POSSIBILITIES FOR USE OF ELETRONIC DOCUMENTATION DURING AIRCRAFT MAINTENANCE TO IMPROVE EFFICIENCY AND QUALITY

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Summary. The main purpose of this paper is to investigate the possibilities for use of electronic documentation in aircraft maintenance. Digitalizing these processes may have a big influence on their quality and can improve efficiency of performing repairs. Creating a paperless environment in aviation not only helps take care of environment but also simplifies maintenance processes. Research of a range of already existing IT solutions for aircraft maintenance regarding documentation confirms that using them instead of traditional means can improve efficiency and quality of aircraft checks. This can be achieved by reducing time to create documentation and minimizing amount of errors while filling paperwork.

Keywords: maintenance, documentation, job card, non-routine card, electronic maintenance systems, electronic documentation

1. CURRENT STATE

Reliable aircraft maintenance is always invariably linked with consistent and therefore comprehensive documentation of all maintenance steps. As a result, MRO companies accumulate several tons of paper documentation every year.

The maintenance process starts by the planning department issuing a work package, which consists of a group of task cards written in paper format. Most maintenance operators have used a system to automatically monitor the time mechanics spent working on given card. In other cases mechanics manually write the time they spent on the task card. This manual recording often results in inaccuracies of time needed to complete certain tasks. When a card is closed rte time recorded has to be manually entered into a system by clerical staff, which can lead to further inaccuracies. These mistakes can be caused not only by typing errors, but also trying to read, often very small, handwriting. Maintenance planners have original equipment manufacturer estimates of Man Hours required to perform each task from the aircraft maintenance manual. Experienced staff knows that the MH estimates provided by OEMs have to be multiplied by certain factors to get the realistic amount of labour used depending on multiple factors such as their staff experience, aircraft age, available tools and others. The materials required for each routine task are also indicated on the job card. Maintenance planners could therefore predict the routine labour and material requirement of the check. [1] Mechanics performing routine inspections on the task cards have findings, which lead to non-routine task cards being written by supervisors. This would include a request for materials and parts, and then mechanics had to record the non-routine MH for these task cards. [2] When a maintenance check ends, all of this paperwork needs to be put into an archive and kept there for a proper amount of time specified by aviation authority, for example EASA requires MRO to keep records for two years. [3] Periods for records keeping required by FAA are specified in Code of Federal Regulations Part 91. [4]

It is part of IATAs plan for the nearest future to achieve paperless aircraft operations in all aspects – onboard documentation, maintenance, flight preparation and in-flight activities. The plan is to have

all documentation connected with maintenance (manuals, job cards, part certificates, paperwork related to logistics) only in digital form. These changes are being implemented through Simplifying the Business (StB) program. [5]

2. ANALYSIS OF EXISTING SOFTWARE

There is a wide range of aircraft maintenance software already existing. Some MRO companies use their own systems. As an example, Lufthansa and their web-based IT platform manage/m can be presented. This software consists of multiple modules allowing users to not only create work packs and job cards, but also monitor aircraft condition, parts reliability. It is capable of keeping track of maintenance check progress and archiving records. [6]

Only major airlines and MRO companies can afford developing an IT system for themselves. There are many companies offering software to MROs, most well-known being Sheorey Digital Systems software called ARMS, AMOS made by Swiss Aviation Software and TRAX made by TRAX Maintenance. A comprehensive MRO system will have many modules that communicate and pass data between each other for a full maintenance management system to work. All of these products consist of multiple modules allowing for more accurate shop floor data collection (SFDC). This leads to more accurate data being forwarded to maintenance planners and supervisors giving them possibility for optimizing processes at their companies. [1] Moreover, eliminating redundant data input means that transmission errors and data inconsistencies are avoided. Function and role-specific menu guidance and special documentation aids in the form of auto-fill and subsequently also auto-correction and auto-completion help the mechanics to enter the data quickly and without errors. Thanks to mobile terminals that are used widely in the production area, all information is available in real-time. All employees involved in the maintenance process can immediately access the specific information that is relevant for them from any location. Simplified search functions and transparent menu guidance help employees quickly access the required data

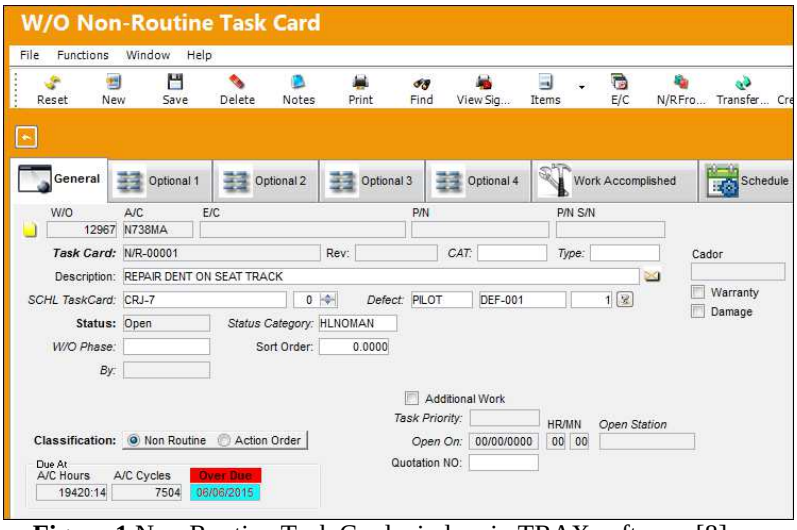

Figure 1 Non-Routine Task Card window in TRAX software [8]

Figure 1 gives an example of software offered to MRO companies. Mechanic can easily enter data into the sheet which allows minimizing amount of errors made. Optional tabs allow him to enter further detail about damage found such as its type, precise location and dimensions. After clicking the save button card is immediately visible to other users which are very useful, for example when engineering action is required. In case a mistake is made entry can be corrected without the need to redo the entire card. In case of some repairs a repeated inspection is required. In this case information about it can be entered directly into the system which makes updating aircraft records much easier as

all required data is collected in one place. Once all work is accomplished, the card gets signed off by authorized personnel using a digital or electronic signature.

3. COMPARISON OF USING TRADITIONAL AND ELECTRONIC DOCUMENTATION

In order to better understand the differences between traditional and electronic documentation a comparison has been made in the table below.

Table 1 Comparison of conventional and electronic documentation

Traditional documentation	Electronic documentation
• Manual work time recording; • Filled in and signed using handwriting; • Need an archive for storage; • Manual recording of used materials; • Data from task cards have to be manually put into the system; • Handwritten Non Routine Cards and ordered material; • Manual monitoring of completed task cards to determine check progress; • Request for material has to be manually forwarded to storage facility or logistics department;	• Contains pre-made work packs for given type of check; • Automatic prediction of required materials and tools for planned tasks; • Scanned bar codes help monitor work time; • Bar codes on parts allow them to be identified as used; • No need for storage room, data can be archived on a virtual drive; • Check progress is updated in real time as cards are signed off in the system; • Request for material is sent directly to appropriate department;

It is easy to notice that electronic documentation has multiple advantages over conventional paperwork. Using it can help in improving quality and efficiency of aircraft maintenance. However, companies using traditional documentation would have to invest in an IT system to switch over to a more modern way of creating and keeping maintenance records. While it has many advantages it also carries additional costs of implementation. Also, in case of system failure (for example server downtime) work cannot be continued until problem gets solved.

4. SUMMARY AND CONCLUSIONS

There are multiple benefits to acquiring accurate data regarding Man Hours and material information for each check. The first of these benefits involves following the progress of a check in real time. This visibility of check's progress allows labour efficiency to be improved. This can be achieved by increasing the ratio of active to inactive labour hours. As part of a motivational programme users can use the system to monitor which employees are working most effectively and reward them accordingly. The second main benefit is that users of such systems are given an accurate analysis of routine and non-routine Man Hours and materials. This ultimately makes it possible to follow an aircrafts maintenance costs, and can also be a useful tool in fleet planning, since rising non-routine ratios and maintenance costs can be followed.

Paperless maintenance not only helps to save paper, environmental resources, time and money, but also expedites the provision and transmission of all information and increases the quality of data input. Documenting data electronically means that some work processes can even be eliminated completely or become more streamlined, clearer and less susceptible to errors. The

resulting high level of transparency benefits MRO operation and can be passed on almost completely to customers and operators.

Although digital maintenance records have their flaws they still present many advantages over conventional documentation and are the way to go into the future.

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