed or 'accomplished' flight details. Trax typically interfaces to flight operations, financial systems, HR, and the business-to-business (B2B) module such as Aeroexchange for purchasing parts."

Other than Trax, programmes such as Boeing Toolbox, an OEM-provided application; and Microsoft Excel, feed into Transavia's operations to provide specific additional tasks. It is Trax, however, as the core M&E system, that provides the bulk of the functionalities needed by Transavia. To date, Trax performs: production management, including shop floor data collection (SFDC); maintenance package and workscope planning, in combination with Excel worksheets for manpower shift management; inventory management; engineering management; warranty management; line maintenance management, such as MEL and deferred defects where Boeing Toolbox is also used; quality control management; technical logs, including defect management; and electronic techlog information.

Transavia uses its own applications for HR, such as manpower scheduling. Native accounting is carried out via FIS2000, a solution from IBM which provides invoice control, and financial and management accounting.

Overall, Transavia's migration from PMI to the Trax system lasted about 16 months. "Every implementation phase lasted about three months," says Roderick Pape at Transavia. "The data migration itself took about one month to carry out. If we need to upgrade the system now, it takes about one month."

Overall, Pape estimates that Transavia is still several years away from being fully reliant on paperless maintenance IT systems. "It is partly because of agreements with lessors on handovers and returns of leased aircraft that paper records are still required," says Pape. "Due to regulations and demands by other companies, we are still expected to keep paper processes going to a certain extent."

Due to the increased efficiency of improved data and process quality that Transavia has experienced through its maintenance IT systems, however, it is looking to make the appropriate adjustments in the near future. "We aim to become paperless (as far as possible), including electronic sign-off for taskcards," says Pape. "We are also working to incorporate more interfacing and integrating with flight and aircraft data for line maintenance planning."

Configuration issues

Several factors may hinder or slow integration. "When a business looks to upgrade or implement a new system, it is prudent to involve the whole business in the initial stages of discussion. This will also ensure there are fewer concerns and disagreements later in the implementation phases," outlines Louw. "The ERP also often replaces or enhances existing procedures and processes that may have been used for a number of years. This can slow the road to full integration.

"The biggest issues are usually the quality and completeness of data. This must be addressed as part of the implementation process under the airline's CAMO authority," adds Godwin. "Another issue is having a dedicated customer team." While the requirements of lessors still present one of the main barriers for large airlines and MROs making the final push to become completely paperless, regulatory confidence also needs to grow in some areas of maintenance performance. One example is the move to mobile technology *(see Wearable Technologies, February/March 2015, page XX)*. These concepts need to be further welcomed and accepted by authorities, before those in question fully focus on the efforts required to become IT reliant. Access databases, adherence to data standards, spreadsheets and other in-house initiatives show a willingness to make certain steps. It may be several more years, however, before the industry perceives the configuration of maintenance IT covering all areas of activity as the norm. AC

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