Compliant Aviation Reliability Reporting

Structure & Guidelines.

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Introduction

Reliability reports are considered as working tools for engineering & maintenance management designed to confirm or deny the effectiveness of the AMP, as well as offer statistical analysis in terms of aircraft in operation, hours flown, etc. Therefore, the format & content of this document is not just important to airline Quality & Safety Assurance and the regulator, but also as a 'How am I doing?' guide for Engineering and maintenance.

In a previous article, the author discussed various approaches in terms of descriptive statistical analysis. In that article, we highlight the importance of either graphical or tabulated displays, and discussed the importance of correct selection in order to avoid ambiguity or a lack of understanding on the part of the engineering and maintenance departments.

The next and no less important step in the communication process will also require compliant reporting in terms of reporting format and layout, whilst also ensuring compliance with regulatory requirements.

This paper focuses on two distinct areas:

1. Regulatory requirements for Reliability reporting;
2. Reporting Format & Structure

Regulatory Requirements for Reliability Reporting

The following narrative has been based upon Appendix I to AMC M.A.302 and AMC M.B.301 (b) under EASA, and has been structured in this paper to directly highlight specific reporting requirements. The reader should also refer to the equivalent guideline document as per the regulatory requirements in their own country.

6.5.5 – Display of Information

- **Means of Display** - Graphical, Tabular Format or a combination of both formats.

- **Separation or Discard of Information**
  Rules should be stated and applied. However, the AMC does not explicitly require for the presence of these rules as a part of the reported data. However, a summary of the effected rule or reference to it in the reliability manual would provide the reader with a complete picture of the data that the reader is looking at.

- **Format**
  Display formats shall be such that identified trends (including any forecasting), specific highlights and related events would be readily apparent, and allow the reader to directly associate the graphical &/or tabulated data to a specific event, AMP amendment, maintenance campaign, etc.

- **Nil Returns**
  There is always a likelihood, that on occasion, expected events, failure modes, etc. may not actually happen. In order to account for this, and ensure that the engineering or maintenance manager remains confident of apparent gaps in the tabulated or graphical data, provisions should be included in the format that clearly indicate 'Nil or Zero Returns'.

  As has been pointed out, a Nil Return may actually mean that observations might exist but have failed to be reported.

  THE DISPLAY MUST CLEARLY STATE THAT A PROCESS OF VERIFICATION ENSURING THAT THE GAPS ARE 'NIL OBSERVATIONS' RATHER THAN OBSERVATIONS THAT WERE NOT REPORTED MUST BE APPENDED TO THE DISPLAY.

- **Standards or Alert Levels**
  Where "standards" (E.G. – MTBF, utilizing the Crow-AMSAA Model for repairable systems), or Alert Levels (Calculated utilizing Population/Sample Mean & Standard Deviation) should be orientated accordingly.

- **Use of 3-Month Moving Average or Other Trend lines**
  From time to time, statisticians introduce trend lines as a means of forward planning or a 3-month moving average as a means of assessing alert-level exceedances with regard to 'Watch' or 'Action' status. Although not explicitly required in the reliability report by the regulator, the use of trend lines provides the reader with an immediate interpretation upon which he/she can act.

6.5.9 – Presentation of Information to the Competent Authority (Regulator)

Prior to the issuance and dissemination of reliability reports, regulators demand that report formats, forms, templates, etc., be submitted as a part of the terms of approval of the Reliability Programme. Requirements are as follows:

a) The format and content of routine reports. (See below)

b) The time scales for the production of reports together with their distribution.
   - Reliability reports are issued on a monthly basis as a basic minimum.
   - Regardless some operators also issue summarized reliability reports on a quarterly or annual basis

c) The format and content of reports supporting request for increases in periods between maintenance (escalation) and for amendments to the approved maintenance programme.

These reports should contain sufficient detailed (sample) information to enable the competent authority to make its own evaluation where necessary.

Reporting Format & Structure

When developing a report format, it is important to remember, that the most useful report should not contain an excessive amount of data and graphs. Together with clear explanatory notes, the reported data becomes and effective tool, rather than a non-descript document that adds little value other than to tick a compliance box.

Monthly Report Content

The monthly report should focus upon:

1. Items that have just gone on Alert or Watch;

2. Items under investigation;

3. Items that are in, or completed corrective action;

4. Progress of items that are still under analysis

5. Progress of items in a corrective action - implementation phase.

6. List of Alert Levels (by ATA Chapter or Item)

7. <u>Technical Performance & Reliability Data</u>:
   - PIREPS / MAREPS / CAREPS
   - Technical Despatch Reliability
   - Fleet Size, Aircraft in Service, Total Flying Hour Availability
   - Service Utilization, Average Leg Time
   - Total Duration
   - Average of Flight Delay, Delays per 100 revenue departures
   - Technical Cancellations
   - Technical Incident per 1000 flying hours

8. <u>Component Reliability Data:</u>
   - Quantity per Aircraft
   - Mean Time to Removal (MTTR)
   - Mean Time Between Removal (MTBR)
   - Mean Time between Unscheduled Removals (MTBUR)
   - Failure Rate
   - Mean Time To Failure (MTTF)
   - Mean Time Between Failure (MTBF)
   - Landings Per Removal (LPR)
   - Unscheduled Removal Rate (URR)

9. <u>ETOPS, Engine & APU</u>
   - Fleet Size available for ETOPS routes.
   - ETOPS Flight hours
   - ETOPS Revenue Departures
   - ETOPS Despatch Reliability
   - Engine/APU Flying Hours & Cycles
   - Engine/APU Despatch Reliability
   - Engine/APU Removals Rate
   - Engine In-Flight Shut Down (IFSD)
   - Engine Shop Visit Rate

Where points 4 & 5 are concerned, the report shall also indicate the status of the corrective action, and the percentage of the fleet completed (As applicable). Items from points 4 & 5 must also remain in the monthly report, until:

- The action item has been completed across the entire fleet, and
- Any related reliability data demonstrates positive results.

Reliability Report Structure & Management

There are no hard and fast rules as to how completed reliability reports for each aircraft fleet type should by managed. Generally, there are two options:

1. Single Report – Each fleet type separated into its own section in the reliability report
2. Individual (Stand-Alone) Reliability reports for each aircraft type in the fleet.

Regardless this can be a complicated decision, which very much depends upon the size and complexity of the operator or maintainer. Regardless before committing to how reliability reports should be managed, refer to the engineering and maintenance organisations to determine how best they would like the data to be received.

The structure of the report may be sub-divided as follows:

I. <u>Fleet Statistics</u>
   a. Utilization Report
   b. Reliability Summaries
      i. Aircraft Despatch & Operational Reliability
      ii. Aircraft Technical Reliability
      iii. Technical Delay Report
      iv. Landing Gear Status
      v. Hold Item List (MEL) Monitoring

II. <u>Aircraft Type Report</u>
   a. PIREPS per ATA Chapter (Summary & Graphics)
   b. Unscheduled Component Removals

III. <u>Significant Events</u>
   a. Engine & APU Removals
   b. Other Significant Events

IV. <u>Yearly Data</u>
   a. Yearly Rates

Other Data Requirements

- Contents
- Definitions (including formulae utilized)
- Corrective Actions, Status, fleet progress & follow-Ups

Conclusion

- The reliability report is not just a collection of graphs, tables and numbers that are designed to dazzle higher-level management.

- It is not a document that has been created for the sake of creating work for others or to tick a compliance box within the Quality & Safety Assurance departments and the Regulator.

- The reliability report is a living and working tool. That not only provides operational & technical statistics, but also provide management with a picture of:
    - What problems are being encountered (If any), and
    - What is being done about those problems

- Reliability reports must also track progress and effectiveness of corrective actions, not least, the effectiveness of the AMP.