Several airlines now a fully electronic hangar maintenance process in place. This centres around electronic, interactive task cards viewed through tablet computers or laptops. These require two-way communication and connectivity for the devices at least some of the time.

Configuring an IT system for electronic task cards & maintenance production

Several airlines and independent maintenance & repair organisations (MROs) are now using tablet computers and other devices to view and sign task cards, and store technical records electronically. They have therefore achieved, or are close to achieving, a fully electronic and paperless maintenance system. Here, we examine how a maintenance and engineering (M&E) information technology (IT) system is configured and structured to make this possible.

Task & job cards

The ultimate objective of paperless maintenance is to send task cards from the main M&E system to tablet computers, laptops, android devices, or computer terminals in the hangar for use by mechanics.

The cards not only have to be viewed easily, but also conform to the shape and design of the computer device. There also needs to be a system and layout for accepting signatures, while mechanics need to view documents and manuals, report findings, and record measurements and component changes. The system therefore needs to interact with the user, and have two-way communication for at least some of the time. So sending cards and maintenance tasks from the M&E system to mechanics is not enough if the system is to be entirely electronic and paperless.

These issues affect the choice of format for the content that is used on the M&E system to generate the task cards.

Several systems are now in operation or being implemented. Air Canada Jazz uses Trax as its M&E system. Documents and manuals are converted into XML format, and task cards are rendered on tablet computers. The mechanics sign task cards digitally, and technical records are electronic.

Southwest Airlines uses EmpowerMX's FleetCycle system to generate electronic task cards for non-routine maintenance. These are signed electronically. The system will add routine cards later this year.

Delta Air Lines also uses FleetCycle, and will be implementing a system of electronic task cards. These will be signed electronically on Samsung Galaxy tablets.

Columbia Helicopters, in Oregon, has integrated its Ramco M&E system with IDMR's 'Inform' content management system (CMS). It will be implementing a system later in 2013 for fully electronic maintenance task cards on tablet computers and digital signatures.

"The process starts by importing the originating task cards and basic documentation from the original equipment manufacturer (OEM)," says Israel Revivo, president and chief executive officer at IDMR. "The airline's or MRO's M&E system has to be able to handle the data from the OEM, as well as to produce task cards, and send the information to the computing devices."

Some M&E systems will be capable of managing this process on their own, while others will need to use a CMS or a document management system (DMS). The need for a CMS/DMS depends on how an airline manages its maintenance programme, and generates task cards.

Chris Reed, managing director at Trax, explains that there are broadly three ways of managing maintenance programmes. "The first is for an airline to follow the OEM's published maintenance programme, and the regular revisions. The operator then uses the standard maintenance programme issued by the OEM, although the operator may add some additional tasks of its own. The steps for performing tasks and their intervals will not change.

The maintenance programme is managed by the OEM in its document management and task card publishing systems. These include Airbus's ADOC and Boeing's maintenance performance toolbox (MPT).

A second option is for the airline to incorporate its own changes into the OEM's maintenance programme, by adding its own additional tasks, and editing some of the OEM's content.

"The third option is where the airline writes its own customised maintenance programme," says Reed. "In this case, the airline takes the OEM's original data, but manages everything itself. So the airline writes and customises all procedures, task intervals and others, and then has these approved by its regulatory authority."

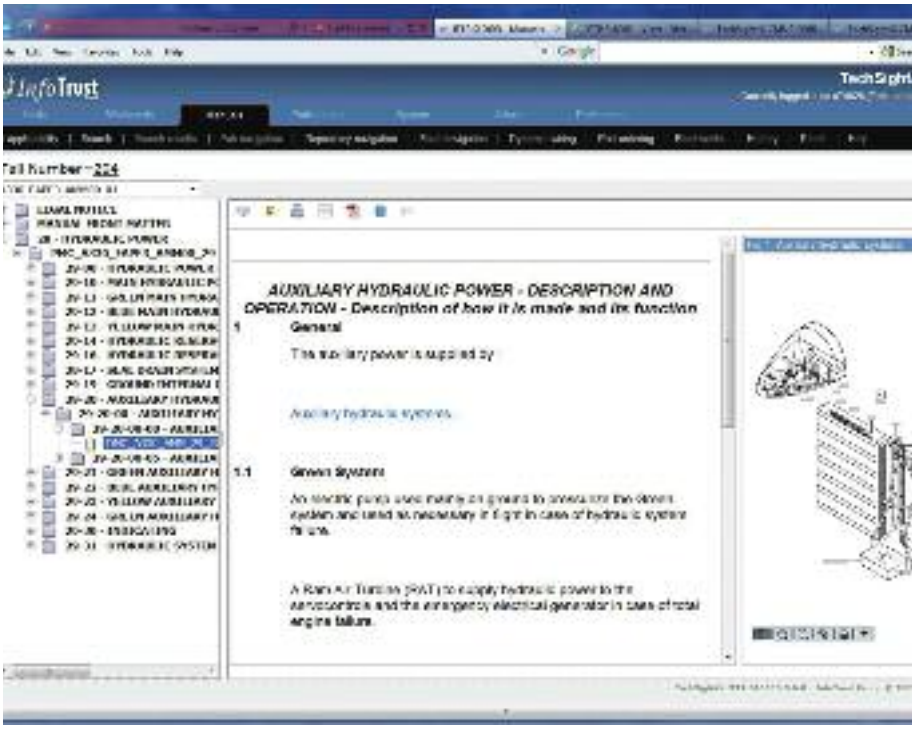
As a general rule, an M&E system cannot manage a large amount of authoring, editing, and task card design and production by itself, so the more an airline customises its maintenance programme and generates task cards to its own formats, the stronger the case for using a CMS/DMS.

It will therefore be possible for an airline to configure a paperless system for electronic task cards using an OEM's on-line maintenance programme management, DMS, and task card production system.

A CMS/DMS is needed, however, for a higher level of detail on task cards and greater freedom with task card production and layout.

Data format

One main issue is what document format is appropriate. The three main document and manual formats used by most M&E systems are PDF, SGML and



A fully electronic maintenance process requires task cards to be interactive, so that mechanics can communicate with various other departments. This requires connectivity in the system. Because connectivity will inevitably be intermittent, the content on the task card reader devices has to be synchronised with the content on the main M&E and CMS system.

XML. The four systems already in use with airlines as described above all use data and documents in XML.

"The best document format to use for a fully electronic system is XML," says Revivo. "Most M&E systems divide the instructions on task cards into two levels. The first is the basic header information, which includes all the identification data. This is information relating to: the work order number; the zone of the aircraft; the aircraft line number; the aircraft registration; and several other pieces of basic information. The second part describes how to perform the task from the aircraft maintenance manual (AMM).

"These instructions are divided into separate steps, and each step has to be signed for," continues Revivo. "In some cases it has to be signed by just the mechanic, and in others by the mechanic and the supervisor. This means that all the different steps have to be divided on the task card, and each one needs to have the appropriate signature strips. Most M&E systems cannot divide the instructions and tasks into the separate steps, and place them into separate boxes for viewing on computers or tablet devices. This capability is provided by a CMS/DMS. A CMS uses granular detail in the documents and manuals, which is required if the operator wants to use the information accurately. Without the use of a CMS, the instructions in a task card are pasted into a single block on the card. The CMS allows the card to be laid out exactly as its looks on the OEM's cards."

The detail in which the task card information can be laid out also concerns the format of documentation. "Having a completely electronic system for maintenance points to XML being the document format," says Mike Denis, vice president of consulting at InfoTrust. "There are several reasons for this. One is the fact that an electronic task card system has to be interactive, because the mechanic does not just need to read the card and then sign it. An interactive card allows the mechanic to send communications from the card to other departments. Findings, reports and measurements have to be made, and parts have to be searched for and requested. When the mechanic searches for a part from the task card, for example, it needs to be routed to the illustrated parts catalogue (IPC). The mechanic also needs to consult the various manuals and documents. These interactions are made easier by links between XML documents.

"Another reason is that the OEMs constantly updates these documents and the MPD, which includes the various manuals," continues Denis. "The process of making these revisions and updates is automated, so they are made quickly throughout the entire M&E system when the documents are in XML. Having the data in XML also allows up-to-date content to be pulled from the latest version of the manual, and the sub-tasks to be put into the appropriate steps."

XML provides several other advantages. "For certain maintenance tasks mechanics are required to record calibration readings, measurements, level of corrosion or minimum and maximum values, among others," continues Revivo. "These can be recorded electronically on the task card, and kept on the M&E system and in technical records. When such findings have to be recorded, manuals must be consulted while the task is being carried out. Again, this shows the need for an interactive task card. All these processes are far easier when the data are in XML rather than PDF. All documents also need to be in SGML or XML to get the required level of granularity."

This raises the issue of the difference between SGML and XML formats. "Documents in SGML have layout and task card design properties, so the content still has to be formatted to fit the size and shape of the screen of whatever device is being used," explains Reed. "XML is just raw data, so it is entirely flexible, and can, for example, wrap around pictures and diagrams.

"The links between task cards and part numbers in the IPC, for example, exist with documents in SGML or XML format. These links have to be built into PDF documents," adds Reed.

Dinakara Nagalla, president at EmpowerMX, agrees that to get the entire task card and mechanic reporting system to work at the most granular level then the data and documents need to be in XML format. "Full benefits are realised with an XML system. A task card in XML can be formatted so that the right people can sign off on each of the particular steps of each task. Links can also be built into the task card where the mechanic can interact with the card. This is for items such as reporting findings, reporting part or component changes, or adding a follow on action. We do this in our electronic task card system by adding blue click-on buttons or boxes on the side of the card. The use of XML also allows pictures or diagrams to be made larger or smaller by clicking.

"When our FleetCycle system is implemented at Delta Air Lines, the task cards will be rendered in HTML," adds Nagalla.

Hardware & connectivity

There are several elements to configuring the entire M&E system for the purposes of electronic, interactive task cards, and paperless records.

In addition to the M&E system and CMS/DMS, there are several issues to consider in relation to hardware and infrastructure. "The exact choice of hardware depends on how the entire system communicates," says Revivo. "There are several ways that task cards can be sent from the M&E and CMS to the devices used by the mechanics. A WiFi signal, for example, will be appropriate for an airline's own internal

networking. If an external network is used, then a VPN network is required, and then the system operates with a WiFi or cellular network. This means that the mechanic can still operate the system from a remote location, provided there is a cellular network in the vicinity."

This raises the important issue of whether the tablets or other devices being used by the mechanics are on-line or off-line. Fixed computer terminals in the hangar clearly can be on-line all the time. Tablet devices, laptops or androids will need to be used by most mechanics, however, if they are to view task cards while performing maintenance in situ.

Devices that are off-line clearly do not have constant contact with the M&E and CMS, so task cards have to be pre-loaded into the devices when on-line. While this may be an acceptable practice for loading the cards onto the device, the devices will have to be on-line and connected if the mechanics are to interact with the cards to report and record findings, consult manuals, order parts, or communicate with engineers and supervisors.

Two-way communication

The two basic options to airlines are therefore a one-way or a two-way communication system.

One-way communication only allows cards to be sent to devices, and so requires the devices to be on-line temporarily. Task cards can be loaded when in an office, for example.

Two-way communication allows mechanics to interact with task cards, and communicate with the M&E and CMS system, or other individuals. This requires the system to be on-line for at least some of the time.

Achieving connectivity for tablets and androids means WiFi or cellular signals will be required in the hangar or around the aircraft at line maintenance stations. "The problem is that even though a signal can be provided for devices to be on-line all the time, signals and device connectivity often gets lost when inside an aircraft. Connectivity is even lost when in the upper regions of a 777 cabin, for example," says Denis. "FedEx and UPS aircraft, for example, are not at the gates of passenger terminals like passenger aircraft. Line maintenance is performed at remote stands, so their aircraft are always losing connection."

The fact that tablets and devices will be off-line for some of the time has several implications. "The first issue it raises is the size of data transmissions to and from the devices, which influences the choice of document format," continues Denis. "PDF documents, for example, can be as large as 20 megabytes, so if a mechanic loses connectivity on their device, it takes a long time to reload task and job cards. This means that transmitting data can be one of the biggest costs of having an electronic task card and paperless system."

The amount of data that has to be transmitted is reduced to just kilobytes when task cards and other data are in XML format.

The fact that there will always be intermittent connectivity means that a lot of content needs to be on the tablets: all relevant manuals and the IPC, as well as task cards. "InfoTrust puts the entire AMM, IPC and minimum equipment list (MEL) on the tablets. This is another factor in favour of using XML, because first of all the size of data transmissions will be small," says Denis. "Intermittent connectivity also means that the content on the tablet has to be synchronised with the M&E and CMS system's up-to-date information. Technical writers update the content of manuals and the IPC daily, and publish it overnight, when maintenance activity is at its lowest. With the data in XML, only the revised content has to be uploaded onto the tablet devices, rather than the entire manual which would be the case if the document were in PDF."

The mechanic starting work then has to request the latest, up-to-date content to be loaded on to their tablet. This is known as a 'pull' system. The InfoTrust system has an audit module that allows the user's management to track which mechanics have updated their content.

"The alternative is a 'push' system," continues Denis. "This is where

management forces the latest content onto mechanics' devices following the updates made by technical writers. Whether a 'pull' or 'push' system is used, the synchronisation is only possible when the devices have connectivity with the M&E and CMS system's server."

With all this content on the tablet, the mechanic can then work with the device off-line. To get such a system certified by the Federal Aviation Administration (FAA) a policy on the frequency of re-synchronising content has to be in-place.

The other implication of intermittent connectivity is that not all two-way communications to and from the tablet will be sent in real-time. "This means that we have had to develop a queuing system," says Denis. "Messages will be held in the queue until the tablet or android device establishes connectivity.

Maintenance process

The process whereby mechanics carry out maintenance tasks can involve several steps for the task cards to be interactive. These all affect the configuration of an electronic task card system.

These steps include: consulting manuals and documents when performing tasks; viewing diagrams and requesting parts; writing and reporting findings; communicating with engineers and supervisors; reporting component changes; and requesting standard non-routine cards or for the creation of special non-routine cards. All the relevant manuals and documents will either have to be on the tablet, or available through connectivity to the M&E and CMS system.

Accessing manuals

Manuals can be accessed through tablet devices in several ways.

Denis explains that the method of access depends on the document format. "If it is a PDF then the manual has to be accessed via a file server. If SGML or XML is used then the manuals are in the CMS.

"If the mechanic is looking at an HTML task card, and there is reference to a manual, there are links and references that allow the mechanic to access the relevant manual pages that are held in the CMS," adds Denis.

"The IDMR system is to have the pages of the manuals relevant to the maintenance task included as a section of the task card," says Revivo. "There will also be a link to the relevant manual, such as the AMM, and then the system will navigate the user to the appropriate page. Most airlines are opting for the first version of having manual pages attached to the task card. Boeing SGML data, for example, contains all the AMM data already part of the task card's work instructions. Hyperlinks can be created to other manuals."

Trax has created a system where the page from a manual is automatically created from the raw XML data. This happens when the mechanic clicks on the particular manual on the screen, and opens the appropriate page.

Request parts

Requesting parts goes in-hand with accessing manuals and documents. "Just like manuals, part numbers on task cards and the manual pages are linked to the IPC, so that mechanics can find and request them," says Denis. "InfoTrust has a shopping cart system, so that the mechanic can request parts as they go through all the task instructions and manual pages. At the end the mechanic can check out, or undo a request for a part. The orders go to the material management system."

As with other interactions from the task card, sent messages and requests will be held in a queue, and will be sent when connectivity is established. Receipt of a message acknowledging a request, or confirmation that parts are ready will be received when the mechanic's device

establishes connectivity.

Most M&E systems are not sophisticated enough to perform all material management functions. This configuration requires the M&E system to be integrated with more comprehensive purchasing and finance systems. If this is set up correctly, the whole process is seamless to the mechanic.

"The ideal system would allow the mechanic to order parts through a type of shopping list, and then submit their request," says Revivo. "The mechanic would receive a message to say that their requested parts are ready for collection at the parts store in the hangar. The tablet would therefore need to be connected with the M&E system and CMS. This would then have all material management capability, which would include listing the number of each part number available and their location. Once the part request has been submitted by the mechanic, the system would be configured to allocate the parts to the mechanic, and instigate the logistics process of preparing those parts for collection."

This shopping cart and delivery system implies several system configuration standards. "The system in Trax also provides a list of alternative part numbers to the actual one requested," says Reed. "This whole shopping cart system works with data in SGML and XML, because the data format provides links between the task cards and other modules of the system. The part numbers are an element of the document data in the system. If the data is in PDF format, these links have to be built into the document."

As described, EmpowerMX's system of interactive task cards has various blue buttons, one of which is 'Asset Request', used for requesting parts. "The electronic system is designed, using links, to ensure that the mechanic is only given the choice of the correct, allowable part numbers," says Nagalla. "This prevents incorrect part numbers being fitted."

Changing components

The changing of components and parts either comes from an instruction in a routine task or as a result of fault being found during a routine inspection. In the case of consumable parts, just the fact that old parts have been discarded and new parts have been used as replacements has to be recorded. This monitors the material and parts inputs of maintenance checks.

The changing of repairable and rotable components has wider consequences than changing consumable and replaceable parts. This is because rotables and repairables affect the aircraft's configuration, inventory requirements, and reliability statistics. The removal and installation of repairable and rotable components therefore has to be tracked.

With a traditional paper task card system, recording changes to aircraft component configuration can either be manual (by keying data into a M&E system) or automated (by tracking each movement of a component by swiping its bar code with scanning equipment).

Routine and non-routine task cards have boxes for recording removed and installed part numbers. This can be freetext, so the mechanic can write onto the card. "The ultimate aim with an electronic task card is to autopopulate these fields with the 8130 tag or Form 1 data that barcode readers scan when tracking components," says Denis. "This is only possible if the CMS has certain information, since the system needs to ensure that correct part numbers are installed on each individual aircraft.

"This all requires each component to have an electronic 8130 form, which is in the M&E system," continues Denis. "This is already being done if the user is tracking components with barcode scanners, and is also repairing their own rotable components. The problem is that just about all airlines outsource at least

some component repair, and repair providers do not have an electronic 8130 system. If an airline wants to have a system for autopopulating component number fields on task cards as parts are removed and installed, and parts repair is being outsourced, then the only way to make it work is if the component data are in XML. This is because all applications of the system have to communicate with each other. When barcodes on component parts are scanned, the information is turned into XML messages.

Reporting findings

Mechanics have to make several types of reports when carrying out the range of maintenance tasks. These include recording numerical measurements in relation to calibrating and testing aircraft systems or structures, and reporting findings for particular types of inspections. All measurements and reports are manually written on traditional paper task cards, and have to be inserted in fields on electronic task cards.

Reports include the performance of routine tasks, such as lubricants being supplied, or time-expired parts being discarded and replaced.

Findings will include the incidence of corrosion, delamination of structures, broken or loose components and mechanical structures, and all other items that lead to non-routine rectifications being required.

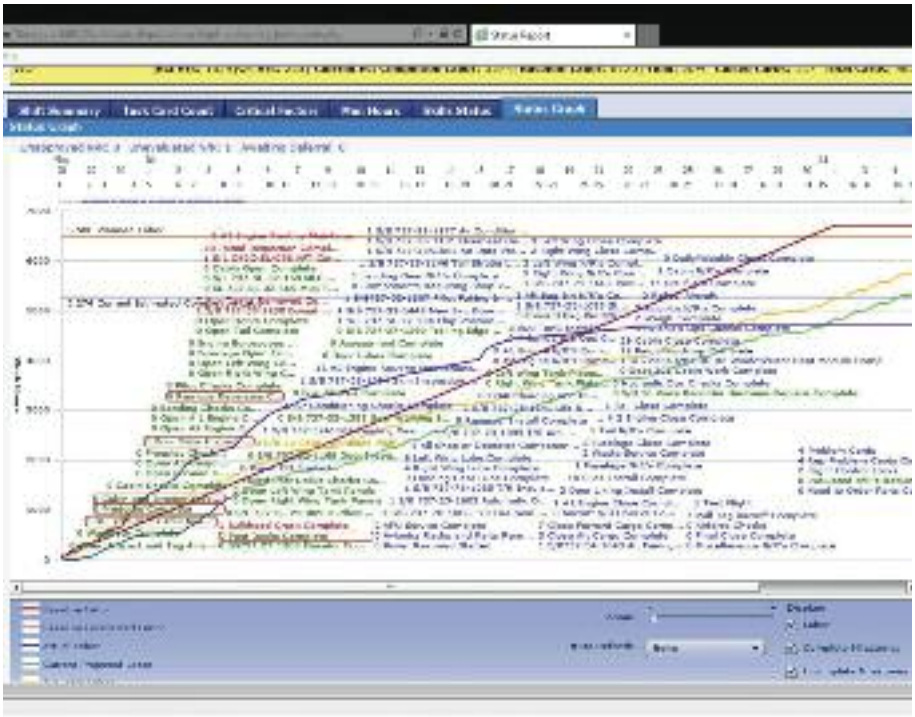
EmpowerMX's electronic task card has an 'Add WIP' blue button, to record work in progress or findings and reports by mechanics. "A finding can be a conclusive action, where just a task has to be done and there is no requirement for a non-routine to be written. An example is replacing a part, such as a lightbulb, or applying a lubricant," explains Nagalla. "The other type of finding is where something is found to be wrong, and a non-routine card has to be performed as a consequence. The many examples of this can include corrosion, metal delamination, or loose and broken moving parts.

"In this case the mechanic can click on the 'Add non-routine' button on the interactive task card, and then click on the 'Edit action' blue button," continues Nagalla. "Findings are then typed in by the mechanic, using the touch-sensitive keyboard on the screen. The findings report that is subsequently sent has the originating task card number with it, in addition to the ATA Chapter and zone number, work order number and all other relevant information.

"We have also designed the findings report page to have pull-down menus to minimise the information that has to be recorded," says Nagalla. "Standard reports for describing the type of finding or defect can be selected. This reduces and standardises the choices for rectification. This ultimately means that a statistical analysis of findings and subsequent non-routines can be made, to see which ones appear regularly. Once the findings report has been filled in it is sent to engineers in the Quality Assurance department for evaluation."

A lot of routine cards have a range of actions for certain findings. Examples of the simplest findings and actions are: a fall in oil levels, and filling up to the required level; or finding a certain amount of wear of a particular mechanical structure or component, and installing a new part or sub-component.

"Findings can be entered from pull-down menus when they are simple or relatively standard. Alternatively they can be typed in," says Reed. "The simplest findings require standard responses from mechanics, and no further communication is required. More complex findings will require review and consideration by supervisors. These findings therefore have to be sent by mechanics after they have been made,



EmpowerMX's FleetCycle system has functionality to monitor to the progress of a check in real-time. Data relating to tasks being completed is fed into the system as mechanics sign off on each task.

and supervisors have to view them in real time so that corrective action can be taken."

Communication with supervisors

Mechanics may also want to report that parts are unavailable, that damage has been found, or that pictures need to be sent to engineers and supervisors as task cards are worked on. Pictures can be sent if a camera is installed on the tablet computer, and there is connectivity with the main M&E and CMS system. "There can also be a menu box where the mechanic can write requests for help to supervisors and engineers," says Revivo. "Communication has to be in real time to prevent the progress of checks and workpackages being compromised. There is the option of sending an e-mail direct to the supervisor."

The EmpowerMX electronic task card has an 'Add Note' blue button for mechanics to send messages to supervisors, crew chiefs, inspectors or technical support engineers.

Denis explains that the original tablet solution for electronic task cards was a one-way system. "A two-way communication system and connectivity is required if there is to be communication between mechanics, supervisors and technical support engineers. InfoTrust offers a web-browser-based solution with a tablet application. It is important here to note that applications that work on androids do not work on iPads or windows-based tablets."

An effective communication system with supervisors and technical support engineers will therefore require the system to have connectivity.

Non-routine task cards

All airlines have an established library of non-routine template cards for each aircraft type in their fleet. The library for new types is established after the type has entered service.

Non-routine cards broadly fit into two categories: standard; or one that is unique, and has not been written before.

"If a standard or usual finding occurs, then the mechanic can click on a link on the task card in our system to either go to a repair reference; or go to the non-routine card library, and find the appropriate non-routine card," says Denis.

The issue becomes more complex if an unusual finding is made, and an engineering authorisation (EA) is required to generate a particular rectification. There are two steps to this process. The first is determining what to do to get the aircraft operational, which can be a temporary fix. The second is determining the terminating action required. This can sometimes be a simple case of paperwork, or the design and approval of a final repair. An EA is a non-routine, but because it is not standard, it has to be reported to an engineer, designed and then approved. Approval is either by an engineer, or an OEM.

"The initial findings and write-up reports made on the routine card ensure that the associated routine card number and work order number are linked to the non-routine card. This ensures that when a non-routine card is being created, the header data, together with the findings and routine card reference is filled out on the non-routine card," says Denis. "There are some cases where an inspector writes up the findings from a routine inspection, and these are analysed by technical support before it creates a non-routine card."

Creation of a non-routine card can start with the mechanic as it reports its findings. "The mechanic clicks a button on the routine card, and the basic data is populated on the non-routine card," says Reed. "The template is then sent to the non-routine queue if it is a complex non-routine card. It is then sent by supervisors to engineering support, and they complete the generation of the non-routine card."

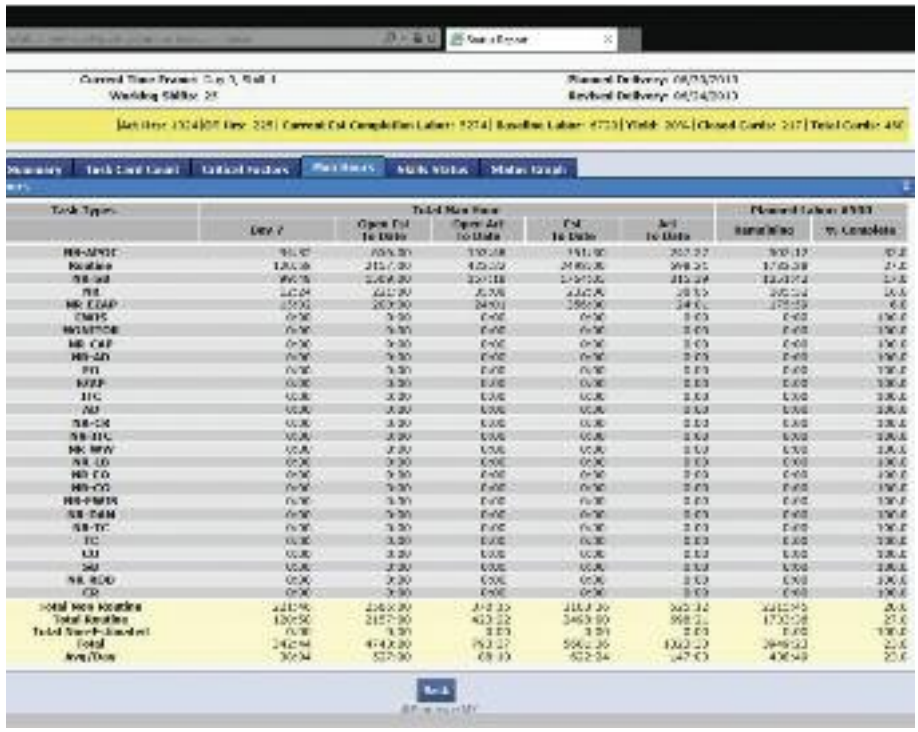
Several links are required between the routine and non-routine cards. This includes generating statistics for non-routine ratios, and the links are automatically created when the non-routine button is clicked.

"The corrective action on a non-routine card will be written by an engineer or supervisor after receiving the findings," says Revivo. "The system is then instructed to add signature boxes for mechanics and inspectors as appropriate, although most are not usually signed by mechanics. The steps to perform the corrective action, and the shops required can all be listed. We have also created a system for making a form for routing parts and components around the various shops in the facility. This way the mechanic is provided with the card and all the right parts and materials."

Shop-floor data collection

The process of shop-floor data collection (SFDC) started with the use of barcode readers on traditional paper, manually-signed cards. The scanning of barcodes on task cards, and material and parts packaging allows for the accurate recording and analysis of man-hour (MH) and material cost inputs.

The accuracy and speed of providing SFDC data can be enhanced with electronic task cards. The logging on and off of each task card by the mechanic will provide the MH, as well as dispense with the need to scan cards and have barcode scanners. Requesting and dispatching parts and materials via interactive electronic task cards will also dispense with the need to scan the packing of parts and materials, since their consumption can be recorded automatically by the M&E and CMS system.



Once a check has been completed, the data recorded through the interactive task cards provides a high level of detail in relation to man-hours and materials consumed. This can then be used to provide a detailed analysis of the number of man-hours and cost of material used in each element of the check.

"The use of interactive, electronic task cards also means that the SFDC data are provided in real-time as the mechanics complete and perform each of their tasks," says Revivo. "The system can also constantly monitor the progress of the check, and then calculate the probable time remaining to complete the check, as well as the remaining MH and material inputs.

"The system provides a high level of granularity of SFDC data," continues Revivo. "This includes the routine cards that originated non-routine cards, and an analysis of MH used for non-routine rectifications. This means the level and type of non-routine action that arises from the same task card on all aircraft in the fleet can be examined and analysed."

The objective for many airlines is to get an accurate account of the MH and materials used, both in the routine and non-routine portions of a check. "Our FleetCycle system has certain triggers, so that if a mechanic forgets to log off a task, for example, the system logs off automatically," says Nagalla. "It can also record MH for several cards when a mechanic has logged onto several cards all at the same time. The system distributes the MH recorded evenly between the cards.

"FleetCycle provides a detailed summary page of the inputs used after the check is completed," says Nagalla. "This includes the estimated and actual hours and materials used for each task card. A similar summary can be provided for the check. This can show the MH used for routine inspections, modifications, cleaning, interior repairs and refurbishment, non-routine cards, airworthiness directives (ADs) and service bulletins (SBs), and special items such as ageing aircraft programmes."

Reed makes the point that using a traditional system of paper cards took several days or even weeks to get an approximate report of the MH and materials used. This meant that it could take up to three months to get the necessary information to bill a customer when selling third-party maintenance.

Technical records & audit

The method of storing completed electronic task cards raises the issue of whether the cards have electronic or digitised signatures. Both can be done on tablet computers when using electronic task cards.

"An electronic signature requires recognition of the mechanic with a security code device, such as a PIN number," says Denis. "The use of electronic signatures informs the M&E system that the task is completed. This is an acceptable method of showing that cards have been completed by the FAA. There are problems, however, with regulatory authorities around the world that do not accept electronic signatures, and have consequently asked for paper task cards to be manually signed in parallel." The use of electronically-signed task cards can therefore cause problems when later selling an aircraft.

A digitised signature is more widely accepted by regulatory authorities around the world, and is also preferred by aircraft buyers and lessors. Digitised signature is the actual process of signing the cards on the screen, and an image of the mechanic's signature being captured. "Using this system paperless maintenance and technical records will be accepted universally," advises Denis. "The M&E system and CMS with electronic task cards have an image of the signature added to the card, and it is stored in XML format in the CMS. This is archived in the CMS, and can be reproduced electronically or physically printed."

EmpowerMX has used a system of electronic signature for Delta Air Lines. "Delta has decided it will use two electronic signatures on each task card, since this is acceptable to the FAA," says Nagalla. "Once the cards are signed they are sent back to the records system, where the card is made into a PDF so that it cannot be tampered with. The PDF records are then stored with Air Vault's system, while the M&E system gets the information that the card is closed, as well as the SFDC data."

Auditing maintenance tasks, and the accuracy of tasks completed is also a process that should be accelerated and completed more accurately with an electronic task card system. Auditing included ensuring that all task cards are signed. An electronic system will highlight any open cards, although this will be highlighted when the check is in progress.

It also accounts for all rotable component changes being properly recorded, and that the correct parts have been used on the aircraft. The traditional system of auditing would be to take a random sample of all task cards. "An electronic system can automatically reconcile the removed and installed parts with the component inventory and parts that have been removed, and with the reports made by the mechanics via the interactive task cards," explains Reed. "An electronic system can instantly highlight discrepancies, such as the incorrect use of a rotable component."

IDMR has built-in functionality to prevent a card being submitted as closed until all the sign-off boxes on the card are completed, and all the mandatory measurement parameters of the particular task have been recorded. "This means that every single step has to be carried out and accounted for," says Revivo. "There is the option to make a step non-mandatory, so it is given a non-applicable or a void status." AC