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Reliability Programme Oversight

1. Purpose and scope

This Notice specifies the requirement for an effective reliability program under Regulation 10 of Civil Aviation (Safety) Regulations, 2017 and to also implement a Reliability Programme as specified in Part M Subpart G under M.A.302 g.
This Notice is designed to be used by Part-M Subpart G Organizations and Part CAMO - To assist them in the production and/or maintaining of their own reliability program.

2. Requirement

A reliability programme should be developed for aircraft maintenance programmes based upon maintenance steering group (MSG-3) logic or those that include condition monitored components or that do not contain overhaul time periods for all significant system components.

Notwithstanding the above an operator shall also develop a procedure to initiate a special evaluation or impose special operational restrictions if information obtained from reliability monitoring indicates degraded level of safety.

3. General

Part M requires the aircraft maintenance program to include a reliability program for complex motor powered aircraft when the maintenance program is based on maintenance steering group logic or on condition monitoring, and develop and control a maintenance program for the aircraft managed, including any applicable reliability program.
This Airworthiness Notice establishes the requirement to perform sample inspection on Maintenance Program compliance and Reliability evaluation at a one year interval and it hereby develops a documented process for the on-going oversight of reliability programs including procedures for SSR to initiate a special evaluation or impose special operational restrictions if information obtained from reliability monitoring indicates degraded level of safety.

4. Applicability

A reliability program should be developed in the following cases:

a. the aircraft maintenance program is based upon MSG-3 logic
b. the aircraft maintenance program includes condition monitored components

c. the aircraft maintenance program does not contain overhaul time periods for all significant system components.
d. when specified by the Manufacturer's maintenance planning document or MRB.
e. The aircraft is subject to an Extended Diversion Time Operation (EDTO) approval issued by SSR SCAA.

A reliability program need not be developed in the following cases:

a. the maintenance program is based upon the MSG-1 or 2 logic but only contains hard time or on condition items
b. the aircraft is not a complex motor powered aircraft
c. the aircraft maintenance program provides overhaul time periods for all significant system components.

For the purpose of this paragraph, a significant system is a system the failure of which could hazard the aircraft safety.

Notwithstanding paragraphs above, an organization/operator may however, develop its own reliability monitoring program when it may be deemed beneficial from a maintenance planning point of view.

The purpose of a reliability programme is to ensure that the aircraft maintenance programme tasks are effective and their periodicity is adequate.

In the absence of a reliability programme the operator will however provide an appropriate means of monitoring the effectiveness of the maintenance programme as required by M.A.301 (e).

5. Approval, Revision and Monitoring of Reliability Programs

a. Maintenance reliability program approvals are a means of complying with the Civil Aviation (Safety) Regulations, 2017 as amended. The programs are to be administered and controlled by the Aircraft Operators (AOC) and monitored by the SSR Inspector. An operator's application for approval should be accompanied by a document describing elements of the reliability program.

b. The purpose of a reliability program is to ensure that the aircraft maintenance program tasks are effective and their periodicity is adequate.
c. The reliability program may result in the escalation or deletion of a maintenance task, as well as the de-escalation or addition of a maintenance task.
d. A reliability program provides an appropriate means of monitoring the effectiveness of the maintenance program.
e. Procedures for implementing revisions to the program should be described in sufficient detail to identify all elements which require SCAA approval. The AOC holder should also identify the section in the organization given the responsibility to approve amendments to the program. Elements of the program which require SCAA approvals whenever there is a change include:

    i. Reliability measurement;

ii. Changes involving performance standards, including instructions relating to the development of these standards;
iii. Data collection analysis;
iv. Data analysis methods and application to the maintenance program;
v. Procedures for adding or deleting systems or components; and
vi. Procedures for transferring systems or components to another program.

f. When evaluating program revision procedures, consideration should also be given to the following:

i. Does the program provide for periodic review to determine if the established performance standard is still realistic or in need of recalculation?
ii. What is the distribution arrangement for program revisions?
iii. Are the overhaul and inspection intervals controlled by reliability methods identified in the appropriate maintenance manuals?

6. Performance standard

Each reliability programme should include a performance standard expressed in mathematical terms. This standard becomes the point of measure of maximum tolerable unreliability. Thus, satisfactory reliability trend measurements are those which fall at or preferably below the performance standard. Conversely, a reliability trend measurement exceeding the performance standard is unsatisfactory and calls for some type of follow-up and corrective action. A performance standard may be expressed in terms of system or component failures per thousand hours of aircraft operation, number of landings, operating cycles, departure delays, or of other findings obtained under operational conditions. In some instances, an upper and lower figure may be used. This is known as a reliability band or range and provides the standard by which equipment behavior may be interpreted or explained.

When the performance standard is not met, the programme should provide for an active investigation which leads to suitable corrective action.
A description of the types of action appropriate to the circumstances revealed by the trend and the level of reliability experience should be included in the programme. This is the core of maintenance control by reliability measurement. It is the element that relates operating experience to maintenance control requirements. Statistical techniques used in arriving at reliability measurements presented in support of maintenance control actions should be described. Appropriate corrective actions might be:

a) Verify that engineering analysis is appropriate on the basis of collective data in order to determine the need to change the maintenance programme;
b) Actual maintenance programme changes involving inspection frequency and content, functional checks, or overhaul times;
c) Aircraft system or component modification, or repair; or
d) Other actions peculiar to the condition that prevails.

The results of corrective action programmes should become evident within a reasonable time from the date of implementation of corrective action. An assessment

of the time permitted should be commensurate with the severity or safety impact of the problem. Each corrective action programme should have an identified completion date.

Due to the constantly changing state of the art, no performance standard should be considered fixed as it is subjected to change when reliability changes. The standard should be responsive and sensitive to the level of reliability experienced. It should be “Stable” without being “Fixed”. If, over a period of time, the performance of a system or component improves to a point where even abnormal variations would not produce an alert, then the performance standard has lost its value and should be adjusted downward. Conversely, should it become evident that the standard is consistently exceeded in spite of taking the best-known corrective measures to produce the desired reliability, then the performance standard should be re- evaluated and more realistic standard established. Each programme should contain procedures to accomplish, when required, such changes to the prescribed performance standards.

7. Establishing initial standards

In order to establish the initial standards for structural components, engines and systems, the past operating experience with the same (or, in the case of new aircraft, similar) equipment should be reviewed in sufficient depth to obtain a cross-section of the subject system's performance. Normally, a period of six months to one year should be sufficient. For a system common to a complex motor powered aircraft fleet of aircraft, a representative sample may be used, while small fleet systems may require 100 per cent review. Examples of industry experience are past and present individual operators' industry experience of similar equipment and performance analysis of the similar equipment currently in service.

Operators introducing a new aircraft into service may establish their alert values by using this available data. If industry experience is used in establishing a reliability programme 's performance standards, the programme should include a provision for reviewing the standards after the operator has gained one year of operating experience.

Due to different operating conditions and system design, it is necessary to use different measuring devices (either singly or combined) to obtain satisfactory performance criteria. As stated before, there are various methods used to evaluate and control performance -aircraft diversions, mechanical interruptions in flight, delays and flight cancellations and component unscheduled removal rates.

8. Engineering Judgement

Engineering judgment is itself inherent to reliability programmes as no interpretation of data is possible without judgment. The organisation which runs the programme is expected to ensure that sufficiently qualified personnel with appropriate engineering experience and understanding of reliability concept is available.

It follows that failure to provide appropriately qualified personnel for the reliability programme may lead the Authority to reject the approval of the reliability programme and therefore the aircraft maintenance programme.

9. Reliability Programme Objective

A statement should be included summarizing as precisely as possible the prime objectives of the program. To the minimum it should include the following:

a. To recognize the need for corrective action,
b. To establish what corrective action is needed and,
c. To determine the effectiveness of that action.

The extent of the objectives should be directly related to the scope of the program. Its scope could vary from a component defect monitoring system for a small organization, to an integrated maintenance management program for a big organization. The manufacturer's maintenance planning documents may give guidance on the objectives and should be consulted in every case.

In case of a MSG-3 based maintenance program, the reliability program should provide a monitor that all MSG-3 related tasks from the maintenance program are effective and their periodicity is adequate.

10. Identification of items

The items controlled by the program should be stated, e.g. by ATA Chapters. Where some items (e.g. aircraft structure, engines, APU) are controlled by separate programs, the associated procedures (e.g. individual sampling or life development programs, constructor's structure sampling programs) should be cross referenced in the program.

11. Terms and definitions

The significant terms and definitions applicable to the Program should be clearly identified.

12. Information sources and collection

Sources of information should be listed and procedures for the transmission of information from the sources, together with the procedure for collecting and receiving it, should be set out in detail in the Operator's and maintenance organization's manuals as appropriate.
The type of information to be collected should be related to the objectives of the Program and should be such that it enables both an overall broad-based assessment of the information to be made and also allow for assessments to be made as to whether any reaction, both to trends and to individual events, is necessary.
The following are examples of the normal prime sources:

a. Pilots Reports.
b. Technical Logs.
c. Aircraft Maintenance Access Terminal / On-board Maintenance System readouts.
d. Maintenance Worksheets.
e. Workshop Reports.
f. Reports on Functional Checks.

g. Reports on Special Inspections
h. Stores Issues/ Reports.
i. Air Safety Reports including SAFA reports and ramp inspections.
j. Reports on Technical Delays and Incidents.
k. Other sources: ETOPS/EDTO, RVSM, LVO(CAT II/CAT III)
I. Airworthiness review reports.

In addition to the normal prime sources of information, due account should be taken of continuing airworthiness and safety information.

13. Data analysis and display

The data collected should identify rates of failure and removal of the components and parts being monitored. It should also provide root cause analysis of failure.
Collected information may be displayed graphically or in a tabular format or a combination of both. The rules governing any separation or discarding of information prior to incorporation into these formats should be stated. The format should be such that the identification of trends, specific highlights and related events would be readily apparent. The above display of information should include provisions for “Nil Returns” to aide examination of the total information.
Where "standards" or "alert levels" are included in the program, the display of information should be oriented accordingly.

14. Establishing alert values statistically

Many programs establish alert values by reviewing past performance and establishing the numerical value for the alert. Some operators prefer the statistical or mathematical approach. The development of alert values may be based on industry accepted statistical methods such as standard deviations, or the Poisson distribution. Some programs use the average or baseline method. The standard should be adjustable with reference to the operator's experience and should reflect seasonal and environmental considerations. The program should include procedures for periodic review of, and either upward or downward adjustment of, the standards as indicated. It should also include monitoring procedures for new aircraft until sufficient operating experience is available for computing performance standards. All methods, however, require a sufficient quantity of accurate data be available for analysis.

In order to establish system alert values, an evaluation should be made of the operational performance of each system to be controlled by the program. The yardsticks covering failure performance should be clearly defined in the program. Using these definitions, the failure data for each system to be extracted from pilot-reported malfunctions for at least a 12-month period. The "mean" and the "standard deviation" are then computed from those data, and each system's alert value is established equal to the mean plus three standard deviations.

The current performance level of each system should be computed on a monthly basis as a three-month cumulative performance rate. This rate is computed by multiplying the number of in-flight malfunctions for a three-month period by 1000 and dividing by the total aircraft flight hours for the same period. Maintaining a cumulative rate requires that the first month's data be deleted and the data for the current month added to the sum of the previous two months.

When a trend of deteriorating system performance is detected, or if a system is over the alert value, an active investigation is conducted to assess the causes of the change in system performance and to develop an active corrective program, if required, to bring the system performance under control.

15. Oversight of reliability program

The oversight of reliability program should be based on the following criteria:

- ***Corrective Actions.***

The procedures and time scales both for implementing corrective actions and for monitoring the effects of corrective actions should be fully described. Corrective actions shall be applied to any reduction of the acceptable level of reliability revealed by the program and this may include the following:

(a) Changes to maintenance, operational procedures or techniques.
(b) Maintenance changes involving inspection intervals and content, functional checks, overhaul requirements and time limits, which will require amendment of the scheduled maintenance programs or specific tasks in the approved maintenance program. This may include escalation or de-escalation of tasks, addition, modification or deletion of tasks.
(c) Amendments to approved manuals (e.g. maintenance manual, crew manual);
(d) Initiation of modifications;
(e) Special inspections of fleet;
(f) Spares provisioning;
(g) Staff training and
(h) Manpower and equipment planning.

Note: *Some of the above corrective actions may need SCAA's approval before implementation.*

The procedures for effecting changes to the maintenance program should be described, and the associated documentation should include essential elements e.g. planned completion time scales for each corrective action identified.

- ***Organisational Responsibilities***

The organisational structure and the department responsible for the administration of the reliability program should be stated. The chains of responsibility for individuals and departments (Engineering, Production, Quality, Operations etc.) in respect of the program, together with the information and functions of any program control committees (reliability board), should be defined. Participation of SCAA should be stated. This information should be contained in the continuing airworthiness maintenance exposition as appropriate.

- ***Presentation of information to SCAA***

The following information should be submitted to SCAA for approval as part of the reliability program:

a) The format and content of periodic reports;
b) The time scales for the production of reports together with their distribution;
c) The format and content of reports supporting request for increases in periods between maintenance (escalation) and for amendments to the approved maintenance program. These reports should contain sufficient information to enable SCAA to make its own evaluation.

- ***Evaluation and review***

Each program should describe the procedures and individual responsibilities in respect of the continuous monitoring of the effectiveness of the program. The time periods and the procedures for both routine and non-routine reviews of maintenance control should be detailed (progressive, monthly, quarterly, or annual reviews).
Each Program should contain procedures for monitoring and, as necessary, revising the reliability "standards" or "alert levels". The organizational responsibilities for monitoring and revising the "standards" should be specified.

Although not exhaustive, the following list gives guidance on the criteria to be considered during the review.

a) Utilization (high/low/seasonal);
b) Fleet commonality;
c) Alert Level adjustment criteria;
d) Adequacy of data;
e) Reliability procedure audit;
f) Staff training or
g) Operational and maintenance procedures.

- ***Continuing surveillance***

SCAA will monitor all aspects of the operation it has authorized in order to ensure that the level of reliability achieved in EDTO/ ETOPS remains at the necessary level and that the operation continues to be conducted safely. In the event that an acceptable level of reliability is not maintained, that significant adverse trends exist or that significant deficiencies are detected in the design or the conduct of the operation, SCAA is to initiate a special evaluation, impose operational restrictions, if necessary, and require corrective action for the operator to adopt, to resolve the problems in a timely manner or suspend the EDTO/ETOPS authorization unless there is a corrective action plan acceptable to SCAA.

Causes of engine in-flight shutdown or other engine/propulsion system problems may be associated with design problems and/or maintenance and operation procedures applied to the aeroplane. It is important to identify the root cause of events so that the appropriate corrective action is implemented. An operator should not be considered responsible for the occurrence of a design-related event in its fleet. However, maintenance or operational problems may be wholly or partially the responsibility of the operator. If an operator has an unacceptable engine in-flight shutdown rate attributed to maintenance or operational practices, then action tailored to that operator may be required by the State of the Operator.
A high rate of engine in-flight shutdowns for a small fleet may be due to the limited number of engine operating hours and may not be indicative of an unacceptable rate.

The underlying causes for such a jump in the rate will have to be considered by the State.

The State of the Operator should alert the State of Design when a special evaluation is initiated and provide for its participation independent of the determined cause.

Random Inspection frequency on maintenance program compliance and reliability evaluation is required to be performed once per year as established by SCAA Technical Procedure TP AIR 3-03.

In evaluating the reliability program, SCAA Airworthiness Inspector should make use of the Quick Guidance List in table SF 01 in Appendix I to this Notice.

16. Notice revision

This Notice becomes effective from the date of issue

Appendix I

Quick Guidance List - Table SF 01

	Reliability Development Programs	Standard or Requirement	N/A	SAT	UN SAT
1	Does the organization follow the reliability/maintenance development programme as described in the manual?				
2	Is the data collection source being adhered to for? - unscheduled removals, - confirmed failures, - pilot reports, - sampling inspections, - functional checks, - shop findings, - service difficulty reports, and - other sources that the carrier may consider appropriate?				
3	Does the data analysis system recognize and ensure the need for corrective action?				
4	Is correction action implemented in a timely manner?				
5	Does the correction action function allow for? - component modification, - aircraft modification, - revised maintenance, overhaul, or operating procedures, and - time limitations or revised inspection schedule?				
6	Is the individual responsible for the programme knowledgeable with the procedures described in the Reliability Manual?				
7	Does the organization follow the procedures for adjusting maintenance and overhaul intervals as described in the Reliability Manual?				
8	Does the organization conform to the reliability program as detailed in the Reliability Manual?				
9	Does the engine ECM program function as described in the CAME and is it effective in preventing on wing failures ?				
10	Is the reliability report published at an appropriate interval to operational environment? (progressive, monthly, quarterly, or annual)				
11	Is the data comparable with industry?				
12	Is the information presented and submitted to SCAA?				
13	Have all aspects of the operation been authorized to ensure that the level of reliability achieved in EDTO/ ETOPS remains at the necessary level and that the operation continues to be conducted safely? Note: In the event that an acceptable level of reliability is not maintained, that significant adverse trends exist or that significant deficiencies are detected in the design or the conduct of the operation , Airworthiness Inspector is to initiate a special evaluation, recommend to impose operational restrictions, if necessary by following the appropriate procedure, and require corrective action for the operator to adopt, to resolve the problems in a timely manner or recommend to suspend the EDTO/ETOPS authorization unless there is a corrective action plan acceptable to SCAA.				