

Structuring a M&E IT system to achieve a range of functionalities and meet long-term requirements is a complex process. The first main issues to consider are how to configure a system to get all desired engineering, content management and job card production functionalities.

# Structuring a M&E IT system to achieve engineering, content management & job card production functionality

Airlines and independent maintenance, repair & overhaul (MROs) providers have to consider many issues when choosing a core maintenance and engineering (M&E) system and all of its associated point solutions. One of the primary issues is how to structure a system to provide engineering functions, content and documentation management, job card production, and keep maintenance and technical records.

The ability of M&E and other systems to improve the efficiency of engineering, content management, and job card production functions is constantly evolving. The systems have reduced much of the work that used to be performed manually in these tasks, and have simplified recording maintenance inputs and findings, and keeping maintenance and technical records.

## Ultimate system

The ultimate goal for airlines and MROs may be to achieve a paperless process, by: eliminating or minimising the manual management of data inputs and migration into M&E systems; fully automating revisions to documents and data, and reconciling changes;

automating task and job card generation; publishing and distributing job cards electronically; and recording the completion of maintenance tasks and associated findings; and keeping maintenance records electronically.

The ultimate goal is now technically possible, but most airlines and MROs, however, are somewhere in between, and need to gradually change or upgrade their IT systems, processes and hardware to achieve this. There are four main issues that airlines and MROs need to address to make this goal possible.

The first of these is to get their content management systems (CMSs) and their data and documents to a level where revisions issued by the original equipment manufacturers (OEMs) can be made automatically. Depending on the M&E and CMS systems in place, this process can be automated with data in portable document format (PDF), standard generalised mark-up language (SGML), and in extensible mark-up language (XML).

The documentation for most aircraft and engine types is provided in either PDF or SGML, which allows automation of the document and data revision and reconciliation process. "When OEMs issue revisions to data and manuals, there

is generally a cascade of updates through all the different manuals and the user's own job cards and documents on its M&E and CMS systems. The process can happen automatically, but it still requires a lot of manual intervention," says Michael Denis, vice president of consulting at InfoTrust.

The second main issue is job card creation, layout, publishing and viewing. More manual work is required in the creation of job cards when the original documentation source is scanned. SGML-formatted documentation makes publishing job cards easier. "SGML data takes into consideration paginating, forming and publishing job cards. XML data just focuses on content, not on styling or layout," explains Denis. "Cross-references between job cards, the OEM's manuals, and an airline's own aircraft maintenance manual (AMM) must initially be created manually in PDF, SGML and XML documentation and content."

The third main issue is to generate fully electronic job cards from the data and documentation in the CMS and M&E system, distribute them to all maintenance stations in a user's network and all its third-party maintenance providers. Once published and



distributed, usually via the internet, the job cards must be viewed by mechanics on suitable devices, such as fixed computer terminals, laptops or tablet computers.

These job cards will also need to be in an electronic format that allows mechanics to sign off on tasks, record findings, and add other text, and to allow inspectors and supervisors to write their findings and signatures electronically. That is, a truly electronic task card and electronic technical records. This can be referred to as Level 2 electronic signature.

Regulatory authorities must be satisfied that the entries are made secure on electronic task cards. If so, these electronic task and job cards are accepted as legal technical records, and paper records, and scanned copies, are therefore no longer needed.

This level of electronic signature is different to the less sophisticated system of level 1 electronic signatures. These are simply used to inform the M&E system that a task has been completed, but manual signatures are also made on printed task cards in parallel. These are then often scanned to make searches for technical records easier than searching through paper records.

The fourth main issue is that the electronic format of the job cards will have to allow data and findings captured on them to be sent back to the M&E system to avoid having to manually enter these inputs.

## M&E system evolution

A central function of core M&E systems has been to provide a single database of all the data and information relating to: the maintenance planning

document (MPD) and task numbers; task and job card numbers; aircraft configuration; the master parts list (MPL) of permitted parts used by the user; aircraft fleet and utilisation data; staff and mechanics skills data and related information; and several other categories of engineering information.

The use of a single M&E system compares to the dozens or even hundreds of separate legacy systems used by airlines and MROs in the past. "Many airlines built their own point solutions; each one with a single function," says Sharhabeel Lone, partner global business strategy at Saks Consulting. "There was literally a single system for each management function, such as task card numbers, part numbers, aircraft configuration, and just about every single function in engineering and maintenance. Not all these systems had interfaces between them, so a lot of data transfer was made manually, with a lot of scope for errors and inaccuracy.

"The fact that legacy systems can be replaced by a single M&E system on a single database means it is easier for the user to extract data, when creating job cards for example," adds Lone.

M&E systems cannot provide all the content management and task card creation and publishing functions by themselves at the highest possible levels, however. While M&E systems could manage databases of key engineering data when much of it was entered and extracted manually, and task and job cards were created manually, the advent of intelligent data in SGML or XML format and content has given rise to the need to introduce a CMS to work together with many of the M&E systems. There is a dividing line between the functionality of M&E systems and CMSs.

*When considering the selection of a M&E system and related modules, the long-term objectives of coordinated engineering functions, fully automated revisions and updates of content, and the production of fully electronic task cards should be considered.*

M&E systems automated some of the functions that were performed manually and on paper. An M&E system can maintain a database of MPD and AMM task numbers, and of part numbers in the MPL, order and maintain parts inventories, and manage aircraft and engine fleet configurations. It can also keep track of flight hour, flight cycle and overall utilisation data for each aircraft and engine in a user's fleet, and alert the user when maintenance tasks and workpackages are coming due.

Many M&E systems have some form of content management functions, but these are often rudimentary. They allow the user to input and make revisions, and generate task and job cards with less sophisticated layout and publishing functionality than a CMS.

## Content management

Managing engineering functions through a database in an M&E system may not meet all of an airline or MRO user's needs. Several main issues that were still performed almost 100% manually can now be handled by a CMS: loading and storing documents provided by the relevant OEMs; managing revisions and updates to documentation and data; maintaining a database of part numbers in the illustrated parts catalogue (IPC) published by OEMs; maintaining the MPL; authoring and editing task and job cards; and generating the layout and publishing of task cards.

M&E systems are generally used by engineers for engineering functions, such as fleet management, MPD management, and workpackage planning. CMSs are used by planning engineers to manage revisions to documents and manuals, and author and edit task and job cards; and by mechanics to view cards when performing maintenance, to search for appropriate parts, and record findings.

There are four main stages of content and documentation management. The first of these is authoring and editing. "This applies to both OEMs and airlines. OEMs author original documents, while airlines customise manuals and task cards to their own requirements. This includes editing OEM-issued cards or writing their own additional cards," says Denis.

Then there is the process of inputting



and managing revisions and updates that are issued by the OEMs. “This is the key function of content and document management, and the highest value of the four main stages,” says Denis.

The third stage is publishing task and job cards. This involves designing the physical layout of cards, as well as putting the data and electronic content on a device so that it can be read. Task and job cards can be produced and read in formats ranging from paper to desktop computers, laptops or tablet computers. It is already possible to present cards on iPads; Enigma started this in 2011. The most common format for on-screen presentation is PDF, but a few airlines have rendered cards in hyper text markup language (HTML) in recent years.

There is clearly a flow of electronic data and information between the M&E and CMS systems while managing revisions and updates, and writing task and job cards. Generating job cards takes information such as task card numbers, part numbers, skill types, particular tools and aircraft line number effectivity from the M&E system. Revisions and updates made to documents, such as the AMM or IPC, have to be made in all other affected and related documents in the CMS and in databases within the M&E system.

“The M&E system will perform functions on its own, and has to be synchronised with the manuals and contents in a CMS,” says Jonathan Yaron, chief executive officer at Enigma. “There are five main reasons why the M&E system needs to be synchronised with a CMS. The first is that revisions and updates to manuals, documents and content are made regularly; quarterly in the case of some OEMs. Many changes are mandatory. The CMS should be able

to make all these changes automatically. The final result should be that where the same information is kept in both systems, such as the MPL, the data should be identical after each revision is made.

“A second reason is that the AMM in the CMS has to be synchronised with the maintenance event planning module in the M&E system,” continues Yaron. “Without automation, it takes a long time to update the M&E system each time revisions are published. Using manual processes, some updates can take several years.

“A third issue is that when mechanics deal with defects during line maintenance they have to search for parts in the M&E system, and then go to the library of documents in the CMS to generate a repair if the two systems are not synchronised,” continues Yaron. “Line mechanics can spend up to 50% of their time searching for parts. If the two are synchronised, the correct parts will be listed automatically by the system when a repair is generated. Links between the two systems will also immediately inform the mechanic if and where the parts are available. This saves time and results in less dead inventory.”

A fourth reason is that the traditional task of creating and writing job cards manually by referring to manuals kept in different systems can be automated with a synchronised M&E system and CMS. “A CMS with the right links between all relevant elements of a job card can automatically put task and job cards together,” says Yaron.

A fifth main reason is that mechanics only need to sign on to a single system, saving time and improving compliance in all engineering and maintenance processes.

*There are several important issues to consider when planning how the M&E and CMS systems will work together. These include the data standards used across the system, and how revisions will be processed and audited.*

## Data standards and formats

There are four formats for data to be handled by M&E and CMS systems: traditional paper; and the three levels of intelligent data - PDF, SGML and XML. These three are not to be confused with the authoring standards of ATA Spec 2100, iSpec 2200 and S1000D. Airlines and independent MROs have to be clear about what data formats and standards their M&E and CMS systems can handle.

The traditional paper format can still be used by a CMS, together with an M&E system. “Paper documents can be scanned and converted into PDF,” says John Stone, director of product market management at Ramco. “The user then manually adds associations and links between documents and data in the M&E system. Revisions received can be scans of the new documents, or the changes entered manually into the affected documents. The manual processes needed for scanned paper documents mean there is little point in having more than the basic CMS in an M&E system. The M&E system can create job cards on screen from the scanned items. These can be printed on paper, or rendered as a PDF for electronic distribution.”

A user with paper and PDF content can attach a scanned copy of a document to a maintenance task. Part numbers and links or cross-references between task cards and graphics or part numbers have to be created manually.

Forms of intelligent, electronic content include PDF, SGML and XML. These three formats allow cross-references and links between different documents to be created. The CMS systems differ in terms of their ability to create links and cross-references between these three data formats. These links allow more automation in the process of making revisions and job card creation.

Enigma is an example of a CMS that can handle all functions with data and content in PDF. OEMs started providing PDF content to airlines in the 1990s.

SGML was another format that first began being used in the 1990s. Most aircraft, components and engines being manufactured at the time and since, and a few older types that were built prior to this, have their documentation and content supplied in SGML format.

“SGML data has intelligent content,

and pagination and formation properties for laying out and publishing task and job cards,” says Denis.

“SGML documents are loaded into M&E systems and a CMS via CD-ROMs or the internet,” continues Denis. “This is just one feature in reducing manual input compared to paper and scanned content. Cross-references and links between manuals, however, have to be created; for example where a part number in an OEM’s manual has to be linked to an airline’s own AMM that it had authored, or a task card linked to the IPC.”

SGML content has layout and pagination properties, which means that when revisions are made to a picture or the text, the layout is also changed.

The introduction of XML-formatted content in recent years has added further intelligence to content over SGML content. It will be used on types such as the 787, A350 and C-Series. “Whereas layout, pagination and publishing are part of SGML content, they are not important in XML,” says Denis.

SGML and XML need applications to view and read the content. “The file that manages XML content is different to the file that manages the layout when task cards, for example, are viewed,” says Denis. “This means that when a picture or text is revised or changed through an

update, the user does not have to worry about how this will affect the layout of a task card. This becomes a separate issue when task cards are authored. The case is different with SGML, which is written and authored mainly for viewing in a browser. An additional style sheet is needed so that the content may be viewed in a number of possible ways.”

With documents and content for some aircraft and engine types still being provided on paper and in PDF, there are specialist providers that can convert these into SGML or XML data. This, however, adds to the costs of content management.

There are four main CMSs available, each with a different philosophy on data formats. InfoTrust converts all new and revised data and content into XML format before making revisions and updates, even though the content for most aircraft types is in SGML.

Enigma takes content in PDF, SGML and XML formats. “We keep content and data in the original standard and format because content will always be revised and updated over time and the operating life of an aircraft and engine type,” says John Snow, vice president of marketing and business development at Enigma. “Keeping data in its original standard keeps revisions and updates simple.”

Two other CMSs on the market are

Corena and Aerosoft’s DigiDOC.

Aerosoft provides two M&E systems; DigiMAINT and WebPMI, either of which can be interfaced with DigiDOC. All three are capable of handling SGML and XML formats; and iSpec 2100, iSpec 2200 and S1000D standards.

Several Aerosoft customers are integrating one of these M&E systems with DigiDOC. In the meantime, DigiMAINT is being integrated with Mxi Technologies’s Maintenix at Icelandair. DigiDOC, in its previous web version, has been integrated with Swiss AviationSoftware’s AMOS, IFS and SAP M&E systems.

## Alternative CMS options

Airlines and MRO users can subscribe to alternatives to the main CMSs.

The first of these is CMS services provided by OEMs. Boeing provides this through its maintenance performance toolbox (MPT) service. It allows users to keep their documents and manuals in an account on a server. These are edited and authored documents, which have been approved by the user’s regulatory authority. The user’s revisions and upgrades can also be managed by Boeing.

Airbus provides documents through

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Some M&E system vendors offer their systems without an interfaced CMS. Trax developed its own CMS as a module of the M&E system. The CMS within Trax has been slowly upgraded. "It cannot do everything that a pure CMS can. It can edit documents, but it does not do sophisticated layout," says Chris Reed, managing director at Trax. "Air Canada uses Trax for most of the content management functions, but uses Airbus's ADOC service to provide sophisticated layouts when generating task and job cards for its Airbus fleet. The completed documents and manuals are then exported from ADOC to Trax. Other customers use Trax for all their content management functions. What customers do depends on the sophistication they require. Some airlines, for example, make no edits to manuals and job cards."

Commsoft is another M&E provider that has so far operated without interfacing with a CMS. Commsoft takes the view that CMSs are difficult to justify on economic grounds for its current customers, and that its OASES system works well enough on its own. Commsoft, is however, in dialogue with Airbus and Boeing to develop interfaces with their document and job card management products.

Commsoft users take all content from the OEMs. "The content is provided in PDF, and our OASES system has an application to extract the header data from PDF task cards issued by the OEM through an electronic scanning process. This collects data such as task reference, description, aircraft zones, required access and man-hours to complete the task. These data are used to construct a task card in the OASES database," says David Pusey, director at Commsoft. "This process links the pages from the OEM task to the OASES work card. Images are attached when the cards are authored. While most OEM data comes in PDF format, some are provided in Excel. Data and content are also often available as SGML or XML, but many airlines find this expensive."

Once OASES has extracted data from the PDF, updates and revisions can be done electronically. "Commsoft offers a revision service for its users, as well as a CMS that allows it to create task cards by taking pages from the OEM's manuals," says Pusey. "Rather than update individual documents when a revision is issued, we replace the entire content and so have a complete revised set. We replace all tasks introduced on the new MPD release and automatically withdraw any tasks which have been dropped on the

latest revision. OASES also allows users to produce difference reports between versions. Once the new MPD is approved by the airline and its regulatory authority, it is made live with a single click.

"OASES does not cross-reference between documents, which makes managing content straightforward," continues Pusey. "The fact that we work with data extracted from PDFs means there are no problems transferring data between OASES and other M&E systems, which can be faced by airlines and their maintenance providers when other M&E systems are used. After generating a workpackage, the entire document is created as a single PDF file, and sent by the airline to the maintenance provider.

"Similarly, OASES used by an MRO can import workpackages from airlines. This requires the airline to provide an additional list of task references, usually in Excel," continues Pusey. "The tasks will be on the MRO's OASES system, so a list of tasks from the airline generates the work order. The task cards are then generated."

### Authoring & editing

The first stage of content management is document, manual and job card authoring and editing. When data,

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content and manuals, supplied by the OEMs, are first entered into the M&E system and CMS, there are several ways in which documents and manuals can be edited and new ones authored.

First, templates must be created for all task and job cards to be used in the future.

Second, an airline's or MRO's own task and job cards must be authored.

Third, the OEM's cards must be edited.

Creating task card templates applies to all types of cards, even those that are exactly the same as those provided in the OEM's documentation. This is because some airlines still like to create their own task and job card templates so that revisions and updates can be processed automatically in the future.

The AMM, which details how to perform each task and job card, will have the information used as the basis for creating job cards. A template for task and job cards, which will be used by mechanics when performing maintenance, can be set up using the functionality in the CMS. A task and job card template will have links created so that they extract the correct text, information, data and illustrations each time they are created when preparing for a maintenance event.

The links are used to ensure the correct part numbers, tools, mechanic skills, illustrations and other details are used. These links have to be created manually by the system user.

"The data and content stored in the M&E system and CMS have been tagged so that an application can extract the appropriate and important parts when creating a task or job card," says Snow. "With this capability, a CMS will build a job as and when needed. The information

is dynamically inserted when required, so that job cards can be generated from scratch by extracting data directly from the latest authorised manuals. Using an automated revision process ensures that the manuals and job cards are always up to date. The authoring and publishing software knows which data to extract from the database, because of the links between documents that have been created manually or by the software. Our CMS software uses effectivity rules so that, for example, one part number is allowed on one group of aircraft line numbers, and a different part number is allowed on a second group. This ensures that job cards are always accurate and specific to the aircraft being serviced, and is made possible by the intelligence of SGML, XML and even PDF data and content."

Airline and MRO users also have to author their own cards, usually for items relating to interior cleaning, repairs and refurbishment. Airlines also may wish to edit the OEM's original cards, and other manuals. These can be referred to as customer-originated changes (COCs). The data for these edits and new cards have to be written in the correct data format, as well as have the relevant links created.

Another element is the creation of the MPL according to the user's needs. The IPC provides the particular part number, which originates from the OEM.

The airline user will usually have several alternative part numbers, stored in the MPL, allowed for each particular IPC part number. Another issue is that when the user creates the MPL it will often substitute the OEM's part numbers for its own part numbers that it uses in the IPC and MPL.

Part numbers can broadly be divided

*Several airlines are now using fully electronic task cards in various elements of airframe maintenance. Fully electronic task cards can be used on tablet computers, and so avoid the use of manual signatures paper technical records.*

between OEM-approved and non-OEM-approved. OEM-approved parts can be provided by the OEM itself, such as Boeing, or from another major component and parts manufacturer. Non-OEM-approved will be parts manufacturer approved (PMA) parts, which offer a cheaper alternative to the OEM-approved parts while still meeting safety and performance requirements set by regulatory agencies.

The MPL will be populated by the user, since it will decide what alternative parts it is prepared to use according to its policy. Links between the IPC and MPL will have to be created, as well as links between the AMM task cards and IPC.

Once all edits and authored documents, content and data have been completed, the airline or MRO system user has to have all the task cards and relevant manuals approved by its regulatory authority. The original documents manuals and data should be archived in the system.

## Revisions & updates

Once all the OEM's documents, manuals and data for a particular aircraft or engine type have been entered into the M&E system and CMS for the first time, and the user has completed all authoring and editing tasks, the user's system has to deal with regular revisions and updates issued by OEMs. This is the most important task of content management.

Revisions can be issued to text, task and sub-task numbers, illustrations, part numbers, maintenance intervals, tools and skills.

Virtually all airlines have some COCs. These additional tasks, edits or additions to OEM task and job cards, and edits and changes to the MPL present a challenge when revisions are issued by the OEM, which is generally once every three to six months. This is because the COCs will need to remain the same in some cases, while the OEM's content is updated due to revisions it has issued. In other cases the COCs will have to be edited on account of the revisions.

With content supplied electronically, revisions can mean that the user still has to re-edit or re-author the affected documents or task cards manually. With the correct links and tags in the content and databases, however, revisions can be made automatically and electronically, with little manual intervention.

Fully electronic task cards can be used on tablet computers and other devices. Fully electronic task cards need to have signature strips that can be made secure.

Ideally, each time a revision is issued all relevant documents and content that are affected should automatically be updated in a cascade effect throughout the whole M&E system & CMS. If this is achieved, then all a user's documents and content will be kept up to date with the OEM's publications.

An example of a revision is where a certain type of lubricating fluid is changed, or a particular part number. In a fully automated system, provided the links that have been created in the system are correct, then when the revision instructs a new material or part number to be used, all affected documents throughout the system should be revised automatically, and replace the information so that the new material or part is used in the future.

Enigma has a particular process for automated revisions. "The first main stage is that once an OEM revision has been issued, the content of revised documents should be compared with the existing authorised OEM documents and any approved COCs," says Snow. "There can be three types of document following a revision: a completely new OEM task; a revised OEM task without a COC; and a revised OEM task where a COC already existed prior to the revision being issued.

"New OEM tasks and revised OEM tasks that do not have COCs can go through the automated revision management process," continues Snow. "Documents with a revision from the OEM that affects an existing COC, have to go through another decision stage to see whether the OEM's revision conflicts with the COC. If it does not it can also go through the automated revision process. If it there is a conflict, however, then there has to be a manual comparison or analysis of the revision and COC by an authoring engineer to manually determine whether to make the revision, keep the COC or revise the COC. Once all documents have been through the automated revision process, the updated documents are sent to the various modules in the CMS. The cascade from this is that job cards, inventory, the MPL, and aircraft configuration and maintenance plans in the M&E system are automatically updated."

There are differences between data formats in the ease with which implementing revisions and updates are made. "SGML content includes more information for publishing than XML,

Aircraft: 250		Job Card Work Capture:		Work Package: APU Component Maintenance - 02	
Hours: 57032.8		Cycles: 49292.0		EWS/LINE-HGR 27-Jun-2012 12:00	
Task: 02 32-00-00-00-00-00 (Landing Gear Door Check Valve Replacement)				Revision: Rev 3	
Work / Req: 02 32-00-00-00-00-00 (Landing Gear Door Check Valve Replacement)				WO Number: WO - 002715	
Description:				WO Line No: 5	
Instructions:					
Job Stop:					
Reason: TFOHFT					
Notes:					
Actions:					
1. <b>Job Card Approved 24-JUL-2012 14:33</b> Completed & Authored					
Document References: 70254-2					
Job Card Steps:					
Order	Description	Signed By			
1	Remove Fuel Tank	[Signature]			
2	Remove Landing Gear Door Check Valve	[Signature]			

although XML does include style sheets. SGML is not an efficient way of passing data, and it is hard to extract data, such as part numbers from SGML," says James Elliott, product marketing manager at MXi. "Many revisions still have to be made manually with SGML, because some changes have to be identified manually."

The tagged data in XML content makes it easy for users to search for particular part numbers. As only the data, not the layout, are defined in XML, revisions can be done automatically and quickly.

Once the user is satisfied that all the revisions have been correctly implemented, the updated documents and job cards must be approved by the user's regulatory authority. Additional sets of content, manuals and documents will therefore be created each time a revision is issued. A further set will be created once the user has edited the revised set. The user should archive each set.

The set most recently approved by the regulator should be used and published by the user for its engineering department and mechanics.

## M&E & CMS integration

One example of an integration between a M&E system and CMS which successfully operates an automated revision process is Korean Air's combination of Oracle's cMRO and Enigma's CMS in recent years.

Korean Air's objectives included the use of a tablet device and fully electronic task cards for electronic record and electronic signature (ERES), and the ability to generate its own job cards and add its own content. Of 14 manuals, 12

are in SGML format and two are in PDF format.

Following implementation of the system, Korean Air has been able to revise OEM manuals in real time, and create a standard layout for all job cards. The result is that it can start publishing updated task and job cards within three days of receiving a revision from an OEM.

## Layout and viewing

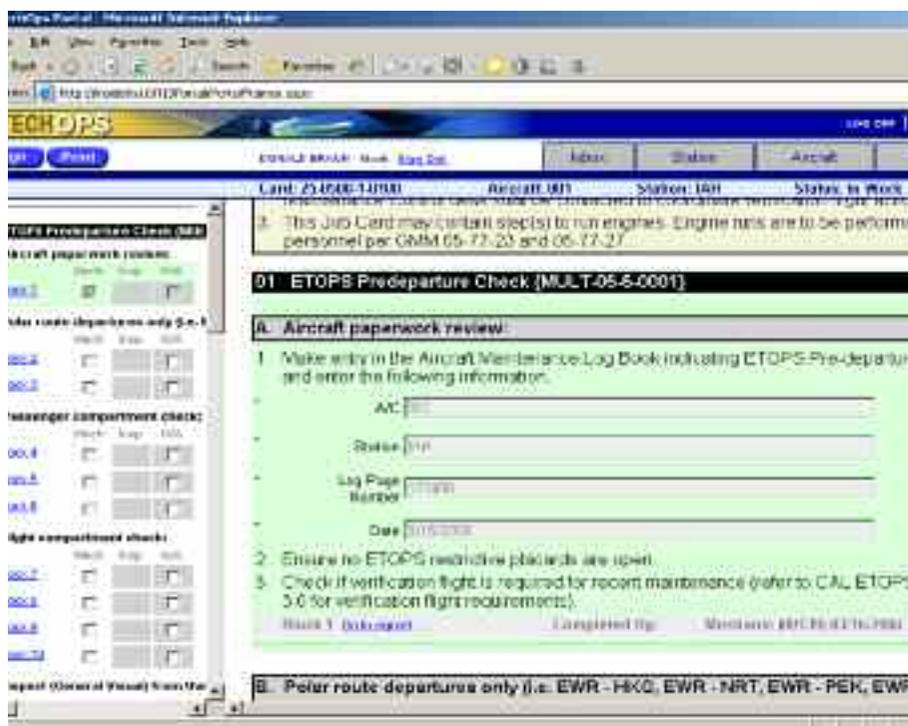
Once the information and data that are to be included in task and job cards have been defined, the appearance of the card must be laid out.

Layout concerns borders and dimensions, fonts, text flow around illustrations and other criteria similar to page layout for printed publications. The CMS designs the layout.

Creating layout requires an application for presenting the content and its design. "While the content may be in SGML or XML format, a file such as document type definition (DTD) is required," says Reed. "DTD is a set of mark-up definitions that define a document type for a mark-up language, such as SGML, XML or HTML."

Layout for a task or job card will be determined by style sheets depending on the type of viewing device the user will have. A different set of style sheets is designed for each type of viewing device. Style sheets can be changed to suit each user's requirements. An example is sign-off blocks on job cards. One user may prefer blocks at the bottom, while another may prefer them on the right-hand side.

"While Maintenix can cross-reference multiple sources of information that are



all related to a specific task, and compile all of these during its creation, it cannot change the layout of task and job cards, and it really needs a CMS to do this,” says Elliott.

## Electronic task cards

Layout is partly affected by the format in which the task card will be viewed, and on which type of device. Task cards can still be printed, and so will be rendered as a PDF first. Electronic task cards can also be created in PDF or HTML format for this purpose.

In all cases, spaces are required for mechanics, supervisors and inspectors to sign and record findings and make notes, whether written manually or keyed into a space on the card. The layout therefore depends on whether the card will be published as a paper card for use with or without level 1 electronic signatures, or as a truly electronic card with spaces for electronic signature and data capture by mechanics and supervisors.

“Electronic cards have to be created in some type of mark-up language to associate these signature blocks with the task and card number,” says Stone. “This means the content has to be in SGML or XML, and the cards rendered in PDF or HTML.”

Snow points out that one difference between PDF and HTML, in the case of electronic task cards, is that in PDF the content on the card remains in a fixed position when the mechanic viewing it on a screen zooms in and out, while in HTML the text dynamically flows around illustrations and other items in the card when zooming in and out on a screen.

This raises the issue of whether electronic task cards should be in PDF or

HTML format. PDF task cards were the first to be used as truly electronic, while HTML task cards have started to be used in recent years. MXi generates electronic task cards in PDF. “The cards need to be viewed on a tablet, laptop or some other convenient device. A full view of one page of the card is required on the screen, and the document must be in a format that allows it to be encrypted,” says Elliott. “Information, such as findings, is recorded electronically, and then sent back to Maintenix, the M&E system.

“While we use PDF cards like this, Maintenix is fully web-based, so the content can be viewed using HTML,” continues Elliott. “HTML is a better format for distributing cards across a whole maintenance network.”

Enigma’s CMS is used in conjunction with Oracle’s and SAP’s M&E systems to generate and distribute fully electronic task cards in PDF format. “The PDF task cards have a data entry block on them, which is a space for the mechanic to type findings,” says Snow. “The airline has to consider which format the content and job cards should be created in to be secure. This is because regulatory authorities need to be convinced that an electronic task card has signatures and typed findings that remain secure after sign-off for them to be satisfied that job cards cannot be tampered with afterwards. Although HTML is regarded as the format for distributing cards over the internet, PDF cards can also be distributed like this. HTML cards may even be less secure than PDF cards.

“We take SGML, XML and PDF content to produce electronic task and job cards in PDF,” continues Snow. “We can also put a workflow into the card. This opens signature and finding blocks

Fully electronic task cards can be generated in PDF or HTML format for use on various devices.

for the mechanic’s input. Once the mechanic has made his signature and recorded his findings, those sections are locked and the inspector’s signature blocks are opened. Once the inspector has signed off the PDF is locked, and sent to a document repository where it cannot be changed.”

Trax also generates electronic task cards in PDF. “We can generate task cards with the capability for level 1 electronic signature, which is only suitable for informing Trax the task has been completed. Paper task cards still have to be printed for this,” says Reed. “We also generate fully electronic task cards in PDF format. These allow level 2 electronic signatures, with electronic signature fields and a secure capability. These dispense with the need for paper cards and manual signatures. A customer airline using this is Air Canada Jazz. It generates electronic task cards for 90% of its maintenance. The other 10% have to be paper cards because its lessors require any airworthiness directives performed on the aircraft to be recorded on paper. Air Canada Jazz has been using tablet and laptop computers for the past three years.”

Trax is developing a system for presenting cards on iPads and other mobile devices. This should be available in late 2012. iPads require different methods of handling and managing the content and data, and Reed expects them to make it easier for use by mechanics.

HTML-rendered fully electronic task cards have been in use for a few years. InfoTrust is one CMS provider that generates fully-electronic task cards in HTML. “HTML is the best way for running electronic cards through a web browser,” says Denis. “The data and content starts in XML, and is transformed into HTML cards for use in the web browser for viewing by mechanics. We have custom-built an application to run the electronic cards on a tablet computer. Continental Airlines, which has now been absorbed into United, uses this system, created by InfoTrust, for creating and signing off routine task cards, using ruggedised laptops. Southwest is using a fully electronic solution for generating non-routine task and job cards.”

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