

The management of subcontracted maintenance contracts requires an array of functionalities and capabilities in the M&E IT system. This includes basic data relating to a customer's fleet, up to date detailed planning information, SFDC to provide accurate planning data, and a two-way data exchange capability.

M&E system functionality for managing third party maintenance contracts

Management of subcontracted maintenance for airline customers requires the maintenance provider's maintenance and engineering (M&E) IT system to have functionalities, including: check quotation and man-hour (MH) and material caps; managing purchases; fixing prices in maintenance contracts; managing a customer database; bidding for contracts; and exchanging check information. These functionalities in some key M&E IT system products are reviewed here.

Customer management

An airline-owned or independent maintenance provider has to manage multiple sets of data for third-party airline customers, whether for one-off airframe checks or long-term contracts.

The main element of managing subcontracted maintenance with an M&E system is estimating all required labour and materials inputs, agreeing contract terms, and accurately monitoring all used inputs. "An M&E system needs data on all relevant terms and conditions of a contract between the maintenance provider and an airline customer," says Nadine Etong, director of MRO product line at IFS. "This will require a customer management module. A lot of standard information is held for each customer, and there are also many differences between maintenance checks for the same customer."

Some of the initial information held for a customer will be data on its fleet. "The registration for each aircraft and its manufacturer's serial number (MSN) are logged," says David Pusey, projects director at Commsoft. "A lot of data will

be associated with each aircraft registration. If these aircraft are maintained on a long-term basis, their maintenance programme needs to be loaded into the M&E system. This is complicated by the applicability of each task in the maintenance programme to each aircraft that is managed. The M&E system needs to select the correct tasks for an aircraft in the maintenance planning stages.

"The maintenance programme will also include the manufacturer's and maintenance provider's estimates for routine labour for each task, with an escalation factor applied," continues Pusey.

"The data for actual routine MH budgets will often be acquired from the database of MH and material inputs from previous checks performed on the same and other aircraft. This will originate from a shop floor data collection (SFDC) system," adds Pusey.

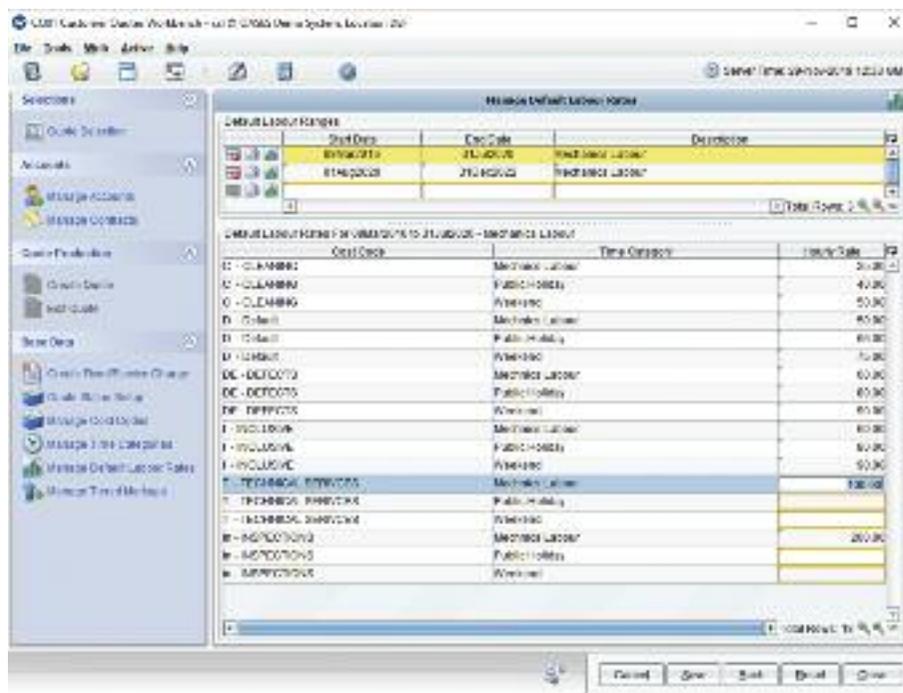
Contract bidding

The contract bidding process starts with basic information about the fleet, the related maintenance programme, and the aircraft's maintenance status or detail about the content of the workpackage being quoted for.

The maintenance provider starts by estimating the MH and material inputs, including: labour for routine inspections and non-routine (N-R) rectifications; labour for special items such as airworthiness directives (ADs), service bulletins (SBs), and engineering orders

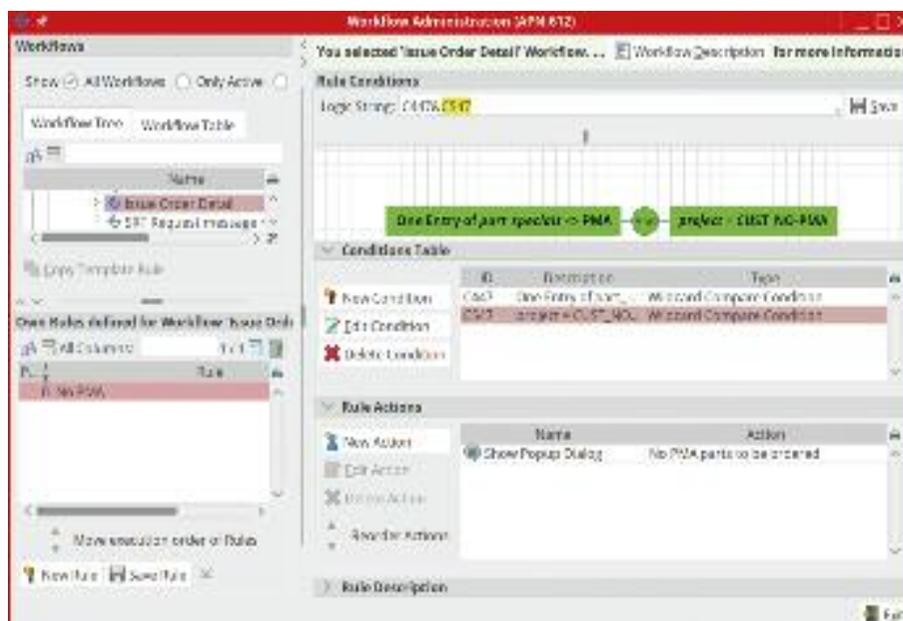
To manage third party contracts, M&E systems need to hold a customer's fleet data, including maintenance programme and applicability of tasks to each tail number. It also needs to hold an array of information relating to customer preferences.





Commssoft's OASES has a page to set labour rates for different skill sets when estimating and bidding for contracts.

When preparing for an airframe check, Swiss Aviation Software's AMOS system allows the user to set up rules relating to parts usage. The ability to use PMA parts is an example.



bids and internal estimations.

“Bidding by a maintenance provider to fill particular slots has traditionally been done by engineers tracking the work being performed in the hangar on large whiteboards or printouts,” says Stone. “Since the completion date for existing work is often not firm when bidding for a new contract, it creates problems for the sales team to accurately provide slot availability dates to customers.”

A maintenance provider also needs to keep other detailed data. Each airline has preferences regarding the involvement it wishes to have in approving N-R rectifications, the sources from which to acquire N-R parts, the types of parts and materials that can be used, the data it provides to the maintenance provider and the format, and the data that is returned to the airline.

All this information needs to be held in a dedicated module on the M&E system. “Our OASES system starts with a module for creating a quotation for a check. This has fields for the user to enter detailed information,” says Pusey. “This includes different labour skills and the associated MH rate charged. These rates can vary for all the maintenance provider’s customers.”

These labour parameters are the basis for check-planning and contract-bidding. Related information that is necessary to make a bid includes detailed information for each employee, their skill set, and their availability each day and week in terms of hours and shifts, hangar space availability, and related equipment required to perform the proposed check.

The first stages of check-planning and estimating resources and inputs for routine inspections are fairly predictable, making forecasting relatively easy. The MH required for routine inspections depend on the maintenance provider’s internal labour efficiency. Some providers may have a high degree of labour efficiency, coupled with a high labour rate; others may offer lower labour rates, but also have low levels of labour efficiency that may result in a higher number of MH being consumed.

Man-hour caps

A main point of negotiation between maintenance provider and airline are the N-R defects and rectifications that arise out of the routine inspections. The number of MH required in these cases can be relatively easy to estimate, according to a

(EOs); interior cleaning and any refurbishment; unplanned component changes; and any stripping and repainting.

Estimates by check-planning engineers can be made relatively easily for established customer airlines based on experience. The number of MH used for defects and findings can be estimated with reasonable accuracy if the maintenance provider has a database of previously performed maintenance checks, especially for the same customer. The risk or perceived risk of N-R defects and related MH will be high when performing one-off checks for unknown customers. Maintenance providers clearly have an advantage if they have an SFDC system to accurately record labour and material inputs. An SFDC system may be based on scanners to read barcoded printed task cards and part packages, or scan a pdf version of the task card. SFDC can be performed automatically on a truly digital and

interactive task card, where parts are requested electronically by the mechanic from the task card presented on the screen.

“With accurate real-time SFDC capability and a contract handling module in the M&E system, accurate billing for the airline customer is greatly improved,” says John Stone, vice president of product management at Ultramain. “One of the biggest drivers for our independent maintenance providers in wanting to go paperless is to improve customer billing.

“The post-check auditing process for a third-party maintenance provider takes a lot of time when maintenance has been conducted with paper task cards,” continues Stone. “It can often take several weeks, and is prone to errors. This therefore delays issuing the final invoice.”

An accurate SFDC system will closely monitor the progress of a check in real time, and provide a database of accurate information for making future contract

probable routine to N-R ratio. The ratio of N-R work to routine inspections will generally increase as the aircraft progresses through each base check cycle, and with each successive base check cycle. Typical rates can be considered, but will vary according to location and environment of operation, style of operation, lifetime quality of maintenance, and the operator.

N-R defects, findings and rectifications do not just apply to routine inspections. N-R work also arises out of interior cleaning and refurbishment; N-R rectifications will also be needed for ADs, SBs and EOs.

The number of MH used for the N-R portion of the check can account for a sizeable percentage of the total number used in the workpackage, so this represents a high cost and risk to the operator and maintenance provider. The difficulty arising from N-R work, which is inevitable in an airframe maintenance check, is that under a traditional airline in-house maintenance production line, each finding and N-R rectification must be inspected, considered and approved by engineering staff.

This does not present any managerial, logistical or delay issues when maintenance is performed in-house by an airline at its own facility. The reverse is true when performing base checks for third-party customers. Getting approval from the customer airline to rectify each defect with

an N-R corrective action is too time-consuming, and delays the check's progress.

The MH paid by the airline customer for N-R actions and rectifications can be pre-agreed in the maintenance contract with the MRO. MROs use MH 'caps' as a reference point for a fixed amount of N-R labour, with customers paying over the cap for additional N-R labour. "The cap either applies per defect or to the number of N-R MH per maintenance task card or event, like an AD or EO," says Chris Clements, sales representative at Swiss Aviation Software. "There can be several defects per task card, especially for large zonal inspections or complex items or systems. The number and severity of defects arising increases as the aircraft ages."

When a third-party maintenance provider bids for a contract, the airline will ask for a quote for a fixed-price portion of the check. This will include the routine inspections for ADs, SBs and EOs, component and engine changes, and a fixed quantity of labour for N-R work. This will be an amount of labour equal to the number of defect MH specified in the cap. An example will be a cap rate of 30MH. There are several systems that can be used for additional 'rechargeable' labour required over the cap rate.

The maintenance provider will estimate the likely actual N-R labour required, and

the number and severity of defects that could arise. This will be based on the routine portion, age of the aircraft, and past experience. The predicted N-R labour has been considered against the airline's requested cap rate, which will be based on the average MH per defect, since routine tasks and defects vary in size. The MRO will offer the airline a fixed price, which the airline will pay in advance if the bid is won. There are three main ways of capping N-R for MH labour.

Not-to-exceed MH cap

The first is a not-to-exceed system. "In this case the MH cap defines the upper limit that the airline must pay, so any additional N-R labour needed because the average MH per defect has exceeded the cap rate cannot be recharged, and the airline does not have to pay for it," says Clements. "Not-to-exceed also means that if the average MH per defect is less than the cap rate, the MRO still receives the fixed price paid for."

Exclusive MH cap

A second form of cap is an 'exclusive' agreement. In this case, the cap defines the number of N-R MH the airline has to pay for in the fixed-price portion of the check. All additional MH required for defects are



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the MRO provider can buy without prior permission from the airline, and those that require its authorisation. An M&E system also needs to be able to set a maximum price limit per part, for a group of parts for a task, or a consignment for parts. The customer's permission is needed above this limit. This often applies to rotatables.”

The materials and parts related to each task will be held in the check-planning module. “The materials and consumables are usually provided by the MRO, and the rotatable components by the airline operator. Most airlines want to provide from their own stocks,” says Pusey.

A growing number of airlines uses specialist rotatable suppliers to source rotatable inventories and related support. “An airline may want the MRO to source rotatable components from the specialist provider, so the M&E system needs to have information on all the airline's preferred suppliers,” says Etong. “This should include their location, relevant contact and request processes, the customs and logistics, and probable transport time for shipping and receiving components. There is a lot of information relating to all supply chain elements, and the priority is to avoid delaying the progress of a check because components are unavailable.”

In hand with MH estimates, the M&E system will also require functionality for defining surcharges and mark-ups to apply

to materials and parts used. The rate applied will partly depend on the customer.

“OASES has a page where authority for purchasing parts and components takes place. This includes information on the related task card, the P/N, the unit and mark-up rate. The rate of mark-up can be applied in the system according to the category of part,” says Pusey.

There is also the choice of P/N for a task; as with many tasks there are several alternatives. OEMs list their own P/Ns in the aircraft's technical manuals. Airlines, however, may source alternative parts from other, often cheaper, suppliers. Airlines list all permissible P/Ns in their M&E systems and task cards, and maintain a complete list of parts they use in an approved parts list (APL) in their illustrated parts catalogue (IPC) and M&E system.

“This presents certain issues with respect to M&E system functionality,” says Chris Reed, managing director at Trax. “OEM parts are often the only ones permitted on leased aircraft. Other aircraft may be allowed to use a wider range of P/Ns. The M&E system therefore needs to have the same level of functionality for parts applicability as it does for task cards and each aircraft MSN. The M&E system also needs to be able to alert the system user on permitted P/Ns when planning and quoting for a check or workpackage.”

A further complication can arise with

an airline's APL. Some airlines have devised their own part numbering systems, with P/Ns that differ from those of the OEMs and original suppliers. This causes problems when outsourcing maintenance to third-party providers, since an airline's P/Ns have to be converted to a system recognisable by the MRO. This is becoming less of an issue as more airlines standardise the data that they exchange with MRO providers in accordance with Spec 2000 Chapter 18. “There is also the point that the airline will send data and task cards to the MRO in advance for preparation of the check,” says Reed. “This allows the MRO to complete check-and material-planning, and consult the airline if necessary.”

In addition, there is other associated data relating to warranties. The system can list if the part has a warranty, and the period for making a claim. There can also be fields to provide special information on a part, such as if it is a part manufactured approval (PMA) item, and whether or not a PMA is permitted to be used, or requires the operator's authorisation.

The M&E system needs to have additional fields for confirmation of certification documents being held, customs and freight handling charges, and sales tax and the country of its jurisdiction.

“Upper limits, caps and flat-rate handling and mark-up charges can also be



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An example of a customer portal into the maintenance provider's M&E system is Trax. This page provides macro data relating to the progress of an airframe check.

used when charging a customer for a group of materials, consumables and expendables when quoting for a check. All the part and component provisioning rules and data have to be pushed to every relevant module in the system," continues Etong. "This especially includes the supply chain module." In the case of digital and interactive task cards, a mechanic can alert to findings, and request an N-R, and parts and components from the materials store.

The authorisation to buy parts, and their provider, can be defined in the bidding module.

Contract quotation

With all elements of labour and material used in a check planned, and all related details included, a quote can be sent to the airline to bid for the work.

"This will often start with a fixed price for the standard and routine elements of a check, together with the capped portion for the labour and material used in the N-R tasks and rectifications in the check charged on a fixed basis," says Etong. "The N-R portion is variable, and charging on a time and material (T&M) basis can make it easier to get the estimate correct."

Some of the fixed-price elements will include a cost for aircraft parking, preparation for the check and installing gantries and steps, storage of material and equipment, washing, and engine and component changes. "The fixed-price portion of a quote often includes routine tasks, some ADs and EOs, and some minor items that have been deferred from lighter checks," says Etong. "T&M is the basis for charging the complex elements of the check. In addition to N-R, they will include interior reconfiguration, major modifications, and big N-Rs. It is only possible to estimate the labour used for this portion of the check, and it is much harder to estimate the parts and materials used. These elements are also capped in the

negotiation, to cover the predictable N-R work. The IFS system has a bidding and quoting module that describes all the items in a check and analyses different financial scenarios."

At some stage there will be a transition from a workpackage estimate to an actual quote, and then from a quote to a work order if the bid for contract has been won. "The workscope is the same as the quote when the aircraft arrives in OASES so that there are no discrepancies. This will include the MH and material caps," says Pusey.

Data exchange

One final consideration for M&E system functionality in relation to managing subcontracted maintenance is the exchange of data, first from the airline to the MRO before the check, and then from the MRO back to the airline after check completion.

The traditional system of the airline providing printed task cards ready for work together with consumables and expendables with the aircraft is still used in many cases. Completed and signed cards, accompanied by N-R cards created during the check, are sent back to the airline. Data then has to be entered manually.

"Paper task cards cause several problems," says Stone. "The content of the completed paper task cards has to be entered directly into the airline's M&E system. The maintenance provider has the regulatory obligation to track its own work, so the data must be entered a second time into its own system. There can be discrepancies between the data entered into the airline's and maintenance provider's M&E systems, which can lead to contract disputes. The best solution is for the maintenance provider to enter data into its own system, and then send it to the airline."

A truly electronic and interactive task card system will be based on data. Data

transmission can cause difficulties, because of differences with numbering and data formats, the use of different fields by M&E systems, and customised versions of an M&E system. These issues require data to be converted from one party's standard to the other's using conversion tables, which requires several weeks of work by planning engineers.

"Data used by airlines and MROs is becoming standardised, following the adoption of the Spec 2000 Chapter 18 data specification standards," says Pusey. "After a maintenance check, the airline needs to update its M&E system with the status of all the work performed on the aircraft, including completed task cards, loading defects, and the aircraft's configuration and maintenance status. The airline can have the MRO do it, either by accessing the airline's server wirelessly, or via the Cloud.

Customer portal

With a maintenance check in progress, there is constant communication between the airline and MRO. Traditionally, the airline has its engineering representative on site while its aircraft undergoes a workpackage at the MRO's facility. The representative monitors the progress of the check as paper task cards are completed, approves N-Rs as findings and defects occur, and acts as a contact for the airline for the approval of the purchase of high-cost components.

With the advent of electronic maintenance and tasks cards, and the development of M&E systems, airlines can monitor the progress of the maintenance check on their aircraft. "This is basically access to a special module of the MRO's M&E system via the internet. Airlines still send a representative to the MRO, they can monitor the check via the internet, and communicate with their engineering department," says Reed. "Clearly the MRO provider limits what the airline can see, such as actual MH used." Monitoring the progress of a check, for example, will be made easier with system graphics in a portal, than it is manually following completed paper task cards.

A customer portal within an electronic maintenance system will make it easier and faster for the on-site airline representative to liaise with the MRO. **AC**

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