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FLIGHT DATA ANALYSIS PROGRAMME MANUAL

First Edition — 2013

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AMENDMENTS

The issue of amendments is announced regularly in the ICAO Journal and in the monthly Supplement to the Catalogue of ICAO Publications and Audio-visual Training Aids, which holders of this publication should consult. The space below is provided to keep a record of such amendments.

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Safety Management Manual (SMM) (Doc 9859)
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Human Factors Guidelines for Safety Audits Manual (Doc 9806)

Manual of Aircraft Accident and Incident Investigation (Doc 9756)
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ACRONYMS AND ABBREVIATIONS

ACAS	Airborne collision avoidance system
ADRS	Aircraft data recording system
ASR	Air safety report
ATC	Air traffic control
Doc	Document
FDA	Flight data analysis
FDAP	Flight data analysis programme
FDAPM	Flight data analysis programme manual
FDR	Flight data recorder
FOQA	Flight Operational Quality Assurance
GPWS	Ground proximity warning system
ICAO	International Civil Aviation Organization
LOSA	Line operations safety audit
QAR	Quick access recorder
SDCPS	Safety data collection and processing system
SOP	Standard operating procedures
SMM	Safety management manual
SMS	Safety management system(s)

Chapter 1
INTRODUCTION

1.1 BACKGROUND

Initially, the principal use of flight recorders was to assist accident/incident investigators, especially in those accidents with no surviving crew members. Early on, it was recognized that analysis of the recorded data was also useful for better understanding of safe operations. By routinely accessing the recorded flight parameters, much could be learned about the safety of flight operations and the performance of airframes and engines. Valuable data on what goes right in day-to-day operations were available, putting accident and incident data into perspective. As well, analysis of this de-identified data could assist in the predictive identification of safety hazards before an incident or accident occurred.

To capitalize on these benefits, a number of operators set up systems to routinely analyze recorded flight data. The aviation industry is increasingly analyzing recorded data from normal operations in support of organizations' safety management systems (SMS). Flight data analysis (FDA) has provided management with another tool for proactively identifying safety hazards, controlling and mitigating the associated risks.

Recognizing the important safety value in such programmes, ICAO adopted their use and published Standards and Recommended Practices (SARPs) in Annex 6 for Part I and III, outlining the requirements to establish and maintain a flight data analysis programme (FDAP). Further details on FDAP provisions are contained in Section 1.5.

The associated guidance material on FDA was initially contained in the first edition of the ICAO *Safety Management Manual (SMM)* (Doc 9859) in Chapter 16.3. This material was incorporated into a separate new guidance (Doc 10000) in order to highlight the importance of establishing such a programme (FDAP). Secondly, the material contained in SMM needed to be further developed and updated and therefore became too specific and detailed to remain as part of the SMM. The content of the first edition of this manual is based on the initial text in the ICAO Doc 9859. The text has been updated and duplications have been removed. The following content changes should be highlighted:

- The manual better describes the relationship between the SMS and the FDAP; the FDAP is an effective tool for the safety assurance component of air operators.

- The manual also better describes safety culture in relation to a non-punitive system, safety culture and duty of care.

- The new text adopts a systematic and comprehensive approach to describing the FDAP. In particular the FDAP processes are redrafted to be coherent and appropriately aligned with the safety risk management principles as contained in the SMM.

- Furthermore, the manual provides a more detailed description of the composition of the FDA team and describes the key objectives for an effective relationship between the FDA team and the management rather than proposing a specific method.

1.2 OBJECTIVES AND SCOPE

This manual is addressed to States providing oversight to air operators as well as air operators performing commercial air transport operations with aeroplanes and helicopters.

The objective of this manual is to provide:

- a description of the relationship between SMS and FDAP;
- an overview of the FDAP elements; and
- guidance for the establishment and implementation of a FDAP.

1.3 STRUCTURE OF THIS MANUAL

The manual consists of four chapters. Chapter 1 provides background information, the objectives and a description of the relationship between SMS and FDAP. Chapter 2 contains a description of the elements of the FDAP. Chapter 3 addresses the protection of FDA data, the involvement of stakeholders and the appropriate safety culture. Finally, Chapter 4 outlines the establishment and the implementation of the FDAP.

1.4 FLIGHT DATA ANALYSIS PROGRAMME

FDA, sometimes referred to as Flight Data Monitoring or Flight Operational Quality Assurance (FOQA), provides a systematic tool for the proactive identification of hazards. FDA is a complement to hazard and incident reporting and to a line operations safety audit (LOSA).

Annex 6, Part I defines “flight data analysis” as a process of analyzing recorded flight data in order to improve the safety of flight operations.

The FDAP may be described as a non-punitive programme for routine collection and analysis of flight data to develop objective and predictive information for advancing safety, e.g. through improvements in flight crew performance, training effectiveness, operational procedures, maintenance and engineering or air traffic control (ATC) procedures.

FDA involves:

- capturing and analyzing flight data to determine if the flight deviated from a safe operating envelope;
- identifying trends; and
- promoting action to correct potential problems.

Periodically, flight data are transferred from the aircraft and analyzed by the ground analysis system at a centralized location.

Deviations of more than certain predetermined values, called “exceedances”, are flagged and evaluated. The FDA team will propose and evaluate corrective actions, as well as produce exceedances aggregation over time to determine and monitor trends. FDA also allows for early identification of aircraft system degradation for maintenance action.

1.4.1 Objectives of a flight data analysis programme

FDAPs are increasingly being used for the monitoring and analysis of flight operations and engineering performance. They are a mandatory type of safety data collection and processing systems (SDCPS) of the SMS for operators of aeroplanes of a maximum certificated take-off mass in excess of 27 000 kg, and an advisable component for those that are below that mass threshold. Successful FDAPs encourage adherence to standard operating procedures (SOPs), determine non-standard behaviour, thereby

improving safety performance. They can detect adverse trends in any part of the flight regime and thus facilitate the investigation of events in addition to those which have had serious consequences.

Flight data analysis can be used to identify non-standard or deficient procedures, weaknesses in the air traffic control (ATC) system and anomalies in aircraft performance. FDA allows the monitoring of various aspects of the flight profile, such as the adherence to the prescribed take-off, climb, cruise, descent, approach and landing SOPs. Specific aspects of flight operations can be examined either retrospectively to identify problem areas, or proactively prior to introducing operational change and subsequently, to confirm the effectiveness of the change.

During incident analysis, flight data of the related flight can be compared with the fleet profile data, thereby facilitating analysis of the systemic aspects of an incident. It may be that the parameters of the incident flight vary only slightly from many other flights, possibly indicating a requirement for change in operating technique or training. For example, it would be possible to determine whether a tail-scrape on landing was an isolated event, or symptomatic of a wider mishandling problem, such as over-flaring on touchdown or improper thrust management.

Engine monitoring programmes may utilize FDAP data for reliable trend analysis as manually coded engine data are limited in terms of accuracy, timeliness and reliability. It is also possible to monitor other aspects of the airframe and systems.

In summary, FDAPs offer a wide spectrum of applications for safety management. Furthermore, it also offers the benefit to improve operational efficiency and economy that compensate the needed investment. The objective is to:

- determine operating norms;
- identify potential and actual hazards in operating procedures, fleets, aerodromes, ATC procedures, etc.;
- identify trends;
- monitor the effectiveness of corrective actions taken;
- feed data to conduct cost/benefit analysis;
- optimize training procedures; and
- provide actual rather than presumed performance measurement for risk management purposes.

Furthermore, it is significant that FDAPs are non-punitive and contain adequate safeguards to protect the source(s) of the data.

1.4.2 Flight data analysis programme integrated within a safety management system

FDA aims at continuous improvement of the overall safety performance of an operator and it should be integrated in the safety assurance component of the operator’s SMS. Ideally, where multiple systems are utilized to identify hazards and manage risk, they should be integrated to maximize their combined effectiveness, to ensure resources are being distributed appropriately across the systems and, where possible, to reduce duplicated processes for greater system efficiency. So, an operator wishing to implement an FDAP and which already has a mature SMS processes in place should be able to readily adopt and understand the fundamental processes of an FDAP.

For example as part of an Operators SMS’s, safety assurance processes, they will have identified indicators or parameters chosen for measuring and monitoring the Operators safety performance including “operational events”. These events may be low consequence (deviation, non-compliance events) or high

consequence safety performance indicators (accident and serious incident rates). Such data is routinely fed into or part of the SDCPS.

The Operators SMS's assurance processes would also have procedures for corrective or follow-up action to be taken when targets are not achieved and/or alert levels are breached that are set for each of the performance indicators/parameters.

Alert and target levels serve as markers to define what is the abnormal/unacceptable occurrence rate as well as the desired target (improvement) rate for the indicator. The alert level for a particular safety indicator is the demarcation line between the acceptable trending region and the unacceptable region. Target level setting is the desired improvement level within a defined future milestone or monitoring period. With such defined alert and target settings, it becomes apparent that a qualitative/quantitative performance outcome can be derived at the end of any given monitoring period. This may be done by counting the number of alert breaches and/or the number of targets achieved for an individual indicator and/or a package of safety indicators. Further guidance on setting alert and target levels can be found in the Safety management manual's third edition.

Under such an assurance programme the management would also be responsible for setting procedures to review new and existing aviation safety-related facilities and equipment including operations and processes for hazards/risks before they are established or when changes to operations is introduced.

The FDA specific data output could be easily integrated into existing databases for measuring safety performance, managing change and continuous improvement. Such cross communication between an FDAP and SMS would increase the robustness of the processes and help achieve greater effectiveness in safety and quality of the system/programme.

Where an FDAP is in place but not integrated in the SMS, the operator will need to develop the processes to assure effective means of safety performance measurement and corrective action plans in order to maintain continuous improvement of the operations.

An FDAP held remote from the SMS of an operator would cause a substandard performance of the SMS for its continuous improvement. Moreover, information from other SMS data sources gives context to the flight data which will, in return, provide quantitative information to support analysis that otherwise would be based on subjective reports. Air safety reporting, avionic and systems maintenance, engine monitoring, ATC and scheduling are just a few of the areas that could benefit. This is why Annex 6, Part I requires the implementation of a FDAP as part of the operator's SMS.

The degree of integration between an operator's SMS and its FDAP will depend on many factors, including the relative maturity of the two systems as well as operational, organizational and regulatory considerations.

Note.— Guidance on integration of management systems is provided in the ICAO Safety Management Manual (SMM) *(Doc 9859), 3rd edition.*

1.5 ICAO SARPS ON FLIGHT DATA ANALYSIS PROGRAMME

Annex 6, Parts I and III contain high level provisions for establishment and maintenance of an FDAP as part of an operator's SMS. As FDAP shares the fundamental building blocks of an SMS, the provisions call for FDAP to be part of an SMS.

Annex 6, Parts I and III SARPs are listed as per the latest Amendments 37 and 17, respectively. It should be noted that although these amendments have undergone some modifications due to the development of Annex 19 — *Safety Management*, there is no change on the intent or context of the SARPs.

1.5.1 Annex 6, Part I, Chapter 3, Section 3.3

The SARPs related to FDAP for international commercial air transport operations with aeroplanes are as follows:

Annex 6, Part I
INTERNATIONAL COMMERCIAL AIR TRANSPORT-AEROPLANES

CHAPTER 3. GENERAL

3.3 Safety Management

Note.— Annex 19 includes safety management provisions for air operators. Further guidance is contained in the Safety Management Manual (SMM) *(Doc 9859).*

3.3.1 **Recommendation.—** *An operator of an aeroplane of a certificated take-off mass in excess of 20 000 kg should establish and maintain a flight data analysis programme as part of its safety management system.*

3.3.2 An operator of an aeroplane of a maximum certificated take-off mass in excess of 27 000 kg shall establish and maintain a flight data analysis programme as part of its safety management system.

Note.— An operator may contract the operation of a flight data analysis programme to another party while retaining overall responsibility for the maintenance of such a programme.

3.3.3 A flight data analysis programme shall be non-punitive and contain adequate safeguards to protect the source(s) of the data.

Note 1.— Guidance on the establishment of flight data analysis programmes is included in the Manual on Flight Data Analysis Programme (FDAP) *(Doc 10000).*

Amendment No. 37

1.5.2 **Annex 6, Part III, Chapter 1, Section 1.3**

The SARPs related to FDAP for international commercial air transport operations with helicopters are as follows:

Annex 6, Part III
INTERNATIONAL OPERATIONS- HELICOPTERS

SECTION II
INTERNATIONAL COMMERCIAL AIR TRANSPORT

CHAPTER 1. GENERAL

1.3 Safety Management

Note.— Annex 19 includes safety management provisions for air operators. Further guidance is contained in the Safety Management Manual (SMM) *(Doc 9859).*

1.3.1 Recommendation.— An operator of a helicopter of a certified take-off mass in excess of 7000 kg or having a passenger seating configuration of more than 9 and fitted with a flight data recorder should establish and maintain a flight data analysis programme as part of its safety management system.

Note.— An operator may contract the operation of a flight data analysis programme to another party while retaining overall responsibility for the maintenance of such a programme.

1.3.2 A flight data analysis programme shall be non-punitive and contain adequate safeguards to protect the source(s) of the data.

Note 1.— Guidance on the establishment of flight data analysis programmes is included in the Manual on Flight Data Analysis Programmes (FDAP) *(Doc 10000).*

Amendment No. 17

Chapter 2
FLIGHT DATA ANALYSIS PROGRAMME DESCRIPTION

2.1 FDAP OVERVIEW

The quality and capability of an operator's FDAP will be dependent on the selection, availability of flight parameters, and the quick access recorder's (QAR's) availability. The selected flight parameters should be relevant and appropriate to reflect the safety, quality or risk level of the process thereby providing a performance track. It is important to note that the programme description herewith provides baseline components. Therefore, depending on availability of resources, technology, complexity and size of operation the programme will need to be modified to suit the needs of the operator.

2.2 FDA EQUIPMENT

FDAPs generally involve systems that capture flight data, transform the data into an appropriate format for analysis and generate reports and visualization to assist in assessing the data. The level of sophistication of the equipment can vary widely. Typically, however, the following equipment capabilities are required for effective FDAPs:

- an on-board device to capture and record data on a wide range of flight parameters. These flight parameters should include, but not be limited to the flight parameters recorded by the flight data recorder (FDR) or aircraft data recording systems (ADRS). The flight parameter performance (range, sampling rate, accuracy, recording resolution) should be as good as or better than the performance specified for FDR parameters;

- a means to transfer the data recorded on board the aircraft to a ground-based processing station. In the past, this largely involved the physical movement of the memory unit from the QAR. To reduce the physical effort required, later transfer methods utilize wireless technologies;

- a ground-based computer system (using specialized software) to analyze the data (from single flights and/or in an aggregated format), identify deviations from expected performance, generate reports to assist in interpreting the read-outs, etc.; and

- optional software for a flight animation capability to integrate all data, presenting it as a simulation of in-flight conditions, thereby facilitating visualization of actual events for analysis and crew debriefing.

2.2.1 **Airborne equipment**

Modern glass-cockpit and fly-by-wire aircraft are equipped with the necessary digital data buses from which information can be captured by a recording device for subsequent analysis. Older, non-digital, aircraft are capable of capturing a limited set of data, but may be retrofitted to record additional parameters. Nevertheless, a limited parameter set will allow for a useful, basic FDAP.

The flight parameters recorded by the FDR or ADRS may determine a minimum set for an FDAP. In some cases the flight parameters and FDR/ADRS recording duration required by law to support accident and incident investigations may be insufficient to support a comprehensive FDAP. Thus many operators are opting for additional recording capacity, capable of being easily downloaded for analysis.

QARs are optional non-crash protected recorders installed on the aircraft and record flight data in a low-cost removable medium. They are more accessible and record the same parameters for a longer duration than the FDR. New technology QARs and new flight data acquisition systems offer the possibility to capture and record thousands of flight parameters. They also allow for increasing the sampling rate or the recording resolution of specific flight parameters to values appropriate for advanced flight data analysis. The expanded data frame greatly increases the resolution and accuracy of the output from ground analysis programmes. However the data frame definition is one of the more difficult parts of setting up a FDAP. For example in a mixed fleet, it is very expensive to obtain the necessary capability to read different data sets.

An increasing number of aircraft being fitted with light-weight flight recorders as standard equipment, these units will provide a source of flight data for operators of smaller aircraft. This will enable such operators to implement a FDAP commensurate with the size of their operations even if there are no provisions requiring them to institute FDAPs. The light-weight recorders make use of low-cost removable memory cards which may simplify the process to download and analyze the flight data.

To eliminate the task of moving the data from the aircraft to the ground station by physically removing the recording medium of the QAR, newer systems automatically download the recorded information via secure wireless systems when the aircraft is in the vicinity of the gate. In other systems, the recorded data is analyzed on board while the aircraft is airborne. The relevant encrypted data is then transmitted to a ground station using satellite communications. Fleet composition, route structure and cost considerations will determine the most cost-effective method of removing the data from the aircraft.

2.2.2 Ground-based computer system for flight data analysis

Flight data are downloaded from the aircraft recording device into a ground-based computer system including analysis software, where the data are held securely to protect this sensitive information. Such computer systems are commercially available; however, the computer platform will require appropriate front-end interfaces to cope with the variety of recording inputs available today.

FDAPs generate large amounts of data requiring specialized analysis software. This analysis software facilitates the routine analysis of flight data in order to identify situations that may require corrective action.

The analysis software checks the downloaded flight data for abnormalities. The exceedance detection typically includes a large number of trigger logic expressions derived from a variety of sources such as flight performance curves, SOPs, engine manufacturers' performance data, airfield layout and approach criteria. Trigger logic expressions may be simple exceedances such as redline values. The majority, however, are composites which define a certain flight mode, aircraft configuration or payload-related condition. Analysis software can also assign different sets of rules dependent on aerodrome or geography. For example, noise sensitive aerodromes may use higher than normal glide slopes on approach paths over populated areas. The set of trigger logic expressions is normally user-defined.

Exceedances and routine measurements can be displayed on a ground computer screen in a variety of formats. Recorded flight data are usually shown in the form of color-coded traces and associated engineering listings, cockpit simulations or animations of the external view of the aircraft.

2.3 PROCESSING FDA DATA

2.3.1 Exceedance detection

Exceedance detection, such as deviations from flight manual limits or SOPs is one way of extracting information from flight data. A set of core events/parameters establishes the main areas of interest to an operator.

Examples: High lift-off rotation rate, stall warning, ground proximity warning system (GPWS) warning, flap limit speed exceedance, fast approach, high/low on glide slope and heavy landing.

Exceedance data provides factual information which complement crew and engineering reports.

Examples: Reduced flap landing, hard landings, emergency descent, engine failure, rejected take-off, go-around, airborne collision avoidance system (ACAS) or GPWS warning and system malfunctions.

Operators may also modify the standard set of core events to account for unique situations they regularly experience or for the SOPs they use.

2.3.2 Routine measurements

Data can be retained from all flights, not just the ones producing significant events. A selection of parameters is retained that is sufficient to characterize each flight and allow a comparative analysis of a wide range of operational variability. Emerging trends and tendencies are monitored before the trigger levels associated with exceedances are reached.

Examples of flight parameters monitored: Take-off weight; flap setting; temperature; rotation and lift off speeds versus scheduled speeds; maximum pitch rate and attitude during rotation; and gear retraction speeds, heights and times.

Examples of comparative analyses: pitch rates from high versus low take-off weights; unstable approaches; and touchdowns on short versus long runways.

2.3.3 Incident investigation

FDAPs provide valuable information for incident investigations and for follow-up of other technical reports. Quantifiable recorded data have been useful in adding to the impressions and information recalled by the flight crew. The FDAP data also provide an accurate indication of system status and performance, which may help in determining cause and effect relationships.

Examples of incidents where recorded flight data could be useful: High cockpit workload conditions as corroborated by such indicators as:

- late descent;
- late localizer and/or glide slope interception;
- large heading change below a specific height; and
- late landing configuration;
- unstabilized and rushed approaches, glide path excursions, etc.;
- exceedances of prescribed operating limitations (such as flap limit speeds, engine over-temperatures); and
- wake vortex encounters, low-level wind shear, turbulence encounters or other vertical accelerations.

2.3.4 Continuing airworthiness

Both routine measurements and exceedances can be utilized to assist the continuing airworthiness function. For example, engine-monitoring programmes look at measures of engine performance to determine operating efficiency, predict impending failures and assist in maintenance schedule.

Examples of continuing airworthiness uses: Engine thrust level and airframe drag measurements; avionics and other system performance monitoring; flight control performance; monitoring on-condition systems and engine deterioration; and brake and landing gear usage.

2.3.5 Integrated safety analysis

All the data gathered in an FDAP should be integrated in a central safety database. By linking the 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 of integration: 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.

2.4 ANALYSIS AND FOLLOW-UP

Overviews and summaries of FDA data are compiled on a regular basis, usually weekly or bi-weekly, whilst individual significant events would be expected to be more timely followed up. All data should be reviewed to identify specific exceedances and emerging undesirable trends and to disseminate the information to flight crews.

If deficiencies in the flight technique are recognized, the information is de-identified in order to protect the identity of the flight crew. The information on specific exceedances is passed to a flight crew contact person. This person provides the necessary contact with the flight crew (see section 4.3 “The FDAP team”) in order to clarify the circumstances, obtain feedback and give advice and recommendations for appropriate action, such as flight crew re-training (carried out in a positive and non-punitive way), revisions to operating and flight manuals or changes to ATC and aerodrome operating procedures.

All events are archived in a database. The database is used to sort, validate and display the data in easy-to-understand management reports. Over time, this archived data can provide a picture of emerging trends and hazards which would otherwise go unnoticed.

Lessons learned from the FDAP may warrant inclusion in the company’s safety promotion activities. Care is required, however, to ensure that any information acquired through FDA is de-identified before using it in any training or promotional initiative unless permission is given by all the crew members involved. Care should also be taken that, in order to avoid an exceedance, flight crews do not attempt to “fly the FDA profile” rather than follow SOPs. Such a behavior would have a negative impact on safety.

A proper value should be programmed for trigger and exceedance and designed to include an acceptable buffer that will disregard minor deviation, spurious events, as well as introduce an adequate operational

margin to fly the plane through SOPs, instead of leading the flight crew to focus on FDA parameters in order to avoid deviations.

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 and effectiveness of corrective actions adequate?
- 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?

All successes and failures should be recorded, comparing planned programme objectives with expected results. This provides a basis for review of the FDAP and the foundation for future programme development.

Chapter 3
PREREQUISITES FOR AN EFFECTIVE FDAP

Several conditions that are fundamental to a successful FDAP are discussed below.

3.1 PROTECTION OF FDA DATA

3.1.1 Overall approach

The Operator's management, flight crews and the State of the Operator have legitimate concerns regarding the protection of FDA data, which include:

- use of data for disciplinary purposes;
- use of data for enforcement actions against individuals or against the company, except in cases of criminal intent or willful misconduct;
- disclosure to the media and the general public under the provisions of State laws regarding access to information; and
- disclosure during civil litigation.

However, the integrity of a FDAP rests upon protection of the FDA data. Any disclosure for purposes other than safety management can compromise the required cooperation of the affected flight crew for clarifying and documenting an event. Thus, preventing the misuse of FDA data is a common interest of the State, the operator and the flight crews.

Data protection can be optimized by:

- adhering to the agreement between management and the flight crews, where available;
- strictly limiting data access to selected individuals;
- maintaining tight control to ensure that data identifying a specific flight are kept securely;
- ensuring that operational problems are promptly addressed by management; and
- to the extent possible, non-reversible de-identification of the flight data files after a time appropriate for their analysis.

3.1.2 Policy on retention of data

Because of the large volumes of data involved, it is important that a strategy for data access, both on and off line, is carefully developed to meet the needs of the FDAP users.

The most recent flight data and exceedances are normally kept readily available to allow fast access during the initial analysis and interpretation stages. When this process is completed it is less likely that additional data from the flights will be required so the flight data can be archived. Exceedances are usually kept on line for a much longer period to allow trending and comparison with previous events.

3.1.3 De-identification policy and procedures

A policy on FDA data de-identification is an absolutely critical area that should be carefully written down and agreed to before it is needed in extreme circumstances. Management assurance on the nondisclosure of individuals must be very clear and binding. The one exception is when the operator/flight crew believes that there is a continuing unacceptable safety risk if specific action regarding the flight crew is not taken. In this case an identification and follow-up action procedure, previously agreed to before the particular event, can be brought into play. Experience has shown that this is very rarely required. Most

often a flight crew responds to advice from the FDA flight crew contact person to submit an air safety report (ASR) and they may then be covered by protection assured under that programme.

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 operator and the flight crews. Strict rules of access should be enforced during this period. In the case of a mandatory occurrence or accident, any data retained by the programme may not be de-identified or removed from the system prior to the investigation or confirmation that it is not required. This will allow the safety investigators access to all relevant information.

3.1.4 Set authorized access levels

The FDA ground-based computer system must have the ability to restrict access to sensitive data and also control the ability to edit data. For example, the FDA flight crew contact person could have full access, while operations management would only have access to de-identified data and the ability to add comments and edit a few appropriate fields.

3.2 INVOLVEMENT OF FLIGHT CREWS

As with successful incident reporting systems, the trust established between management and its flight crews is the foundation for a successful FDAP. For most operators this will be accomplished through an association, while for others the State authority may be the custodian of flight crew involvement under the limitation of the due “duty of care”. Here it is incumbent upon management to provide assurance of the FDAP intent, conditions of use and protection given to its employees. This trust can be facilitated by:

- early participation of the flight crew representatives and/or authority representatives in the design, implementation and operation of the FDAP; and

- a formal agreement between management and the flight crews, and/or authority identifying the procedures for the use and protection of data.

3.3 SAFETY CULTURE

Consistent and competent programme management characterizes successful FDAPs. Indications of an effective safety culture of an operator include:

- top management’s demonstrated commitment to promoting a proactive safety culture,

- the cooperation and accountability of all organizational levels and relevant personnel representatives meaning that anyone believing to have identified a potential risk should feel able to report and expect follow-up action to be considered. From the line pilot to the fleet manager all have responsibility to act.

- a written non-punitive company policy that covers FDA and makes clear that the main objective of the FDAP should be to improve safety, and not to allocate blame or liability;

- an identified safety manager whose role and functions are defined following the recommendations of the Safety Management Manual (Doc 9859);

- a FDAP management by a dedicated staff under the authority of the safety manager, with a high degree of specialization and logistical support;

- involvement of persons with appropriate expertise when identifying and assessing risks. For example, flight crews experienced on the aircraft type being analyzed are required for the accurate diagnosis of operational hazards emerging from FDA analyses;

- a focus on monitoring fleet trends aggregated from numerous operations, rather than on specific events. The identification of systemic issues adds more value for safety management than isolated events;

- a well-structured de-identification system to protect the confidentiality of the data; and

- an efficient communication system, to permit timely safety action, for disseminating hazard information and subsequent risk assessments internally and to other organizations.

Chapter 4
ESTABLISHING AND IMPLEMENTING AN FDAP

4.1 IMPLEMENTATION PLAN

Typically, the following steps are required to implement an FDAP:

- management approval of the programme;
- implementation of a formal agreement between management and flight crews;
- identification of an FDAP implementation committee, including the future FDA team members; this committee should be involved in all of the following steps;
- development of a business plan, including processes, software and hardware and assignment of adequate resources;
- establishment and verification of operational and security procedures;
- development of a FDAP procedures manual;
- assessment of possible interfaces between the FDAP and other safety data sources (i.e. SDCPS) and of integration of the FDAP into the SMS;
- selection of equipment (airborne, ground-based computer system, interface with other data sources and the SMS);
- selection and training of the FDA team members, according to their respective roles;
- testing of data transfer; testing of the ground-based computer system (including data acquisition, definition of trigger logic expressions, data analysis and visualization, data de-identification, final storage of data);
- testing of data security, including security procedures;
- identification of areas of interest that should be first looked at in the data;
- checking of the proper decoding and of the quality of flight parameters used by the FDAP; and
- start of data analysis and validation, focused on key areas in operation.

Note.— FAA Advisory Circular 120-82 provides an example of an FDAP implementation plan.

Historically, bearing in mind the time required to obtain flight crew/management agreements and develop relevant procedures, an operator with no FDA experience would not likely achieve an operational FDAP in less than twelve months. Another year may be required before any safety and cost benefits appear. Improvements in the analysis software, or the use of outside specialist service providers, should shorten these time frames to ensure FDA coverage during the safety critical period of introduction to service.

4.2 AIMS AND OBJECTIVES

A phased approach is recommended so that the foundations are in place for possible subsequent expansion into other areas. Using a building block approach will allow expansion, diversification and evolution through experience.

Example: With a modular system, begin by looking at basic safety-related issues only. Add engine health monitoring, etc. in the second phase. Ensure compatibility with other systems.

A staged set of objectives starting from the first week's replay and moving through early production reports into regular routine analysis will contribute to a sense of achievement as milestones are met.

Examples:

Short-term goals:

a) establish data download procedures, test analysis software and identify aircraft defects;

b) validate and investigate exceedance data; and

c) establish a user-acceptable routine report format to highlight individual exceedances and facilitate the acquisition of relevant statistics.

Medium-term goals:

a) produce annual report — include key performance indicators;

b) add other modules to analysis (e.g. continuing airworthiness); and

c) plan for next fleet to be added to programme.

Long-term goals:

a) network FDA information across all company safety information systems and integrate the FDAP into the SMS;

b) ensure FDA provision for any proposed advanced training programme; and

c) use utilization and condition monitoring to reduce spares holdings.

Initially, focusing on a few known areas of interest will help prove the system's effectiveness.

Examples: Rushed approaches, or rough runways at particular aerodromes; unusual fuel usage on particular flight segments, etc. Analysis of such known problem areas may generate useful operational confidence leading to the analysis of other areas.

4.3 THE FDAP TEAM

Experience has shown that the "team" required to run a FDAP can vary in size from one person for a small fleet, to a dedicated section for large fleets. The descriptions below identify various functions to be fulfilled, not all of which need a dedicated position.

- *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.

- *Flight operations interpreter*. This person is usually an experienced pilot in the type and operation who knows the operator's route network and aircraft. This team member's in-depth knowledge of SOPs, aircraft handling characteristics, airports and routes will be used to place the FDA data in a credible context.

- *Technical interpreter*. This person 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 operator.

- *Flight crew contact person*. This is a person usually assigned by the operator for this responsibility (safety manager, agreed flight crew representative, honest broker), or a mutually acceptable substitute, for confidential discussion with flight crews involved in events highlighted by FDA. 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.

- *Engineering technical support*. This person is usually an avionics specialist, involved in the supervision of FDR serviceability. Indeed, the 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.

- *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 and LOSA) and with the operator's SMS, creating a credible integrated context for all information. This function can reduce duplication of follow-up investigations.

- *Replay operative and administrator*. This person is responsible for the day-to-day running of the system, producing reports and analysis. Methodical, with some knowledge of the general operating environment, this person keeps the programme moving. Operators may utilize the services of a specialist contractor to operate the FDAP.

All FDAP team members need appropriate training or experience for their respective area of data analysis and should be subject to a confidentiality agreement.

Each team member should be allocated a realistic amount of time to regularly spend on FDA tasks. With insufficient human resources, the entire programme will underperform or even fail.

4.4 CONTINUOUS IMPROVEMENT

New safety issues identified and published by other organizations, 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 the FDAP.

The FDA processes and procedures will need to be amended when the FDAP matures and each time there are changes in the operations, the internal organization of the aircraft operator or the interface with other data sources and processes.

In order to assess the general effectiveness of the FDAP, a periodic review or an audit may be beneficial. Such a review could determine:

- if anticipated safety benefits are being realized;
- if the FDA procedures reflect the actual operation of the FDAP, and if they have been followed;
- whether the information provided to FDAP users is accurate, timely, and usable; and
- if the tools employed to collect and present data are still adequate and if other technology would be more effective.

— END —