



EUROPEAN AUTHORITIES COORDINATION GROUP  
ON FLIGHT DATA MONITORING (EAFDM)

SAFETY PROMOTION  
Good Practice document

# GOOD PRACTICE ON THE OVERSIGHT OF FLIGHT DATA MONITORING PROGRAMMES

Version 1



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## Note

This document was produced by the members of the European Authorities coordination group on FDM (EAFDM). Information on the EAFDM can be consulted at <http://www.easa.europa.eu/safety-and-research/european-authorities-coordination-group-on-flight-data-monitoring-EAFDM.php>

According to its terms of reference, the EAFDM is a voluntary partnership between the European Aviation Safety Agency (EASA) and National Aviation Authorities of EASA Member States, with the following objectives:

- to foster actions by National Aviation Authorities of EASA Member States which contribute to improving the implementation of FDM Programmes and to making FDM programmes more safety effective
- to contribute to a high and uniform level of safety in Europe
- to contribute to a better overview of air transport operational safety in Europe

The EAFDM is also open to observers and advisers from National Aviation Authorities of States who are not members of EASA.

The experts that contributed to this document were from the following authorities:

- Austro Control (Austria)
- BCAA (Belgium)
- TraFi (Finland)
- DGAC (France)
- IAA (Ireland)
- ULC (Poland)
- INAC (Portugal)
- AESA (Spain)
- FOCA (Switzerland)
- CAA (United Kingdom)
- EASA
- GCAA (UAE, observer)

According to its terms of reference, the EAFDM is a voluntary and independent safety initiative. **Therefore this document should not be considered as official guidance from any of the authorities taking part in the EAFDM.**

If you would like to give your comments or a feedback on this document, please write to [fdm@easa.europa.eu](mailto:fdm@easa.europa.eu).

# Executive Summary

This document is intended to provide good practice<sup>1</sup> for National Aviation Authorities on the oversight of aircraft operators' FDM programmes.

**Flight data monitoring (FDM)** can be a powerful tool for an operator to improve and monitor its operational safety. Although it is only required by European air operation rules for large aeroplanes (over 27 000 kg maximum certificated take-off mass), it has proved to be very beneficial for operators of lighter aeroplanes and operators of helicopters.

National Aviation Authorities of EASA Member States are responsible for the oversight of the Management Systems of their approved Air Operator Certificate (AOC) holders, including their FDM programme.

The **European Authorities coordination group on FDM** (EAFDM) would like to offer practical guidance on how to effectively oversee FDM programmes, and therefore it decided to gather the experience of its members and make it available to National Aviation Authorities.

This good practice document aims at providing advice on the principles to be checked.

This good practice document was prepared with the European air operations rules in mind, as well as the state of play of FDM in Europe. However, it is believed that the content of this document can be of use for National Aviation Authorities that are not members of EASA.

It is understood that implementing the good practice offered by this document could present challenges to both National Aviation Authorities and operators who are less experienced in the field of FDM. A phased approach may be taken in such cases with a view to achieve higher standards in the long term.

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<sup>1</sup> This document is not an EASA acceptable means of compliance or an EASA guidance material.

# Definition of terms

The following definitions are provided for the acronyms that are used in this document:

<b>AOC</b>	Air Operator Certificate
<b>ASR</b>	Air Safety Report
<b>ATQP</b>	Alternative Training and Qualification Programme
<b>CAA</b>	Civil Aviation Authority
<b>CFIT</b>	Controlled flight into terrain
<b>EAFDM</b>	European Authorities coordination group on Flight Data Monitoring
<b>EASA</b>	European Aviation Safety Agency
<b>FDA</b>	Flight Data Analysis
<b>FDM</b>	Flight Data Monitoring
<b>ICAO</b>	International Civil Aviation Organisation
<b>LOC-I</b>	Loss of control in flight
<b>MAC</b>	Mid-air collision
<b>MCTOM</b>	Maximum certificated take-off mass
<b>NAA(s)</b>	National Aviation Authority(ies)
<b>NAA-MS</b>	National Aviation Authority of an EASA Member State
<b>RE</b>	Runway excursion
<b>SMS</b>	Safety Management System (term used by ICAO)
<b>SOP</b>	Standard Operating Procedure
<b>SSP</b>	State Safety Programme

# I. Background

## 1. The objectives of an FDM programme

### A tool for the operator to monitor its operational safety

According to Commission Regulation (EU) 965/2012, “Flight Data Monitoring (FDM) means the proactive and non-punitive use of digital flight data from routine operations to improve aviation safety”. Together with a reporting system, FDM is a vital part of a well-functioning Management System for an aircraft operator, and it acts as one of the main data sources for monitoring the operational safety level.

In addition, many mature FDM programmes have benefited operators through the feedback of representative FDM derived information to their training departments and flight crews. A formalised and recognised approach to linking FDM with training is employing an FDM programme as part of the deployment of an Alternative Training and Qualification Programme (ATQP).

### The role of a National Aviation Authority

European regulations expect the competent authority to have oversight of the Management Systems of their aircraft operators. An important element thereof is how the FDM data is used and analysed by the aircraft operator in order to define adequate measures for safety improvement and assurance.

Also, the oversight of FDM programmes by an NAA-MS can feed into its State Safety Programme (SSP) by providing information on the general level of implementation of the FDM programmes by aircraft operators.

### A component of the operator’s Management System

FDM was described in EU OPS as a component of an operator’s accident prevention and flight safety programme. With the advent of the concept of the (Safety) Management System, FDM is a natural data source for the Management System.

Therefore the use of FDM programmes by aircraft operators is normally checked in the frame of the Management System oversight.

**Note:**

According to Regulation (EC) 216/20082, Annex IV, 8.a.4, ‘the operator must implement and maintain a management system to ensure compliance with these essential requirements for operations and aim for continuous improvement of this system’. The term ‘Management System’ used throughout this document is considered to encompass the ICAO concept of ‘safety management system’<sup>3</sup>. The essential elements of the Management System of an aircraft operator are described in ORO.GEN.200. They include, among others:

“(a)(3) the identification of aviation safety hazards entailed by the activities of the operator, their evaluation and the management of associated risks, including taking actions to mitigate the risk and verify their effectiveness;”

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2 Regulation (EC) 216/2008 ‘on common rules in the field of civil aviation and establishing a European Aviation Safety Agency’ (commonly called the ‘Basic Regulation’).

3 The principle of the Management System concept is that organisations can integrate the new safety risk management elements into their existing system of management. It is offering more flexibility since organisations may still refer to their SMS, QMS or SQMS etc., as long as they can demonstrate that the provisions of Part ORO are met. This is also considered in line with systems thinking: in reality, the organisation should have only one management system, which entails specific features to control the processes and requires feedback channels and interactions between processes and with third parties. The better all these elements are integrated the better the organisation will manage risks.

## The “safety culture” (or “just culture”) presupposition

An FDM programme is intrinsically non-punitive, featuring as part of a positive safety culture. As such it has to function within a just culture and the operator’s overall responsibilities related to its Management System.

This means that in cases of gross negligence or a significant continuing safety concern, the decision to sanction an individual flight crew member may be in part based on FDM data, however such a decision has to be made within the Management System framework and procedures and require preliminary safety assessment by the Safety Manager.

## 2. ICAO Standards and Recommended Practices

ICAO Annex 6 Part I (International Commercial Air Transport – Aeroplanes) contains a Standard requiring an operator of an aeroplane of a maximum certificated take-off mass (MCTOM) in excess of 27 000 kg to have an FDM programme ‘as part of its safety management system’ (this concept is encompassed by the Management System described in ORO.GEN.200). Annex 6 Part I also contains a corresponding Recommended Practice for operators of aeroplanes of an MCTOM exceeding 20 000 kg.

ICAO Annex 6 Part III (International Operations – Helicopters) contains a Recommended Practice recommending a FDM programme for operators of helicopters of an MCTOM exceeding 7 000 kg or a passenger seating configuration of more than 9.

Relevant provisions of ICAO Annex 6 are copied in Annex 2 of this document.

ICAO Annex 19 (Safety Management) contains provisions on the implementation of a Management System and of a State safety oversight system.

## 3. European Regulation

### Air operation rules

Paragraph ORO.AOC.130 of Commission Regulation (EU) 965/2012, Annex III (Part ORO) contains the implementing rule requiring an FDM programme for aeroplanes with an MCTOM of over 27 000 kg and operated for commercial air transport. Commission Regulation (EU) 965/2012 is applicable in all EASA Member States since 29 October 2014.

AMC1 ORO.AOC.130 of EASA Executive Director (ED) Decision 2012/017/R contains acceptable means of compliance for the implementation of paragraph ORO.AOC.130 of the implementing rules. AMC1 ORO.AOC.130 covers the following aspects:

- Use of FDM information
- Flight Data Monitoring Analysis Techniques
- Flight Data Monitoring Analysis, Assessment and Process Control Tools
- Education and Publication
- Accident and incident data requirements
- Company occurrence reporting scheme
- Data recovery strategy
- Data retention strategy
- Data Access and Security policy
- Procedure Documentation
- Airborne systems and equipment

In addition, more detailed guidance material has been introduced into GM1 ORO.AOC.130 of EASA ED Decision 2012/017/R.

**Note:**

In June 2013 EASA published Notice of Proposed Amendment (NPA) 2013-10 on Helicopter offshore operations. The Comments Response Document (CRD) 2013-10 was published in August 2014. It contains a draft requirement that whenever operating a helicopter equipped with a flight data recorder (FDR) for offshore commercial air transport, the operator shall establish an FDM programme.

## Flight Data Monitoring for Alternative Training and Qualification Programmes

Operational requirements applicable to an Alternative Training and Qualification Programme (ATQP)<sup>4</sup> are laid down in Commission Regulation (EU) 965/2012, Annex III (Part ORO), paragraph ORO.FC.A.245. An acceptable means of compliance is provided by EASA ED Decision 2012/017/R, AMC1 ORO.FC.A.245.

AMC1 ORO.FC.A.245 outlines that the purpose of FDM for ATQP is to enable the operator to:

- provide data to support the implementation of ATQP and justify changes to the ATQP;
- establish operational and training objectives based upon an analysis of the operational environment;
- monitor the effectiveness of flight crew training and qualification.

Indeed, the ATQP should include a feedback loop in order to measure if the overall targets of training are being achieved. An FDM programme is expected as a basis for such a feedback loop.

**Note:**

Adapting the flight crew training programme nearest to the specific needs of the operator should allow them to better grasp the risks they face, mitigate them and improve safety.

The identification of the training needs is reliant on an evidence base which may also include data such as:

- occurrence reports;
- internal audits of real operating conditions (Line-oriented evaluation and line-oriented quality evaluation);
- information feedback from instructors and examiners;

The operator should establish a procedure for data handling to ensure the confidentiality of individual flight crew members.

An ATQP needs a certain degree of data coverage in order to function properly. FDM data collection should reach a minimum of 60% for all relevant flights conducted by the operator before ATQP approval is granted.

An advanced FDM programme is required when an extension to the ATQP is requested.

**Note:**

According to AMC1 ORO.FC.A.245, 'an advanced FDM programme is determined by the level of integration with other safety initiatives implemented by the operator, such as the operator's Management System. The programme should include both systematic evaluations of data from an FDM programme and flight crew training events for the relevant crews. Data collection should reach a minimum of 80 % of all relevant flights and training conducted by the operator. This proportion may be varied as determined by the competent authority.'

It is important to account for the fact that the development of unique items of training/monitoring in an ATQP requires time, in terms of gathering evidence from data, the practicalities of implementation of new training,

.....  
4 An ATQP gives an operator the possibility to establish an alternative training and checking programme that should maintain at least an equivalent or improved level of flight crew proficiency to the existing operational training requirements. ATQPs offer an increased scope for developing training initiatives; in such programmes, the syllabus for the training is specifically adapted to the organization and its operations and aircraft fleet.

assessing potential associated risks and establishing success/failure etc. Thus a staged approach to this may be needed with short term and long term goals set out at the start, with a process to modify these if justified through experience, as the programme develops.

### **Flight Data Monitoring for the serviceability of a flight data recorder**

Commission Regulation (EU) 965/2012, Annex IV (Part CAT) contains in paragraph CAT.GEN.MPA.195 a requirement that the aircraft operator maintains the serviceability of the flight recorders through operational checks.

Acceptable means of compliance are provided by EASA ED Decision 2012/018/R paragraph AMC1 CAT.GEN.MPA.195. This paragraph recommends an annual inspection of the FDR recording, however in the case where the aircraft is subject to an FDM programme this could be relaxed. For this alleviation to be acceptable, the data source of FDR mandatory flight parameters and of FDM data should be the same, the FDR should be fitted with reliable built-in-test equipment (most solid-state FDRs are, but magnetic tape FDRs are not) and the integrity of the FDR mandatory flight parameters should be monitored by the FDM programme.

Hence, under certain conditions, an FDM programme can be an acceptable substitute for the annual inspection of the FDR recording.

### **Oversight role of NAA-MS**

The oversight role of the NAAs-MS is as defined in Commission Regulation (EU) 965/2012.

According to Article 3 of this Regulation, Member States shall ensure that the competent authority has the necessary capability to ensure the oversight of all persons and organisations covered by their oversight programme, including sufficient resources to fulfil the requirements of the Aviation Regulations.

Personnel of the authority are required to carry out certification and oversight tasks like the performing of audits, investigations, assessments, inspections, including ramp inspections and unannounced inspections and any other task to grant a proper oversight of air operators.

Annex II (Part ARO - authority requirements for air operations) contains more specific requirements. The oversight role includes the surveillance that an operator has established and maintained a flight data monitoring programme.

## 4. Guidance on FDM

### Guidance material of the International Civil Aviation Organisation

ICAO Flight Data Analysis Programmes Manual (ICAO Doc 10 000) provides general guidance on what an FDM programme usually consists of, the prerequisites for an effective FDM programmes and how it can be established.

### Guidance material of the UK Civil Aviation Authority

CAP 739, Flight Data Monitoring (Second edition June 2013).

This document outlines good practice relating to first establishing and then obtaining worthwhile safety benefits from an operator’s Flight Data Monitoring (FDM) programme.

### Guidance material of U.S. Federal Aviation Administration

U.S. Department of Transportation, FAA – Advisory Circular No: 120-82.

This advisory circular (AC) provides guidance on “developing, implementing, and operating a Flight Operational Quality Assurance (FOQA) program”. FOQA is the term used by the FAA for FDM.

### Guidance material of Global HFDM

Helicopter Flight Data Monitoring, Industry Best Practice (April 2012).

This document provides guidance on FDM specifically for helicopter operators.

## II. What to check

This section offers a number of checks that can be done during an audit or an inspection, to help gain assurance that the FDM programme is implemented correctly and when applicable, properly used for the ATQP. This list is only indicative and it is not exhaustive. Since the EAFDM is a voluntary and independent safety initiative, the checks proposed in this section should not be confused with official requirements or guidance.

**Note 1:**

The provisions taken as a reference in this section for proposing checks are ORO.AOC.130 and AMC1 ORO.AOC.130 as published on 27 November 2014.

**Note 2:**

It is unlikely that an auditor will have sufficient time to cover all of the aspects of an FDM programme detailed in this section, during a single audit. Nor will such coverage be necessarily needed on a regular basis. However, it is recommended that a structured approach is followed by determining what particular aspects need to be checked in advance as part of the pre-audit preparation and on an ‘as relevant’ basis during the audit e.g. for specific safety issues or certain aspects relating to FDM’s integration in the management system. Further to this it is recommended that to support an effective assessment, aircraft operators are asked to provide recent examples (as relevant to the line of discussion) to support their declared policies and processes.

**Note 3:**

It is important that the auditors involved in the oversight of FDM programmes have knowledge and experience sufficient to assess the responses of the operators and derive meaningful conclusions.

**Note 4:**

This section proposes a series of checks that are distinguished as ‘basic’ [B] or ‘advanced’ [A]. These are guidelines to help the auditors when overseeing FDM programmes with different levels of maturity. Any operator with an FDM programme is expected to be able to provide satisfactory responses to the ‘basic’ checks proposed. However, as the operator programme matures, it is expected that more advanced aspects of the FDM programme will be explored. Once the ‘basic’ capability of the FDM programme is established, it is recommended that the aspects covered under the ‘advanced’ checks are introduced, as relevant, and checked accordingly. ‘Potential consequences of no activity’ have been noted for the ‘advanced’ checks to highlight the importance and need for FDM programmes to evolve to tackle those aspects. In any case, the auditor is advised to give consideration to the level of maturity of the operator FDM programme that is audited and adapt the use of these proposed checks accordingly.

**Note 5:**

The implementation of an ATQP implies the need for a mature FDM programme. Therefore:

- No distinction is made between basic and advanced checks in subsection 2 related to ATQP; and
- An operator with an ATQP would be expected to be able to reply satisfactorily to advanced questions in subsection 1.

Likewise, no distinction is being made between checks in subsection 3 (FDM programmes for alleviating FDR serviceability checks).

## 1. For all FDM programmes

The principles that are recommended for check are based on paragraph ORO.AOC.130 of the Air Operation requirements<sup>5</sup>, Part ORO, as well as the related acceptable means of compliance AMC1 ORO.AOC.130.

### Principle 1: basic requirement

#### ORO.AOC.130 Flight data monitoring — aeroplanes

“(a) The operator shall establish and maintain a flight data monitoring system, which shall be integrated in its management system, for aeroplanes with a maximum certificated take-off mass of more than 27 000 kg.

(b) The flight data monitoring system shall be non-punitive and contain adequate safeguards to protect the source(s) of the data.”

Check:

- a. [B]Statement of safety objectives, including adherence to just/safety culture principles in the implementation of the Management System, signed by the accountable manager.
- b. [B]Safety policy statement explicitly addressing the use of FDM data for identifying, monitoring and mitigating safety risks, signed by the accountable manager. This should mention that no punitive use of FDM data is made at the FDM programme level (refer to Section I.1).
- c. [B]Statement on the general condition of use and protection of the FDM data.
- d. [B]The flight crew members have access to the safety policy statement and the corresponding documents signed by the accountable manager.
- e. [B]Flight data for all aeroplanes with MCTOM of over 27 000 kg are scanned and analysed on a regular basis
- f. [B]Evidence of analysis since the introduction of a fleet or of developing the FDM programme for any new fleet
- g. [B]Inclusion of the FDM programme into the Management System processes.

#### Note 1:

The term “flight data monitoring programme” was replaced by “flight data monitoring system” in ORO.AOC.130. Although this term is not common, it is understood that this still applies to the notion of an FDM programme. For the purposes of clarity, EASA Opinion 06-2012 proposes to reinstate the original term “flight data monitoring programme” in ORO.AOC.130. The corresponding Regulation has not yet been adopted by the European legislator, however for the purposes of this document, the term “FDM programme” is used.

#### Note 2:

ORO.AOC.130 requires that the FDM programme is “integrated in the operator’s management system”. ORO.GEN.200 requires that this Management System includes, among others:

“(a)(3) the identification of aviation safety hazards entailed by the activities of the operator, their evaluation and the management of associated risks, including taking actions to mitigate the risk and verify their effectiveness;”

As detailed in AMC1 ORO.GEN.200(a)(1)(2)(3)(5) and AMC1 ORO.GEN.200(a)(3), this means that the aircraft operator should have a process to manage its safety risk. Hence, the FDM programme outputs should be used for safety risk management, as part of its integration into the Management System.

5 Refer to Commission Regulation (EU) 965/2012 laying down technical requirements and administrative procedures related to air operations.

## Principle 2: responsibilities

### AMC1 ORO.AOC.130 Flight data monitoring – aeroplanes

“(a) The safety manager, as defined under AMC1-ORO.GEN.200(a)(1), should be responsible for the identification and assessment of issues and their transmission to the manager(s) responsible for the process(es) concerned. The latter should be responsible for taking appropriate and practicable safety action within a reasonable period of time that reflects the severity of the issue.”

Check:

- a. [B]Inclusion of FDM in the safety manager’s responsibilities.
- b. [B]How does the operator assure themselves that the time allocated to their safety personnel/number of personnel on the FDM programme is adequate, given the operator’s activity and fleet size?
- c. [B]Safety risk internal information process which includes:
  - i. *Allocation of responsibility for discovery and transmission.*
  - ii. *In case of an agreement with a third party to analyse data that details the operator’s overall responsibility: What is the timeframe for reporting? Are the analysis needs specified? Who are the recipients inside the operator? Who is doing the data quality checks? (e.g. see Principle 4g, Principle 5b and Principle 5c).*
- d. [B]Evidence on a given example, of timely action by the responsible manager after being informed.
- e. [A]How is FDM knowledge transferred to new staff/successors? Is FDM included in staff succession planning? Potential consequence of no activity: Following staff turnover, FDM programme loses key knowledge impacting upon its standards and development, with negative impact on the operator’s management system.

Note 1:

The safety manager is defined both for complex operators (AMC1-ORO.GEN.200(a)(1)) and for non-complex operators (AMC1 ORO.GEN.200(a)(1);(2);(3);(5)), in general he/she is the person responsible for managing and facilitating the oversight of safety.  
The responsibilities of the nominated persons identified by ORO.AOC.135 include implementing safety actions to address issues identified by the safety manager.

Note 2:

Some Operators may have contracted the processing of flight data to an external company (FDM service provider). However, the overall responsibility for the FDM programme and integrating it into their Management System lies with the operator. Therefore, the scope of the support by a service provider should be clearly defined, and there should be evidence that the aircraft operator’s FDM programme is integrated with its Management System. In addition, agreements with the FDM service provider or a formal policy should cover, when applicable, the protection of FDM data.

## Principle 3: objectives

### AMC1 ORO.AOC.130 Flight data monitoring – aeroplanes

“(b) An FDM programme should allow an operator to:

- (1) identify areas of operational risk and quantify current safety margins;
- (2) identify and quantify operational risks by highlighting occurrences of non-standard, unusual or unsafe circumstances;
- (3) use the FDM information on the frequency of such occurrences, 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;

(4) put in place appropriate procedures for remedial action once an unacceptable risk, either actually present or predicted by trending, has been identified; and

(5) confirm the effectiveness of any remedial action by continued monitoring.”

Check:

- a. [B]Policy Statement & Procedures on hazard identification methods and risk management includes the FDM programme (as part of the operator’s Management System).
- b. [B]In case the FDM data analysis has been subcontracted to a third party, the operator has the ownership of the specifications for the FDM events and measurements.
- c. [B]Evidence of use of FDM data together with other sources to identify and assess operational risks
- d. [B]Evidence on a given type of incident that FDM data were used to quantify the safety margins.

## Principle 4: analysis techniques

### AMC1 ORO.AOC.130 Flight data monitoring – aeroplanes

“(c) FDM analysis techniques should comprise the following:

(1) Exceedance detection: searching for deviations from aircraft flight manual limits and standard operating procedures. A set of core events should be selected to cover the main areas of interest to the operator. A sample list is provided in Appendix 1 to AMC1 ORO.AOC.130. The event detection limits should be continuously reviewed to reflect the operator’s current operating procedures.

(2) All flights measurement: a system defining what is normal practice. This may be accomplished by retaining various snapshots of information from each flight.

(3) Statistics - a series of data collected to support the analysis process: this technique should include the number of flights flown per aircraft and sector details sufficient to generate rate and trend information. “

Check:

- a. [B]Exceedance detection program tailored to operating standards i.e. SOPs in general and aircraft type.
- b. [A ] Exceedance detection program tailored to specific operating scenarios: for example, the category of approach, specific aerodromes, IFR/VFR, winter operations. Potential consequence of no activity: FDM event detections are not representative of operational context and genuine event occurrences may be missed due to inappropriate event thresholds.
- c. [B]FDM programme adapted to existing and new operational risks/safety issues/ safety priorities, e.g. events thresholds and/or measurements to support monitoring:
  - i. *Existing issues/risks, changing safety issues and operational changes (such as new SOPs, new missions, new population of pilots)*
  - ii. *Common operational issues identified by the European Aviation Safety Plan and the State Safety Plan*
- d. [A]Review process in place to keep up to date and history of changes. Potential consequence of no activity: FDM program does not evolve and is not synchronised with the operator’s risks. The FDM programme has no traceability, limiting internal oversight and the operator is unable to interpret historical reports.
- e. [A]The all flights measurements (E.g. speed at touchdown) cover the FDM events (existing and new) when possible e.g. for monitoring normality and quality of operations. Potential consequence of no activity: Limited understanding and analysis of normal operations (e.g. plotting and analysing the distribution of specific flight data measurements for all flights) for identifying/monitoring new/existing risks. Inability to rationalise existing events (e.g. their thresholds) that may be tailored to SOPs versus actual operational results that may fall outside the scope of what can be captured by these events. Lack of monitoring quality of performance beyond SOPs to support continuous improvement.
- f. [B]Support statistics compiled, for instance including number of flights flown or scanned by the FDM programme (by departure and arrival airfield and by fleet), in order to be able to compute rates.

- g. [A]Are operational departments and aircraft system experts involved when necessary in the design of new events or in setting event threshold? Potential consequence of no activity: FDM staff do not have the full context/information necessary to optimise the development and use of certain events.
- h. [A]How are FDM events/all flights measurements tested and evaluated? Potential consequence of no activity: Issues that are expected to be captured by events/all flights measurements are not, giving a false result or hidden errors introduced into the system with uncontrolled consequences.<sup>6</sup>
  - i. [B]Statistical analyses used to monitor safety levels and trends.
  - ii. [B]Where data sample size is not sufficient for statistical analyses, how else is the data used for safety analysis?

**Note:**

Some FDM software packages may not offer the capability to define all-flight measurements. While it is advisable to select a product that has the all-flight measurement capability, some products do not offer this. In such cases it is recommended to follow up whether the operator is deriving alternative solutions, and involving the FDM software provider when necessary.

## Principle 5: tools for analysis, assessment and process control

### AMC1 ORO.AOC.130 Flight data monitoring – aeroplanes

“(d) FDM analysis, assessment and process control tools: the effective assessment of information obtained from digital flight data should be dependent on the provision of appropriate information technology tool sets.”

Check:

- a. [B]Provision of dedicated analysis software (in the operator premises or accessible by the operator, for instance in the case where FDM data processing is subcontracted)
- b. Initial validation process used (e.g. integrity of FDM files).
  - i. [B] Does the operator conduct basic data quality checks following data replay and software analysis of the events /‘all flights measurements’, e.g.
    - 1. For the time period of the data replayed, for a given aircraft, is the number of flights extracted from the data the same as the number based on operator flight logs?
    - 2. Does each replayed flight file contain all the expected phases of flight?
    - 3. If applicable, do they review whether their FDM ‘all flights measurements’ produce values for each flight as expected?
  - ii. [A]Is the operator aware of the validation processes (and how they work) of the software? Potential consequence of no activity: Limited investigative capacity in identifying technical issues with the output of the software for resolution by the software provider. Assumed quality standards leading to unsatisfactory results.
- c. [B]Data verification and validation process:
  - i. [B]Evidence of validation of the quality of flight parameters used for the FDM events (consistency and accuracy);
  - ii. [B]How are ‘nuisance’ events tracked and sorted out?
  - iii. [B]Validation of FDM events triggered by the system;
- d. [B]Data displays – traces and listings, other visualisations.

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<sup>6</sup> The logic for FDM events can sometimes involve dependencies based on assumptions in the system e.g. an FDM event linked to the system definition of the cruise flight phase (such as turbulence in cruise) – if the cruise phase of a given flight does not conform to this system definition as expected (i.e. the definition is not met), then the turbulence event associated will not trigger, even if the other relevant event trigger conditions are met.

- e. [B]The FDM analyst(s) has access to interpretive material, such as weather data, aircraft flight manuals, flight plans, airport charts, to support their analysis.
- f. [B]How is contextual data integrated into the assessment process of occurrences together with FDM?
- g. [B]Links with other safety information and safety processes, such as the internal reporting system, the training programme.
- h. [B] The software has the technical capability to define various levels of access to the data. If not, how does the operator overcome this?
- i. [B]The operator can adjust the definition of FDM events and all flights measurements in a timely manner (by themselves or through a third party).
- j. [B]Is the Operator aware of how the FDM events/ all flight measurements work and their limitations? Evidence on a relevant example.

## Principle 6: safety communication

### AMC1 ORO.AOC.130 Flight data monitoring – aeroplanes

“(e) Education and publication: sharing safety information should be a fundamental principle of aviation safety in helping to reduce accident rates. The operator should pass on the lessons learnt to all relevant personnel and, where appropriate, industry.”

Check:

- a. [B]FDM findings are communicated to relevant parties once discovered.
  - i. *Is there an adequate means to report important messages outside of the regular reporting processes?*
  - ii. *Does the FDM reporting cover the safety priorities identified by the operator? E.g. from their risk register.*
- b. [B]Examples of means of distribution of safety messages (e.g. Newsletter or flight safety magazine, urgent safety communications.)
- c. [A]Does the operator follow-up to check the uptake of FDM messages, e.g.
  - i. *Do FDM trends correlate with the uptake of safety messages by flight crew members as expected? Example: after communication on a given safety issue and recommendations to the flight crews, a positive event trend can be observed in the FDM data. Potential consequence of no activity: Operator is unable to determine whether their safety communications have been effective.*
- d. [B]Simulator/training feedback: are lessons-learnt fed back to training? Is any feedback taken into account from the training function e.g. areas to monitor?
- e. [B]Do the flight crew have the opportunity to request and view their own data, e.g. for a specific flight where they were the handling pilots? Is assistance provided for interpretation of the flight data?
- f. [B]Evidence that operational departments (for example, maintenance, ground operations) receive relevant information for their area of responsibility.
- g. [B]Presentation of FDM-based safety performance indicators (SPIs): How are the SPIs contextualised and what is done to support the recipients in understanding their context? Are the SPIs relevant?
- h. [A]The operator engages with external stakeholders (e.g. aviation authorities) to inform them of relevant safety issues (e.g. ATC vectoring causing unstable approaches or other ongoing risks with ATC or an aerodrome). Potential consequence of no activity: Industry/the regulator does not benefit from potentially unique insights into safety issues that are common/new in industry. Likewise the operator does not benefit from the experiences of the rest of industry/the regulator on topics relevant to them.

## Principle 7: official safety investigation requirements

### AMC1 ORO.AOC.130 Flight data monitoring – aeroplanes

“(f) Accident and incident data requirements specified in CAT.GEN.MPA.195 take precedence over the requirements of an FDM programme. In these cases the FDR data should be retained as part of the investigation data and may fall outside the de-identification agreements.”

Check:

- a. [B]Procedures in the Operations Manual to retain and protect original FDR data where an accident or a serious incident has taken place
- b. [B]The case of an official safety investigation is included in the confidentiality procedure (refer to Principle 12).

#### Note 1:

In case of an accident or a serious incident, it is helpful to preserve all the FDM data of the occurrence flight, since there can be more flight parameters recorded or the sampling rate may be higher.

#### Note 2:

Because of numerous cases of non-preservation of flight recorder recordings following serious incidents (resulting in recording overruns), it is advisable to have more specific provisions on preservation of FDR and FDM recordings included in the Operations Manual. These provisions should cover as a minimum the case of an accident or a serious incident.

## Principle 8: integration of FDM with occurrence reporting

### AMC1 ORO.AOC.130 Flight data monitoring – aeroplanes

“(g) Every crew member should be responsible to report events. Significant risk-bearing incidents detected by FDM should therefore normally be the subject of mandatory occurrence reporting by the crew. If this is not the case then they should submit a retrospective report that should be included under the normal process for reporting and analysing hazards, incidents and accidents.”

Check:

- a. [B]Means of confirming if an FDM exceedance detection has been the subject of an internal occurrence report (e.g. a crew safety report or air safety report) and vice versa.
- b. [B] Procedure for assessing internal occurrence reports using FDM data to help determine whether they should be subject to mandatory reporting to the NAA.
  - i. *How does the operator determine when analysis of FDM data is needed?*
- c. [B]Procedures for requesting an internal occurrence report if needed.

#### Note 1:

The principle stated in (g) should be applicable to all the internal reporting programmes of the operator, and not just be limited to those occurrences for which reporting to the NAA is mandatory.

#### Note 2:

Although not all FDM events will necessarily require an MOR to the NAA, it is up to the operator to assess if an occurrence (detected through FDM, internal occurrence reporting or other channels) needs to be reported to their NAA. Please note that the enforcement of retrospective reports can potentially be counterproductive as it can impact upon the credibility and confidence in the FDM programme. Therefore due care needs to be taken. Direct crew contacts can often yield even more useful information in a trusting environment versus forced crew reports in a non-trusting environment.

## Principle 9: data recovery

### AMC1 ORO.AOC.130 Flight data monitoring – aeroplanes

“(h) The data recovery strategy should ensure a sufficiently representative capture of flight information to maintain an overview of operations. Data analysis should be performed sufficiently frequently to enable action to be taken on significant safety issues.”

Check:

- a. [B]Statement on recovery objectives and targets: what is the data collection rate (flights scanned versus flights flown; what is the delay between flight and analysis (in particular when the analysis is subcontracted), for example on one individual aircraft: when was the latest flight for this aircraft collected for FDM? When was the latest flight for this aircraft scanned by FDM software?
  - i. *Note: if the operator has an ATQP programme, is the relevant target for data collection being met? – see section 2, ‘FDM programmes supporting an ATQP’.*
- b. [B]The operator has in place procedures for the timely download and analysis of data
- c. [B]How does the operator determine a representative sample? (for example, proportion of a fleet, of aircraft at each base, flight destinations, etc. scanned by FDM).
  - i. *In the cases of small % recovery, does the entire data sample get analysed?*
- d. [B] Method used to achieve timely processing and targets.
- e. [B]What process (for example in the maintenance programme or the MEL) does the operator have to follow-up on the serviceability of the FDM recorder?
- f. [B]Recent FDM data - is there enough data? Is any one of the main airfields operated or any fleet missing in these?

## Principle 10: data retention

### AMC1 ORO.AOC.130 Flight data monitoring – aeroplanes

“(i) The data retention strategy should aim to provide the greatest safety benefits practicable from the available data. A full dataset should be retained until the action and review processes are complete; thereafter, a reduced dataset relating to closed issues should be maintained for longer-term trend analysis. Programme managers may wish to retain samples of de-identified full-flight data for various safety purposes (detailed analysis, training, benchmarking etc.)”

Check:

- a. [B]Statement on data retention policy, including, if data eventually needs to be de-identified:
  - i. *Identification period (period during which the identification of individuals in the dataset is still possible by authorised personnel);*
  - ii. *De-identification policy and timescales.*
- b. [B]Clear policy for FDM data retention in case of an occurrence subject to mandatory reporting to the national aviation authorities.
- c. [B]Dataset relating to closed issues or for retrospective analysis: How does the operator assure themselves that they have enough information for trending over a given fleet, a given airfield, a given season etc., as appropriate.

## Principle 11: data protection

### AMC1 ORO.AOC.130 Flight data monitoring – aeroplanes

“(j) The data access and security policy should restrict information access to authorised persons. When data access is required for airworthiness and maintenance purposes, a procedure should be in place to prevent disclosure of crew identity.”

Check:

- a. [B]Access policy statement, including:
  - i. *List of persons/posts with access, data views, their use of data;*
  - ii. *Procedure for secure Continued Airworthiness use of FDM data;*
  - iii. *Procedure for secure use of FDM data for training.*
- b. [B]In case where FDM is subcontracted, data access policy of the subcontractor.

## Principle 12: confidentiality procedure

### AMC1 ORO.AOC.130 Flight data monitoring – aeroplanes

“(k) The procedure to prevent disclosure of crew identity should be written in a document, which should be signed by all parties (airline management, flight crew member representatives nominated either by the union or the flight crew themselves). This procedure should, as a minimum, define:

- (1) the aim of the FDM programme;
- (2) a data access and security policy that should restrict access to information to specifically authorised persons identified by their position;
- (3) the method to obtain de-identified crew feedback on those occasions that require specific flight follow-up for contextual information; where such crew contact is required the authorised person(s) need not necessarily be the programme manager or safety manager, but could be a third party (broker) mutually acceptable to unions or staff and management;
- (4) the data retention policy and accountability including the measures taken to ensure the security of the data;
- (5) the conditions under which advisory briefing or remedial training should take place; this should always be carried out in a constructive and non-punitive manner;
- (6) the conditions under which the confidentiality may be withdrawn for reasons of gross negligence or significant continuing safety concern;
- (7) the participation of flight crew member representative(s) in the assessment of the data, the action and review process and the consideration of recommendations; and
- (8) the policy for publishing the findings resulting from FDM.”

Check:

- a. [B]There is a written procedure addressing all the bullet points of AMC1 ORO.AOC.130(k), i.e. the ‘procedure to prevent disclosure of crew identity’;
- b. [B]Does this written procedure cover all operations under the AOC? Are copies readily available to flight crew members? Did the safety manager and flight crew representatives sign this procedure?

## Principle 13: airborne equipment

### AMC1 ORO.AOC.130 Flight data monitoring – aeroplanes

“(l) Airborne systems and equipment used to obtain FDM data should range from an already installed full quick access recorder (QAR), in a modern aircraft with digital systems, to a basic crash-protected recorder in an older or less sophisticated aircraft. The analysis potential of the reduced data set available in the latter case may reduce the safety benefits obtainable. The operator should ensure that FDM use does not adversely affect the serviceability of equipment required for accident investigation.”

Check:

- a. [B] Procedure for the safe storage and handling of the recording media. Documentation needed for data decoding (i.e. Data Frame Layout documentation<sup>7</sup>). Documentation on installation, test and maintenance procedures for the FDM recorder.
- b. [B] Procedures to ensure serviceability of the FDR if it is used for FDM, in light of any additional wear on FDR.
- c. [A] There is an entry for the FDM recorder (normally the QAR) in the Minimum Equipment List which is compliant with CS-MMEL8, Item 31-31-3 (Quick Access Recorder). Potential consequence of no activity: Aircraft can be grounded if the FDM recorder is discovered to be unserviceable, without any lead time to rectify the problem.

#### Note 1:

The checks proposed here are maintenance-related, therefore the NAA should incorporate them into the appropriate audits.

#### Note 2:

According to the Certification Specifications and Guidance Material for Master Minimum Equipment List (CS-MMEL), the recommended QAR rectification interval is category C, meaning that corrective action should be done within 10 days of the discovery of the defective QAR.

## 2. FDM programmes supporting an ATQP

This section discusses aspects that need to be considered on FDM as part of an ATQP in context of the points outlined in AMC1 ORO.FC.A.245.

### Principle A-1: FDM as a feedback loop to the ATQP

#### AMC1 ORO.FC.A.245 Alternative training and qualification programme

“(a) Alternative training and qualification programme (ATQP) components

The ATQP should comprise the following:

(...)

(5) A feedback loop for the purpose of curriculum validation and refinement, and to ascertain that the programme meets its proficiency objectives.

(i) The feedback should be used as a tool to validate that the curricula are implemented as specified by the ATQP; this enables substantiation of the curriculum, and that proficiency and training objectives have been met. The feedback loop should include data from operations flight data monitoring, the advanced flight data monitoring (FDM) programme and LOE/LOQE programmes.

7 Documentation that presents the necessary information to convert FDM binary data into parameters expressed in engineering units.

8 Annex to EASA ED Decision 2014/004/R

(...)

(7) (...)

(ii) (...)The purpose of an FDM or advanced FDM programme for ATQP is to enable the operator to:

- (A) provide data to support the programme’s implementation and justify any changes to the ATQP;
- (B) establish operational and training objectives based upon an analysis of the operational environment; and
- (C) monitor the effectiveness of flight crew training and qualification. “

Check:

- a. Evidence that trends and safety findings identified with the FDM programme are reflected in the training programme. (Example of a safety issue highlighted by a series of occurrence reports, either through the mandatory reporting to the NAA or through the internal occurrence reporting system.). Timeframe between identification of a trend or a safety finding and inclusion in the training programme where applicable.
- b. Evidence that the FDM programme is used to support the understanding of operations (e.g. operational practices and risks) and establish training objectives.
- c. Evidence that the results of changes to the training programme are, when applicable, followed up through the FDM programme.

## Principle A-2: effective FDM programme before starting the ATQP

### AMC1 ORO.FC.A.245 Alternative training and qualification programme

“(a) Alternative training and qualification programme (ATQP) components

The ATQP should comprise the following:

(...)

(7) A data monitoring/analysis programme consisting of the following:

(i) A flight data monitoring (FDM) programme as described in AMC1 ORO.AOC.130. Data collection should reach a minimum of 60 % of all relevant flights conducted by the operator before ATQP approval is granted. This proportion may be increased as determined by the competent authority. “

Check:

- a. All the individual aircraft involved in the ATQP are included in the FDM programme, regardless of their MCTOM
- b. The principles (note: in this document they are numbered 1 to 13 in part 1 of section II), as presented in AMC1 ORO.AOC.130 are applied
- c. Data collection rate of the FDM programme is higher than the baseline determined by the competent authority (at least 60%) when considering all flights of aircraft involved in the ATQP.
- d. Are all routes and bases covered by the FDM programme?

## Principle A-3: advanced FDM programme for extending the ATQP

### AMC1 ORO.FC.A.245 Alternative training and qualification programme

“(a) Alternative training and qualification programme (ATQP) components

The ATQP should comprise the following:

(...)

(7) A data monitoring/analysis programme consisting of the following:

(i) ...

(ii) An advanced FDM when an extension to the ATQP is requested: an advanced FDM programme is determined by the level of integration with other safety initiatives implemented by the operator, such as the operator's safety management system. The programme should include both systematic evaluations of data from an FDM programme and flight crew training events for the relevant crews. Data collection should reach a minimum of 80 % of all relevant flights and training conducted by the operator. This proportion may be varied as determined by the competent authority.”

Check:

- a. All the individual aircraft involved in the ATQP are included in the FDM programme, regardless of their MCTOM
- b. Data collection rate of the FDM programme is higher than the baseline value set by the NAA
- c. Means to ensure that the data collection rate can stay above the baseline value set by the NAA (at least 80%) and that the data is representative of all operations (e.g. do certain routes that are seldom flown require better coverage, are data samples representative for any given route).
- d. Is there a system in place to collect data from flight simulator training devices and/or feedback from training for use by the FDM programme? What is the process for using such data and determining what safety areas need to be monitored through the FDM programme?

## Principle A-4: data gathering and exchange

### AMC1 ORO.FC.A.245 Alternative training and qualification programme

“(a) Alternative training and qualification programme (ATQP) components

The ATQP should comprise the following:

(...)

(7) A data monitoring/analysis programme consisting of the following:

(i) ...

(ii)...

(iii) Data gathering: the data analysis should be made available to the person responsible for ATQP within the organisation. The data gathered should:

(A) include all fleets that are planned to be operated under the ATQP;

(B) include all crews trained and qualified under the ATQP;

(C) be established during the implementation phase of ATQP; and

(D) continue throughout the life of the ATQP.”

Check:

- a. Procedures and means for a two-way communication between the FDM team and the ATQP manager and records thereof.
- b. Content and format of the information provided by the FDM team to the ATQP manager e.g. update reports; feedback on specific ATQP items, identification of new emerging issues.
- c. Can an example of communication between the FDM team and the ATQP manager be provided?
- d. Aircraft not subject to ORO.AOC.130 that are included in the ATQP programme: are they covered by the (advanced – as discussed in the AMC) FDM programme?

“(iv) Data handling: the operator should establish a procedure to ensure the confidentiality of individual flight crew members, as described by AMC1 ORO.AOC.130. “

Check:

- a. If the FDM access policy addresses the access rights of the ATQP manager.
- b. Procedure in case it was determined that a flight crew member needs corrective training: refer to Principle 12

### 3. FDM programmes for alleviating FDR operational checks

#### Principle B-1: monitoring the quality of FDR parameters

##### **AMC1 CAT.GEN.MPA.195(b) Preservation, production and use of flight recorder recordings**

“Whenever a recorder is required to be carried, the operator should:

perform an annual inspection of FDR recording and CVR recording, unless one or more of the following applies:

(1)...

(2) Where the following conditions are met, the FDR recording inspection is not needed:

- (i) the aircraft flight data are collected in the frame of a flight data monitoring (FDM) programme;
- (ii) the data acquisition of mandatory flight parameters is the same for the FDR and for the recorder used for the FDM programme;
- (iii) the integrity of all mandatory flight parameters is verified by the FDM programme; and
- (iv) the FDR is solid-state and is fitted with an internal built-in-test equipment sufficient to monitor reception and recording of data.”

Check:

- a. Data acquisition of the FDM airborne equipment: is it the same as the data acquisition of the FDR, or does it capture data from the same sources as the sources used for the mandatory flight parameters of the FDR?
- b. Procedures to monitor the integrity of flight parameters in the FDM programme. Do they cover all mandatory FDR parameters and follow the guidance provided in GM1 CAT.GEN.MPA.195(b)? Is an inspection report available?

## III. Examples of FDM oversight in practice

A questionnaire was distributed to give an overview of current practice in FDM oversight. Five NAAs-MS responded and some good practice extracted from their replies is presented here.

### 1. FDM and Management System

The oversight of FDM is not conducted in isolation, but in the frame of the oversight of the aircraft operator's Management System of which the FDM programme is a component.

Therefore all responders indicated that they did not conduct standalone FDM oversight audits.

### 2. Before and between safety audits

In order to be able to assess how the FDM data is used and analysed by the aircraft operator, a National Aviation Authority of an EASA Member State (NAA-MS) may want to have access to the safety meetings where the FDM events and trends are reviewed, or to get copies of the minutes of these meetings. Awareness of recent safety issues at the aircraft operators and how they were solved should help making the audit questions more relevant and focused. Access to the Safety Manager is a way to follow up on safety issues between safety audits.

One NAA-MS indicated that their methodology between flight safety audits is mainly to observe the operator's safety oversight in action, to ensure that there are suitable managers and processes, a good reporting culture supported by FDM, adverse trends are addressed, and there is suitable feedback to pilots. The Inspector will attend the operator's safety meetings on a sample basis, where occurrence reports and FDM matters are discussed. He/she will also have regular meetings with the operator's senior management where current issues will be discussed and he/she will have access to information from Inspectors who line fly with the operator. The Inspector will be on the circulation list for the regular FDM report circulated to management and for safety information circulated to pilots. The Inspector will also attend operator training meetings on a sample basis, where FDM and occurrence reports should be used to determine training requirements, especially when the operator has set up an ATQP.

Another NAA-MS mentioned monthly meetings between the Inspector and his/her assigned operators, during which events including details of FDM data are discussed.

### 3. Auditors

In most NAAs-MS, the Inspectors don't have specific training on FDM. However it is recommended for an effective FDM programme assessment that Inspectors receive at least basic training on FDM, and get when needed the assistance of an FDM expert to prepare the audit.

**Note:**

In addition to the prerequisite requirements of an Inspector (such as flight operations and management system), basic FDM training would typically include a presentation of relevant implementing rules, AMC and GM, general explanations on how FDM events and FDM all-flight measurements work, and an overview of other guidance material. Knowledge of FDM software would also be beneficial.

One NAA-MS indicated that they have safety management and flight safety specialists that can get involved if the assigned Inspector asks for their support.

Another NAA-MS explained that their Inspectors have flight operations management or training experience, hence they have been involved in operator FDM programmes. In addition an FDM course is included in the

Inspectors' initial training. One Inspector has specialised in FDM and carries out visits to operators with the assigned Inspector on an irregular basis.

## 4. The FDM questions

A number of NAAs-MS have developed a questionnaire based on the points enumerated in AMC1 ORO.AOC.130. It is advised not to limit the questions strictly to checking that policies and procedures are established. A sample check of a few concrete examples related to the recent history of operation of the aircraft operator will help in getting a better assessment of if the aircraft operator is actually implementing the FDM programme in a proper way, and integrating FDM data with other safety data sources. In any case, how advanced the questioning is can depend on the maturity of the FDM programme: see Section II.

One NAA-MS indicated that the Inspector usually prepares a list of topics and questions for the flight safety audit, varied depending on his/her observations and current issues with the specific aircraft operator and other aircraft operators.

According to another NAA-MS, the FDM questions are customised to take into account the particular safety objectives of the audited aircraft operator, the experience of the aircraft operator with FDM, the nature of operations (scheduled or unscheduled flight, day or night operation, short or long range, etc.), and the case where an operator has implemented an ATQP (which must be supported by an FDM programme or an advanced FDM programme).

Typically, copies of agreements with pilot representatives, policy documents covering FDM data handling, confidentiality agreements and procedures, evidence of a communication channel from the FDM team to the pilots and the management are also checked. The NAA-MS may also require copies of the meeting minutes or other evidence that regular meetings were held covering FDM and safety issues (safety action group, safety review group, etc.).

## IV. The larger picture

### 1. Integration of FDM oversight into operator's Management System

Because FDM aims at continuous improvement of the overall safety performance of an operator, it should be integrated in the operator's Management System. Ideally, where multiple systems are utilized to identify hazards and manage risk they should be integrated to maximize their combined effectiveness and reduce duplicated processes for greater system efficiency.

An FDM programme held remote from the Management System of an operator would result in substandard performance and inhibit continuous improvement. Moreover, information from other Management System data sources gives context to the flight data which will, in return, provide quantitative information to support analysis that otherwise would be based on reports, which provide limited information. Occurrence reporting, maintenance, ATC and flight planning are just a few of the areas that could benefit.

In addition to the daily interactions between the FDM programme and the Management System, the aircraft operator should have processes in place to ensure that the FDM programme remains efficient and reliable. This includes:

- ▶ performance indicators (e.g. time to detect events, time to process and analyse data, data recovery rate, number/rate of events detected/analysed, etc.);
- ▶ The follow-up of events detected by the flight data monitoring programme (level of safety, trends, implementation of corrective and preventive actions, etc.);
- ▶ feedback on the effectiveness of the FDM programme (use/usefulness of the FDM data for the risk assessment, level of understanding by the pilots/instructors of the FDM summaries or statistics);
- ▶ Internal audits (compliance with procedures, capability to take into account new identified risks, etc.).

### 2. Use of FDM data for training: how to assess it is appropriate?

When using FDM data for training:

- ▶ The training should be focused at correcting a safety issue, which as a consequence will reduce the corresponding FDM event rate. However it is undesirable to create a trend to “fly the FDM profile” i.e. pilots flying according to FDM events thresholds in contradiction with procedures and good airmanship. The complete definition of an FDM event's trigger logic does not need to be provided to trainees, and the training content should highlight the actual risk and safety defences rather than FDM events generated by the FDM programme.
- ▶ “Raw” FDM data from an FDM programme are often not adequate on their own for use in a training programme. This is because FDM data may provide accurate information on what happened, but not necessarily on why it happened. FDM data usually need to be complemented with occurrence reports or other sources.
- ▶ Sufficient data analysis should have been carried out to identify the extent of the safety issue, i.e. the fleets affected, the population of pilots affected and their profile, the location and time where it is more likely to occur, and any necessary contextual information. To be effective, additional training should be directed to where it is needed.

### 3. Preservation of FDM data in the case of a safety investigation

ICAO Annex 13 on Accident and Incident Investigations gives the authority's investigator the entitlement to access to all data and evidence that are relevant for the investigation. In Europe, these principles were transposed to Regulation (EU) 996/2010. This Regulation applies, among others, to the official investigations of accidents and serious incidents which have occurred in Europe, or where an EASA Member State is involved as State of the Operator (see Article 3).

Article 11:

*"2. Notwithstanding any confidentiality obligations under the legal acts of the Union or national law, the investigator-in-charge shall in particular be entitled to:*

...

*(c) have immediate access to and control over the flight recorders, their contents and any other relevant recordings;*

...

*(g) have free access to any relevant information or records held by the owner, (...), the operator or the manufacturer of the aircraft,..."*

Article 13:

*"3. Any person involved shall take all necessary steps to preserve documents, material and recordings in relation to the event..."*

Article 15:

*"1. The staff of the safety investigation authority in charge, or any other person called upon to participate in or contribute to the safety investigation shall be bound by applicable rules of professional secrecy"*

Subsequently, it is advised that the FDM data file pertaining to an accident or a serious incident is integrally preserved and made available on request by the official safety investigation authority.

Care should also be taken of the confidentiality of the official safety investigation.

In addition, in the particular case where the flight data recorder (FDR) is used for the FDM programme, AMC1 ORO.AOC.130 indicates that:

*"(f) Accident and incident data requirements specified in CAT.GEN.MPA.195 take precedence over the requirements of an FDM programme. In these cases the FDR data should be retained as part of the investigation data and may fall outside the de-identification agreements. "*

The principles enumerated here above should be reflected in the FDM programme procedures and in any internal memorandum of understanding on FDM. The staff involved with the FDM programme should be aware of these principles.

### 4. Level of access to FDM programme data by an inspector

With FDM integrated with the Management System as stated in ORO.AOC.130, the NAA needs to be able to see clear demonstrable evidence of proper process and specific examples to support this. For example, with regard to safety risk management, the inspector may need to ask the operator to demonstrate how they control particular risks (as part of the operator's safety risk management) and as such how FDM is used to support this. In some cases it could be necessary for the operator to show via an example, how a particular FDM indicator works/is used to monitor certain risks and how incidents or trends are followed up and contextualised with other information.

The Inspector has the following provisions based on Commission Regulation (EU) No 965/2012:

Article 2

Definitions

*For the purposes of this Regulation:*

‘...

*5. Personnel authorised by the competent authority to carry out certification and/or oversight tasks shall be empowered to perform at least the following tasks:*

*(a) examine the records, data, procedures and any other material relevant to the execution of the certification and/or oversight task;*

*(b) take copies of or extracts from such records, data, procedures and other material;*

...’

In the operating rules, it states:

**‘ORO.GEN.140 Access**

*(a) For the purpose of determining compliance with the relevant requirements of Regulation (EC) No 216/2008 and its Implementing Rules, the operator shall grant access at any time to any facility, aircraft, document, records, data, procedures or any other material relevant to its activity subject to certification, whether it is contracted or not, to any person authorised by one of the following authorities:*

*(1) the competent authority defined in ORO.GEN.105;*

....’

The above help support an ‘evidence-based’ approach in the audit. Of course due care needs to be taken when exercising such privileges, with regard to the relevance of requesting to see certain information and the usefulness, if applicable, in gathering it. The NAA is not responsible for an operator’s management system. Note: Any information needed for safety investigation needs to be sought through the proper channels and processes, rather than on an ad-hoc basis.

If safety intelligence is collected to support oversight, it needs to be at a mature level that has been formed as a result of a proper operator safety risk management system process, involving all relevant sources of data (not just FDM, as this can lack context).

## 5. Coordination with NAA safety promotion functions

As safety promotion can be an effective way to enhance safety, many NAAs have engaged in various safety promotion initiatives with their aircraft operators. Such safety promotion initiatives may include FDM-related matters<sup>9</sup>.

There should be a mutual understanding of the respective missions and constraints of the safety oversight function and the safety promotion function inside an NAA. Care should be taken not to adversely affect safety promotion initiatives.

In practice:

- Inspectors have to be informed of any safety promotion initiative run at their NAA covering FDM (such as an FDM forum) in case someone contacts them concerning this topic;
- Inspectors may also learn of the conclusions of safety promotion initiatives that are of interest for improving the oversight of FDM programmes. However any such information should usually be de-identified so that they cannot be used against a particular aircraft operator;
- The NAA staff in charge of a safety promotion initiative encompassing FDM should have access to the findings related to FDM made by Inspectors, so that they can adjust the programme of the initiative accordingly. Alternatively, Inspectors may be invited to give a de-identified summary of findings related to FDM made during the last audit/inspection period at a meeting of the safety promotion initiative.

9 Refer to EAFDM’s ‘Guidance for National Aviation Authorities, Setting up a national Flight Data Monitoring forum’.

# Annex 1 – Examples of acceptable and unacceptable situations

Note:

The below table is not proposed (and not suitable) as a readily applicable means of assessment. It only outlines the concept of an NAA's previous idea which was used, only in part, to help rationalise responses to a 'one-off' FDM audit questionnaire. A detailed review of the FDM aspects to check is offered in Section II.

FDM Principle	Description of Acceptable	Description of Unacceptable	Safety Hazard
<b>1. For all FDM programmes</b>			
<b>Principle 1 Basic requirement:</b>	Full resourcing and management drive behind system	Miserable resourcing and no management commitment. FDM is primarily used to monitor and sanction flight crews. FDM programme is not endorsed by the accountable manager.	Ineffective oversight and management of hazards
<b>Principle 2 Responsibilities:</b>	Clear understanding of responsibilities leading to full implementation	Lack of acceptance of responsibility. No actions taken and no concern.	Ineffective management of hazards due to failure to take responsibility.
<b>Principle 3 Objectives:</b>	Clear objectives and full process	Lack of clarity and hit and miss processes	Ineffective understanding and control of risks.
<b>Principle 4 Analysis Techniques:</b>	Full understanding and use of analysis - comprehensive events, all flight measurements and strong understanding and use of statistical methods.	Minimal use of event data, weak assessment of risks, lack of monitoring of normal operation and no statistical information used.	Ineffective analysis leading to failure to identify risks.
<b>Principle 5 Tools for Analysis, Assessment and Process Control</b>	Comprehensive tools set. Analysis, assessment facilitation, quality and process control tools	Minimal tools available. Lacking flexibility and ease of use. No de-brief or assessment tools worthy of note. Process control and quality tools missing.	Poor quality data, interpretation and assessment leading to ineffective analysis and failure to identify risks.
<b>Principle 6 Safety communication:</b>	Proactive information and education material, regular publications with targeted practical content based on recent operational experience.	No evidence of any FDM information being used to support safety communication/promotion.	Failure to inform authorities or other organisations of identified risks.
<b>Principle 7 Official safety investigation requirements</b>	Tight control and preservation of data surrounding accidents/serious incidents or when requested as part of an official investigation. Good procedures which are understood and implemented operationally.	The involved personnel are not aware of their duty to preserve flight data or they do not know how to preserve flight data.	Determination of the causes of the accident or serious incident was impeded due to missing flight data.
<b>Principle 8 Integration of FDM with Occurrence reporting</b>	Close co-ordination and two way cross fertilisation between FDM and internal occurrence reporting. Actions taken to reconcile differences and improve understanding of individual and group issues.	No cross checking between FDM programme and internal occurrence reporting systems. Barrier between investigations or cross feeds of insights.	Lack of understanding of significant incidents due failure to correlate all data sources.

FDM Principle	Description of Acceptable	Description of Unacceptable	Safety Hazard
<b>Principle 9 Data recovery</b>	Aiming for and achieving fully representative data recovery and confidence in the quality of data.	Poor data recovery overall, with no justification (except resources). Segments of operation missed completely. Fleets, bases, leased in aircraft etc.	Failure to identify risks due to gaps in programme coverage of entire operation.
<b>Principle 10 Data retention</b>	Retaining the data for a period that extracts the last safety benefit. Retention shows the recognition of the need for retrospective analysis and trending. Sensible de-identification is implemented as a routine part of this process.	All data destroyed immediately after running through FDM program. Lack of understanding of the benefits of trending, big picture, long term views of data. Problems with de-identification of data prior to assessment.	Inability to identify trends and issues due to lack of data or over cautious de-identification.
<b>Principle 11 Data protection</b>	Rigorous control of the access rights of individuals/post holders. Audit trail of access and actions. Secure computer and data systems.	No control of data access or no one is allowed access to data. Open terminals with undefined access and no audit trail tracking.	Loss of control and confidence in the FDM process adversely affecting overall safety culture.
<b>Principle 12 Confidentiality procedure</b>	Clear, practical document that covers all the major aspects of these principles. Signed up to by all parties.	No document or one that does not reflect the practices found. Alternatively processes scattered around a number of other documents that are uncoordinated.	Lack of understanding, clarity of purpose and buy-in to the FDM process.
<b>Principle 13 Airborne Equipment</b>	Proper provision of airborne equipment that is fit for purpose and does not adversely affect other aircraft systems. Procedures in place to deal with faults, repairs and MEL aspects.	Unapproved equipment. Use of magnetic-tape FDRs.	Individual aircraft flying with an inoperative FDM recorder for a long period (more than 10 days), effectively escaping monitoring.
<b>2. FDM programmes supporting an ATQP</b>			
<b>Principle A-1: FDM as a feedback loop to the ATQP</b>	FDM findings or trends are reflected in the practical and/or theoretical curricula of flight crew members. Changes in the training programme are monitored by the FDM programme.	No FDM output is reflected in the training programme. The changes to training that could be monitored through FDM are not.	The training programme is out-of-synch with the actual operational risks and therefore ineffective.
<b>Principle A-2: effective FDM programme before starting the ATQP</b>	Effective FDM programme (refer to Principles 1 to 13) covering all individual aircraft included in the ATQP, all frequent routes flown by those aircraft.	The FDM programme in place is not satisfactory. Some aircraft included in the ATQP are not monitored at all through FDM. Some frequent routes completely escape monitoring.	The FDM monitoring of the ATQP fleet has significant gaps, so that safety issues may remain unchecked.
<b>Principle A-3: advanced FDM programme for extending the ATQP</b>	The FDM data collection rate for the ATQP fleet is at least the baseline value. The data collection rate for flight crew training events conducted in the frame of the ATQP is also higher than the baseline value. Data from FDM is systematically used in conjunction with other sources to support safety risk assessment.	Some aircraft included in the ATQP are not monitored at all through FDM. The data collection rate for FDM and/or flight crew training events is less than the baseline value. Use of FDM outputs without any context or no use of FDM data. FDM data are not used together with data from crew training events.	Data coverage is insufficient to support an advanced FDM programme. Integration with training is insufficient to support early detection and end-to-end management of safety issues.
<b>Principle A-4: data gathering and exchange</b>	Complete, up-to-date and useful results of the FDM programme are provided to the ATQP manager. There is efficient two-way communication between the FDM team and the ATQP manager.	Information provided by the FDM team to the ATQP is not complete or too seldom, or already obsolete. The FDM results are not usable as such and no explanation was provided.	The training programme is relying on incomplete and/or obsolete information, and therefore not fully effective.

FDM Principle	Description of Acceptable	Description of Unacceptable	Safety Hazard
<b>3. FDM programmes for alleviating FDR operational checks</b>			
<b>B-1: monitoring the quality of FDR parameters</b>	The data source of mandatory flight parameters is the same for FDR and FDM. A complete inspection of the quality of the mandatory flight parameters is conducted at time intervals specified in the AMC for the FDR recording inspection and following the related guidance material, and is evidenced by inspection reports.	There has been no inspection of mandatory flight parameters, or inspections are superficial and/or incomplete. For several mandatory flight parameters, the data source is not the same as for the FDR.	FDR recording quality problems remain undetected until an accident or serious incident occurs. Subsequently, circumstances and causal factors remain unclear because valid FDR data are missing.

# Annex 2: Regulation and guidance related to Flight data monitoring and safety management

## 1. ICAO Provisions

### ICAO Annex 6 to the Convention on International Civil Aviation, Operation of aircraft Part I: International Commercial Air Transport – Aeroplanes (Amendment 37-A):

The Standards and Recommended Practices related to FDM for commercial air transport aeroplanes operators are:

**“3.3.1 Recommendation** — An operator of an aeroplane of a certificated take-off mass in excess of 20000 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 Programmes (FDAP) (Doc 10000).

*Note 2.*— Legal guidance for the protection of information from safety data collection and processing systems is contained in Attachment B to Annex 19.”

### ICAO Annex 6 to the Convention on International Civil Aviation, Operation of aircraft Part III: International Operations – Helicopters (Amendment 18-A):

The Standards and Recommended Practices related to FDM for commercial helicopter operators are:

**“1.3.1 Recommendation.**— An operator of a helicopter of a certified take-off mass in excess of 7 000 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).

*Note 2.*— Legal guidance for the protection of information from safety data collection and processing systems is contained in Attachment B to Annex 19.”

## Flight Data Analysis Programme Manual

ICAO Document 10 000 (Flight Data Analysis Programme Manual) provides an overview of the components of a FDM programme, its prerequisite and how to implement it. It also provides description of the relationship between an aircraft operator's Management System and its FDM programme.

## 2. European regulation and guidance material

### Flight data monitoring programmes for large commercial air transport aeroplanes

Paragraph ORO.AOC.130 of Commission Regulation (EU) 965/2012, Annex III (Part ORO), contains the requirement on commercial air transport operators that for aeroplanes with an MCTOM of over 27 000 kg, a flight data monitoring programme is established.

An acceptable means of compliance is provided by paragraph AMC1 ORO.AOC.130 of EASA ED Decision 2012/017/R

In addition, more detailed guidance material on FDM programmes has been introduced into GM1 ORO.AOC.130 of the same ED Decision. GM 2 ORO.AOC.130 refers to UK CAA CAP 739 for additional guidance.

### Flight data monitoring for supporting an ATQP

Requirements for getting approval for an alternative training and qualification programme (ATQP) are laid down in Commission Regulation (EU) 965/2012, Annex III (Part ORO), paragraph ORO.FC.A.245. An acceptable means of compliance is provided by EASA ED Decision 2012/017/R, AMC1 ORO.FC.A.245. This acceptable means of compliance includes the provision of a FDM programme or an advanced FDM programme.

### Flight data monitoring for alleviating FDR operational check

Annex IV to Commission Regulation (EU) 965/2012 (Part CAT), contains a requirement on operators to perform operational checks to maintain the serviceability of flight recorders: see paragraph CAT.GEN.MPA.195. An acceptable means of compliance is provided by EASA ED Decision 2012/018/R, AMC1 CAT.GEN.MPA.195 (b). This acceptable means of compliance includes an alleviation of the annual FDR recording inspection, when, among other conditions, an FDM programme is in place.

### Flight data monitoring for commercial helicopter off-shore operations

Comments Response Document to Notice of Proposed Amendment 2013-10 on helicopter off-shore operations (published on 06 June 2013) contains draft provisions on FDM programmes.

**Note:**

The draft rules proposed by a Notice of Proposed Amendment are subject to changes after the public consultation or by the European legislator. The provisions presented below are not final. For the most recent development on this rulemaking project, please consult EASA website.

## Annex 3: Safety Culture and Just Culture

According to the Safety Culture Framework developed by the ECAST SMS Working Group<sup>10</sup>:

“Safety Culture is the set of enduring values and attitudes regarding safety issues, shared by every member of every level of an organization. Safety Culture refers to the extent to which every individual and every group of the organization is aware of the risks and unknown hazards induced by its activities; is continuously behaving so as to preserve and enhance safety; is willing and able to adapt itself when facing safety issues; is willing to communicate safety issues; and consistently evaluates safety related behaviour.”

Also according to this document:

“Just Culture is clearly an element of [a Safety Culture framework] (in the Justness Characteristic or component). Throughout the literature on Safety Culture it is quite obvious that Justness is indeed an indispensable component of Safety Culture.”

Commission Regulation (EU) No 691/2010 defines<sup>11</sup> just culture as:

“a culture in which front line operators or others are not punished for actions, omissions or decisions taken by them that are commensurate with their experience and training, but where gross negligence, wilful violations and destructive acts are not tolerated;”

An important part of a good just culture depends on how an organization oversees safety reports which may contain information about potentially unsafe/risky actions, either directly or indirectly taken by its employees. These may be the result of slips, common mistakes, technical failures or can even be related to systematic training issues. When reviewing such occurrences, consideration should be given as to whether the person's actions were reasonable. It could be that the actions taken were the same as what another competent person may have reasonably taken in a similar situation. Part of this is ensuring that the right level of expertise is available to help understand the context and situation surrounding what occurred. Employees at all levels should be encouraged to report any occurrences or issues that may affect safety and be open to learning from these.

A safety culture and a just culture should be fostered. However in the rare cases, in which gross negligence, wilful violations or destructive acts are apparent, such acts/behaviour should not be tolerated. Through following of clear and proper procedures, anyone involved in cases of possible gross negligence will receive fair treatment and proportionate remedial action to prevent a reoccurrence.

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10 Available on ESSI/ECAST website: <http://easa.europa.eu/essi/ecast/>.

11 Commission Regulation (EU) 691/2010 of 29 July 2010 laying down a performance scheme for air navigation services and network functions and amending Regulation (EC) 2096/2005



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