CIVIL AVIATION AUTHORITY OF BOTSWANA

GENERAL ADVISORY CIRCULAR

CAAB Document GAC-011

ESTABLISHMENT AND OVERSIGHT OF A RELIABILITY PROGRAM AND MAINTENANCE PROGRAM ESCALATION

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1. PURPOSE

This General Advisory Circular (GAC) provides operators with information and guidance on establishment and on-going oversight of a reliability program, and escalation of an aircraft maintenance program.

2. STATUS OF THIS ADVISORY CIRCULAR

This General Advisory Circular is an original issuance.

3. EFFECTIVE DATE

This GAC becomes effective immediately.

4. APPLICABILITY

The information in this GAC applies to operators required to have reliability programs as part of the aircraft maintenance programs.

5. RELATED REGULATIONS

Copies may be obtained from the Government Printer.

- Civil Aviation (Air Operator Certification and Administration) Regulations

6. RELATED PUBLICATIONS

- ICAO Annex 6 – Operation of Aircraft, Part 1
- ICAO Doc 9760 – Airworthiness Manual

Copies may be obtained from Document Sales Unit, ICAO, 999 University Street, Montreal, Quebec, Canada H3C 5H7.

7. DEFINITIONS AND ACRONYMS

7.1 The following acronyms are used in this circular

CAAB Civil Aviation Authority of Botswana

ETOPS Extended Range Twin Engine Operations

FAA US Federal Aviation Administration

GAC General Advisory Circular

ICAO International Civil Aviation Organization

MEL Minimum Equipment List

MPD Maintenance Planning Document

MRB Maintenance Review Board

MRBR Maintenance Review Board Report

MSG Maintenance Steering Group

RVSM Reduced Vertical Separation Minima

TCDS Type Certificate Data Sheet

Advisory Circulars (Aces) are intended to provide advice and guidance to illustrate an acceptable means, but not necessarily the only means, of complying with the regulations, or to explain certain regulatory requirements by providing informative, interpretative and explanatory material. Where a regulation contains the words "prescribed by the Authority," the AC may be considered to prescribe a viable method of compliance, but status of that "prescription" is always "guidance" (never regulation).

8. BACKGROUND

8.1 Regulation 70.(1) of the Civil Aviation (Air Operator Certification and Administration) Regulations requires a maintenance program to contain, when applicable, condition monitoring and reliability program descriptions for aircraft systems, components and power plants.

8.2 The purpose of a reliability program is to ensure that the aircraft maintenance program tasks are effective and their intervals are adequate. A 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.

8.3 A reliability program is an integral part of an aircraft maintenance program consisting of:

- Data collection
- Data analysis
- Corrective action
- Performance standards
- Data display and report
- Maintenance program adjustment and process change,
- Program revision.

8.4 A reliability program is an appropriate means of monitoring the effectiveness of a maintenance program.

8.5 A reliability program should be developed in the following cases:

(1) the aircraft maintenance program is based upon MSG-3 logic;

(2) the aircraft maintenance program includes condition-monitored components;

(3) the aircraft maintenance program does not contain overhaul time periods for all significant systems and components, and

(4) when specified by the Manufacturer's maintenance planning document (MPD) or Maintenance Review Board Report (MRBR).

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

(a) the maintenance program is based upon MSG-1 or 2 logic and only contains hard time and on condition items.

(b) the aircraft is not complex and it is below 5 700 kg maximum take-off mass.

(c) the aircraft maintenance program provides overhaul time periods for all significant systems and components.

***Note**: For the purpose of this paragraph, significant system is a system the failure of which could endanger aircraft safety.*

8.7 Notwithstanding paragraphs 8.5 and 8.6 above, an organization/operator may however, develop a reliability monitoring program when it is deemed beneficial from a maintenance planning point of view.

9. SMALL FLEET OPERATIONS

9.1 For the purpose of this paragraph, a small fleet of aircraft is a fleet of less than six (6) aircraft of the same type.

9.2 The requirement for a reliability program is irrespective of the operator's fleet size.

9.3 Complex reliability programs could be inappropriate for a small fleet. It is recommended that such organisations tailor their reliability programs to suit the size and complexity of operation.

9.4 One difficulty with a small fleet of aircraft is the small amount of available data which can be processed. When this amount is too low, calculation of alert value is not possible.

9.5 An organisation operating a small fleet of aircraft should consider the following elements when establishing a reliability program:

(a) The program should focus on areas where a sufficient amount of data is likely to be processed.

(b) When the amount of available data is very limited, there is need for an objective assessment of the program's ability to identify negative trends. In the following examples, careful engineering analysis should be exercised before taking decisions:

- A "0" rate in the statistical calculation may possibly simply reveal that there is no sufficient statistical data;
- When alert values are used, a single event may have the figures reach the alarm level. Discretion is required to distinguish between false and real alarm.
- Small operators may establish contact with other organisations operating the same type of aircraft in order to share statistical data for comparison purposes. Making evaluations of data provided by the manufacturer is also another acceptable means of compliance of sharing operational experience.

9.6 In order to obtain accurate reliability data, it should be recommended to pool data or analysis with one or more other organisation(s). Section 13 of this document specifies under which conditions it is acceptable that organisations share reliability data.

9.7 Notwithstanding the above there are cases where the organisation will be unable to pool data with other organisation, e.g. at the introduction to service of a new type. In that case the CAAB will impose additional restrictions on the MRB/MPD tasks intervals (e.g. no variations or only minor evolution are possible, and with CAAB approval).

10. RELIABILITY DEPARTMENT

10.1 In approving the organization's maintenance and reliability programs, the Authority is expected to ensure that the operator has a fully equipped Reliability Department. The department should be manned by sufficiently qualified personnel with appropriate engineering experience and understanding of reliability program concepts. The reliability program document should define minimum qualification standards for a reliability officer or engineer and the assigned duties and responsibilities.

10.2 Failure to provide appropriately qualified personnel for the implementation of the reliability program will undermine its effective implementation and therefore invalidates the approval.

11. CONTRACTED MAINTENANCE

11.1 If maintenance is sub-contracted, the aircraft maintenance program which includes the associated reliability program should be managed and presented by the operator to the CAAB. It is understood that the organisation may delegate certain functions to a contracted maintenance organisation provided the latter demonstrates capability to run the program. These functions are:

(a) Developing the aircraft maintenance and reliability programs,

(b) Performing the collection and the analysis of the reliability data,

(c) Providing reliability reports, and

(d) Proposing corrective actions to the continuing airworthiness management organization/operator.

11.2 Notwithstanding the above, the decision to implement a corrective action (or the decision to request from the CAAB the approval to implement a corrective action) remains the organisation's prerogative and responsibility. In relation to paragraph 11.1 (d) above, a decision not to implement a corrective action should be justified and documented.

11.3 The arrangement between the organisation and the maintenance organisation should be specified in the maintenance contract and the operator's and maintenance organisation's relevant manuals and procedures.

12. RELIABILITY PROGRAM DEVELOPMENT

12.1 Objectives of the Reliability Program

12.1.1 A statement should be included summarizing the primary objectives of the program. At the minimum it should the following:

(a) Systematic identification of negative and positive trends

(b) establish what corrective action is needed,

(c) Develop a system for maintenance program adjustment and process change, and

(d) Determine the effectiveness of the follow up action.

12.1.2 The extent of the objectives should be directly related to the scope of the program. This could vary from component defect monitoring system for a small organisation, to an integrated maintenance management program for a big organisation. Further guidance is provided in the manufacturer's MPD and other documents such as FAA Advisory Circular 120-17.

12.1.3 The reliability program should provide a monitoring mechanism for all MSG-3 related tasks from the maintenance program to show that they are effective and their intervals are adequate.

12.2 **Identification of Controlled Maintenance Items**

The maintenance items controlled by the program should be stated, e.g. by the ATA chapters. In all cases 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.

12.3 **Terms and Definitions**

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

12.4 **Maintenance Data Sources and Collection**

12.4.1 Sources of maintenance data 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 organisation's manuals.

12.4.2 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 adjustment is necessary. The following are examples of normal data 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.

(j) Reports on technical delays and incidents.

(k) Other sources: ETOPS, RVSM, CAT II/III.

12.4.3 In addition to the normal sources of information, continuing airworthiness and safety information from the manufacturer should also be considered.

12.5 **Display of Information**

12.5.1 Collected information may be displayed graphically or in a tabular format or a combination of both. The rules governing any 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. Where “standards” or “alert values” are included in the program, the display of information should be oriented accordingly.

12.6 **Maintenance Data Analysis and Interpretation**

The method employed for analyzing and interpreting the program information should be explained.

12.6.1 Examination

Methods of examination of information may be varied according to the content and quantity of information of individual programs. These can range from examination of the initial indication of performance variations to formalized detailed procedures at specific periods, and the methods should be fully described in the program documentation.

12.6.2 Analysis and Interpretation

The procedures for analysis and interpretation of information should be such as to enable the performance of the items controlled by the program to be measured; they should also facilitate recognition, diagnosis and recording of significant problems. The whole process should be designed to enable a critical assessment to be made of the effectiveness of the program. Such a process may involve:

(a) Comparisons of operational reliability with established or allocated standards (in the initial period these could be obtained from in-service experience of similar equipment of aircraft types).

(b) Analysis and interpretation of trends.

(c) The evaluation of repetitive defects.

(d) Confidence testing of expected and achieved results.

(e) Studies of life-bands and survival characteristics.

(f) Reliability predictions.

(g) Other methods of assessment.

12.6.3 The range and depth of maintenance data analysis and interpretation should be related to the particular program and to the facilities available. The following elements should be considered:

(a) Operational defects and reductions in operational reliability.

(b) Defects occurring on line and at main base.

(c) Deterioration observed during routine maintenance.

(d) Workshop and overhaul facility findings.

(e) Modification evaluations.

(f) Sampling programs.

(g) Adequacy of maintenance equipment and publications.

(h) Effectiveness of maintenance procedures.

(i) Staff training.

(j) Service bulletins, technical instructions, etc.

12.6.4 Where the organisation relies upon contracted maintenance and/or overhaul facilities as an information input to the program, the arrangements for availability and continuity of such information should be established.

12.7 Corrective Actions

12.7.1 The procedures and time scales both for implementing corrective actions and for monitoring the effectiveness of corrective actions should be fully described. Corrective actions shall correct any reduction in the acceptable level of reliability revealed by the program and could take the form of:

(a) *Maintenance program adjustments and process changes*. These may include alteration of inspection frequency and content, functional checks, overhaul requirements and time limits, which will require amendment of the schedules maintenance periods or tasks in the approved maintenance program. This may include escalation or de-escalation of tasks, addition, modification or deletion of tasks.

(b) Changes to operational procedures or techniques;

(c) Amendments to approved manuals (e.g. maintenance manual, crew manual);

(d) Initiation of modifications;

(e) Special inspections of fleet campaigns;

(f) Spares provisioning;

(g) Staff training; and

(h) Manpower and equipment planning.

Note: *Some of the above corrective actions may need CAAB approval before implementation*

12.7.2 The procedures for effecting changes to the maintenance program should be described, and the associated documentation should include a planned completion date for each corrective action, where applicable.

12.8 Organisational Responsibilities

The organizational structure and the reliability department responsible for the administration of the 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 the CAAB should be stated. This information should be contained in the operator's and maintenance organisation manuals as appropriate.

12.9 Presentation of Information to the CAAB

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

(a) The format and content of routine reports.

(b) The time scales for the production of the reports together with their distribution.

(c) The format and content of reports supporting request for increases in periods between maintenance (escalation) and for the amendments to the approved maintenance program. These reports should contain sufficient detailed information to enable the CAAB to make its own evaluation where necessary.

12.10 **Program Evaluation and Review**

12.10.1 Each Program should describe the procedures and individual responsibilities in respect of continuous monitoring of the effectiveness of the program as a whole. 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, procedures following reliability "standards" or "alert values" being exceeded, etc.).

12.10.2 Each Program should contain procedures for monitoring and, as necessary, revising the reliability "standards" or "alert values". The organisational responsibilities for monitoring and revising the "standards" should be specified together with associated time scales.

12.10.3 Although not exclusive, the following list gives guidance on the criteria to be taken into account 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.

(g) Operational and maintenance procedures.

12.11 **Approval of Maintenance Program amendments**

The CAAB may authorize the organization to implement certain maintenance program changes arising from the reliability program results prior to the formal approval by the CAAB. This may take place when the organisation is satisfied that:

(a) the Reliability Program monitors the effectiveness of the maintenance program in a comprehensive manner, and

(b) the procedures associated with the functioning of the "Reliability Board" provide the assurance that appropriate control is exercised by the Owner/Operator over the internal validation of such changes.

13. POOLING ARRANGEMENTS

13.1 In some cases, in order that sufficient data may be analyzed it may be desirable to "pool" data: i.e. collate data from a number of organisations operating the same type of aircraft. For the analysis to be valid, the aircraft concerned, mode of operation, and maintenance procedures applied must be substantially the same. It should be understood that variations in utilization and operating environment between two organisations may render the systems incompatible. Although not exhaustive the following list gives guidance on the primary factors which need to be taken into account to determine compatibility:

(a) Certification factors, such as: aircraft TCDS compliance (variant) / modification status, including SB compliance.

(b) Operational factors, such as operational environment / utilization, e.g. low/high/seasonal etc. / respective fleet size operating rules applicable (e.g. ETOPS/RVSM/All Weather etc.) / operating procedures / MEL and MEL utilization.

(c) Maintenance factors, such as aircraft age maintenance procedures; maintenance standards applicable; lubrication procedures and program; MPD revision or escalation applied or maintenance program applicable.

13.2 Although it may not be necessary for all of the foregoing to be completely common, it is necessary for an acceptable level of compatibility to be in place in order to effect the pooling arrangement. A decision for a pooling arrangement to take place or not will be taken by the CAAB on a case-by-case basis.

13.3 In case of a short term lease agreement (less than 6 months) more flexibility when applying paragraph 13.1 above may be exercised by the CAAB, so as to allow the owner/operator to operate the aircraft under the same program during the lease agreement effectively.

13.4 Changes by any one organisation to the above, requires assessment in order that the pooling benefits can be maintained. Where an organisation wishes to pool data in this way, CAAB approval should be sought prior to any formal agreement being signed between organizations.

13.5 Whereas this paragraph [6] is intended to address the pooling of data directly between organisations, it is acceptable that the organisation participates in a reliability program managed by the aircraft manufacturer, when the CAAB is satisfied that the manufacturer manages a reliability program which complies with the intent of this paragraph.

For/**Civil Aviation Authority of Botswana**

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