



**DRAFT**

# Advisory Circular

**AC 42-3(0)**

**AUGUST 2012**

## RELIABILITY PROGRAMS

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### 1. REFERENCES

- |   |   |
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| 1 | • The Civil Aviation Act 1988   |
| 2 | • Part 42 of the Civil Aviation Safety Regulations 1998                           |
| 2 | • Part 42 Manual of Standards   |
| 2 | • Part 145 of the Civil Aviation Safety Regulations 1998                          |
| 3 | • Regulations 42L, 42M, 132, 174B and 175A of the Civil Aviation Regulations 1988 |
| 3 | • Civil Aviation Order 82.0   |

*Advisory Circulars are intended to provide advice and guidance to illustrate a 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 an AC is referred to in a 'Note' below the regulation, the AC remains as guidance material.*

*ACs should always be read in conjunction with the referenced regulations.*

*This AC has been approved for release by the Executive Manager Standards Division.*

## 2. PURPOSE

**2.1** This Advisory Circular (AC) provides guidance on the practical application of the regulations pertaining to reliability programs and provides examples of processes suitable for organisations operating under Part 42 of the *Civil Aviation Safety Regulations 1998* (CASR 1998).

**2.2** This AC is intended to be read in conjunction with Part 42 of CASR 1998 and its Manual of Standards (MOS) and the associated Acceptable Means of Compliance/Guidance Material document.

**2.3** In addition to providing a way to comply with the Part 42 of CASR 1998 reliability program specifications, this AC describes the way in which the specifications for any reliability program required by or under regulations 42L, 42M and 132 of the *Civil Aviation Regulations 1988* (CAR 1988) can be achieved.

## 3. STATUS OF THIS ADVISORY CIRCULAR

**3.1** This is the first AC to be issued on this subject and supersedes previous Civil Aviation Safety Authority (CASA) guidance provided by Civil Aviation Advisory Publication 42M-2.

## 4. ACRONYMS

<b>AC</b>	Advisory Circular
<b>AMO</b>	Approved Maintenance Organisation
<b>ASETPA</b>	Approved Single Engine Turbine Powered Aeroplanes
<b>ATA</b>	Air Transport Association of America
<b>CAR</b>	Civil Aviation Regulations 1988
<b>CASA</b>	Civil Aviation Safety Authority
<b>CAMO</b>	Continuing Airworthiness Management Organisation
<b>CASR</b>	Civil Aviation Safety Regulations 1998
<b>IFSD</b>	In-Flight Shut Down
<b>MCM</b>	Maintenance Control Manual
<b>MEL</b>	Minimum Equipment List
<b>MOS</b>	Manual of Standards
<b>MPD</b>	Maintenance Planning Data
<b>MSG</b>	Maintenance Steering Group
<b>SB</b>	Service Bulletin
<b>SDR</b>	Service Difficulty Reporting

## 5. BACKGROUND

**5.1** This AC provides information and guidance material that can be used to design, develop and manage reliability programs. The practices described are acceptable to CASA in regard to maintenance program management that incorporate reliability methods.

**5.2** The overall maintenance program development process has two distinct processes within it. The initial maintenance program development (baseline) is the actual preparation of the aircraft maintenance specifications. The reliability analysis collects data associated with the aircraft operating on the maintenance program.

**5.3** The results of the analysis can measure the effectiveness of those maintenance tasks by providing alerts about the systems, components and structures whose performance measures deviates from their expected levels.

**5.4** A reliability program can be expected to enhance safety of flight operation and optimise maintenance costs. The two basic functions of a reliability program are to provide:

- a summary of aircraft fleet reliability and thus reflect the effectiveness of the way in which maintenance is being done (by means of the statistical reliability element); and
- significant and timely technical information by which improvement of reliability may be achieved through changes to the program or to the practices for implementing it.

**5.5** Actions resulting from a reliability program may be to escalate or de-escalate, delete or add maintenance tasks, as necessary. An amendment to the reliability program will require approval by CASA.

## **6. WHO IS REQUIRED TO HAVE A RELIABILITY PROGRAM?**

**6.1** Part 42 of CASR 1998 requires the person responsible for continuing airworthiness for a large aircraft to ensure that there is an approved reliability program for the aircraft before the aircraft is operated. More generally under CAR 1988 and CASR 1998, all operators of transport category aircraft engaged in commercial operations are required, as part of the system of maintenance (generally known as maintenance program) for those aircraft, to have in place a reliability program; where the aircraft's maintenance program:

- was developed using the specification, known as 'ATA MSG-3', published by the Air Transport Association (ATA) of America;
- requires condition monitoring of an aeronautical product or a system of the aircraft;
- is subject to an Extended Diversion Time Operation (EDTO) approval issued under Civil Aviation Order 82.0; or
- is required by the instructions for continuing airworthiness for the aircraft to use a reliability program for the aircraft.

**6.2** Before CASA provides an Approved Single Engine Turbine Powered Aeroplanes (ASETPA) approval for the purpose of regulations 174B or 175A of the CAR 1988, CASA confirms that an associated reliability program will cover the aircraft engine, propeller and equipment required to conduct an ASETPA operation.

## **7. PERSONNEL QUALIFICATION**

**7.1** In approving the operators maintenance and reliability program, CASA expects that the organisation which runs the program (it may be the operator, operators continuing airworthiness management organisation (CAMO), or an approved maintenance organisation (AMO) under contract) hires sufficiently qualified personnel with appropriate engineering experience and understanding of reliability concepts. Trained and experienced personnel enable the interpretation of the data analysis to be made correctly.

**7.2** Failure to provide appropriately qualified personnel for the reliability program may lead CASA to reject the approval of the reliability program and therefore the aircraft maintenance program.

## **8. RELIABILITY PROGRAM DOCUMENT**

**8.1** The operator should develop a document describing the reliability program including at least the following:

- A general description of the reliability program.
- Application of the program by aircraft fleet type/model, aircraft registration marks, or serial numbers, as appropriate.

- The organisational structure, duties and responsibilities.
- Procedures for establishing and reviewing performance standards.
- Data collection system.
- Methods of data analysis.
- Data display and reporting.
- Corrective action program.
- Definitions of significant terms used in the reliability program.
- A copy and explanation of all forms, peculiar to the program.
- A reliability program revision control and approval of revisions to the document (e.g. List of Effective Pages, Table of Contents, etc.).

## **9. REPORTS TO CASA**

**9.1** When approving a reliability program CASA will require that the program includes procedures for providing reliability reports to CASA (to the CASA field office responsible for the relevant operator). The periodicity for report submission would normally be on a quarterly basis but other arrangements may be agreed eg a period that matches MSG3 reporting requirements back to Type Certificate holder would be suitable.

**9.2** The report is required to be indicative of the fleet's reliability and overall effectiveness of the aircraft's maintenance program. Reporting content detail can be seen within Appendix 2.

## **10. APPENDICES**

**10.1** The various elements of a reliability program can be seen within Appendix 1 of this AC.

**10.2** Considerations for reliability program design can be seen within Appendix 2 of this AC.

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Executive Manager  
Standards Division

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**APPENDIX 1****COPY OF CHAPTER 3 OF THE PART 42 MOS REQUIREMENTS FOR APPROVED RELIABILITY PROGRAM****General requirements**

The reliability program must:

- (a) be in writing; and
- (b) define the meaning of any unique terms or acronyms used in the program; and
- (c) contain the records of approval of:
  - (i) the program; and
  - (ii) any subsequent variations to the program.

*Note* Common terms used throughout the industry need not be defined as long as the same meaning is intended.

**Identification and applicability of the program**

The reliability program must contain the following information:

- (a) the type, model, serial number and registration mark of the aircraft controlled by the program;
- (b) the name and address of the registered operator of the aircraft controlled by the program;
- (c) the name and approval certificate reference number of the CAMO responsible for the program.

**Objective of the program**

1. The objective of the reliability program must be described in the program.
2. The applicable instructions for continuing airworthiness must be followed to establish the objective of the program.
3. As a minimum, the reliability program must provide a means of ensuring maintenance program tasks are effective and their periodicity is adequate for continuing airworthiness of the aircraft.

**Identification of items controlled by the program**

1. The aircraft parts, systems and structural elements controlled by the reliability program must be clearly defined and identified in the program.
2. The maintenance program tasks controlled by the program must be clearly identified in the program.
3. Where some items, such as aircraft structure, engines, and auxiliary power units, are controlled by a separate program, such as a manufacturer structural sampling or life development program, this must be referenced in the program.

**Administration of the program**

The individuals responsible for the administration of the reliability program must be identified and their responsibility must be described in the program.

## Data collection

1. A description of the data collection system for the items controlled by the reliability program must be included in the program. Such a description must include the following:
  - (a) identification of sources of data;
  - (b) procedures for transmission and receiving of data from each source;
  - (c) steps of data development from source to analysis;
  - (d) organisational responsibilities for each step of data development.
2. The data collected must be:
  - (a) obtained from items functioning under operational conditions; and
  - (b) accurate and factual to support a high degree of confidence in any derived conclusion; and
  - (c) directly related to the established levels of performance.
3. Examples of sources of data include the following:
  - (a) pilot reports;
  - (b) unscheduled removals;
  - (c) confirmed failures;
  - (d) sampling inspections;
  - (e) workshop findings;
  - (f) functional checks;
  - (g) bench checks.

*Note* All of the above sources may not necessarily be covered in each and every program. The scope and objective of the program, and items controlled by the program, will dictate the nature and source of data.

## Performance standards

1. The reliability program must include a performance standard expressed in mathematical terms for each item covered by the program that defines the acceptable level of reliability for the item. The following are some of the commonly used performance standards:
  - (a) premature removal rates for an item;
  - (b) confirmed failure rates for an item;
  - (c) in-flight shutdown rates for engine;
  - (d) flight delays or cancellation rates due to defect in, or failure of, an item;
  - (e) internal leakage rates for an item.
2. Upper and lower limits may be used to express performance standards. This represents a reliability band or range by which the reliability is interpreted.
3. The program must describe the methods and data to be used for establishment of the performance standard.
4. The performance standard must be responsive and sensitive to the level of reliability experienced. It must not be so high that even abnormal variations would not cause an alert, or so low that it is constantly exceeded in spite of corrective action measures.
5. The performance standards must be based on the operator's own operating experience with the exceptions mentioned in subsection 3.8.6. The period of experience will be dependent on fleet size and utilisation.

6. If the operator's operating experience of an aircraft type or model is non-existent or limited, performance standards may be based on 1 or more of the following as applicable:
  - (a) the experience of other operators of the same or a similar aircraft type or model;
  - (b) the operator's own experience of a similar aircraft type or model;
  - (c) the performance of a similar product or system on another aircraft type or model;
  - (d) the expected in-service reliability values used in the design of the aircraft.

*Note* For paragraph (d), the values are normally quoted in terms of mean time between unscheduled removals or mean time between failure, for both individual product and complete systems.
7. The program must contain procedures for monitoring and reviewing performance standards at regular intervals to reflect the operating experience, product improvement and changes in procedures.
8. The program must provide for the review of the performance standards set in accordance with subsection 3.8.6, after the operator has gained sufficient operating experience.

### **Display of information**

1. The reliability program must provide for a format of display that allows easy identification of trends, events and when performance standards are exceeded.
2. The display may be in graphical or in a tabular format or a combination of both.
3. The rules governing any separation or discarding of information before incorporation into the display must be stated in the program.
4. The display of information must include provision for "nil returns" to aid the examination of the total information.

### **Analysis and interpretation of information**

1. The reliability program must provide for the regular analysis and interpretation of information generated by the program.
2. The method employed for analysing and interpreting the information must be explained in the program.
3. The methods used must:
  - (a) enable the performance of the items controlled by the program to be measured; and
  - (b) facilitate recognition, diagnosis and recording of significant problems.

### **Investigation and corrective action**

1. The program must provide for an active investigation and, if applicable, implementation of corrective action when a performance standard is exceeded.
2. If upper and lower limits are used to express performance standards, the follow up requirements for each limit must be fully described in the program.
3. The procedures for implementing corrective actions and for monitoring the effectiveness of the corrective actions must be described in the program.
4. The procedures must include provision of periodic feedback to the individual responsible for taking the corrective action until such time as performance has reached an acceptable level.
5. Corrective actions must correct any reduction in reliability revealed by the program and may take the form of 1 or more of the following:
  - (a) changes to maintenance, operational procedures or techniques;
  - (b) changes to maintenance program tasks, including escalation or de-escalation of tasks, addition, modification or deletion of tasks;
  - (c) one-time special maintenance for the fleet;

- (d) initiation of modifications to aircraft and aeronautical products;
  - (e) changes to provisioning of spare parts for maintenance;
  - (f) changes to manpower and equipment planning for maintenance;
  - (g) training of maintenance personnel.
6. Where applicable, each corrective action must include a planned completion date.

### **Evaluation and review of the program**

1. The reliability program must provide for continuous monitoring of the effectiveness of the program as a whole and identify each individual who is responsible for this monitoring.
2. The program must contain procedures for implementing changes to the program and identify the individual responsible for proposing and preparing the changes.

*Note* There may be more than 1 responsible individual.

### **Pooling of data**

1. For a reliability program for a small fleet of aircraft, it is permitted to “pool” data, that is, to collate data from a number of operators of the same type of aircraft.
2. For this section, a small fleet of aircraft is a fleet of less than 6 aircraft of the same type.
3. For the analysis to be valid, the following things for the aircraft from which data is pooled must be substantially the same:
  - (a) aircraft configuration;
  - (b) aircraft age and utilisation rate;
  - (c) type of operation and operating environment;
  - (d) maintenance program and maintenance procedures.
4. The program must describe the pooling arrangement and the types and extent of data to be pooled.

## APPENDIX 2

### CONSIDERATIONS WHEN DESIGNING A RELIABILITY PROGRAM

#### General requirements

1. A reliability program, in practical terms, should ensure the continuous monitoring, recording and analysing of the functioning and condition of aircraft components and systems. The results are then measured or compared against established normal behaviour levels so that the need for corrective action may be assessed and, where necessary, taken.
2. A good reliability program should contain means for ensuring that the reliability which is forecast can actually be achieved. A program, which is only general, may lack the details necessary to satisfy the reliability requirement. It is not intended to imply that all of the following information should be contained in one program. It is realised that operating philosophy and program management practices, etc., for each operator are different; however, the requirements described in this Appendix could be applied to the specific needs of either a simple or a complex program. All associated procedures should be clearly defined.
3. The significant terms and definitions applicable to the program should be clearly identified. Terms are already defined in MSG-3, CASR 1998, CAR 1988, Part 42 MOS and Civil Aviation Orders. Other terms may be found in the ATA CSDD: 2010 – Common Support Data Dictionary or in mathematical statistics literature.
4. An operator's reliability program requires approval from CASA and its approval status is indicated by the reliability program's revision control.

#### Identification and applicability of the program

1. The organisational structure and the departmental responsibilities for the administration of the program should be stated. The responsibilities 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 Group), should be defined. Participation of CASA at periodic reliability meetings should be considered. This information should be contained in the operator's CAMO exposition or Maintenance Control Manual (MCM) as applicable.

#### Objective of the program

1. A statement should be included summarising as precisely as possible the scope and prime objectives of the program. As a minimum it should include the following:
  - a recognition of the need for corrective action;
  - establishment of the corrective actions needed; and
  - a determination of the effectiveness of those actions.
2. The extent of the objectives should be directly related to the scope of the program. The manufacturers Maintenance Planning Data (MPD) may give guidance on the objectives and should be consulted in every case. Where some items such as aircraft structure, engines, APU, etc. are controlled by separate programs, the associated procedures (e.g. individual sampling or life development programs and manufacturers structure sampling programs) should be cross-referenced in the program.
3. 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.

### Data collection

1. 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.
2. The type of information to be collected should be related to the objectives of the program. Some aircraft systems function acceptably after specific component or sub-system failures. Reports on such failures in those systems, nevertheless, act as a source of data that may be used as the basis of action either to prevent the recurrence of such failures, or to control the failure rates. The following are examples of the normal prime sources:
  - pilots reports;
  - technical logs;
  - aircraft maintenance access terminal/on-board computers;
  - maintenance system readouts;
  - maintenance worksheets;
  - workshop reports;
  - reports on functional checks;
  - reports on special inspections;
  - stores issues/reports;
  - air safety reports;
  - reports on technical delays and incidents; and
  - other sources such as ETOPS, RVSM and CAT II/III operations.
3. In addition to the normal prime sources of information, due account should be taken of continuing airworthiness and safety information promulgated by the National Aviation Authority, design organisations and manufacturers.

### Performance standards

1. Performance standards/alerts require engineering judgement for their application and typically apply to component monitoring, Pilot Reports, etc. A reliability alert level (or equivalent title, e.g. Performance Standard, Control Level, Reliability Index, Upper Limit) is purely an indicator, which when exceeded indicates that there has been an apparent deterioration in the normal behaviour pattern of the item with which it is associated.
2. When an alert level is exceeded an assessment should be made to determine if corrective action should be taken. It is important to realise that alert levels are not minimum acceptable airworthiness levels. When alert levels are based on a representative period of safe operation (during which failures may well have occurred) they may be considered as a form of protection against erosion of the design aims of the aircraft in terms of system function availability. In the case of a system designed to a multiple redundancy philosophy it should not be misunderstood that, as redundancy exists, an increase in failure rate can always be tolerated without corrective action being taken.
3. Alert levels can range from 0.00 failure rate per 1,000 hours both for important components, where failures in service have been extremely rare, and to perhaps as many as 70 Pilot Reports per 1,000 hours on a systems basis for ATA 100 Chapter 25 - Equipment/Furnishings, or for 20 removals of passenger entertainment units in a like period.
4. For structural or significant non-routine findings from major checks, a non-statistical review may identify an alert condition.

### Establishing alert levels

1. Alert levels should, where possible, be based on the number of events, which have occurred during a representative period of safe operation of the aircraft fleet. They should be up-dated periodically to reflect operating experience, product improvement and changes in procedures etc.
2. When establishing alert levels based on operating experience, the normal period of operation taken is between two and three years dependent on fleet size and utilisation. The alert levels should usually be so calculated as to be appropriate to events recorded in one- monthly or three-monthly periods of operation. Large fleets will generate sufficient information much sooner than small fleets.
3. Where there is insufficient operating experience, or when a program for a new aircraft type is being established, the following approach may be used:
  - For a new aircraft type, during the first two years of operation, alert levels should be established in conjunction with the aircraft type certificate holder and operators experience if appropriate and should be closely monitored for effectiveness during the induction period. Program data should still be accumulated for future use.
  - For an established aircraft type with a new operator, the experience of other operators may be utilised until the new operator has accumulated a sufficient period of own experience. Alternatively, experience gained from operation of a similar aircraft model may be used.
  - While setting alert levels for the latest aircraft designs, computed values based on the degree of system and component in-service expected reliability assumed in the design of the aircraft might also be used. These computed values are normally quoted in terms of Mean Time Between Unscheduled Removals or Mean Time Between Failure, for both individual components and complete systems. These initial predictions should be replaced when sufficient in-service experience has been accumulated.
4. There are several recognised methods of calculating alert levels, any one of which may be used provided that the method chosen is fully defined in the operator's program documentation.

### Re-calculation of alert levels

1. Both the method used for establishing an alert level, and the associated qualifying period, apply when the level is re-calculated to reflect current operating experience. However if, during the period between re-calculation of an alert level, a significant change in the reliability of an item is experienced which may be related to the introduction of a known action (e.g. modification, changes in maintenance or operating procedures) then the alert level applicable to the item should be re-assessed and revised on the data subsequent to the change.
2. Procedures for changes in alert levels should be outlined in the approved reliability program and the procedures, periods and conditions for re-calculation should be defined in each program.

### Display of information

1. The displayed information should provide the operator and CASA with an indication of the aircraft fleet's reliability. The rules governing any separation or discard of information prior to incorporation into these displays and reports should be stated.
2. The format, frequency of preparation and the distribution of displays and reports should be fully detailed in the program documentation.

3. Displays should include provisions for “nil returns” to aid the examination of the total information.
4. Where “standards” or “alert levels” are included in the program, the displayed information should be oriented accordingly.

## Reporting

1. Reliability reports typically display the following:

### *Fleet reliability summary*

This summary relates to all aircraft of the same type, and should contain the following information for the defined reporting period:

- number of aircraft in service;
- number of operating days (less maintenance checks);
- total number of flying hours;
- average daily utilisation per aircraft;
- average flight duration;
- total number of cycles/landings;
- total number delays/cancellations; and
- technical incidents.

### *Dispatch reliability (Aircraft technical delays/cancellations)*

All technical delays more than 15 minutes and cancellation of flight(s), due to technical malfunction, are required to be reported. The report should include the delay/cancellation rate for the defined reporting period, the three-monthly moving average rate and, where appropriate, the alert level. The operator should present the information for a minimum period of 12 consecutive months, but need not repeat the occurrences in descriptive form. This information should be presented in such a way as to show the trend over a 2 to 3 year period.

### *In-flight diversions due to technical malfunction or failures (known or suspected)*

While all in-flight diversions due to technical malfunction or failures (known or suspected) should be reported through normal Service Difficulty Reporting (SDR); a summary of all in-flight technical diversions also needs to be reported upon. If the summary references the SDRs, then it need not repeat the occurrences in descriptive form.

### *Engine unscheduled shut-down or propeller feathering*

All In-Flight Shut Down (IFSD) and IFSD rates or propeller feathering in flight, if applicable, listed by type of engine and aircraft for the reporting period should be reported and presented in graphical form. If this information references the SDRs, then it need not repeat the occurrences in descriptive form. When dealing with small numbers of IFSD, IFSD rate, or propeller feathering in flight, this information should be presented in such a way as to show the trend over a 2 to 3 year period.

***Incidents involving inability to control engine/obtain desired power***

All incidents involving inability to control/obtain engine desired power during the reporting period should be reported and presented in graphical form. If this information references the SDRs, then it need not repeat the occurrences in descriptive form. When dealing with small numbers of such incidences, this information should be presented in such a way as to show the trend over a 2 to 3 year period.

***Unscheduled engine removals due to technical failures***

All unscheduled engine removals and rates due to technical failures, listed by type of engine and aircraft for the reporting period should be reported and presented in graphical form. If this information references the SDRs, then it need not repeat the occurrences in descriptive form. When dealing with small numbers of unscheduled engine removals, this information should be presented in such a way as to show the trend over a 2 to 3 year period.

***Component unscheduled removal***

All unscheduled removal of maintenance significant components, by ATA chapter, during the defined reporting period should be reported and presented in graphical form. Some operators may monitor hundreds of components and it may not be feasible for them to graph all data. The format of component removal information should be such that:

- both unscheduled removals and confirmed failures rates should be compared with the alert levels; and
- current and past periods of operation should be compared.

***Operation of aircraft with multiple Minimum Equipment List (MEL) items invoked***

A periodic reliability report should include trend reporting of dispatch of aircraft with multiple MEL items invoked and shall present the information for a minimum period of 12 months. The report need not repeat the occurrences in descriptive form.

***Pilot Reports***

Pilot Reports should be reported to CASA by ATA chapters in graphical and/or tabular form as a count and rate for the defined reporting period, and comparison thereof with the alert level. For certain types of aircraft pilot reported defects are not a valid reliability indicator and in such situations reporting of Pilot Reports would not be required.

***EDTO specific operations***

In addition to non-EDTO reliability reporting requirements, the following information should be provided for EDTO flights:

- number of EDTO flights during the defined reporting period;
- aircraft/engine type/combination involved in the program, e.g. B767/CF6-80C2;
- details of aircraft involved in the program during the reporting cycle;
- average fleet utilisation time and cycles during the reporting cycle;
- EDTO critical component failures or malfunctions, by ATA chapter; and
- EDTO critical system failure reporting.

The reports should explain changes, which have been made or are planned in the aircraft's maintenance program, including changes in maintenance and task 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 programs.

### **Analysis and interpretation of information**

1. The procedures for data analysis 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 such as to enable a critical assessment to be made of the effectiveness of the program as a total activity. Such a process may involve:
  - 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);
  - analysis and interpretation of trends;
  - the evaluation of repetitive defects;
  - confidence testing of expected and achieved results;
  - studies of life-bands and survival characteristics;
  - reliability predictions; and
  - other methods of assessment.
2. The range and depth of engineering analysis and interpretation should be related to the particular program and to the facilities available. The following should be taken into account:
  - flight defects and reductions in operational reliability;
  - defects occurring at line and main base;
  - deterioration observed during routine maintenance;
  - workshop and overhaul facility findings;
  - modification evaluations;
  - sampling programs;
  - the adequacy of maintenance equipment and technical publications;
  - the effectiveness of maintenance procedures;
  - staff training; and
  - Service Bulletins (SB) and technical instructions.
3. Where the operator relies upon contracted maintenance and/or AMOs as an information input to the program, the arrangements for availability and continuity of such information should be established and details should be included.

### **Investigation and corrective action**

1. The procedures and time scales both for implementing corrective actions and for monitoring the effects of corrective actions should be fully described. Corrective actions should correct any reduction in reliability revealed by the program and could take the form of:
  - changes to maintenance, operational procedures or techniques;
  - maintenance changes involving inspection frequency and content, function checks, overhaul requirements and time limits, which will require amendment of the scheduled maintenance periods or tasks in the approved maintenance program (this may include escalation or de-escalation of tasks, addition or modification or deletion of tasks);

- amendments to approved manuals (e.g. Maintenance Manual, Crew Manual);
  - initiation of modifications;
  - special inspections or fleet campaigns;
  - spares provisioning;
  - staff training; and
  - manpower and equipment planning.
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.

### **Evaluation and review of the program**

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 levels” being exceeded).
2. Each program should contain procedures for monitoring and, as necessary, revising the reliability “standards” or “alert levels”. The organisational responsibilities for monitoring and revising the “standards” should be specified together with associated time scales.
3. Although not exhaustive, the following list gives guidance on the criteria to be taken into account during the review.
  - utilisation (high/low/seasonal);
  - fleet commonality;
  - alert level adjustment criteria;
  - adequacy of data;
  - reliability procedure audit;
  - staff training; and
  - operational and maintenance procedures.
4. The program areas requiring Authority’s approval may include changes to the program that involve:
  - any procedural and organisational changes concerning program administration;
  - adding or deleting aircraft types;
  - adding or deleting components/systems;
  - procedures relating to performance standards;
  - data collection system;
  - data analysis methods and application to the total maintenance program; and
  - procedures for maintenance program amendment.

### **Pooling of data**

1. In some cases, it may be desirable to “pool” data (i.e. collate data from a number of operators of the same type of aircraft) for adequate analysis. For the analysis to be valid, the aircraft concerned, mode of operation, and maintenance procedures applied must be substantially the same. Variations in utilisation between two operators may fundamentally corrupt the analysis.

2. Although not exhaustive the following list gives guidance on the primary factors, which need to be taken into account:
  - certification factors, such as aircraft type certificate data sheet (TCDS) compliance (variant)/modification status, including SB compliance;
  - operational factors, such as operational environment/utilisation, e.g. low/high/seasonal/respective fleet size operating rules applicable (e.g. EDTO/RVSM/All Weather operations etc.)/operating procedures/MEL and MEL utilisation;
  - maintenance factors, such as aircraft age, maintenance procedures; maintenance standards, applicable lubrication/servicing procedures, MPD revision or escalation applied or maintenance program applicable.
3. Although it may not be necessary for all of the foregoing to be completely common, it is necessary for a substantial amount of commonality to prevail. CASA makes its approval decisions on a case-by-case basis.
4. In case of a short-term lease agreement (less than 6 month) CASA may grant more flexibility against the above criteria to allow the operator to operate the aircraft under the same program during the lease agreement.
5. Where an operator wishes to pool data in this way, the approval of CASA will need to be sought prior to any formal agreement being signed between operators. CASA approval of data pooling will be described within the program.
6. Whereas this paragraph is intended to address the pooling of data directly between operators, it is acceptable that the operator participates in a reliability program managed by the aircraft manufacturer, when CASA is satisfied that the manufacturer manages a reliability program that complies with the intent of this AC.
7. While regulations require that the operator manage and present the aircraft maintenance program which includes the associated reliability program to CASA, it is understood that the operator may delegate certain functions to an AMO under contract, provided this organisation proves to have the appropriate expertise.
8. The functions that may be delegated to an AMO are:
  - developing the aircraft maintenance and reliability programs;
  - performing the collection and analysis of the reliability data;
  - providing reliability reports; and
  - proposing corrective actions to the operator.
9. Despite the above, the decision to implement a corrective action (or the decision to request from CASA the approval to implement a corrective action) remains the operator's prerogative and responsibility. A decision not to implement a corrective action should be justified and documented.
10. The arrangement between the operator and the AMO should be specified in the maintenance contract and the relevant MCM and procedures manual of the AMO.