FDM

FLIGHT DATA MONITORING

ANAC 2018

Definitions

Flight Data Analysis. A process of analysing recorded flight data in order to improve the safety of flight operations.

(ICAO Annex 6 - Operation of aircraft)

Flight Data Monitoring (FDM) is the proactive use of recorded flight data from routine operations to improve aviation safety.

FDM - EASA

'Flight Data Monitoring (FDM)' means the **proactive** and **non-punitive** use of digital flight data from routine operations to improve aviation safety.

Annex 6, Part I - International Commercial Air Transport Aeroplanes

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.

Annex 6, Part III - International Operations - Helicopters

'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.

Annex 6, Part I - International Commercial Air Transport Aeroplanes

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 flight data analysis programmes is contained in the Safety Management Manual (SMM) (Doc. 9859).*
- *Note 2- Legal guidance for the protection of information from safety data collection and processing systems is contained in Annex 13 , Attachment E.*

Benefits

- Providing data to help in the prevention of incidents and accidents. Fewer flight accidents not only reduce material losses and insurance costs.
- Improved operational insight: providing the means to identify potential risks and to **modify pilot training programs accordingly (EBT)**.
- **ATQP**-Alternative Training Qualification Programme
- Improved fuel consumption

Benefits

- Reduction in unnecessary maintenance and repairs: FDM data can be used to help reduce the need for unscheduled maintenance, resulting in lower maintenance costs and increased aircraft availability.
- Flight Data Monitoring (FDM) programmes provide a powerful tool for the proactive hazard identification.

AMC1 ORO.AOC.130 Flight Data Monitoring

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.

AMC1 ORO.AOC.130 Flight Data Monitoring

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;

AMC1 ORO.AOC.130 Flight Data Monitoring

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

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

AMC1 ORO.AOC.130 Flight Data Monitoring

FDM analysis techniques should comprise the following:

(1) **Exceedance detection:** searching for deviations from Airplane Flight Manual (AFM) limits and Standard Operating Procedures (SOPs).

The event detection limits should be continuously reviewed to reflect the operator's current operating procedures.

AMC1 ORO.AOC.130 Flight Data Monitoring

(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.

AMC1 ORO.AOC.130 Flight Data Monitoring

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 to the industry.

GM1 ORO.AOC.130 Flight data monitoring

Exceedance detection provides useful information, which can complement that provided in crew reports (ASR's).

Examples: reduced flap landing, emergency descent, engine failure, rejected takeoff, go-around, airborne collision avoidance system (ACAS) or EGPWS warning (CFIT),

Unusual Attitudes (UPRT) and system malfunctions.

GM1 ORO.AOC.130 Flight data monitoring

FDM programmes are used for detecting exceedances, such as deviations from flight manual limits, standard operating procedures (SOPs), or good airmanship.

Typically, a set of core events establishes the main areas of interest to operators.

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

Appendix 1 to AMC1 ORO.AOC.130 Flight data monitoring — aeroplanes

Event Group	Description
Rejected take-off	High speed rejected take-off
Take-off pitch	Pitch rate high on take-off
	Pitch attitude high during take-off
Unstick speeds	Unstick speed high
	Unstick speed low
Height loss in climb-out	Initial climb height loss 20 ft above ground level (AGL) to 400 ft above aerodrome level (AAL)
	Initial climb height loss 400 ft to 1 500 ft AAL

Appendix 1 to AMC1 ORO.AOC.130 Flight data monitoring — aeroplanes

Event Group	Description
Glideslope	Deviation under glideslope
	Deviation above glideslope (below 600 ft AGL)
Approach power	Low power on approach
Approach speeds	Approach speed high within 90 seconds of touchdown
	Approach speed high below 500 ft AAL
	Approach speed high below 50 ft AGL

Appendix 1 to AMC1 ORO.AOC.130 Flight data monitoring — aeroplanes

• **Event Group**	**Description**
• Ground proximity warning	Ground proximity warning system (GPWS) operation - hard warning
	GPWS operation — soft warning
	GPWS operation — windshear warning
	GPWS operation — false warning

Appendix 1 to AMC1 ORO.AOC.130 Flight data monitoring — aeroplanes

• **Event Group**	**Description**
• Airborne collision avoidance system (ACAS II) warning	
	ACAS operation — Resolution Advisory

Appendix 1 to AMC1 ORO.AOC.130 Flight data monitoring — aeroplanes

Event Group	Description
Bank angles	Excessive bank below 100 ft AGL
	Excessive bank 100 ft AGL to 500 ft AAL
	Excessive bank above 500 ft AGL
	Excessive bank near ground (below 20 ft AGL)

FDM Case Study 1

Landing in Snow

The first safety event is "Long Flare" which measures the time taken to get from 20ft to touchdown, and the second is a test for high lateral acceleration when taxiing.

The Incident

In this incident the pilot was landing at an airfield in falling snow. He made a textbook ILS approach and started a gentle flare. Some 11 seconds later and 2,300 feet beyond the runway touchdown zone, the aircraft kissed the ground. In the snowy conditions he applied reverse thrust and brakes to reduce speed.

The Incident

His plan was to turn onto the taxiway at the end of the runway, but the aircraft was still travelling at over 30 knots as he started the turn. The turn would have been tight on a good day, but in these conditions the aircraft skidded on the slippery taxiway and slid onto the grass where it came to rest.

Conclusion

In this case the flare duration was almost twice the limit of the Long Flare event, and the turn at the end of the runway would have been over twice the limit of the lateral g event if the aircraft had made the turn at that speed.

If FDM and these issues had been brought to the attention of the pilots, this embarrassing incident might have been avoided.

FDM Case Study 2

Go-Around Procedure

One well established operator was using the Flight Safety Foundation's Approach and Landing Accident Reduction (ALAR) toolkit to train their crews in the importance of the **stabilised approach**. This stresses the importance of initiating a Go-Around if the approach did not meet the airline's Standard Operating Procedures (SOPs) for stability. This was working well, until one day when a crew initiated a Go-Around but during the climbout they experienced an Enhanced Ground Proximity Warning System (EGPWS) "Pull Up" warning.

Investigation

The approach was unsatisfactory and failed to meet the airline's stability conditions so the crew had made the right decision to initiate a Go-Around. This should have led to a safe climbout without subsequent warnings. Investigation of the flight therefore concentrated on the operation of the aircraft following the decision to abort the landing.

Although flap had been retracted in accordance with the procedure, the speedbrakes were still deployed.

Solution

As soon as this data had been analysed and the FSO had completed his interview with the crews, an email was sent to all pilots in the company reminding them of the importance of retracting the speedbrakes and explaining that this was not in the current procedure.

Urgent action was also put into place to correct this omission and issue updated procedures.

Fortunately, EGPWS alerted them to the situation and they avoided an accident.

Short-term goals

- Establish data download procedures, test replay software and identify aircraft defects;
- Validate and investigate exceedance data; and
- Establish a user-acceptable routine report format to highlight individual exceedances and facilitate the acquisition of relevant statistics.

Medium-term goals

- Produce an annual report — include **K**ey **P**erformance **I**ndicators;
- Add other modules to the analysis (e.g. continuing airworthiness); and
- Plan for the next fleet to be added to programme.

Long-term goals

- Network FDM information across all of the operator’s safety information systems;
- Ensure FDM provision for any proposed alternative training and qualification programme (ATQP); and
- Use utilisation and condition monitoring to reduce spares holdings.

THANK YOU FOR ATTENTION

END of FDM

RBO

PRINCIPLES OF RISK BASED OVERSIGHT

RBO DEFINITION

An oversight program that utilizes an Operator's risk profile to determine the frequency with which the operator is subject to surveillance.

Performance Based Oversight

The State's assessment of the level of compliance exhibited by an Operator in respect to the aviation regulations.

The assessment determines effective or non-effective performance and is one of many inputs into RBO decision making.

DISCUSSION

In recognition of this, ANAC began work on the development of a risk based oversight system that would provide standardized risk weightings for operators, take into consideration the impact on the aviation system (size and complexity) and would apply a **variable surveillance frequency based on risk.**

DISCUSSION

The output of ANAC's risk based oversight system is a risk profile for all operators that is derived from its risk indicator level and impact value. The risk profile produces a relative ranking of all AOC and SPO holders based on risk information. The risk indicator level (RIL) uses a series of inputs from a variety of data sources.

Risk Indicator Level

The RIL is derived from:

- the Risk Score from the Risk Indicator Database;
- results of pervious surveillance (i.e. severity of findings of non-compliance);
- availability of surveillance information (i.e. occurrence reports and/or internal reporting systems); and
- whether or not the Operator has implemented a good safety management system (SMS).

Step one

The following **“hazard areas”** as effective indicators of risk within an operator:

- Labour Difficulties – Finantial Problems
- Management Practices
- Compliance Assurance
- Turnover in personnel
- Change in key personnel – Nominated Persons
- Safety record
- Regulatory record – Compliance Oversight
- Seasonal or specialized Operations

Step two

In the process is to consider other aspects that contribute to the safety risk profile of an operator.

The impact value of an enterprise is generated by considering the size and scope of an operation and includes such factors as:

- how many certificates in different categories are held;
- the number of employees and bases.
- the number and different types of aircraft;
- the type of operations (e.g. specialized approved (SPO) organization, domestic airline, international operations, etc).

Step three

In the process is to introduce the risk profile into the risk based oversight planning process.

In the past, planning occurred on an annual cycle, however, with the advent of Operator based risk profiles, it became necessary to plan based on a much longer outlook.

ANAC uses a simple matrix to plot the alpha numeric values of the risk indicator level and impact value.

- The Y axis represents the impact value score and is given an alphabetical designation. The X axis shows the numeric calculation of the risk indicator level. The intersection of these points provides an alpha numeric rating that is used for surveillance planning purposes.

Risk Profile

IMPACT VALUE							
Extensive	E	1E	2E	3E	4E	5E
High	D	1D	2D	3D	4D	5D
Moderate	C	1C	2C	3C	4C	5C
Low	B	1B	2B	3B	4B	5B
Negligible	A	1A	2A	3A	4A	5A
		1	2	3	4	5
		Very Low	Low	Moderate	High	Very High
		RISK INDICATOR LEVEL				

PERFORMANCE BASED OVERSIGHT (PBO)

There remains confusion in respect to the difference between PBO and RBO.

PBO is an assessment by the State of the level of compliance of an operator with the aviation regulations.

In other words, the State is looking at how effectively the operator complies with the aviation regulations. After all, an operator can be compliant but not effective.

Risk Based Oversight (RBO)

Risk based oversight provides a mechanism for recognising operators that are considered lower risk and who demonstrate effective compliance; thereby allowing the State to focus surveillance on operators that require additional attention.

Oversight programme

AMC2 ARO.GEN.305(b)

Audits and inspections, on a scale and frequency appropriate to the operation, should cover at least:

(1) infrastructure,

(2) manuals,

(3) training,

(4) crew records,

(5) equipment,

(6) release of flight/dispatch,

(7) dangerous goods,

(8) organisation's management system.

Oversight programme

The following types of inspections should be envisaged, as part of the oversight programme:

(1) flight inspection,

(2) ground inspection (e.g. documents and records),

(3) training inspection (e.g. ground, aircraft/FSTD),

(4) ramp inspection.

Oversight programme

GM1 ARO.GEN.305(b)

(a) significant lay-offs or turnover of personnel;
(b) delays in meeting payroll;
(c) reduction of safe operating standards;
(d) decreasing standards of training;
(e) withdrawal of credit by suppliers;
(f) inadequate maintenance of aircraft;
(g) shortage of supplies and spare parts;
(h) curtailment or reduced frequency of revenue flights; and
(i) sale or repossession of aircraft or other major equipment items.

National SSP

Action:

ANAC shall establish biannual meetings with operators to analyze the results of the FDM trends analysis of the events that were identified to improve the safety performance in accordance with Regulation (EU) 965/2012 and national Regulation n.º 833/2010.

National SSP

National SPI's		Event Related / Precursors
CFIT: Controlled flight into or toward terrain (EPAS 2017-2021)	1. 2.	GPWS Warning System Triggered; Unstabilised Approach due Turbulence Encounter (Windshear/Microbust);
	3.	Glideslope Warning.
MAC: Airprox/ ACAS alert/ loss of separation/ (near) midair collisions (EPAS 2017-2021)	1. 2. 3. 4.	ACAS/TCAS TA and RA; Airspace Infringement; Near Airborne Collision with RPAS; ATM Conflict Detection (Not detected/Detected late/Inadequate);
	5.	ATM Staff Communication (Hearback/Readback).
	6.	ATM Navigational Equipment.
RI: Runway Incursion – vehicle, aircraft or person (EPAS 2017-2021)	1. 2.	Flight Crew ATC Clearance Deviation (unclear radio communication or misunderstanding taxi clearances); Flight Crew Communications Events (Call-sign Confusion, Breakdown in Communications)
	3.	Aerodrome Marking, Lightning and Signs.

National SSP

RE: Runway excursion (EPAS 2017-2021)	1. 2. 3.	Landing Gear System and wheels or brakes failure; Environment Induced Abrupt Manoeuvre (cross –wind, windsherar, Turbulence); Aircraft Handling (loss of control on ground);
	4.	Unstabilised Approach.
LOC – I: Loss of control inflight (EPAS 2017-2021)	1. 2.	Weather and Environmental Encounters (Wake Turbulence or Wind Shear); Flight Crew Operation/ Interpretation of Equipment (Unintentional pilot mis-management of critical systems);
	3.	Aircraft Handling (unrecovered from aircraft upset).
F-NI: Fire/smoke (non-impact) (EPAS 2017-2021)	1. 2.	Smoke Warning System Triggered in Lavatory (passenger smoking or use of aerosol); Smoke or Fire in Cockpit (Electrical burning);
	3.	Smoke or Fire in Cabin or Cargo Bay.
SCF-NP+ PP: System/Component Failure or malfunction (nonpower plant) + (power plant)	1. 2. 3. 4. 5.	Landing Gear System (Partial Collapse or Retraction/Gear Door Retraction or actuator failure); Wheels and Brakes (Tyre,/Anti-skid failures); Trailing/Leading Edge Flap/Slat Control System (Erroneous/Loss or Unavailability/Actuator failure) ; Air Conditioning & Pressurization System; Navigation System.
	6.	Turbine Engine Failure (Mechanical/Vibration/ Asymmetric Trust);
	7.	Fire on Power plant;
	8.	Reciprocating Engine Failure (Mechanical/ Vibration/Loss of power).
WILDLIFE (BIRD: Birdstrike + WILD: Collision Wildlife)	1. 2.	Rejected Take-Off; Engine Shutdown in-flight;
	3.	Evasive Manoeuvre.
RAMP: Ground Handling	1. 2. 3.	Collision - Vehicle with Standing Aircraft; Cargo Handling and Loading/Unloading (Unsecure or Incorrected); Dangerous Goods Undeclared.
	4.	Push-Back Clearance Deviation;
	5.	Injuries due to Propeller/Jet Blast;
	6.	Load Sheet Incorrectly Completed.

ANAC

THANK YOU FOR ATTENTION

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Autoridade Nacional da Aviação Civil
Portuguese Civil Aviation Authority