



**GUERNSEY
ADVISORY
CIRCULARS**
(GACs)



GAC 39-2

**Aircraft Maintenance
Programmes &
Reliability
Programmes**

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First Issue

January 2020

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1 – Purpose

This GAC provides information regarding the process for the issue, renewal and amendment of Aircraft Maintenance Programmes (AMP) including Reliability Programmes according to GAR 39 Subpart C.

2 – Related laws and regulations

This GAC relates to:

- The Air Navigation (Bailiwick of Guernsey) Law, 2012 (ANL), Chapter II.
- Guernsey Aviation Requirements Part 39.

3 – Definitions

Definitions, in the context of this GAC, will have the meanings listed in GAR Part 1 (Definitions, Abbreviations and Units of Measurement) unless otherwise stated.

4 – Introduction

The objective of this document is to provide guidance for the development and submission for approval of an aircraft maintenance programme (AMP) including Reliability Programmes, if applicable, to the Guernsey Director of Civil Aviation. An approved Aircraft Maintenance Programme (AMP) is the source of all scheduled inspections, relevant controls and supporting data. The AMP should always be active (subject to review and amendment) and utilised which enables effective maintenance to be carried out in a logical, concise, clear and controllable manner.

Some of the subject material in this document may not be 'applicable' to a particular aircraft or fleet. This can only be confirmed by carrying out a detailed assessment as the aircraft or fleet may be affected by subsections of a larger section. Caution should be exercised before assuming that a subject or a subpart of this guidance is considered 'not applicable'.

5 – Principles

There are two approval methods for aircraft maintenance programmes available. Direct approval by the Director and indirect approval by the Director via an appropriately approved CAMO. A "self-declared" maintenance programme, approved by the aircraft owner, is not possible within the GAR Part 39.

1. Direct approval procedure:

This requires the applicant to apply for the approval of an aircraft maintenance programme with the Director of Civil Aviation/ 2-REG directly by providing the AMP and source documents to 2-REG for review full review. If approved, the applicant will receive an AMP approval certificate from the Director/ 2-REG.

2. Indirect approval procedure:

When the continuing airworthiness of the aircraft is managed by a continuing airworthiness management organisation (CAMO) approved in accordance with Subpart G of GAR Part 39 or when there is a limited contract between the owner and this organisation, the aircraft maintenance programme and its amendments may be approved through an indirect approval procedure of the CAMO. Provided that the indirect approval procedure is approved by the Director. Once approved, the applicant will receive an AMP approval certificate from the CAMO via their approved procedure. The CAMO will inform the Director/ 2-REG of the approval.

6 – AMP direct approval application

The applicant should review this guidance material, complete the application form and submit it together with the following to 2-REG:

1. The AMP document, this can either be the 2-REG template or a CAMO template.
2. All source documents for the AMP (e.g. TC-holder/ STC-holder Instructions for Continuing Airworthiness, Modification and Repair data)
3. If applicable, payment of the appropriate application fee.

The maintenance programme needs to be submitted in electronic format.

The aircraft maintenance programme should always contain a unique document reference number, issue number and date and revision number and date.

The maintenance programme shall be produced in the English language in a format that is readily understandable to maintenance personnel.

7 – AMP indirect approval procedures

7.1 Baseline AMP and changes

When properly approved by the Director/ 2-REG according to GAR Part 39 a CAMO may indirectly approve maintenance programmes. The procedures for this are contained in the 2-REG supplement.

The initial or changed maintenance programme within the baseline approved AMP can be indirectly approved by the CAMO. Major changes to this must always be approved by the Guernsey Director of Civil Aviation/ 2-REG via the direct approval procedure.

Definition of Major AMP Changes:

AMP changes considered major:

- Deviation of intervals for safety related tasks that are larger than recommended by the design holders. E.g. CMRs, ALLs, MRBR FEC 5, 8 and 9 tasks.
- Deviation of intervals for non-safety related tasks that are larger than recommended by the design holders, except for optional maintenance tasks.
- Deviation from AD compliance intervals (or AMOC's).
- Deviations from other significant continuing airworthiness tasks such as but not limited to:
 - o Supplemental Structural Inspection Document;
 - o Fuel Tank Safety Inspections;
 - o Ageing Aircraft;
 - o Widespread Fatigue Damage;
 - o Electrical Wiring Interconnection Systems (EWIS).

Definition of Minor AMP Changes:

- Not being a major change.

7.2 Notification

The CAMO shall notify the Guernsey DCA/ 2-REG that an aircraft maintenance programme specific for a customer has been created or changed and has been indirectly approved. Such notification shall take place as soon as possible and no later than 7 days after the issuance of such indirect approval.

The maintenance programme indirectly approved needs to be submitted in electronic format including the approval document.

The aircraft maintenance programme should always contain a unique document reference number, issue number and date and revision number and date.

The Maintenance Programme shall be produced in the English language in a format that is readily understandable to maintenance personnel.

8 – AMP basis and customization

8.1 AMP basis

The maintenance programme is usually based upon the Maintenance Review Board Report (MRBR) and Airworthiness Limitations Section (ALI) and/ or the Type Certificate holder's Maintenance Planning Document (MPD) for large aircraft. For small non-MRB aircraft this is usually Chapter 4 and 5 of the maintenance manual (AMM).

8.2 Evaluation of effectiveness

It is expected that each operator will according to its own operating context, validate the effectiveness and applicability of each task and interval through a continuing cycle of surveillance, investigation, data collection, analysis, corrective action, and corrective action monitoring. Consistent with this continuing cycle, it is expected that those adjustments, necessary to ensure maximum task effectiveness, as well as optimum task intervals, are made. The AMP must be customized to the aircraft or fleet operation.

Mandatory maintenance tasks such as Airworthiness Limitations, Certification Maintenance Requirements and tasks resulting from Airworthiness Directives cannot be changed without prior approval from the Director.

8.3 Aircraft Fleet

It is acceptable to maintain more than one aircraft to the same Maintenance Programme. As long as per tasks the applicability for each aircraft is clearly distinguishable.

9 – Regular and annual reviews

The maintenance programme should be reviewed annually. All supporting documents that have been referenced in the maintenance programme should be considered during the annual review.

For aircraft subject to reliability analysis, the maintenance programme review should be conducted at intervals commensurate with the reliability programme.

It is the responsibility of the maintenance approval holder (MPAH) to ensure that instructions for continued airworthiness with regard to mandatory and non-mandatory requirements, incorporated design changes (modifications and repairs) and any requirements deemed necessary by the Director are evaluated for applicability. Once evaluated, suitable amendments to the maintenance programme must be developed and approved.

Regular and annual reviews of the maintenance programme shall as a minimum include the following items:

- (1) Applicable Mandatory Airworthiness Directives
- (2) Applicable evaluations of reliability analysis
- (3) Operational issues
- (4) Maintenance findings
- (5) Type Certificate holder's recommendations
- (6) Revisions to the MRB and ALI reports
- (7) Revisions the MPD
- (8) Revisions to Chapter 4 and 5 Maintenance Manual
- (9) Applicable Supplemental Type Certificate Holders' revisions to instructions for continued airworthiness
- (10) Aircraft utilisation (hours/cycles etc)
- (11) Changes to aircraft operational utilisation (Type of operation and climatic conditions)
- (12) Review of aircraft and equipment life
- (13) If applicable, a review of the Corrosion Prevention Control Programme (CPCP) tasks and findings.

For aircraft types where the maintenance programme was not derived using the maintenance review board process, condition monitoring and reliability

programmes may not apply. In such cases, pilot reports (PIREPS), component removal, Times Between Overhauls, Minimum Equipment List usage, defect worksheets, Mandatory Occurrence Reports, Air Safety Reports, should be reviewed for trends or patterns.

The maintenance approval holder (MPAH) should maintain records of all applicable continued airworthiness information. Following a review of this information, records should be maintained of technical justification supporting the amendment decisions for both inclusion and non-inclusion in the maintenance programme.

10 – Human performance factors & critical task controls

Consideration should be given to human factors and critical tasks within the maintenance programme such as:

(1) Maintenance Planning:

Data required to effectively produce maintenance inputs including the arrangement of inspections in a manner that avoids conflict of inspection/maintenance activities, typically known as task orientation.

(2) Mandatory Inspection Tasks:

Ensuring maintenance planning personnel have clear visibility of such tasks preventing any unauthorised escalation.

(3) Required Reporting:

Tasks associated with reporting such as the Aging Aircraft Programme Supplemental Structural Inspection Document (SSID) are readily identified.

(4) Critical Task Controls:

Ensuring tasks that are critical in nature are planned and allocated in a segregated manner that prevents the possibility of multiple error maintenance.

(5) Maintenance Resource Planning:

Tasks requiring specialised tooling and or techniques are readily identified with reference to required resources.

11 – Aircraft annual utilization

The MRBR and MPD or Maintenance Manual usually specify a certain utilization for which the MRBR/ MPD is valid. Outside the specified utilization the TC-holder shall be contacted.

If actual utilization differs from anticipated utilization more than 25%, then it will need to be taken into account during the annual review of the aircraft maintenance programme.

A “Low Utilization Programme” is to be used in order to allow operation with an aircraft utilization below the range stated in the MRBR/ MPD.

12 – Aircraft Weighing

Aircraft weighing intervals prescribed are depending on the aircraft operating rules and described in Subpart D of GAR Part 91, 125, 135 and 121.

For GAR Part 91 and 125 operations (General Aviation) the operator shall ensure that the mass and, the CG of the aircraft have been established by actual weighing prior to the initial entry into service of the aircraft. The accumulated effects of modifications and repairs on the mass and balance shall be accounted for and properly documented. Such information shall be made available to the pilot-in-command. The aircraft shall be reweighed if the effect of modifications on the mass and balance is not accurately known.

For GAR Part 135 and 121 operations (Commercial Air Transport) the operator shall establish the mass and the CG of any aircraft by actual weighing prior to initial entry into service and thereafter at intervals of four years if individual aircraft masses are used, or nine years if fleet masses are used. The accumulated effects of modifications and repairs on the mass and balance shall be accounted for and properly documented. Aircraft shall be reweighed if the effect of modifications on the mass and balance is not accurately known.

Detailed guidance on aircraft weighing and fleet mass (weight and balance control system) is available in Regulation (EU) No 965/2012 AMC CAT.POL.MAB.100(b) and FAA Advisory Circular No: 120-27.

13 – Aircraft Parking, Storage and Return to Service

An aircraft which has been taken out of operation and is parked or stored the parking/ storage procedures described in AMM shall be followed.

Other maintenance tasks which become due during the parking/ storage period, may be postponed until the end of the parking period.

Before the aircraft is returned to service, all postponed maintenance tasks defined in the Aircraft Maintenance Programme, all component changes, AD's, etc. and rectification or deferred complaints/open items overdue must be performed.

14 – Variations applied to maintenance task intervals

Variations may be made to certain maintenance task intervals, within the limits of the TC allowable variations.

The decision to vary any of the prescribed periods shall be taken by the MPAH. Particulars of these variations granted shall be entered into the appropriate technical records.

Variations shall not be used routinely to extend maintenance periods and shall be used exclusively for exceptional circumstances.

Variations shall not be applied to:

- a) Airworthiness Limitations and Certification Maintenance Requirements;
- b) Life limits;
- c) Airworthiness Directives;
- d) Tasks which have been classified as mandatory by the TC/ STC Holder.

15 – Escalations of maintenance task intervals

Opposed to variations, escalations are permanent increases to tasks intervals. As service experience is accumulated, task intervals (thresholds/ repeats) may be adjusted to reflect the results of actual in-service data.

MRBR task interval optimization is based on principles that reflect the criticality of airplane systems, components, identified during MSG-3 analysis. Failure Effect Categories should be accounted for during the analysis. Care should be taken regarding escalation of tasks with a MRB Failure Effect Category of 5 and 8.

The escalation of maintenance tasks must be substantiated and justified and approved by the Director.

16 – Airworthiness Limitations and Certification Maintenance

Requirements

The AWL's/ CMR's tasks must be clearly distinguishable from the other tasks in the maintenance programme. Ensuring maintenance planning personnel have clear visibility of such tasks preventing any unauthorised escalation.

AWL's:

The AWL's result from certification activities. These State of Design approved Airworthiness Limitations documents are cross-referenced in the Type Certificate Data Sheet. These maintenance actions are mandatory. The Airworthiness Limitations document is State of Design approved and specifies mandatory maintenance actions.

The Airworthiness Limitations may only be revised with the approval of the State of design. If the inspections cannot be accomplished due to repairs and/ or modifications, an alternate inspection approved by the State of Design must be used.

CMR's:

These maintenance actions are mandatory. These scheduled maintenance tasks may only be revised by the State of Design (One Star CMR's) or State of Registry (Two Star CMR's).

Categories of CMRs:

- ❖ One Star CMR's are those tasks associated with items critical to safety of flight; these "critical" systems must have an expected probability of failure within the "extremely improbable" range.
- ❖ The second category of CMRs, Two Star CMR's, are those tasks associated with items essential to safety of flight; these "essential" systems must have an expected probability of failure within the "improbable" range.

17 – Environmental

17.1 Fuel systems

Fuel systems are susceptible to microbiological growth in hot humid conditions and increased water content when the aircraft sits on the ground in hot humid climates. Fuel system water sampling tasks and fuel tank structural inspection may need to take into account the likelihood of microbiological contamination and corrosion.

17.2 Monitoring

Consideration should be given to routinely monitoring aircraft utilisation and adverse weather conditions (i.e. salt laden atmosphere, high humidity, extreme heat etc). Consideration should include increasing maintenance inputs for cleaning, lubrication and inspection of protective finishes as an example.

17.3 Rough surfaces

There should be mitigations for the effects of operating aircraft on runways that have been categorised as rough surfaces. Type Certificate Holders and any applicable STC holders and APU ETSO/ TSO holder's instructions for continued airworthiness such as service letters and maintenance requirements should be appropriately incorporated into the maintenance programme. Typical mitigations are increased lubrication frequencies of undercarriage components and fittings due to the possibility of increase in lubrication migration from bearing surfaces. Where published data is not available, guidance should be sought from the Type Certificate Holders and any applicable STC holders and APU ETSO/ TSO holders.

18 – Corrosion of aircraft structure

Corrosion Prevention Control programmes (CPCP) require specific controls, procedures and reporting protocols. The maintenance programme should provide details of specific requirements including clear instructions regarding the inspection tasks in order that production maintenance planning is able to resource the tasks appropriately.

Where the Type Certificate Holders and any applicable STC holders and APU ETSO/TSO holders make no specific reference to corrosion control programmes, this should be taken into account when inspecting structure for condition. The assessment may require adjustment of maintenance programme periods. The application of corrosion inhibitors during maintenance may significantly improve the duration of the airframe. Note, any MRBR/ MPD derived from MSG-3 revision

2 or above will not make any reference to CPCP since the tasks are already considered in the structures and zonal programmes.

19 – Design changes

19.1 Approved modifications and repairs

Approved modifications or repairs incorporated on an aircraft may also have “Instructions for Continued Airworthiness”. These should be assessed and included in the maintenance programme.

19.2 Significant structural changes

Significant structural changes may have an effect on structural programmes that may not have been finalised at the time of incorporation. This may be due to a fatigue damage assessment that only affects the fatigue lives from a total cycle/hour amount not yet achieved. In such circumstances it is important to ensure there is a marker in the maintenance programme. This is to ensure that nearer the operation life when the fatigue effects take hold, material required to amend the structural programme is obtained from the Supplemental Type Certificate holder.

20 – Special operational approvals

Special operational approvals granted by the Director such as LVO, RVSM, NAT-HLA, PBN, EDTO and/ or EFB may involve changes to maintenance inspection requirements, frequencies, or tasks introduced by modification to the aircraft. In order to satisfy the approval process of special operations, the inspection tasks supporting the aircraft capability should be referenced.

21 – Safety equipment

Where the aircraft is required to carry safety equipment this should be checked for serviceability at regular intervals. The equipment manufacturer should specify overhaul and life limit periods.

The maintenance programme can make provision for fleet sampling of emergency equipment such as slide rafts. When sufficient operating aircraft allow for a fleet sampling programme, Director approval should be established for its introduction in line with information promulgated by the safety equipment manufacturer.

22 – CVR/ FDR

For each installed CVR/ FDR, arrangements for data acquisition and verification of recorded data should be established with a recognised playback facility. The type acceptance standards should be applied with regard to periods of testing and recorded data verification for each installed CVR/ FDR. Records should be maintained for a minimum period of 24 months for all testing undertaken. Instructions from equipment manufacturers and continued airworthiness organisations shall be integrated as scheduled requirements of the maintenance programme.

23 – Reliability Programmes

23.1 Applicability

A reliability programme should feature in a maintenance programme under the following circumstances:

- (1) The aircraft maintenance programme is based upon MSG-3 logic.
- (2) The aircraft maintenance programme includes condition monitored components.
- (3) The aircraft maintenance programme does not contain overhaul time periods for all significant system components.
- (4) When specified by the manufacturer's maintenance planning document or MRBR.

A reliability programme need **not** be developed in the following cases:

- (1) The maintenance programme is based upon the MSG-1 or MSG-2 logic but only contains hard time or on condition items.
- (2) The aircraft is not above 5,700kg MTOM or is not a multi-engine helicopter.
- (3) The aircraft maintenance programme provides overhaul time periods for all significant system components.

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

23.2 Approval

For approval the Director will require access to all data used to prepare the reliability programme as submitted.

23.3 Contents

The objective of the reliability programme should be included in the maintenance programme detailing the prime elements of the programme. As a minimum it should include a statement to:

- (1) Substantiate that the existing schedule of inspections is appropriate in maintaining the aircraft in an airworthy condition.
- (2) Identify corrective action to any issues of reliability.
- (3) Establish that system reliability conforms to applicable performance data promulgated by the aircraft Type Certificate Holder.
- (4) Determine the optimum level of scheduled inspections.
- (5) Determine the effectiveness of any amendment to the schedule of inspections.

The extent of the objectives should be directly related to the scope of the programme. Its scope could vary from a component defect monitoring system for a small operator, to an integrated maintenance management programme for a large commercial operator. The Type Certificate Holders maintenance planning documents may give guidance on the objectives and should be consulted in every case.

The elements of an operator's reliability program are typically:

1. A data collection system,
2. A performance standards system,
3. Analysis and recommendation,
4. Internal approval and implementation, and
5. A reporting and display format.

23.4 Information collected

The type of information collected for analysis should be related to the objectives of the programme 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:

- (1) Pilots' Reports
- (2) Technical Log
- (3) Aircraft Maintenance Access Terminal/ On-board Maintenance System readouts
- (4) Maintenance Worksheets

- (5) Workshop Reports
- (6) Reports on Functional Checks
- (7) Reports on Special Inspections
- (8) Stores Issues/ Reports
- (9) Air Safety Reports
- (10) Reports on Technical Delays and Incidents

23.5 Procedures

Information and data 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 referred to. These procedures should reside with the organisation responsible for the continued airworthiness management of the aircraft and be reflected in their Maintenance Control Manual (MCM).

23.6 Sampling small fleet sizes

Reliability programmes are dependent on sufficient data sampling. Fleet size is clearly a factor in data gathering. For small fleet sizes of fewer than 6 aircraft of the same type, the following should be considered:

- (1) Complex reliability programmes could be inappropriate for a small fleet. It is recommended that such operators tailor their reliability programmes to suit the size and complexity of operation.
- (2) One difficulty with a small fleet of aircraft consists in the amount of available data that can be processed: when this amount is too low, the calculation of alert level is very coarse. Therefore "alert levels" should be used carefully.
- (3) An operator of a small fleet of aircraft, when establishing a reliability programme, should consider the following:
 - (a) The programme 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, engineering judgement is a vital element. In the following examples, careful engineering analysis should be exercised before taking decisions.
 - (c) A "0" rate in the statistical calculation may possibly simply reveal that statistical data is missing, rather than no potential problem.

23.7 Techniques for Determining Deviation from Performance Standards for operators

Performance Standards are the operational goals or standards developed by an operator to define an acceptable level of operational reliability. A performance standard may be defined within various areas of the operator's AMP or business objectives as it relates to fleet performance.

An operator may elect to use one or a combination of the techniques listed in the table below, Techniques for Determining Deviation From Performance Standards, or any another acceptable method that identifies when the operator defined acceptable performance level is not achieved. Regardless of the method an air carrier chooses, it should be proactive and should be capable of identifying emerging and current operational problems that the carrier may need to correct. The method chosen should not be so liberal that abnormal deviations from an acceptable standard would not be identified as a problem or as an underlying deficiency. Nor should the method be so conservative that it would result in excessive data "noise" from which too many deviations from the standard are identified. An effective method will result in relevant and meaningful data from which potential, emerging, and real-time deficiencies can be identified, analysed, and addressed.

Detailed guidance on Reliability Programmes for Commercial Air Transport operations is available in FAA Advisory Circular No: 120-17B.

Technique	Method	Inputs Required for Analysis	Action Driver	Reliability
Alert-Based	Identifies deviations from a defined standard based on previous performance. The alert level is set so an alert is triggered by an increase in failure rate or scheduled findings to a degree beyond normal variation.	Statistical characterization of historical failure rates or scheduled maintenance findings is required to determine the appropriate alert threshold for the system under consideration.	Investigation required when the performance falls outside normal variation.	Identification of data type(s); definition of the method used to calculate the alert level.
Trend Monitoring	Graph or table that tracks current performance to identify out-of-limit conditions or trends of deterioration.	Understanding of the measurement units that have a relationship to system failures (e.g., hours vs. cycles). Aircraft system data is typically supplemented by data from component removals and confirmed failures.	Investigation required when a metric falls outside performance limits or is predicted to do so in the near term based on the current trend.	Identification of data types; timeframes selected for monitoring performance (for example, monthly, quarterly, or yearly averages). Definition of units of measurement and demonstration so they are appropriate to the type and frequency of events being recorded.

Technique	Method	Inputs Required for Analysis	Action Driver	Reliability Program Requirement
Event-Based	An event-based program monitors and develops recommendations in response to specific operational events.	The number and range of inputs must be sufficient to allow data analysis that results in meaningful conclusions. Much of the information that is compiled to assist in the day-to-day operation of the operator's maintenance program may be effectively used as a basis for this type of continuous mechanical performance analysis.	Investigation of: the lowest performing items, AND any item with a significant change in performance rank, AND events of significant operational or safety consequences.	Identification of data types; definition of performance level and rate of change that would drive investigation.
Index-Based	Multiple data types combined to produce an index ranking of performance (e.g., pilot reports, delays/cancellations, or routine task findings).	Knowledge of the parameters and their interactions that can be used to indicate operational reliability drivers.	Investigation of the lowest performing items, AND of any item with a significant change in performance index trend.	Identification of data types; definition of the index calculation method; definition of performance level and rate of change that would drive investigation; individual data types may be weighted to reflect operator's performance goals and philosophy.

END