AC 119-2-3(Rev 0)
17 September 2018

Civil Aviation Authority of Singapore

Advisory Circular

IMPLEMENTATION OF FLIGHT DATA ANALYSIS PROGRAMME

GENERAL
Advisory Circulars (ACs) are issued by the Director-General of Civil Aviation (DGCA) from time to time to provide practical guidance or certainty in respect of the statutory requirements for aviation safety. ACs contain information about standards, practices and procedures acceptable to CAAS. An AC may be used, in accordance with section 3C of the Air Navigation Act (Cap. 6) (ANA), to demonstrate compliance with a statutory requirement. The revision number of the AC is indicated in parenthesis in the suffix of the AC number.

PURPOSE
This AC provides to demonstrate compliance with, and information related to, requirements regarding the implementation of a Flight Data Analysis Programme (FDAP).

APPLICABILITY
This AC is applicable for the Air Operator Certificate (AOC) holder conducting operations under ANR-121.

RELATED REGULATIONS
This AC relates specifically to Regulation 17 of ANR-119.

RELATED ADVISORY CIRCULARS
- AC 119-2-1 Guidance on Air Operator Certificate Certification Requirements
- AC 1-3 Safety Management Systems

CANCELLATION
This is the first AC issued on the subject.

EFFECTIVE DATE
This AC is effective from 1 October 2018.

OTHER REFERENCES
- ICAO Doc 10000 Manual of Flight Data Analysis Programme
- EASA AMC/GM to Annex III (Part-ORO)

1 BACKGROUND

1.1 As required by Regulation 17 of ANR-119, the AOC holder is to establish and maintain a FDAP as part of its SMS. The FDAP shall be non-punitive and contain adequate safeguards to protect the source(s) of the data.

1.2 Flight Data Analysis (FDA) will enable the AOC holder to identify potential hazards to flight operations. The AOC holder may, based on analysis of flight data, amend Standard Operating Procedures (SOPs) and policy to manage its risks.

1.3 This AC guides the AOC holder on the set up of a FDAP that is integrated within the safety assurance component of its SMS[1], with emphasis on data protection, de-identification and cultivation of a positive safety culture.

2 USE OF FLIGHT DATA ANALYSIS PROGRAMME

2.1 FDAPs should be used to identify systemic causes for deviation from standard operations. They can detect adverse trends in any part of the flight regime and when integrated within a SMS, it will allow an AOC holder to:

- identify operational safety trends and areas of operational risk and, quantify safety margins;
- put in place risk mitigating measures to address unacceptable risk that has been identified; and
- monitor effectiveness of a particular risk mitigating measure

2.2 ANR-91 Regulation 50 states that AOC holders and pilots-in-command of Singapore registered aircraft must make a report of reportable safety matters (or commonly known as Mandatory Occurrence Report, “MOR”). MOR incidents detected by FDAP should therefore normally be reported by the crew in accordance with the established procedures. If the MOR incident is not already reported, the AOC holder should ensure that the MOR report is made immediately. Protocols signed between the AOC holder and crew member representatives regarding FDAP should clearly explain this requirement.

2.3 The protocol referred to in paragraph 2.2 should include an agreed policy on FDA data de-identification before it is needed in extreme circumstances. The AOC holder should provide clear and binding assurance on the nondisclosure of individuals who may be identified through the data collected. There may be exceptions such as when the AOC holder, or a flight crew member, believes that there is a continuing unacceptable safety risk if specific action regarding a flight crew member is not taken. In such a case an identification and follow-up action procedure, previously agreed to before the particular event, can be applied. There should be an initial stage during which the data can be identified to allow confidential follow up by the crew representative or trusted individual agreed to by the AOC holder and the flight crew. Strict rules of access should be enforced during this period. In the case where a MOR is required, any data retained by the programme may not be de-identified or removed from the system prior to the investigation or confirmation.

[1] This AC should be read together with CAAS’ AC 1-3.

3 FLIGHT DATA ANALYSIS PROGRAMME DESCRIPTION

3.1 FDAP Overview

3.1.1 The FDAP is not a one-size-fit-all programme. Depending on availability of resources, technology, complexity and size of operation, the FDAP may need to be tailored to suit the needs of the organisation. Briefly, the FDAP would consist of an on-board device to record data and a means to transfer the recorded data to a processing system. Thereafter, software is needed to process the data for analysis, and if desired, to develop flight animation for stakeholders' analyses and crew debriefing.

3.2 Processing of FDA Data

3.2.1 Exceedance detection

An AOC holder can select exceedance parameters for its FDA data detection system to suit their operation.

Examples of exceedances are:
- excessive pitch on take-off;
- climb out speed low or high during take-off; and
- excessive rate of descent below 1000 feet. The value of tracking exceedance data is it provides factual information which complement crew and engineering reports.

3.2.2 Routine measurements

A selection of routine parameters can also be extracted to analyse trends or tendencies and areas safety interest.

Examples are:
- pitch rates vs take-off weights;
- touchdown points on long runways vs short runways; and
- In the examples above, the measurements could result in correcting handling techniques.

3.2.3 Incident investigation

FDAPs provide valuable information for incident investigations and for follow-up of other technical reports. Data extracted may be useful to enhance recall by the flight crew and also provide accurate indication of system status and performance which may assist to determine the causal factors of the incident.

3.2.4 Continuing Airworthiness

FDAP data could be used for technical monitoring programmes for impending failure prediction and maintenance scheduling.

Examples are:
- engine deterioration; and
- brake and landing gear usage.

3.2.5 Integrated safety analysis

All the data gathered in an FDAP should be integrated in a central safety database. By linking an FDAP database to other safety databases (such as incident reporting systems and technical fault reporting systems), a more complete understanding of events becomes possible through cross-referencing the various sources of information. Care should be taken, however, to safeguard the confidentiality of FDA data when linking the data to identified data.

Example: A heavy landing results in a flight crew report, an FDA exceedance and an engineering report. The flight crew report provides the context, the FDA exceedance provides the quantitative description and the engineering report provides the result.

3.3 Analysis and follow-up

3.3.1 Overviews and summaries of FDA data should be compiled on a regular basis, to identify specific exceedances and emerging undesirable trends and to disseminate the information to flight crews. Revision to operating and flight manuals and changes to ATC and aerodrome operating procedures could also be outcomes of FDA data analysis.

3.3.2 De-identified FDA data should be archived as these over time can provide a picture of emerging trends and hazards in their analyses.

3.3.3 As in any closed-loop process, follow-up monitoring is required to assess the effectiveness of any corrective actions taken. Flight crew feedback is essential for the identification and resolution of safety problems and could include answering the following example questions:

- Is the implementation of corrective actions adequate and effective?
- Are the risks mitigated, or unintentionally transferred to another part of the operations?
- Have new problems been introduced into the operation as a result of implementing corrective actions?

4 PREREQUISITES FOR AN EFFECTIVE FDAP

4.1 Protection / De-identification of FDA Data and Follow-up

4.1.1 The protection of safety data, a tenet under SMS, applies also to FDA data captured under the FDAP. This is very significant in the context of an FDAP. Data protection can be optimised by:

(a) adhering to the protocols between management and the flight crews, where available;
(b) strictly limiting data access to selected individuals in the FDAP team;
(c) maintaining tight control to ensure that data identifying a specific flight are kept secure;
(d) ensuring that operational problems are promptly addressed by management; and
(e) to the extent possible, non-reversible de-identification of the flight data files after a time appropriate for their analysis.

4.1.2 For similar reasons, there should be a well-structured de-identification system to protect the confidentiality of the data under the FDAP. FDA data should be de-identified

by those allocated for the role before it is used in training programmes, fleet meetings or incident reviews unless permission is given by all the crew members involved. Those responsible should clearly understand that any disclosure of identities for purposes other than safety management can compromise the required cooperation of the affected flight crew in clarifying and/or documenting an event.

4.1.3 As in any closed-loop process, follow-up monitoring is required to assess the effectiveness of any corrective actions taken. For example, if the FDAP picks up a proliferation of high rates-of-descent events at low levels on the approach, proposals from those responsible for corrective action should be closely monitored to establish that there is tangible evidence of a reduction in the frequency of these events.

4.2 Policy on Access/Retention/Recovery of Data

4.2.1 Due to the large volumes of data involved, it is important that a strategy for data access and security, both online[2] and offline is carefully developed to meet the needs of FDAP users. In many cases engineering is involved in data retrieval from the aircraft. Policy on access and security must be written down clearly to cover instances like these.

4.2.2 FDA data should be kept for a determined period of time to accommodate trend analysis or incident referral.

4.2.3 There should be data recovery strategy to ensure a sufficiently representative capture of flight information to maintain a current overview of operations. Data recovery should take place in a timely manner to acquire knowledge of immediate safety issues, the identification of operational issues and to facilitate any necessary operational investigation before crew memories of the event can fade.

4.3 Education and Communication

4.3.1 The objectives and the safety recommendations evolving from the FDAP should be visible to all stakeholders if the system is to receive the desired buy-in. Newsletters, flight safety magazines, highlighting examples in training and simulator exercises, periodic reports to industry and the regulatory authority are some means to achieve efficient communication and dissemination of such information.

5 ESTABLISHING AND IMPLEMENTING AN FDAP

5.1 Implementation Plan

5.1.1 Typically, the following steps are required to be taken by the AOC holder to implement an FDAP:

(a) management approval of the programme;
(b) implementation of a formal agreement between management and flight crews; and
(c) identification of an FDAP team.

[2] Some organisations allow access to FDAP findings to crew members, on line, for the purpose of expeditiously disseminating learning outcomes.

5.2 The FDAP Team

5.2.1 Preferably, the responsibility of the Safety Manager should include the implementation of the FDAP and must ensure that trends analysed and mitigation measures must be transmitted to the relevant parties[3]. The team should comprise the following entities:

(a) *Team leader*. It is essential that the team leader earns the trust and full support of both management and flight crews. He/she acts independently of others in line management to make recommendations that will be seen by all to have a high level of integrity and impartiality. The individual requires good analytical, presentation and management skills. He/she should be the safety manager or placed under the authority of the safety manager.

(b) *Flight operations representative/s*. This person/s is usually an experienced pilot on the aircraft type and operation. This team member's in-depth knowledge of SOPs, aircraft handling characteristics, training concepts, airports and routes will be used to place the FDA data in a credible context.

(c) *Technical representative/s*. This person/s interprets FDA data with respect to the technical aspects of the aircraft operation and is familiar with the power plant, structures and systems departments' requirements for information and any other engineering monitoring programmes in use by the AOC holder.

(d) *Flight crew contact person*. This person could be a pilot association officer. He is person usually assigned by the AOC holder for this responsibility. The position requires good people skills and a positive attitude towards safety education. The flight crew contact person should be the only person permitted to connect the identifying data with the event. The flight crew contact person requires the trust of both flight crew members and managers for his/her integrity and good judgment. He should be trained in using FDA data animation for debriefing purposes.

(e) *Engineering technical support*. This person/s is usually an avionics specialist, involved in the supervision of FDR serviceability. Indeed, an FDAP can be used to monitor the quality of flight parameters sent both to the FDR and to the FDA recorder, and thus ensure the continued serviceability of the FDR.This team member should be knowledgeable about FDA and the associated systems needed to run the programme.

(f) *Air safety coordinator*. This person cross-references FDA information with other safety data sources (such as the company's mandatory or confidential incident reporting programme, crew resource management and LOSA) and with the AOC holder's SMS, creating a credible integrated context for all information. This function can reduce duplication of follow-up investigations.

(g) *Replay operative and administrator*. This person is responsible for the day-to-day running of the system, producing reports and analyses. Methodical, with some knowledge of the general operating environment, this person keeps the programme moving. AOC holders may utilise the services of a specialist contractor to operate an FDAP.

5.2.2 This team should be involved in all the ensuing steps:

[3] Note: While an AOC holder may contract the operation of a flight data analysis programme to another party the overall responsibility remains with the AOC holder's accountable manager.

(a) development of a business plan, including processes, software and hardware and assignment of adequate resources;
(b) establishment and verification of operational and security procedures;
(c) development of an FDAP procedures manual;
(d) assessment of possible interfaces between an FDAP and other safety data sources of integration of an FDAP into the SMS;
(e) selection of equipment (airborne, ground-based computer system, interface with other data sources and the SMS);
(f) selection and training of the FDAP team members, according to their respective roles;
(g) testing of data transfer, testing of the ground-based computer system (including data acquisition, definition of trigger logic expressions, alerts, data analysis and visualization, data de-identification, final storage of data);
(h) testing of data security, including security procedures;
(i) identification of areas of interest that should be first looked at in the data;
(j) checking of the proper decoding and of the quality of flight parameters used by an FDAP; and
(k) start of data analysis and validation, focused on key areas in operation.

6 CONTINUOUS IMPROVEMENT

6.1 New safety issues identified and published by other organisations, such as safety investigation reports, safety bulletins by the aircraft manufacturer or safety issues identified by aviation authorities should be assessed for inclusion in a corresponding monitoring activity of an FDAP.

6.2 The FDA processes and procedures should be amended when an FDAP matures and each time there are changes in the operations, the internal organisation of the AOC holder, or the interface with other data sources and processes.