EASA
European Aviation Safety Agency

PIA on
Erroneous Take-Off Parameters

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Safety recommendations addressed to EASA regarding Erroneous Parameters at Take-off Occurrences.

Originator	File number	Manufacturer	Model	Registration	Occurrence UTC date	SR received	Area of SR concern
DSB	NETH-2007-004	MCDONNELL DOUGLAS	MD88	TC-ONP	17/06/2003	02/07/2007	OBWBS & MOPS
BEA	FRAN-2005-001	BOEING	727	3X-GDO	25/12/2003	17/01/2005	OBWBS & MOPS
TSB	CAND-2006-007	BOEING	747	9G-MKJ	14/10/2004	08/05/2014	TOPMS
BEA	FRAN-2008-328	BEA Study	n/a	n/a	21/04/2008	01/09/2008	OBWBS & MOPS; TOPMS; EFB
BEA	FRAN-2011-019	BOEING	737	SU-BPZ	16/08/2008	31/08/2011	Performance Calc + EFB
AAIB	UNKG-2009-080	AIRBUS	A330	G-OJMC	28/10/2008	17/11/2009	TOPMS
AAIB	UNKG-2009-081	AIRBUS	A330	G-OJMC	28/10/2008	17/11/2009	TOPMS
AAIB	UNKG-2012-036	BOEING	737	G-ZAPZ	14/04/2012	04/04/2013	Performance Calc + EFB

EFB:	Electronic Flight Bag	OBWBS:	On-Board Weight & Balance System
MOPS:	Minimum Operational Specifications	TOPMS:	Take-off Performance Monitoring System

SAFETY RISK PORTFOLIO – COMMERCIAL AIR TRANSPORT FIXED WING

		Key Risk Areas (Outcomes)							
	Outcome Percentage of Fatal Accidents (Last 10 Years)	41%	25%	16.6%	16.6%	8.3%	0%	0%	0%
	Outcome Percentage of Non-Fatal Accidents (Last 10 Years)	1.3%	22.6%	31.8%	0.4%	37.6%	3.5%	0.8%	0%
Safety Area	Safety Issues	Aircraft Upset	System Failure	Ground Collisions and Ground Handling	Terrain Conflict	Abnormal Runway Contact and Excursions	Fire	Runway Incursions	Airborne Conflict
Operational	Detection, Recognition and Recovery of Deviation from Normal Operations	•			•	•	•	•	•
	Operation in Diverse Weather Conditions	•		•	•		•	•	•
	Entry of Take-Off and Landing Parameters into Aircraft System	•	•					•	
	Handling and Execution of Go-Arounds	•			•				
	Maintaining Adequate Separation Between Aircraft			•					•
	Fuel Management	•	•		•	•			
	Aircraft Maintenance	•	•	•	•	•	•	•	•
	Loading and Dangerous Goods Handling	•	•	•			•		
	Ground Handling Operations	•		•				•	
	Birdstrikes and Bird Control	•	•						
Technical	Diagnosis and Management of System Failures In Flight	•	•		•	•	•		•
	Contamination of Controls or Critical Surfaces	•	•			•			
	False or Disrupted ILS Signal Capture	•	•			•			

PIA objective: to support ranking of Agency programming activities

- Agency actions: rulemaking, safety promotion, industry standard, oversight, research
- Example with erroneous take-off parameters safety issue:
  - It combines
    - the safety analysis of the occurrences,
    - the assessment of the effectiveness of the actions
    - their related implementation costs and time
- Same principles for other programming drivers like level playing field, efficiency/proportionality, …
- PIA to be updated at least annually:
  - Modification in ranking will allow to implement the most safe and cost-efficient actions

List of actions presented at ESC on 19/06/2015

1. WG-88 on Minimum Operational Performance Specifications (MOPS) for the On Board Weight and Balance System (OBWBS).
2. Reactivation of WG-94 for a Take-off Performance Monitoring System.
3. Results from NLR on '*Electronic Flight Bag (EFB) - Aircraft performance calculations and mass & balance, - Best practices for evaluation and use of EFB*', [end of Summer 2015]
4. Commission Regulation (EU) No 965/2012 to be amended due to transposition of provisions on Electronic Flight Bag (EFB) from ICAO Annex 6 (RMT.0601 and RMT.0602).
5. Operators should review their procedures and training and assess their effectiveness in risk mitigation regarding this subject issue.
6. Operators should train, monitor and assess the performance of their staff involved in pre-flight processes.
7. Operators should review and assess their crew management practices.
8. Management and availability of appropriate equipment (computers, EFBs, etc.) and tools used for obtaining and computing T/O performance data.
9. CAA and EASA Standardisation visits to Member States should focus on Operators' Standard Operating Procedures (SOPs) and training related to this issue and their (SMS).
10. EASA could raise awareness of the issue by issuing a Safety Information Bulletin (SIB)

Assessment of safety occurrences

However … what is the scale of the problem today?

And what are the potential prevention/mitigation actions?

- Fatal and non-fatal accidents 1989 – 2014 (worldwide scope)

Occurrence category	EASA MS related*	Non EASA MS related*	Grand Total
Non fatal accidents	19	10	29
Fatal accident	0	3	3
Total accidents	**19**	**13**	**32**
Total fatalities	**0**	**158**	**158**

*EASA MS related occurrences are events occurring in EASA Member States scope, or with the involvement of an EASA MS operator or aircraft manufacturer

- Summary for EASA MS related events over the last 25 years:
  - 19 non fatal accidents related to EU scope
  - 0 fatal accidents related to EU scope

Root Cause Categorization - Summary

Root Cause Category	Number of Cases	Tail Strikes	Fatal Accidents
Use of wrong TOW for V-speeds calculation	18	10	1
Erroneous calculation of V-speeds by flight crew	2	2	-
Use of wrong available RWY length / RWY data	4	-	-
Incorrect loading of aircraft	2	1	1
Erroneous calculation of C.G. by flight crew	2	2	-
Wrong A/C Take-off Configuration	1	-	1
Miscellaneous	2	1	-

ECR European central repository of occurrences

- In the last 5 years 270 applicable to erroneous take off data of 42 operators.
- Most of the issues are related with a wrong load sheet 48% followed by wrong ZFW entered in the FMC 33%.
- 62% of the events were NOT spotted before take off, and therefore an Erroneous take off parameters occurred.
- 33% of the occurrences were prevented before take off.

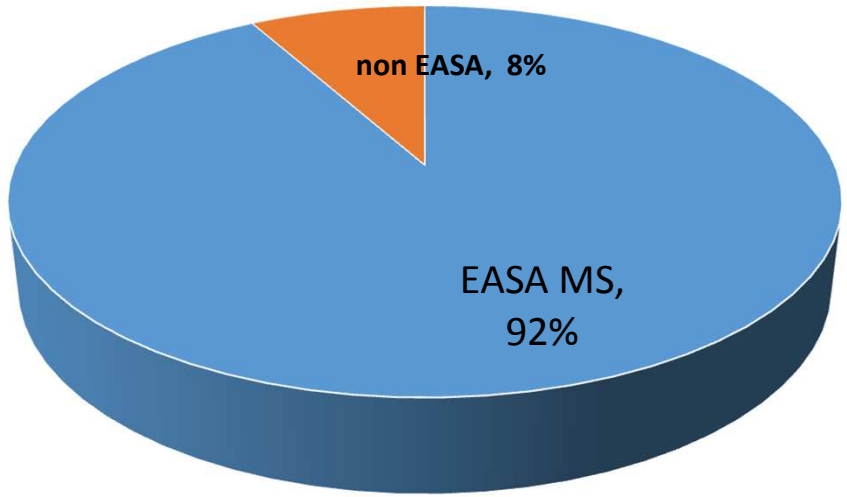
Data survey nº 1: to Know the problem.

Preliminary results:

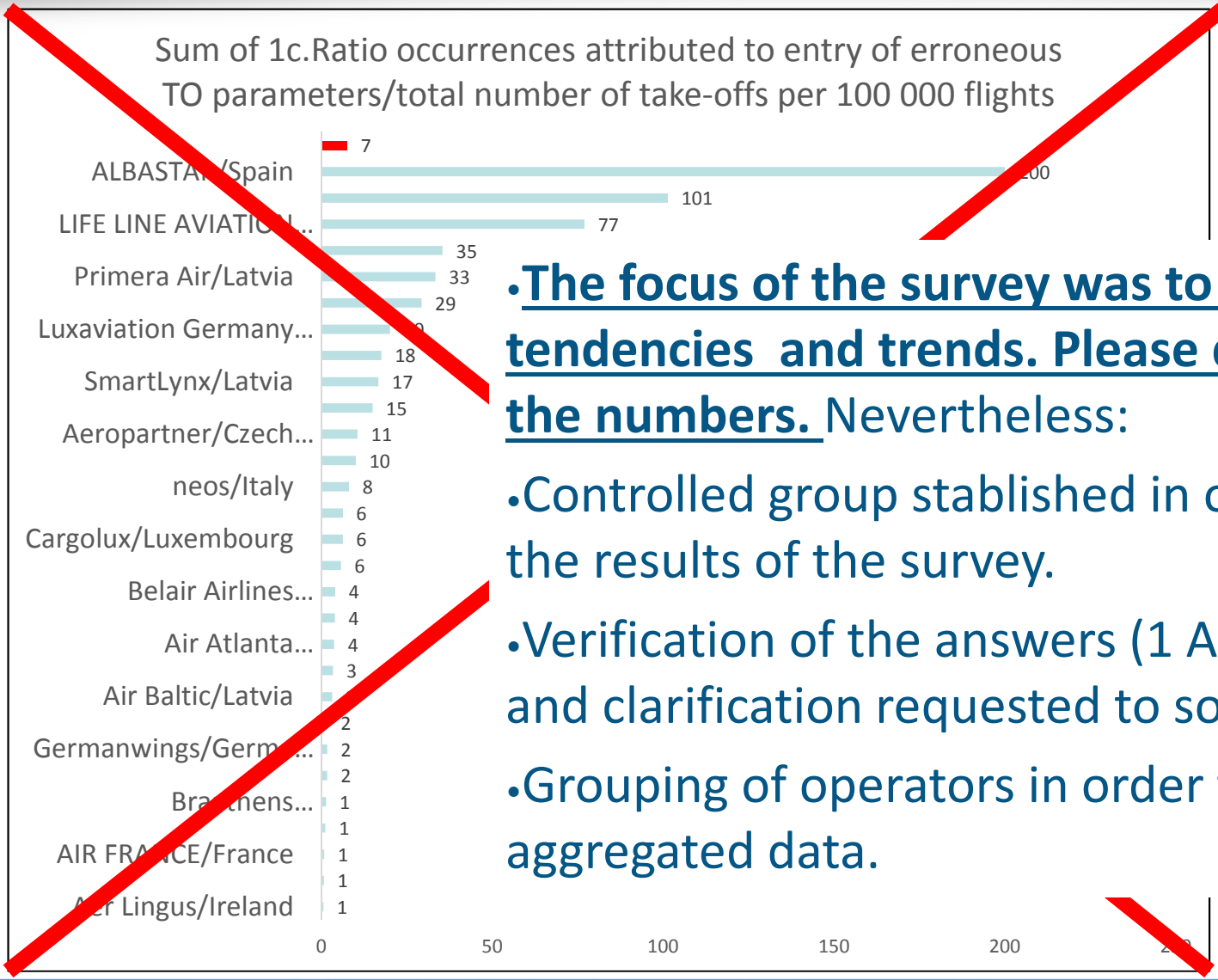
87 participants

(representing 128 erroneous take off data events)

Number of relevant participating organisations: **86**
from 29 countries, of which:



The Survey



- **The focus of the survey was to highlight tendencies and trends. Please don't focus on the numbers.** Nevertheless:
- Controlled group stablished in order to verify the results of the survey.
- Verification of the answers (1 AOC excluded and clarification requested to some operators)
- Grouping of operators in order to have aggregated data.

Correlation of Erroneous take off data and FDM

- The analysis is divided in 3 categories:

1- **Operators without Flight data monitoring (FDM)**

- FDM is required for:
- AOC holders
- + 27.000kgr aircraft

Correlation of Erroneous take off data and FDM

- The analysis is divided in 3 categories:

1- Operators without FDM

2- **Operators using FDM**

Correlation of Erroneous take off data and FDM

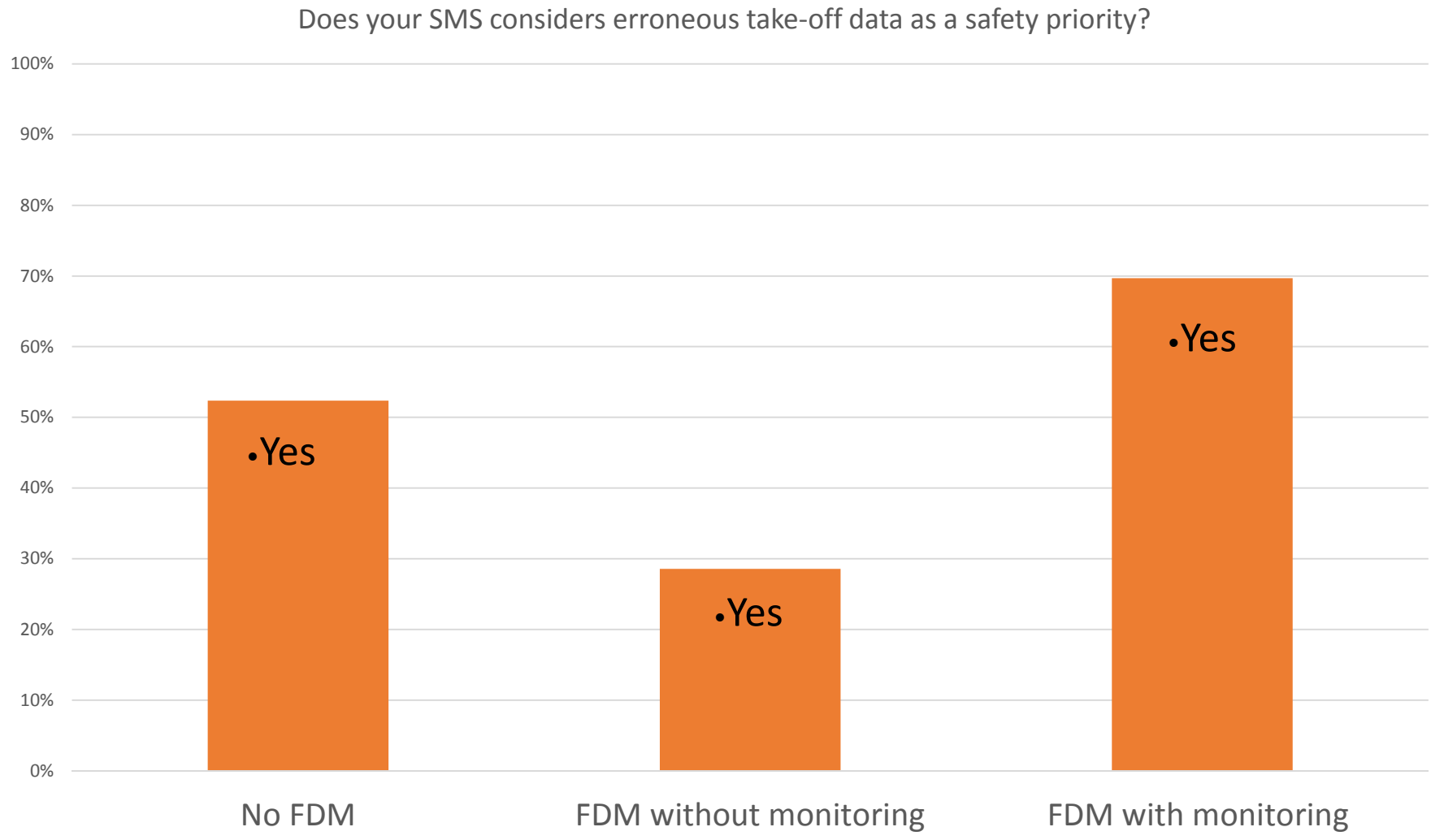
- The analysis is divided in 3 categories:

1- Operators without FDM (Flight data monitoring)

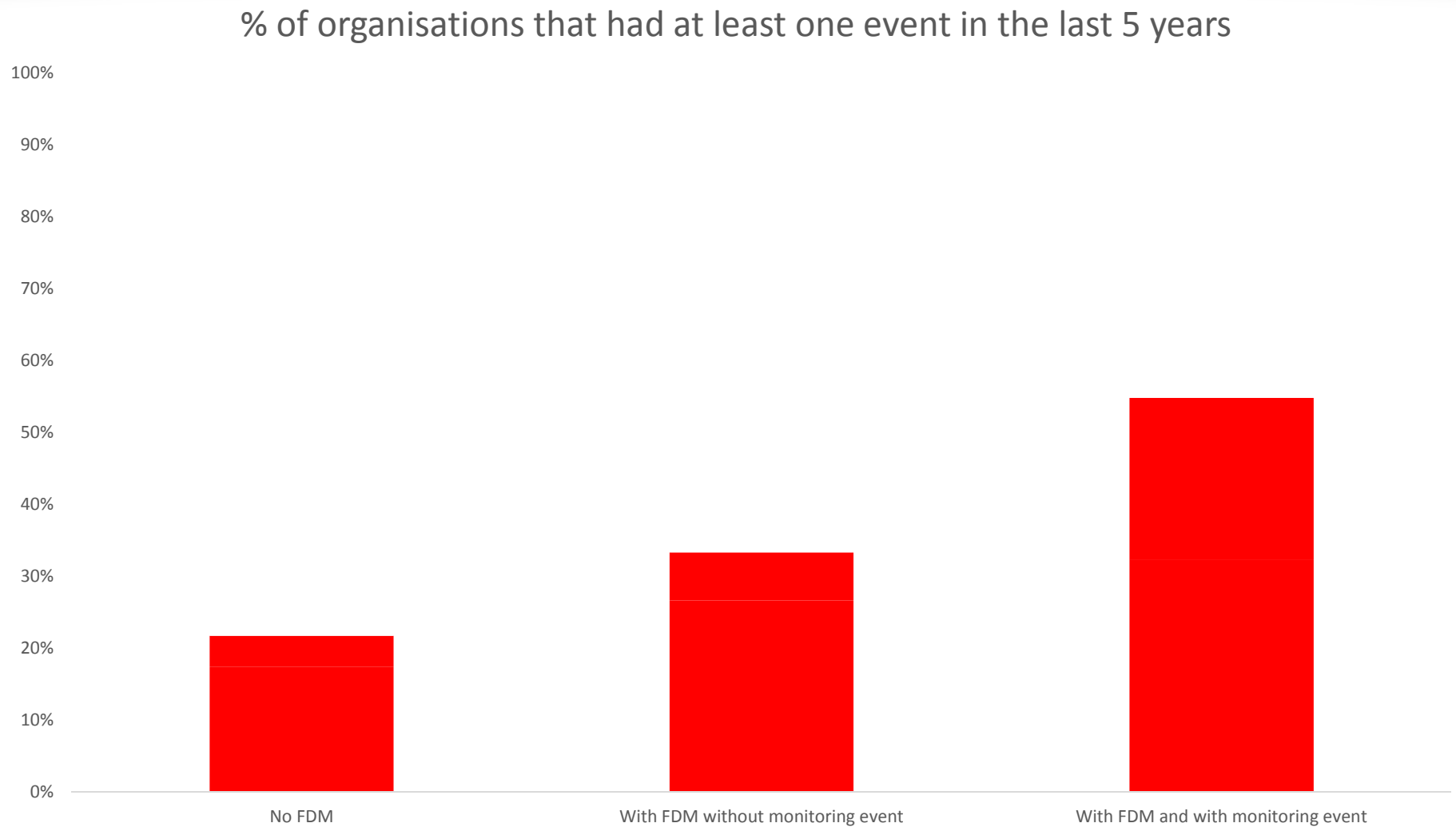
2- Operators using FDM

3- **Operators using FDM + specific FDM event(s)** to monitor erroneous parameters at take off.

Does your SMS considers Erroneous take off data as a safety priority?

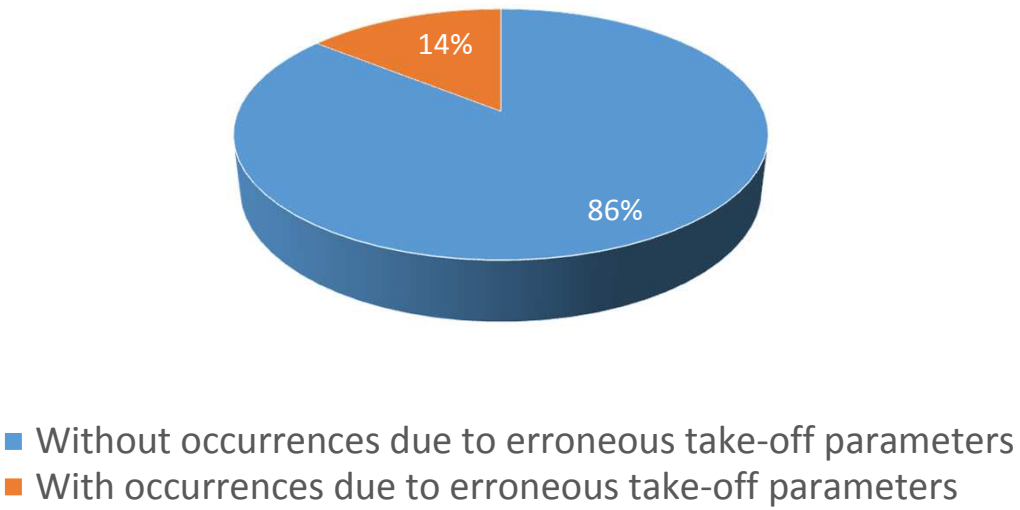


Did you have occurrences of Erroneous TO data in the last **5 years**



Correlation of Erroneous take off data and FDM

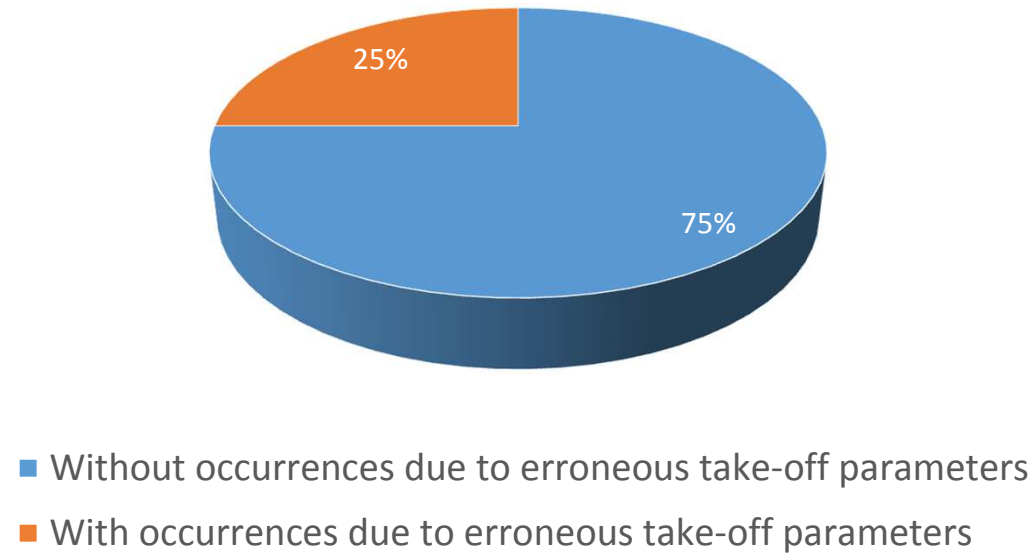
ER TO par occurrences for organisations with neither FDM nor monitoring event in place



- Only 14% of the organizations reported at least 1 event of erroneous take off data.
- Probably a large number of events were not reported

Correlation of Erroneous take off data and FDM

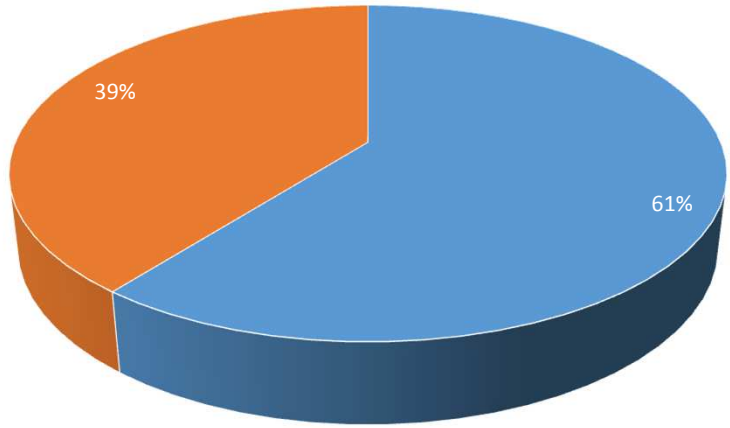
ER TO par occurrences for organisations with FDM in place but no Take-off monitoring event



- 25% of the organizations reported at least 1 event of erroneous take off data.
- Probably a number of events were not notice and consequently not reported

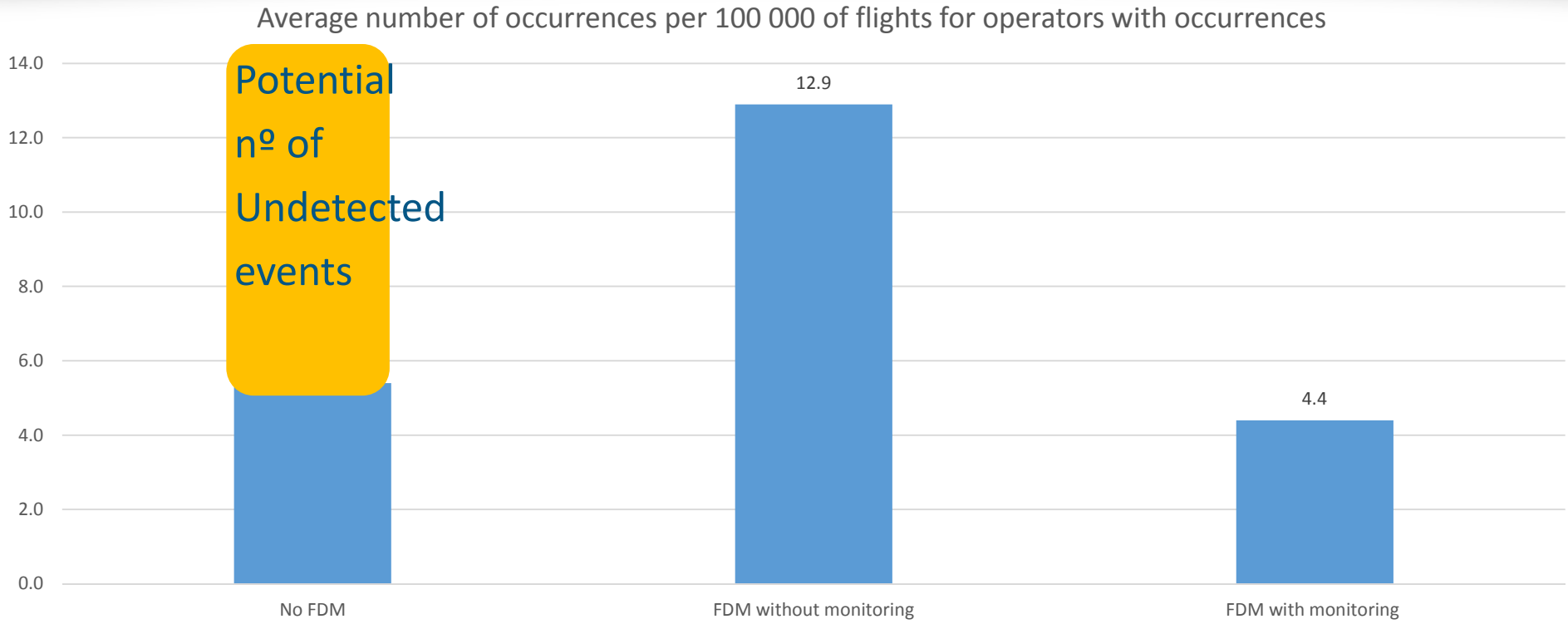
Correlation of Erroneous take off data and FDM

ER TO par occurrences for organisations with FDM and specific event in their FDM to detect erroneous take off parameters



- 39% of the organizations reported at least 1 event of erroneous take off data.
- Operators in this category have a take off FDM monitoring event therefore we assume this number have the best accuracy of the 3.

Correlation of Erroneous take off data and FDM



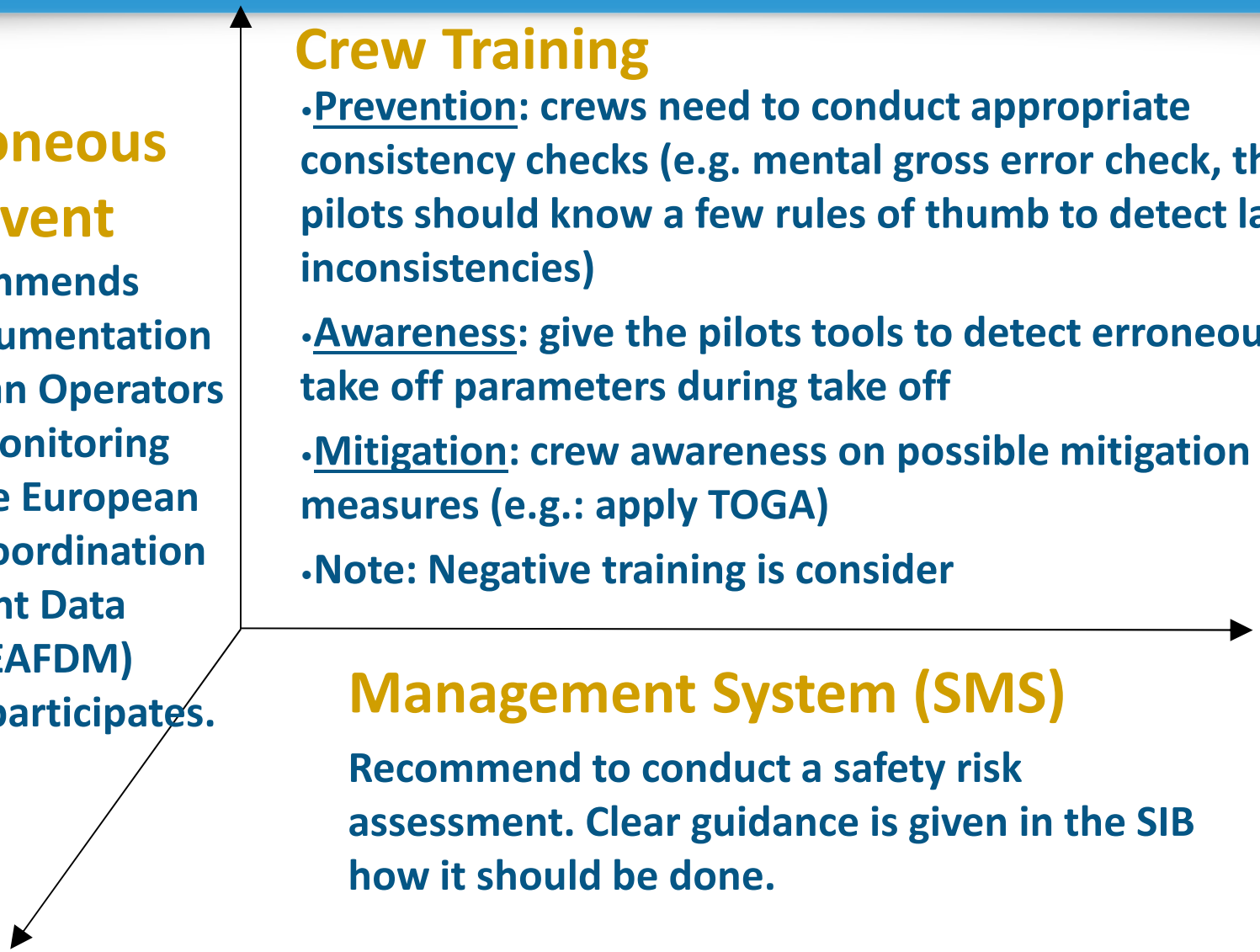
- There are a large number of undetected events for operators with NO FDM
- There a number of undetected events for operators with FDM only
- **It is key important to be aware of the problem, in order to apply the correct mitigation measures, and therefore lower the risks (3rd category)**

Actions

SIB draft: 3 axis.

FDM erroneous take-off event

The SIB recommends technical documentation from European Operators Flight Data Monitoring group and the European Authorities coordination group on Flight Data Monitoring (EAFDM) where EASA participates.



Crew Training

- Prevention: crews need to conduct appropriate consistency checks (e.g. mental gross error check, the pilots should know a few rules of thumb to detect large inconsistencies)
- Awareness: give the pilots tools to detect erroneous take off parameters during take off
- Mitigation: crew awareness on possible mitigation measures (e.g.: apply TOGA)
- Note: Negative training is consider

Management System (SMS)

Recommend to conduct a safety risk assessment. Clear guidance is given in the SIB how it should be done.

Reconfiguration of Actions for decision on SIB

- Short term actions

* SIB ready waiting for ESC decision.

Actions	Data Collection nº 1 (to know the problem)	SIB & ECR study	Data Collection nº 2 (implementation SIB)	FDM Collect nº 3 (effectiveness SIB)
Time scale	October 2015	FEB 2016	JUNE 2016	4Q 2016
Specials	Communication campaign	Stakeholders consultation.	Communication campaign	Interviews

PIA

Identification of the process for Take-off performance calculation (eg. flow chart): to Categorize possible failures and assess efficiency of possible actions (eg WG88…)(aprox 100 hours)

FS2.1 email sectorial focal point (8 hours)

Conclusions

- Those operators that are aware of the problem (FDM monitor event for erroneous take off data + functional SMS) has a better safety performance according to the Survey.
- This reasoning must be further study in order to back up this preliminary result.
- To be checked in a future survey (April 2016)
  - criticality of an event – ECR analysis.
  - Comparability of FDM monitoring events`

Correlation of Erroneous take off data and EFB

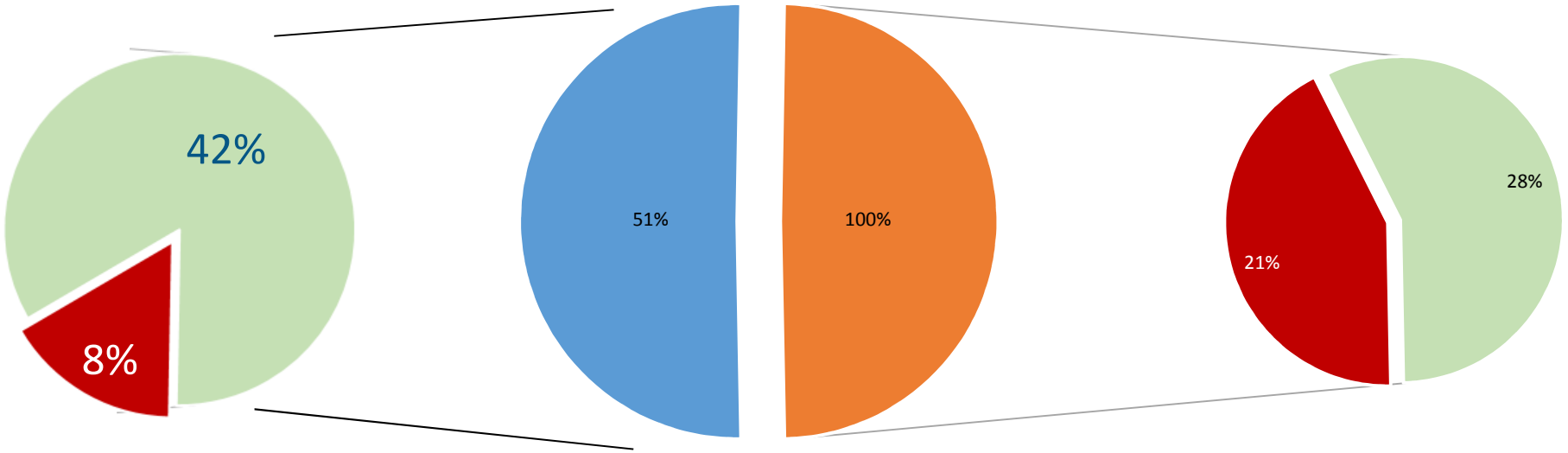
- Caution with chart interpretation
- Graph shows: organisations with EFB has more chances to have at least 1 erroneous take off data event. This might be for instance due to better reporting culture and not necessary due to EFB.
- Therefore study launched by EASA in 2013 “Electronic Flight Bag (EFB) - Aircraft performance calculations and mass & balance - Best practices for evaluation and use of EFB” is fully justified.
- Note: KLM eliminated the use of EFB for take off performance calculation in the cockpit. Performance is calculated by ground personnel and pilots then crosscheck with traditional performance charts.

Grouping of actions with Preliminary Impact Assessment on safety issue « erroneous take-off parameters »

Type of solution	Type of action	Status
Operational guidelines on: • **Training** • **Flight Data Monitoring** • **SMS**	1. **SIB** to recommend to operators • Review procedures and training • Assess their risk mitigation • Review crew management practices • Use appropriate equipment/tools for computing T-O data	*** SIB for ESC approval** *** Initial assessment of safety events in nov-dec 2015** *** SIB impacts assessed with 2 surveys in 2016**
Technical solutions • **A/C weight checks before T/O: WG-88** • **Continous monitoring of a/c weight and requested thrust for T/O: WG-94**	2. Eurocae WG-88 **or** WG-94 technical requirements implemented with **either**: • Industry standard • Safety Promotion • Rulemaking	*** Safety assessment done: 50 to 100% risk reduction** *** Lack cost estimates from industry** *** proposal: EASA to follow industry standard activity**
Use of Electronic Flight Bag RMT.0601/602	**RMT.**0601/0602 • EFB Provisions for the evaluation of W&B and T-O performance applications (NLR report) • transposition of provisions on EFB from ICAO in 965/2012	*** Pending study**

Correlation of Erroneous take off data and EFB

Usage of EFB for calculationg of take-off performance correlated to erroneous take-off occurrences



- Organisations not using EFB
- Organisations using EFB
- Organisations with events due to erroneous take-off parameters
- Organisations with NO events due to erroneous take-off parameters

Workload in 2016 : TO BE FINALISED

Type of solution	Type of action	Workload 2016
Operational guidelines on: • **Training** • **Flight Data Monitoring** • **SMS**	1. **SIB** to recommend to operators • Review procedures and training • Assess their risk mitigation • Review crew management practices • Use appropriate equipment/tools for computing T-O data	**300 to 500 hours**
Technical solutions • **A/C weight checks before T/O: WG-88** • **Continous monitoring of a/c weight and requested thrust for T/O: WG-94**	2. Eurocae WG-88 **or** WG-94 technical requirements implemented with **either**: • Industry standard • Safety Promotion • Rulemaking	**100 Hours**
Use of Electronic Flight Bag RMT.0601/602	**RMT.**0601/0602 • EFB Provisions for the evaluation of W&B and T-O performance applications (NLR report) • transposition of provisions on EFB from ICAO in 965/2012	**50 ??? hours + potential extension of scope for ToR**

Outcome of PIA Erroneous T/O parameters

- Reminder: PIA to be updated at least on a yearly basis
- Proposal
  - Start with SIB implementation
  - In the meantime, EASA participation in EUROCAE WG 88 (OBWBS Action)
  - PIA update on a yearly basis
    - EFB to be integrated when NLR study is available
    - If no improvement after 3 years, reassess the need to implement the OBWBS action
- Outcome of PIA exercise
  - Show how to use in the most efficient way EASA and aviation sector ressources
  - e.g. in the case of erroneous take-off parameters, the PIA has prevented to launch directly a RMT on OBWBS with aircraft cost impacts ➔ SIB is first to be implemented
  - Use of survey to cross-check outcome of internal safety analysis is a key step ➔ in our example, the survey has confirmed the safety analysis with more precise information on FDM use that were not accessible by EASA

FDM take-off event - SIB

	Refers only to existing documentation	UKCAA low acceleration flag event	EASA to develop low acceleration flag event
Time line	Available now	9 months	Over a year
For EASA	40-50 hours	500 hours	1000 hours
For the Operator	Extensive work	low	low
Opinion of our experts SM	Prefer option	Acceptable option	Not available (lack of equipment and resources)
Others	No trips are required.	MoM with UKCAA 1 or 2 trips to UK	Precursor of the Big Data project. Extensive trips to operators.

- **Resources to implement take-off FDM events**

- 1000 hours

START

Implementation of Take-off FDM event

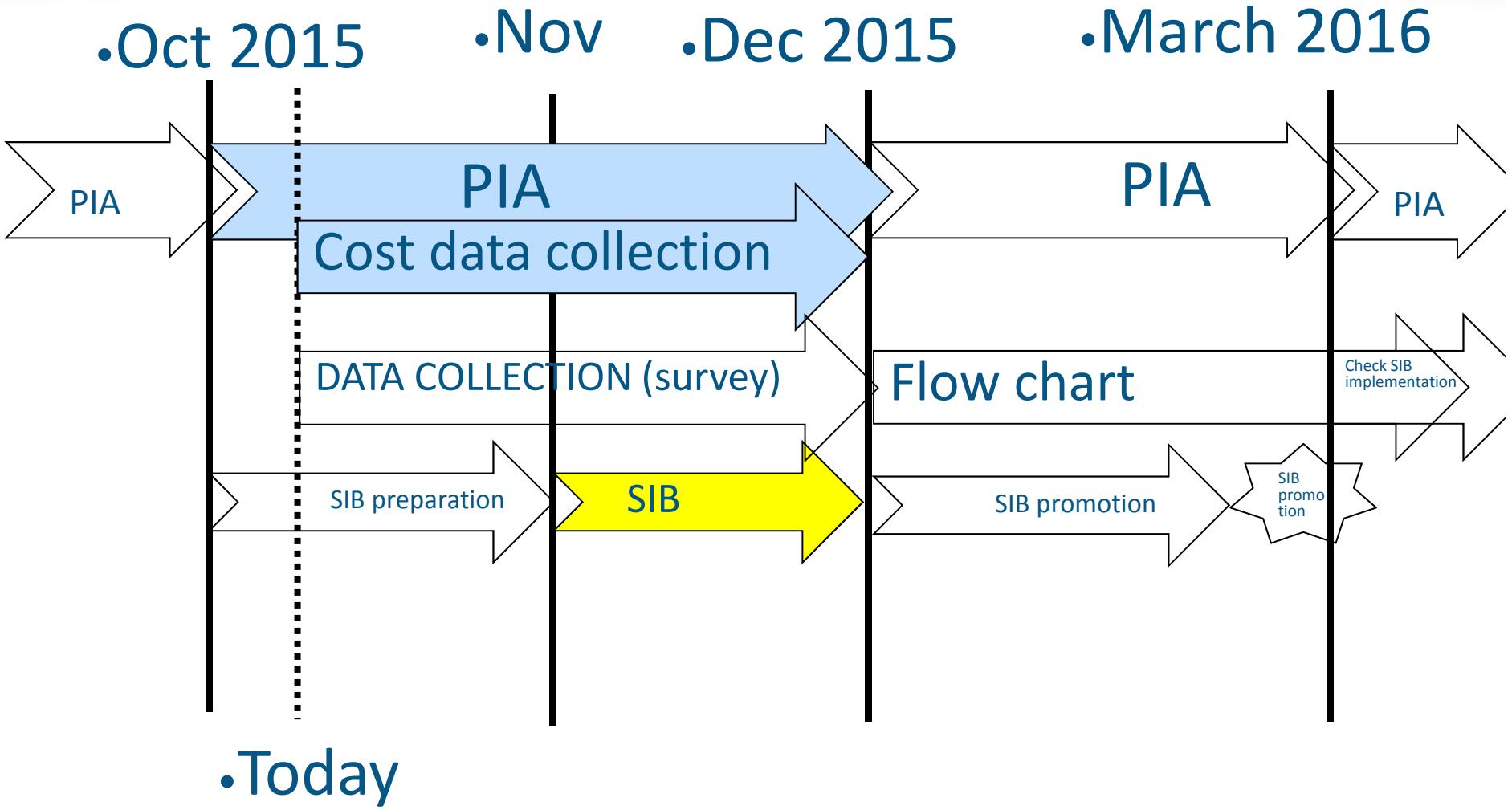
End

EASA/NAAs(eg. UKCAA)

Associations?

Operator

Actions progress



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Thanks for your attention

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