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Information Support Tool for Aircraft Maintenance Task Planning

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Abstract: Aircraft maintenance can be described as a set of tasks that are carried out on an aircraft in order to keep it in an airworthy condition. Aircraft operators aim to achieve profitability and this happens only when the aircraft is flying. Operators can improve their fleet availability by reducing the maintenance time which in turn reduces the overall downtime of the aircraft. This is directly influenced by a number of factors such as availability of tools and spares, availability of labour, time required for maintenance etc. This paper presents a potential method to reduce the overall maintenance time by eliminating duplication of tasks thereby improving the maintenance efficiency. An information support tool will be used to determine whether the maintenance tasks can be grouped together or not. Hence, components maybe maintained simultaneously thereby reducing the number of times an access panel would undergo an opening/closing sequence. Potential gains include reduced work load on the maintenance crew, reduced wear and tear on access panels and reduced maintenance times amongst others.

Keywords: Aircraft Maintenance, Information support tool, Access Panel, Duplication of tasks

I. INTRODUCTION

Aircraft maintenance involves a set of tasks that are performed on an aircraft in order to keep it in an airworthy condition. Airworthiness may be defined as the continued capability of an aircraft to perform in a satisfactory manner the flight operations for which it was designed [1].Aircraft maintenance involves inspections, repairs, modifications or even complete overhaul of the aircraft, its structures, systems and components. Aircraft maintenance can be categorized into two broad categories:

1. Scheduled maintenance
2. Unscheduled maintenance

Scheduled maintenance tasks are carried out based on manufacturer specified intervals while unscheduled maintenance tasks are usually carried out in response to events such as Foreign Object Debris (FOD) damage, pilot reported defects, heavy landings etc.

Modern aircraft maintenance schedules are developed from the document produced by the Air Transport Association (ATA) Maintenance Steering Group (MSG-3) Task Force in 1980 [2]. Aircraft operators develop customized maintenance programmes based on the information available in a Maintenance Planning Data (MPD) document issued to them by an aircraft manufacturer. This document follows the guidelines recommended by the Maintenance Steering Group (MSG-3) philosophy. Aircraft maintenance is an expensive activity and efforts have been taken to develop systems that can minimise downtime by effective planning and control of maintenance [3]. Prior research has also been carried out to develop systems that reduce maintenance costs by improving overall maintenance efficiency. This includes, but is not limited to, development of a process to allocate labour resources [4] as well as development of a computer model using Visual Basic and MS Excel to generate maintenance clusters comprising of Maintenance Task Packages and Maintenance Checks [5].

This paper describes one such potential information support tool that could be used to identify and eliminate duplication of tasks. This would in turn reduce overall downtime thereby improving the maintenance efficiency.

II. METHODOLOGY

Maintenance tasks are described in detail in a maintenance task card. The task card contains information such as type of task, maintenance interval and frequency, procedure to be followed, access panels to be opened etc.

Task cards are issued by the planning and technical departments of an airline's engineering division. Task cards are then handed over to licensed Aircraft Maintenance Engineers (AMEs).

The AME uses his knowledge and prior experience to decide in what sequence tasks must be completed in order to ensure tasks are completed in the minimum amount of time and with minimum wastage of resources.

One factor that affects this time can be attributed to the opening and closing of access panels. Maintenance tasks on most aircraft systems and components can be carried out only after opening their respective access panels. Once the maintenance task is completed, the panel is closed. Very often it may be seen that more than one system or component can be maintained by operating the same access panel.

In such cases, it would be beneficial to carry out maintenance tasks on all those systems or components simultaneously. This prevents the repeated operation of the same access panels. The main benefit of this optimization would be the reduction in time required for

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completion of the maintenance activity which in turn reduces the downtime. Additionally, repeated opening and closing causes increased wear and tear of the various joints and locks which can then reduce the reliability of the aircraft.

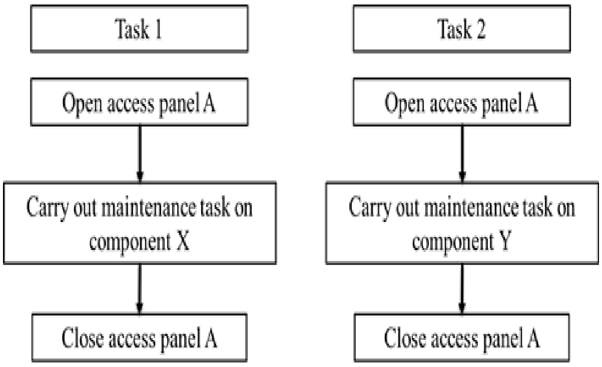

Fig. 1: Sample workflow process

Inexperience or oversight on part of the maintenance crew could lead to situations where this optimal process may not occur. A computer model was developed using the MS Excel 2013 software in order to serve as an information support tool that maybe used to assist in planning and grouping of maintenance tasks effectively. This software was chosen since its programming is relatively simple and most organizations use it as a tool to collect and store data. A flowchart representing the decision making process is shown below.

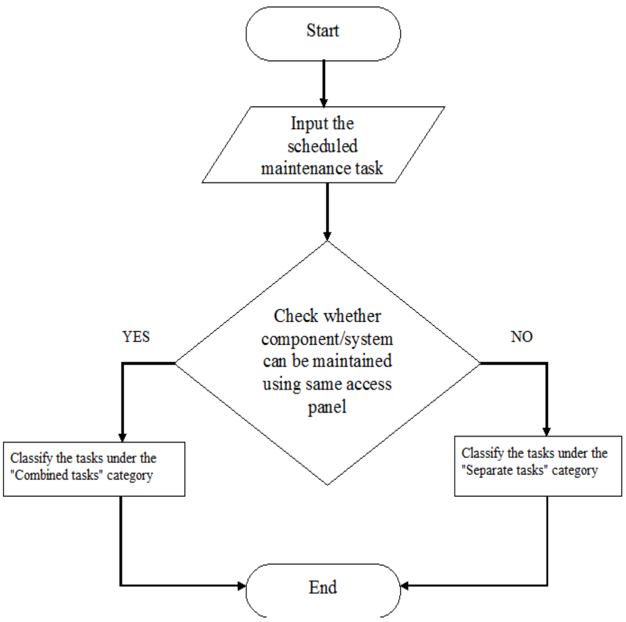

Fig.2: Flowchart depicting decision making sequence

For the purpose of evaluation of the tool, task cards were chosen from a sample aircraft in order to create a maintenance task database. Each task is identified by a two part code such as 20-A, 20-B, 33-F etc. where 20, 33 represent the Air Transport Association (ATA) chapter number and A, B, F are codes unique to a particular task in that chapter.

The two part codes are then entered into a pre-programmed worksheet that uses logic commands to sort and group tasks together based on a set of criteria. Results are displayed in the form of tables that provide information with respect to which maintenance tasks can be performed together or which may be done individually.

Code	Title
20-A	Wing Center Section
20-B	Left Hand-Center Auxiliary Tank
20-C	Left Main Tank
20-B2	Nacelle Strut Aft Fairing
27-T	Flight Control Cables - Exposed
27-T1	Stabilizer Trim Limit/Cutoff Switches
27-S3	Alternate Horizotal Stabilizer Trim System
27-T3	Elevator Pressure Reducer Valve
33-F	Emergency light power supplies
33-G	Floor proximity emergency escape path marking lighting
49-W	Replace the APU inlet guide vane actuator
49-X	Replace the APU surge valve
52-A1	Passenger door stop fittings
52-B1	Passenger door exterior
52-A2	No.2 door -service
74-L	Remove and replace the igniter plug
75-A	Altitude switch - left engine
75-D	Transient pressure unit - right engine
80-C	Starter magnetic chip detector -left engine
80-D	Starter magnetic chip detector -right engine

Fig. 3: Sample database

III.RESULT AND DISCUSSION

The computer model categorizes each maintenance task using the access panel nomenclature as its decision criteria. When two or more maintenance tasks which require the same access panel to be operated is found, the tool groups them together under the “Combined tasks” category. If no match is found, the tool classifies the maintenance task under the “Separate tasks” category.

Accesspanel Code Name	Classification Combined task	 Separate task	 Grand Total
113A 311AL		1	1
27-T1		1	1
1341 134AZ 134BZ 134CZ 134DZ 194ER 5002		1	1
20-A		1	1
315AL 316AR	2		2
49-W	1		1
49-X	1		1
413AL	2		2
75-D	1		1
80-C	1		1
413AL 415AL 416AR 423AL 425AL 426AR		1	1
74-L		1	1
414AR		1	1
75-A		1	1
423AL		1	1
80-D		1	1
444AL 444BL 444CL 444DR		1	1
20-B2		1	1
5002 531AB 531BB 531CB		1	1
20-B		1	1
832 8321 842 8421		1	1
52-A1		1	1
832 842		1	1
52-B1		1	1
842 8421		1	1
52-A2		1	1
NA		1	1
27-T		1	1
Grand Total	4	11	15

Fig. 4: Sample result table

Maintenance engineers can now utilize this information to group and perform maintenance tasks together or carry them out individually by opening and closing their respective access panels. This can limit the number of times duplication of tasks occur thereby improving the overall maintenance efficiency. The time saved by optimizing the maintenance process can instead be utilized to carry out other checks or safety inspections or even allow for earlier dispatch of the aircraft for flight operations. The simplicity of the tool allows for easy modification of the database and it can also be customized to display other information relevant to the maintenance planning process.

IV. CONCLUSION

Aircraft maintenance is a complex activity requiring extensive resources. Aircraft operators try to minimise costs as far as possible while maintaining the highest possible standards of safety. The operator earns revenue only when the aircraft is in flight. Increased delays on ground due to maintenance errors can increase downtime which ultimately results in loss of revenue. Information tools enable maintenance crew to take better decisions.

Expected benefits of using such an information support tool may include:

1. Time savings since duplication of task is prevented.
2. Reduced workload on maintenance crew.
3. Better control by the management on the quality of job.
4. Overall efficiency due to reduced downtime.
5. Reduced wear and tear on panels and fasteners.

REFERENCES

[1] DGCA, Civil Aviation Requirements, Series D, Part II, Issue IV, Dated 1st January 1985.
[2] Friend C. H., "The maintenance schedule and its determination", Aviation Safety Management, pg 47-48.
[3] Samaranayake P., (2006), "Current Practices and Problem Areas in Aircraft Maintenance Planning and Scheduling– Interfaced/Integrated System Perspective", Proceedings of the 7th Asia Pacific Industrial Engineering and Management Systems Conference, 17th to 20th December 2006, Bangkok, Thailand.
[4] Ip W. H., Cheung A. and Lu D., (2005), "Expert system for aircraft maintenance services industry", Journal of Quality in Maintenance Engineering, Vol. 11, Issue 4, pp. 348 – 358.
[5] Muchiri A. and Smit K., (2011), "Optimizing Aircraft Line Maintenance through Task Re-clustering and Interval De-escalation", Proceedings of the 2011 Mechanical Engineering Conference on Sustainable Research and Innovation, Vol. 3, 5th to 6th May 2011, pp. 22-26.