
Working Group B update

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Objectives

- Define and test FDM events to monitor issues identified by WG A
- Identify useful techniques for FDM data analysis
- Define parameters and their characteristics
- Investigate recording systems issues
- Look for ways to improve interoperability between FDM hardware and software
- Provide an overview of innovative technical solutions

Objectives

In summary:

Make FDM better!

Membership

- 46 individuals
- 18 airlines
- 10 FDM software and hardware providers
- 3 research institutions
- All volunteers

How we work

The screenshot displays the Quip workspace for 'Working Group B'. The interface is divided into a left sidebar, a top header, and a main content area.

Left Sidebar:

- Top: EOFDM logo and a notification bell icon.
- Search bar.
- Navigation links: Inbox (3), Starred, New Document.
- Documents section: Working Group B (selected), Working Group B Test, weekly co-leaders, Monitoring Windows, Working Group B <> Q..., Private, All Documents.
- Chat Rooms section: Working Group B Chat (selected), Monitoring Windows, Quip, Humor, LOCI Precursors, and a link to 'New Chat Room'.

Top Header:

- Workspace name: Working Group B.
- Actions: Add People, Star, Settings, Add Document, Edit Document.

Main Content Area:

- WGB call for volunteers:** A document titled 'WGB call for volunteers' with sections for 'Objectives' and 'Meetings'.
- Read this first!** A document titled 'Read this first!' with sections for 'Introduction' and 'Meetings'.
- EOFDM WGB:** A document titled 'EOFDM WGB' with sections for 'Introduction' and 'Meetings'.
- Work in progress:** A green document icon with a person silhouette.
- Members:** A blue document icon with a person silhouette.
- Meeting minutes:** A yellow document icon with a person silhouette and a star.
- Hey Working Group B, questions about Quip? Ask us!** A document titled 'Hey Working Group B, questions about Quip? Ask us!' with sections for 'Getting started' and 'What is Quip?'.
- Introduction to Quip:** A document titled 'Introduction to Quip' with sections for 'Overview' and 'What is Quip?'.
- +:** A large plus sign icon in a dashed box, indicating a new document or workspace.

Progress so far...

- Runway Excursion (RE)
- Loss of Control In Flight (LOC-I)

Runway Excursions

- Official Document Release published on ECAST webpage http://essi.easa.europa.eu/ecast/?page_id=888

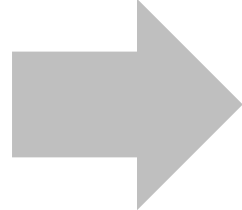
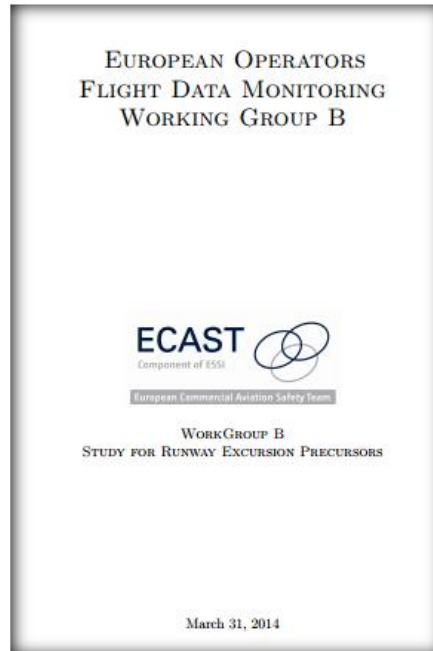
FDM precursors project

On 29 May 2014, Working Groups A and B of EOFDM released their work of FDM precursors for **Runway Excursions**. It is composed of three documents:

- A [cover letter](#) summarising the overall approach and the content of the other documents;
- A [Review of Precursors for Runway Excursions](#), which identifies precursors to monitor in an FDM programme; and
- A [Study for Runway Excursion Precursors](#) which is proposing solutions to program the precursors.

Runway Excursions

- Document Moved to Quip



• <https://eofdmb.quip.com/WcdAOAvEjnl>

Runway Excursions

<https://eofdm.quip.com/WcdAOAvEjnl>

EOFDM Working Group B Work in progress RWY_EXC

WGA28 - Long Flare

WGA Recommendation:
Develop means to detect the start of the flare and to estimate the ground distance covered from the start of the flare until touchdown.

Search Window Applicable:
MW#2 - Monitoring Window #2

Measurements:
• TTT, Time from Flare initiation to Touchdown

Monitoring Windows

Two Monitoring Windows on the take-off and landing phases, according to the definitions below are the basic conditions that should be met to enable each event or measurement extraction defined in the current document. Any specific need for conditions outside these monitoring windows will be presented on the text.

In the pseudo-code below, HEIGHT is defined as the Altitude Above Airfield Level (AAL).

Monitoring Window #1

WGA01 - Monitor Take-Off Performance Calculation

WGA Recommendation:
Monitor Takeoff Performance Calculation: Develop means to detect erroneous data entry or calculation errors which could lead to incorrect thrust settings or incorrect V speeds

WGA02 - Monitor Take-Off Aircraft Configuration

Table 4.3: Take-Off Configuration

Monitoring Window	Measurements
MW1	Brakes Temperature Rudder Trim @ TO Configuration State @ TO Position

WGA03 - Monitor CG Position

Table 4.5: Monitor CG Position
The assessment of the Center of Gravity (CG) out of limits relies on the analysis of an abnormal TTS movement out of its Take-Off normal position during the Take-Off Flight Phase. Subsequent investigation should reveal the cause, which may include more nose loading, load sheet calculations or data entry.
During Take-Off roll the Pitch Control system from Ground Mode to Flight Mode

WGA04 - Reduced Elevator authority

Table 4.7: Reduced Elevator authority

Monitoring Flight Phases	Measurements
MW1	PITCHDOWN 1 MAX(AVG(PICNMW 2), AV(CASIDP(ICNMW 2))

The driver for this procedure determination is the FAA Safety for Operators (FAFO)

WGA05 - Low Acceleration

One of the most common reasons for insufficient acceleration is incorrect FMS inputs (incorrect empty mass, fuel quantities, runway length amongst other parameters). This will affect the takeoff performance calculations and precipitate inappropriate use of do-rated takeoff power settings, leading to the slow acceleration and potentially to a runway overrun. Incorrect FMS inputs are difficult to detect using flight data; the same applies to abnormal acceleration on takeoff, because the relevant data is typically not available in official aircraft performance manuals.

WGA06 - Aircraft Malfunction

Table 4.12: Aircraft Malfunction during Take-Off

Monitoring Flight Phases	Measurements
MW1	DURAT(ON(MASLWR) DURAT(ON(MASLENG)

There are numerous types of aircraft

WGA07 - Late Rotation

Slow rotation: Develop means to detect slow rotations.
Under this recommendation the time between the start of the rotation and the lift-off is monitored. The start time of rotation is designated as T_ROT and the time of lift-off will be referenced in the document as T_LO. Some guidance on Lift-Off determination is provided in Appendix C.
T_ROT may be determined based on a positive pitch angle, a positive pitch rate or the nose gear being uncompresses.
1. Table 4.14: Slow Rotation

WGA07 - Late Rotation

Table 4.16: Late Rotation
WGA07 Late rotation: Develop means to detect rotations started after VR or beyond the expected distance (or time) after the start of the takeoff roll.
Under this recommendation the time at which the rotation is started is designated by T_ROT. If IAS at T_ROT significantly exceeds VR, then an event is flagged
1. Event Description
Measurements:

WGA09 - Late Lift-Off

Table 4.18: Late Lift-Off
For this recommendation the Take-Off distances calculation according to Appendix
• are performed.
• JTY 1 is to be compared with ASDA
• JTY 2 is to be compared with TODA
Event Description
TRD

WGA10 - Rejected Take-Off

Table 4.20: Rejected Take-Off

Monitoring Flight Phases	Measurements	F
MW1	$\Delta J \text{ IAS} < 0$ Power Reduction Flag Application ASD < 0	Reject Off

1. Event Description

WGA11 - Runway remaining after RTO

Table 4.22: Runway Remaining after RTD

Monitoring Flight Phases	Measurements	F
MW1	Ono Chem	Short Distance Long Distance

WGA12 - Inadequate Use of Stopping Devices

Table 4.24: Inadequate Use of Stopping Devices

Monitoring Flight Phases	Measurements	F
MW1 MW2 TRD	TRD	

WGA13 - Insufficient Deceleration

Table 4.26: Insufficient Deceleration
The Insufficient Deceleration can be obtained in an indirect way by calculating the distance between Thrust-Down and where the aircraft attains a speed of 80 kts (Equation D.3.3).
The High Speed Range exit area to be identified by Heading change and removal

WGA14 - Engine Power Increase Change

Table 4.28: Engine Power Increase

Monitoring Flight Phases	Measurements	F
MW1	$\Delta J \text{ IAS} > 0$	Power Duration

1. Event Description

WGA15 - Runway Remaining After Liftoff

Table 4.29: Runway Remaining after Lift-Off

Monitoring Flight Phases	Measurements	F
MW1	Ono Chem	Short Distance

WGA16 - Inadequate Aircraft Control Inputs

Table 4.31: Inadequate Aircraft Control Inputs

Monitoring Flight Phases	Measurements	F
MW1 MW2		

Runway Excursions

- Temporary Revisions produced on:
 - WGA01 – Monitor Take-Off Performance Calculation
 - WGA01 – Low Acceleration
 - WGA07 – Late Rotation
 - WGA08 – Slow Rotation
 - WGA26 – Unstable Approach
 - WGA28 – Long Flare
 - WGA29 – Deep Landing
 - WGA30 – Abnormal Runway Contact

Loss of Control In-Flight

- Document published by WGA
- Containing a Set of 32 Precursors to be tackled by WGB

Precursor	LOC categories					Recommendation
	1	2	3	4	5	
Fire, smoke and fumes	X			X		LOC01
Press. System Malfunction	X					LOC02
Press. System Misuse	X					LOC03
Cockpit door failure	X					LOC04
High Cabin altitude	X					LOC05
O2 masks not used by crew	X					LOC06
Supp. O2 system failure	X					LOC07
CG out of limits		X				LOC08
Special Operations		X				LOC09
Incorrect performance calculation		X				LOC10
Overweight takeoff		X				LOC11
Envelope protection systems		X		X		LOC12
Inadequate aircraft energy		X	X	X	X	LOC13
Inadequate aircraft attitude		X	X	X	X	LOC14
Loss of lift		X	X	X	X	LOC15
FOD			X			LOC16
Electromagnetic Interference			X			LOC17
Adverse Weather			X			LOC18
Windshear			X			LOC19
Severe turbulence			X			LOC20
Icing conditions			X			LOC21
De-icing system failure			X			LOC22
Engine failure			X	X		LOC23
Instrument Malfunction			X	X		LOC24
Structural Failure			X	X		LOC25
Loss of thrust			X	X	X	LOC26
Hardware failure				X		LOC27
Flight control failure or ineffective				X		LOC28
Mismanagement of automation					X	LOC29
Abnormal flight control inputs					X	LOC30
Fuel exhaustion					X	LOC31
Incorrect aircraft configuration					X	LOC32

Loss of Control In-Flight (LOC-I)

- Two documents have been created by WGB to deal with LOCI precursors
- <https://eofdmb.quip.com/W6gxA5uHx3Bm>
- <https://eofdmb.quip.com/Xa7fA5UBouwa>

LOC-I

- Summary document

https://eofdmb.quip.com/Xa7fA5UBouwa

Working Group B > LOC-I

LOC-I Parameters, Events a

	A	B	C	D
1	Parameters		Precursors	
2	Analog		LOC01	LOC02
3	Center of Gravity			
4	Calibrated Airspeed			
5	True Airspeed			
6	Ground Speed			
7	Mach Number			
8	Vertical Speed			
9	VLS Speed (A) , VSSNG (B)			
10	Fuel Flow			
11	Fuel Quantity			
12	Fuel Quantity per Tank			
13	Flaps Position			
14	Slats Position			
15	Slat/Flap Command Lever			
16	Pitch Angle			
17	Angle of Attack			
18	Flight Path Angle			
19	Pitch Rate			
20	Pitch Command			
21	Roll Angle			

parameters measurements events +

LOC-I

Study for Loss of Control In-Flight Precursors (EOFDM WGB)



Introduction

This document is a follow-up of the work performed by Working Group A (WGA), on reporting the potential precursors that could result on the loss of control of the aircraft while it is airborne. WGA findings are documented on the report “Review of Accident Precursors for Loss of Control In Flight” which is published on EOFDM website.

WGA identified a set of 32 precursors which are identified by LOCo1 to LOC32 some of which may be beyond the scope of FDM, but important to address by the industry as possible precursors for LOCI.

Each situation identified is to be analysed according to the methodology proposed in the next section.

As this is a general document applied to different fleets, some may not have the recommended parameters to record on-board. In this case when possible, measurements can be used to reach the desired quantity (ex: dynamic pressure can be obtained from CAS). When these difficulties arise, aircraft vendors and equipment manufacturers should be aware of the industry need so that more rich dataframes can be available for the industry to improve its safety standards.

Methodology for Flight Data Analysis

The proposal to find solutions to cope with the precursors identified will be addressed in three steps, described below:

○ Text Description

Next Steps

- Reception and Study of CFIT document from WGA
- Create documentation for CFIT
“Study for Controlled Flight Into Terrain Precursors”

Thank you for your attention!

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