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R.M. Salimov, O.I. Yurchenko
(National Aviation University, Ukraine)

Modern principles for choosing MSI products in the formation of an aircraft maintenance program based on MSG-3 logic

The article deals with the issues of forming an aircraft maintenance program. The method of formation of scheduled maintenance was analyzed. New approaches to the selection of Maintenance Significant Item products are being considered.

Selection of candidates for MSI objects important for maintenance

The methodology for developing a maintenance program (M) for the functional systems of an aircraft implies the application of a consistent logical analysis and assessment to each product important for maintenance (system, subsystem, module, unit, auxiliary structure, unit, spare part, etc. and uses available technical information. The evaluation is based on the functional failures of the products and their causes [1].

Before the logic of Maintenance Steering Group (MSG-3) can be used for any object, important systems and components of the aircraft - Maintenance Significant Item (MSI) must be identified. The process of identifying items important to maintenance is conservative, based on the expected consequences of failure, using engineering judgments.

The designer divides the aircraft into main functional parts - systems and subsystems - according to sections of the Air Transport Association of America (ATA). Also included in the process are structural elements and rescue equipment. This process continues until all replaceable items on the aircraft have been identified. Then, using a top-down analysis method, the designer lists the products to which the MSI selection criteria will apply.

Prior to the application of MSG-3 logic diagrams to an aircraft product, a preliminary list must be completed, in which:

— the product is clearly identified as MSI;

— product functions, functional failures, consequences of failures, causes of failures are announced;

— any additional information related to the product has been added ATA section reference, fleet applicability, manufacturer designation, product brief description, expected failure rate, hidden features, need to be included in the Minimum Serviceable Equipment List for Aircraft Departure (MEL), redundant units and systems).

This list is intended to demonstrate compliance with the requirements of the operator, and should be an integral part of the overall MSG-3 documentation for this product.

Further questions are asked to the selected important objects:

— Can the failure of this object (subsystem) affect the safety of operation on the ground or in the air?

— Can the failure of this object (subsystem) be noticed during normal operation?
— Can the failure of this object (subsystem) affect the operation?
— Can the failure of this object (subsystem) affect the efficiency of operation?

For those products that answer "no" to all four questions, MSG-3 analysis is not required, and there is no need to further analyze MSI selection at lower levels. In addition, to avoid re-analysis, lower-level items should be listed to identify those that will not be further evaluated. This list shall be submitted by the manufacturer to the Industry Coordinating Committee (ISC) for review and approval.

For products that have a positive answer to at least one of the four questions, MSG-3 analysis is required and the best level to consider must be approved. Consideration should be given to selecting the optimum level to consider, which includes the product as part of the same optimum system to consider [2].

An MSI product is typically a system or subsystem one level above the lowest level defined in Step 1. This level is considered the best level to consider, i.e. it is high enough to avoid unnecessary analysis, but low enough to provide the necessary analysis and coverage of all functions, functional failures and their causes.

Once the optimum level for review has been approved, the list of products resulting from the analysis is considered the "MSI Candidate List" and submitted by the manufacturer to the Industry Coordinating Committee, which in turn reviews and approves this list for subsequent distribution to working groups.

The working groups develop a list of candidates for MSI and, using the MSG-3 analysis, evaluate the selected best level for consideration. If necessary, propose changes to the MSI list. These changes are sent to the Industry Coordinating Committee. The main purpose of developing the list by the working groups is to verify that no item of importance for maintenance has been missed, and the correct level for analysis has been selected. It should be noted that although an item may be selected as an MSI and will be analyzed, this does not necessarily mean that work will be done on that item. The approved MSI list is parsed according to MSG-3 logic.

All objects must be assigned to one of five categories:
1. Object failure is clearly unsafe.
2. Failure of the object explicitly affects the regularity.
3. Failure of the object explicitly affects the economy.
4. Object failure is implicitly unsafe.
5. Object failure is implicitly safe.

Further, by a two-level analysis of obvious and latent functional failures, a list of tasks of maintenance methods is determined, which should be applied during aircraft maintenance under the MRO program (Maintenance, Repair, and Overhaul), taking into account the requirements of safety (safety factor), aircraft readiness for operation (operational factor) and economy (economic factor).

In order to carry out further analysis of a candidate for important objects, it is necessary to determine all of it:
— functions;
— Possible failures of these functions;

— The possible consequences of these failures;

— reasons for these failures.

References

1. ATA MSG-3 SHM WG Detailed Proposal - Rev 1, dated 01/10/2009 [Electronic resource]. https://www.easa.europa.eu/sites/default/files/dfu/IP%20105%20attachment%20.pdf

2. ATA MSG-3 Information - EASA [Electronic resource]. https://www.easa.europa.eu/sites/default/files/dfu/EASA%20CM-MRB-001%20Issue%2002%206_Nov_2019.pdf

3. Salimov R.M., Maksymov V.O., Yurchenko O.I., Upravlinnia tekhnolohichnymy protsesamy tekhnichnoho obsluhovuvannia aviatsiinoi tekhniky// Proceedings of the Fourteenth International Conference of Science and Technology "AVIA-2021″, P.6. [Electronic resource] https://conference.nau.edu.ua/index.php/AVIA/AVIA2021/paper/view/8142