AIC MALAYSIA

PHONE : 6-03-7846 5233
TELEX : PENAWA MA 30128
FAX : 6-03-7847 2997
AFTN : WMKKYAYS
COMM : AIRCIVIL
KUALA LUMPUR

AERONAUTICAL INFORMATION SERVICES
DEPARTMENT OF CIVIL AVIATION
BLOCK A
AIR TRAFFIC CONTROL CENTRE COMPLEX
SULTAN ABDUL AZIZ SHAH AIRPORT
47200 SUBANG
SELANGOR DARUL EHSAN
MALAYSIA

14 / 2005
21 JUL

REQUIREMENT FOR THE ESTABLISHMENT OF FLIGHT DATA ANALYSIS (FDA) PROGRAM

1. INTRODUCTION

1.1 This AIC is issued in the exercise of the powers conferred under Section 24O of the Civil Aviation Act 1969.

1.2 This AIC outlines the requirement for an operator to establish a Flight Data Analysis (FDA) programme as part of its accident prevention and flight safety program.

2. APPLICABILITY

2.1 The requirements contained in this AIC, apply primarily to all air operators (AOC holders) operating international commercial air transport of a maximum certificated take-off mass in excess of 27000 kg.

3. BACKGROUND

3.1 Flight Data Analysis (FDA) programme (sometimes referred to as Flight Data Monitoring (FDM) or Flight Operations Quality Assurance (FOQA)), is the pro-active and non-punitive programme for gathering and analyzing data, digitally recorded during routine flights to improve aviation safety. FDA programmes are a logical component of a mature safety management system.

3.2 The use of this most important safety tool is growing as technology expands the capabilities of gathering and analyzing such data.

3.3 The rate of accident which occur in the arena of operations can be reduced by the proper application of FDA techniques in every day airline operations, thus allowing flight operations occurrences to be analyzed and corrected on a day by day basis.

3.4 The information and insights provided by FDA can improve safety by identifying safety hazards and enhancing training effectiveness, operational procedures, maintenance and engineering procedures, and air traffic control procedures.

3.5 The value of FDA programme is the early identification of adverse safety trends that, if uncorrected, could lead to accidents. A key element in FDA is the application of corrective action and follow-up to assure that unsafe conditions are effectively corrected.

3.6 Recognizing the potential for accident prevention, ICAO has introduced requirements making a flight data analysis program as part of an operator's accident prevention and flight safety programme. Operators of larger aircraft will be responsible for the operation of a non-punitive FDA programme. An operator may contract the operation of a flight data analysis programme to another party (eg. specialist contractor) while retaining overall responsibility for the maintenance of the programme.

3.7 Guidance on flight data analysis programme is contained in the ICAO - Accident Prevention Manual (Doc 9422).

4. DEFINITIONS

4.1 The following terms and phrases are defined for the purposes of FDA to have a standard interpretation of the guidance in this AIC.

a. Aggregate Data.The summary statistical indices that are associated with FDA event categories, based on an analysis of FDA data from multiple aircraft operations.

b. Aggregation.The process that groups and mathematically combines individual data elements based on some criterion (e.g., time, geographical location, event level, aircraft type). Each aggregation is based on factors of interest to the analyst at a particular point in time.

c. Data Validation.A process during which flight data are reviewed to see that they were not generated as a result of erroneous recording or damaged sensors.

d. De-identified Data.Data from which any identifying elements that could be used to associate them with a particular flight, date, or aircrew has been removed.

e. Event.An occurrence or condition in which predetermined values of aircraft parameters are measured. Events represent the conditions to be tracked and monitored during various phases of flight and are based on the sensory data parameters available on a specific aircraft fleet.

f. Event Category.Event categories are areas of operational interests (e.g., aircraft type, phase of flight, geographical location) on which FDA event monitoring and trend analysis is based.

g. Event Levels.The parameter limits that classify the degree of deviation from the established norm into two or more event severity categories. When assigning levels to an event, consideration is given to compliance with civil aviation regulations, aircraft limitations, and company policies and procedures.

h. Event Validation.The process in which an event is determined to be a valid sample of operation outside the established norm. Even though aircraft parameter limits may have been exceeded, a valid event may not have occurred (e.g., significant localizer deviation may have occurred when an aircraft was making a sidestep approach to a parallel runway).

i. FDA Monitoring Team (FMT).A group comprised of representatives from the pilot group, if applicable, and the air operator. This group is responsible for reviewing and analyzing flight and event data and identifying, recommending and monitoring corrective actions.

j. Gatekeeper.The FMT member who is primarily responsible for the security of identified data. The gatekeeper is the individual(s) who can link FDA data to an individual flight or crewmember. The gatekeeper is normally a member of the pilot association (if applicable) or a representative from the line pilots.

k. Ground Data Replay and Analysis System (GDRAS). A software application designed to transform airborne-recorded data into a usable form of analysis, process and scan selected flight data parameters, compare recorded or calculated values to predetermined norms using event algorithms and generate reports for review.

l. Parameters.Measurable variables that supply information about the status of an aircraft system or subsystem, position, or operating environment. Parameters are collected by a data acquisition unit installed on the aircraft and then sent to analysis and reporting systems.

m. Phases of Flight.The standard high-level set of activities performed by pilots on all operational flights (i.e., preflight, engine start, pushback, taxi, takeoff, climb, cruise, descent, holding, approach, landing, taxi, and post-flight operations.

n. Quick Access Recorder (QAR).A recording unit onboard the aircraft that stores flight-recorded data. These units are designed to provide quick and easy access to a removable medium on which flight information is recorded. QARs may also store data in solid-state memory that is accessed through a download reader.

5. OBJECTIVES OF A FDA PROGRAMME

5.1 To identify and quantify operational risks by highlighting when non-standard, unusual or unsafe circumstances occur.

5.2 To use the FDA information on the frequency of occurrence, combined with an estimation of the level of severity, to assess the safety risks and to determine which may become unacceptable if the discovered trend continues.

5.3 Put in place and monitor appropriate risk mitigation to provide remedial action once an unacceptable risk, either actually present or predicted by trending, has been identified; and to verify and optimize the effectiveness of training program and development of SOPs.

6. FDA PROGRAMME DESCRIPTION

6.1 The improvement of flight safety is the driving force behind the implementation of FDA programme. A FDA programme is used to reveal operational situations in which risk is increased in order to enable early corrective action before that risk result in an incident or accident. FDA should interface and be coordinated with the operator's safety programme. The FDA programme should be part of the operator's overall safety and accident prevention programme. Being proactive in discovering and addressing risk will enhance safety.

6.2 In FDA programme, data are collected from the aircraft by using special acquisition devices, such as QARs (Quick Access Recorder), or directly from the FDR. Using one of several transmission methods, data are periodically retrieved and sent to the air operator's FDA office for analysis. This office usually resides within the flight safety organization of the air operator. The data are then validated and analyzed using spe-

cialized processing and analysis software, designed to convert the flight data into usable information.

Note: The quality and capability of FDA program will be directly dependent on the number of parameters available. The operator should see that sufficient parameters are available for collection from the acquisition device or FDR**.**

6.3 The GDRAS (the processing and analysis software) transforms the data into an appropriate format for analysis and generates reports and visualizations to assist personnel in analyzing the collected data. It extracts FDA events from the raw digital data stream based on parameters, threshold values) e.g., descent rate in excess of 1,000 feet per minute on approach), and/or routine operational measurements that are specified by the air operator. The analysis may focus on events that fall outside normal operating boundaries as well as the manufacturer's aircraft operating limitations. The FDA manager then reviews the events to assess their validity and potential significance. The FDA events are then marked for appropriate handling.

6.4 In terms of determining the root causes of systemic problems that need correction, aggregate FDA data have proven to be of greater value than detailed parameter data gathered during a single flight. Individual data records are typically aggregated into categories to assist the analyst in looking for trends and patterns. For example, an analysis may be conducted on the average maximum rate of descent below 2,000 feet by airport by fleet type. This may be useful to better understand the meaning of the data once related events indicate that this is an area requiring investigation. This analysis may suggest that all fleets are experiencing high descent rates at a certain airport or just a specific aircraft type. This type of information can be used to pinpoint the potential source of the problem and, hopefully, suggest the nature of appropriate corrective action.

6.5 Data that could be employed to determine flight crewmember identity are removed from view in the electronic record as part of the initial processing of the airborne data. However, air operator FDA programmers typically provide for a gatekeeper, who is provided with a secure means of determining identifying information for a limited period of time, in order to enable follow-up inquiry with the specific aircrew associated with a particular FDA event. Such contact is usually limited to situations when further insight into the circumstances surrounding an event is needed. The gatekeeper is typically a line captain designated by the air operator's pilot association (if applicable). The concurrence of the gatekeeper is required in order to initiate a follow-up with an individual pilot. Follow-up inquiries with individual crewmembers concerning FDA events will normally be accomplished by a line captain designated as a gatekeeper by the air operator's pilot association (if applicable).

7. FDA ANALYSIS PROCESS

7.1 The FDA analysis process must be developed based on the objective and scope of the intended programme. At a minimum, the process will be determined depending on whether information will be used to evaluate or effect change in any or all of the following areas:

- Operational Safety
- Aircraft Performance
- Aircraft System Performance
- Crew Performance
- Company Procedures

- Training Programs
- Training Effectiveness
- Airport Operational Issues

7.2 Analysis Techniques

7.2.1 Two types of analysis techniques can be applied to FDA data. They are parameter exceedence analysis and statistical analysis.

7.2.1.1 Exceedence Analysis

7.2.1.1.1 This involves setting a specific limit for the GDRAS to detect for a particular parameter (e.g., roll angle exceeds 45 degrees). This data can be rendered over multiple flights to determine the number of exceedence occurring per flight segment. In addition, the data can be trended to determine which phase of flight, airport, or runway, if appropriate, depending on the event type. Levels of exceedence can be programmed for particular events based on the operator's risk assessment to assist in focusing resources on implementing corrective action on the highest perceived operational risk area.

7.2.1.2 Statistical Analysis

7.2.1.2.1This is used to create profiles of flight, maintenance, or engineering operational procedures. The profiles can use several measurements to build distributions of various criteria. A distribution of data will show all flights and enable a carrier to determine risk based on mean and standard deviations from the mean. One procedure an operator may look at is approach tracks. A profile would be designed to measure the different criteria of an approach, like airspeed, rate of descent, configuration, or power setting. For example, the GDRAS will capture the maximum airspeed of every flight on final approach. A series of distributions will show a picture of how all flights are performing. The operator can then determine when an approach track may lead to an unstable approach and landing.

8. FOUNDATIONS FOR AN EFFECTIVE FDA PROGRAMME.

8.1 Good planning and preparation are the foundations for an effective FDA program. An air operator needs to develop a FDA plan that defines how the system will integrate with other areas of the company and establish a FDA steering committee to coordinate the inter-departmental cooperation and communication.

8.2 Establish a Steering Committee

8.2.1 The steering committee should define its members, meet regularly, and identify all applicable representatives from flight operations, maintenance, safety, training and the pilot association (if applicable) or the line pilots.

8.3 Define Goals and Objectives

8.3.1 A key step for effective FDA programme is to clearly define the vision, goals and objectives of the programme. These goals should be meaningful and measurable.

8.4 Selection of Personnel

8.4.1 Selecting personnel to staff the FDA programme depends on the programme's scope, the size and organization of the air operator. A typical programme includes a FDA manager, one or more FDA analyst, a FDA Monitoring Team (FMT) composed of experienced pilots. FMT members should be technically proficient on the aircraft types used in the FDA programme and have excellent communication and problem-solving skills.

8.5 **Define Safeguards**

8.5.1 FDA programme requires vigilant security and privacy protection for confidentiality of the data and to protect data against unauthorized disclosure, alteration, misuse, or destruction. The issue of data protection and security is sensitive and focuses on the confidentiality of a particular air operator , flight, date, or flight crew and a recorded event.

8.6 **Negotiate Pilot Agreement (if necessary)**

8.6.1 Establishing the air operator's FDA programme may necessitate the negotiation of an agreement between the air operator and its pilots. This agreement defines the specifics of the FDA programme and its objectives and administration. This agreement is crucial for obtaining cooperation from the pilot community to ensure that line pilots play an integral part in the process.

8.7 **Develop and Document FDA Program Procedure**

8.7.1 The FMT should develop and document procedures for operating and managing the programme. It includes the procedures for data security and data management including backup and recovery, data archiving and restoration, monitoring and fine-tuning databases and even sets.

8.8 **FDA Meetings**

8.8.1 An air operator should conduct periodic FDA meeting (preferably every 30 days) to provide company management with updated trends, information, and evaluation of previously implemented corrective actions.

9. APPENDIX

9.1 Appendix A outlines typical events, therein referred to and shall be taken, read and construed as an essential and integral part of this AIC.

DATO' IR KOK SOO CHON
Director General
Department of Civil Aviation
Malaysia

Appendix A

Typical FDA Program Exceedence Detection and Routine Parameter Analysis

1. Traditional Event Set

These operational events are typical of those found in current programs and form an excellent starting point for any monitoring programme.

Event Group	Event Code	Description
Flight Manual Speed Limits	01A	Vmo exceedence
	02A	Mmo exceedence
	03A	Flap placard speed exceedence
	03G	Gear down speed exceedence
	03I	Gear up/down selected speed exceedence
Flight Manual Altitude Limits	04	Exceedence of flap/ slat altitude
	05	Exceedence of maximum operating altitude
High Approach Speeds	06A	Approach speed high within 90 sec of touchdown
	06B	Approach speed high below 500 ft AAL
	06C	Approach speed high below 50 ft AGL
Low Approach Speed	07A	Approach speed low within 2 minutes of touch-down
High Climb-out Speeds	08A	Climb out speed high below 400 ft AAL
	08B	Climb out speed high 400 ft AAL to 1000 ft AAL
Low Climb-out Speeds	08C	Climb out speed low 35 ft AGL to 400 ft AAL
	08D	Climb out speed low 400 ft AAL to 1500 ft AAL
Take-off Pitch	09A	Pitch rate high on take-off
Unstick Speeds	10A	Unstick speed high
	10B	Unstick speed low
Pitch	20A	Pitch attitude high during take-off
	20B	Abnormal pitch landing (high)
	20C	Abnormal pitch landing (low)
Bank Angles	21A	Excessive bank below 100 ft AGL
	21B	Excessive bank 100 ft AGL to 500 ft AAL
	21C	Excessive bank above 500 ft AGL
	21D	Excessive bank near ground (below 20 ft AGL)
Height Loss in Climb-out	22D	Initial climb height loss 20 ft AGL to 400 ft AAL
	22E	Initial climb height loss 400 ft to 1500 ft AAL
Slow Climb-out	22F	Excessive time to 1000 ft AAL after take-off

High Rate of Descent	22G	High rate of descent below 2000 ft AGL
Normal Acceleration	23A	High normal acceleration on ground
	23B	High normal acceleration in flight flaps up/down
	23C	High normal acceleration at landing
	23D	Normal acceleration; hard bounced landing
Low go-around	024	Go-around below 200 ft
RTO	026	High Speed Rejected take-off
Configuration	40C	Abnormal configuration;speed brake with flap
Low Approach	042	Low on approach
Configuration	43A	Speedbrake on approach below 800 ft AAL
	43B	Speedbrake not armed below 800 ft AAL (any flap)
Ground Proximity Warning	44A	GPWS operation - hard warning
	44B	GPWS operation - soft warning
	44C	GPWS operation - false warning
	44D	GPWS operation - windshear warning
Margin to Stall	45A	Reduced lift margin except near ground
	45B	Reduced lift margin at take-off
	46A	Stickshake
	46B	False stickshake
Configuration	047	Early configuration change after take-off (flap)
Landing Flap	48A	Late land flap (not in position below 500 ft AAL)
	48B	Reduced flap landing
	48D	Flap load relief system operation
Glideslope	56A	Deviation under glideslope
	56B	Deviation above glideslope (below 600 ft AGL)
Buffet Margin	061	Low buffet margin (above 20,000 ft)
Approach Power	75A	Low power on approach

2. New Operational Event Program Triggers

In addition to the traditional events detailed above there could be a number of new events used to detect other situations which an air operator may be interested in. Some of the new triggers are relatively simple to implement while others would need careful coding and research to avoid false events while still activating against good data.

Description	Notes
Engine parameter exceedence (eg TGT etc)	One of a range of engine monitors
Full and free control checks not carried out	Essential pilot actions and a measure of control transducers.
Taxi out to take-off time - more than (x) minutes	Can be measured against a standard time for that airfield and runway.
High Normal Acceleration -Rough taxi-way	Detection along with an estimate of position derived from groundspeed and heading.
High Longitudinal Acceleration - Heavy braking	as above
Excessive Taxi Speed	as above
Take-off configuration warning	
Landing gear in transit longer than (x) seconds	To be used as an indicator of system problems and wear
Flap/slats in transit longer than (x) seconds	as above
Master Warning	All master warnings, even if false, heard by the crew are a useful indicator of distractions and "mundane/known problems".
Engine failure	To determine crew performance as well as help technical investigation.
Autopilot vertical speed mode selected below (x) ft	One of a range of auto flight system usage monitors
Fuel Remaining at landing below minimums	
Airborne holding - more than (x) minutes	
Excessive control movement - airborne (especially rudder)	This will indicate control problems that other events might not identify
TCAS warning	A must for monitoring future significant hazards and crew reactions
Reverse thrust not used on landing	
Auto ground spoiler not selected for landing	
Landing to shutdown time - more than (x) minutes	Indicates taxiway or stand allocation problems