MAINTENANCE CONTROL BY RELIABILITY METHODS

1.0 PURPOSE

1.1 This advisory circular (AC) is issued to provide information and guidance which may be used to design or develop a maintenance programme that utilizes reliability control methods. The aircraft maintenance reliability program is a subsection of an approved aircraft maintenance programme.

1.2 It gives practices acceptable to the Authority with regard to development, management and approval of aircraft maintenance reliability control programmes using the Manufacturer Maintenance Planning Document (MPD) which establish the criteria for classifying maintenance processes.

2.0 REFERENCES.

2.1 Regulation 29(1) of the Rwanda Civil Aviation (Operation of Aircraft) Regulations 2008 requires an AOC holder to ensure that each aircraft is maintained in accordance with the approved maintenance programme.

2.2 Regulation 29(3) of the Rwanda Civil Aviation (Air Operator Certification And Administration) Regulations 2008 puts a requirement that a maintenance programme for aircraft with maximum takeoff mass above 13,310 kg operated under the Regulations to include a reliability programme.

2.3 The Authority Advisory Circular No. RCAA-AC-AIW008 (Aircraft Maintenance Program Development) and the Federal Aviation Administration AC 120-17A (Maintenance Control by Reliability Methods).

3.0 GUIDANCE AND PROCEDURES

3.1 General:

3.1.1 The Reliability Control Program focuses on maintaining failure rates below a predetermined value; i.e. an acceptable level of reliability.

3.1.2 The maintenance philosophy, consideration of operational and environmental factors, record keeping systems, the extent and scope of the operator's application of reliability control, are reflected and defined in his/her own reliability programme document.
3.1.3 There are four general categories of an operator's maintenance programme –

a) Systems/components;

b) Powerplants/components;

c) Aircraft/engine checks and inspections; and

d) Structural inspection/overhaul.

3.1.4 All four may be controlled by a composite programme, or each may be handled individually. The programme can encompass a select group of items from a category without affecting other controls for the remaining items of that category. For example, the basic engine might be maintained by a programme that does not include its accessories. The accessories could be on another programme or they could be under traditional operations specifications control.

3.1.5 Statistical analysis is most effective in its application to systems and components because the occurrence of failures can be readily reduced to meaningful statistics. When alert rates are used in the analysis, graphic charts (or equivalent displays) show areas in need of corrective action. Conversely, statistical analysis of inspection findings or other abnormalities related to aircraft/engine check and inspection periods requires judgmental analysis. Therefore, programmes encompassing aircraft/engine check or inspection intervals might consider numerical indicators, but sampling inspection and discrepancy analysis would be of more benefit.

3.1.6 The three Primary Maintenance Processes utilized by maintenance programmes are:

a) hard-time;

b) on-condition; and

c) condition-monitoring.

3.1.7 Each programme should include specific definitions of the processes it uses and how they are applied. The detailed requirements for the condition-monitoring process are included in the Airline Manufacturer Maintenance Planning Document – MSG-2 and 3 (as revised) issued by appropriate Authorities.

3.2 Control Systems

3.2.1 The maintenance reliability program must reflect the application of the following control systems:

a) data collection;

b) data analysis;

c) corrective action;

d) performance standards;

e) data display and report;

f) maintenance interval adjustment and process change, and;

g) programme revision.
3.2.2 These systems explain the framework which the operator can use to develop his particular reliability programme.

3.3 **Data collection system**

3.3.1 Typical sources of performance information are as follows, however, it is not implied that all of these sources need be included in the programme nor does this listing prohibit the use of other sources of information:

a) Pilot reports;

b) In-flight engine performance data;

c) Mechanical interruptions/delays;

d) Engine shutdowns;

e) Unscheduled removals;

f) Confirmed failures;

g) Functional checks;

h) Bench checks;

i) Shop findings;

j) Sampling inspections;

k) Inspection writeups; and

l) Service difficulty report / Mechanical Reliability Reports (MRR).

3.4 **Data analysis system**

Data analysis is the process of evaluating mechanical performance data to identify characteristics indicating a need for programme adjustment, revision of maintenance practices, hardware improvement (modification), etc. The initial step in analysis is the comparison of the data to a standard representing acceptable performance. The standard may be a running average, tabulations of removal rates for past periods, graphs, charts, or any means of depicting a "norm."

3.5 **Corrective action system**

The actions to be taken are a reflection of the analysis and should be positive enough to effectively restore performance to an acceptable level within a reasonable time. The system should provide periodic feedback until such time as performance has reached an acceptable level. Special provisions should be included for critical failures; i.e. failures in which loss of the function or secondary effects of the failure impair the airworthiness of the aircraft.

3.6 **Statistical performance standards system**

A performance measurement expressed numerically in terms of system or component failures, pilot reports, delays or some other event (bracketed by hours of aircraft operation, number of landings, operating cycles, or other exposure measurement) serves as the basis for the standard.
3.7 **Data display and report system**

Programmes incorporating statistical performance standards (alert type programmes) should develop a monthly report, with appropriate data displays, summarizing the previous month's activity. The report should cover all aircraft systems controlled by the programme in sufficient depth to enable the Authority and other recipients of the report to evaluate the effectiveness of the total maintenance programme. It should highlight systems which have exceeded the established performance standards and discuss what action has been taken or planned. The report should explain changes which have been made or are planned in the aircraft maintenance programme, including changes in maintenance and inspection intervals and changes from one maintenance process to another. It should discuss continuing over-alert conditions carried forward from previous reports and should report the progress of corrective action programmes.

3.8 **Maintenance interval adjustments**

Maintenance interval adjustments should not interfere with an ongoing corrective action. Special procedures for escalating systems or components whose current performance exceeds control limits should be provided.

3.9 **Programme revision system**

The programme should include a procedure for revision which is compatible with the Authority approvals. The programme areas requiring formal Authority approval include any changes to the programme that involve:

a) Any of the program control systems in 3.2 above.
b) Adding or deleting components/systems.
c) Adding or deleting aircraft types.
d) All procedural and organizational changes concerning administration of the programme.

3.10 **Program Administration**

3.10.1 Administration of reliability programmes (as discussed in this circular) requires a specific organizational structure within the operator's maintenance organization. Participants of the reliability programme administration team should be drawn from appropriate elements of the organization and should be authorized to act on behalf of their elements. In any case however, the Manager Quality should be responsible for the management of all the approved activities of the reliability programme.

3.10.2 The reliability programme administration team may vary from one operator to another. It may have a technical board that analyses performance deteriorations and shop findings to make determinations that may be acted on by an administrative board. The two boards can be combined if this better serves the needs of the particular operator. The board type of administration should entail meetings scheduled for some specified interval and should provide for assembling a board at any time a decision is needed.

3.10.3 In the absence of a formal administration team, operators with sufficient organizational capability may designate or assign appropriate responsibilities to specific element of the operator's organization.

3.10.4 It is important to know that the effective management of the established procedures of operating each system is essential to the success of the programme. These procedures should be incorporated in appropriate sections of the operator's manual system. Forms should be used, as necessary, to facilitate and document recurring transactions that involve several elements.
3.11 Reliability Programme Document

3.11.1 The operator should develop a document describing the application of reliability control methods. This document should include at least the following:

a) General description of the programme;
b) Organizational structure, duties and responsibilities;
c) Description of the individual systems;
d) Derivation of performance standards (if used);
e) Changes to the programme including designation of changes requiring Authority approval;
f) Copy and explanation of all forms peculiar to the system; and

g) Revision control and certification of revisions to the document.

3.11.2 The document should describe the workings of all systems in sufficient detail to provide for proper operation of the programme. It should include in detail how the three maintenance processes are applied. The document should describe the monthly report and any other reports relative to the programme, and include samples of these reports with instructions for their use. The organisational element(s) responsible for publishing reports should be identified and the distribution should be stated. Copies of pertinent reports should be provided to the Authority.

3.11.3 The document should also include definitions of significant terms used in the programme with particular emphasis on definitions of the three maintenance processes.

4.0 PROGRAMME APPROVAL

4.1 Initial Approval

4.1.1 The programme document and related data should be submitted to the Authority in the form and manner prescribed. Guidance on the submission will be provided at the Pre-Application Meeting. Reference should be made to Advisory Circulars RCAA-AC-AIW003 (The Organisation Five Phase Certification and Approval Process) and No. RCAA-AC-AIW002 (Development and Preparation of Manuals).

4.1.2 Approval will be certified with the organisation maintenance programme document and specified in the Operations Specifications.

4.2 Revision Approval

Amendments to the Reliability Programme shall be subjected to a review, evaluation and approval process before incorporation. It is important to take in consideration the impact of the proposed amendments on the overall organisation manual system.

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