FDA Seminar – Miami
25-27 October 2016

FDA Within SMS

Capt Paul DUBOIS
Manager SMS & FDA Assistance
AIRBUS

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FDA Within SMS - SMS Reminder

SAFETY

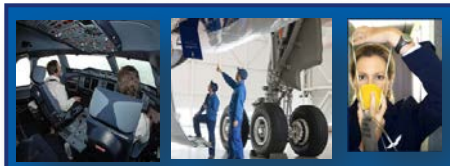
MANAGEMENT

SYSTEM

FDA Within SMS - SMS Reminder

Technical

Mechanical Improvements, Better Technology



Human

CRM, MRM, Human Performance

Organizational

SMS, Organizational Performance

1950s **1980s** **2000s** **2010s**

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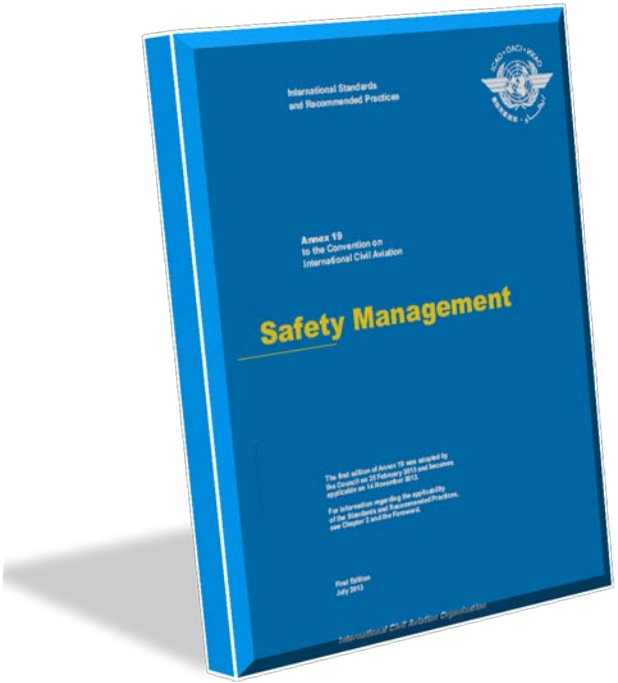
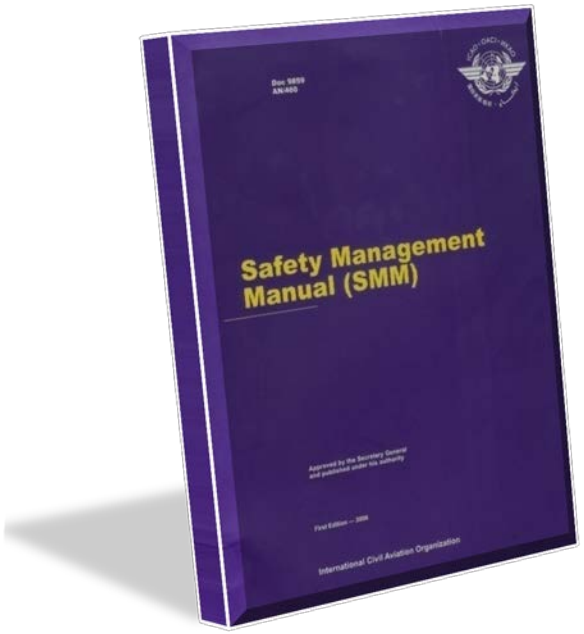
FDA Within SMS - SMS Reminder

ICAO defines SMS Standards in ANNEX 19 Safety Management



FDA Within SMS - SMS Reminder

ICAO provides SMS guidance in the Safety Management Manual (SMM) Doc 9859 3rd Edition



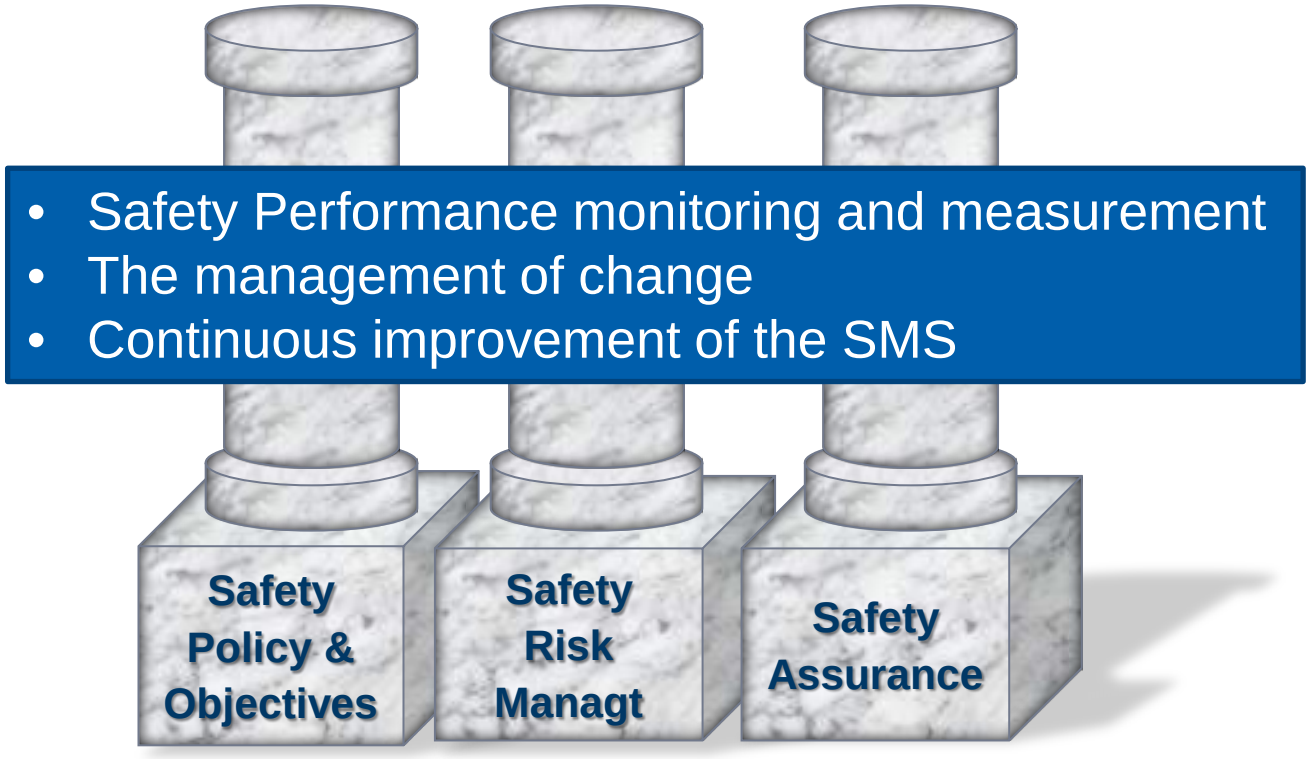
FDA Within SMS - SMS Reminder

- Management commitment and responsability
- Safety accountabilities
- Appointment of key safety personnel
- Coordination of emergency response planning
- SMS documentation

FDA Within SMS - SMS Reminder

- Hazard Identification
- Safety Risk Assessment
- Mitigation

FDA Within SMS - SMS Reminder



FDA Within SMS - SMS Reminder

FDA Within SMS - SMS Framework

FDA Within SMS - Flight Data Analysis Programme

ICAO Annex 6: Operation of Aircraft

Chapter 3.3 Safety Management

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 SMS.

Manual of Flight Data Analysis Programmes

ICAO Doc 10000 / 1st Ed 2014

FDA Within SMS - Flight Data Analysis Programme

« FDA, sometimes referred to as Flight Data Monitoring or Flight Operational Quality Assurance (FOQA), provides a systematic tool for the proactive identification of hazards ».

« an FDAP is an effective tool for the safety assurance component of air operators ».

FDA Within SMS - Flight Data Analysis Programme

« The Objective is to:

- To determine operating norms
- Identify potential and actual hazards in operating procedures, fleets, aerodromes, ATC procedures, etc…
- Identify trends
- Monitor the corrective actions effectiveness
- Provide data to conduct cost-benefit analysis
- Optimize training procedures
- Provide actual performance measurement for risk management purpose».

FDA Within SMS - SMS Framework

FDA Within SMS - Safety Risk Management

FDA Within SMS - Safety Risk Management

"The objective of Safety Risk Management is to assess the risks associated with identified hazards and develop and implement effective and appropriate mitigations."

ICAO (SMM 3rd version)

FDA Within SMS - Safety Risk Management

Safety

"The state in which the possibility
of harm to persons or of property damage
is reduced to, and maintained
at or below, an acceptable level
through a continuing process of
hazards identification and
safety risk management."

ICAO (SMM 3rd version)

FDA Within SMS - Safety Risk Management

Hazard

"A condition or an object with the potential of causing:

- Injuries to personnel
- Damage to equipment or structures
- Loss of material, or
- Reduction of ability to perform a prescribed function."

ICAO (SMM 3rd version)

Safety Risk

"Safety Risk is a product of the human mind intended to measure the seriousness of,

or to "put a number" on,

the consequences of hazards"

"The predicted likelihood and severity of the consequences or outcomes from an existing hazard."

ICAO (SMM 3rd version)

FDA Within SMS - Safety Risk Management

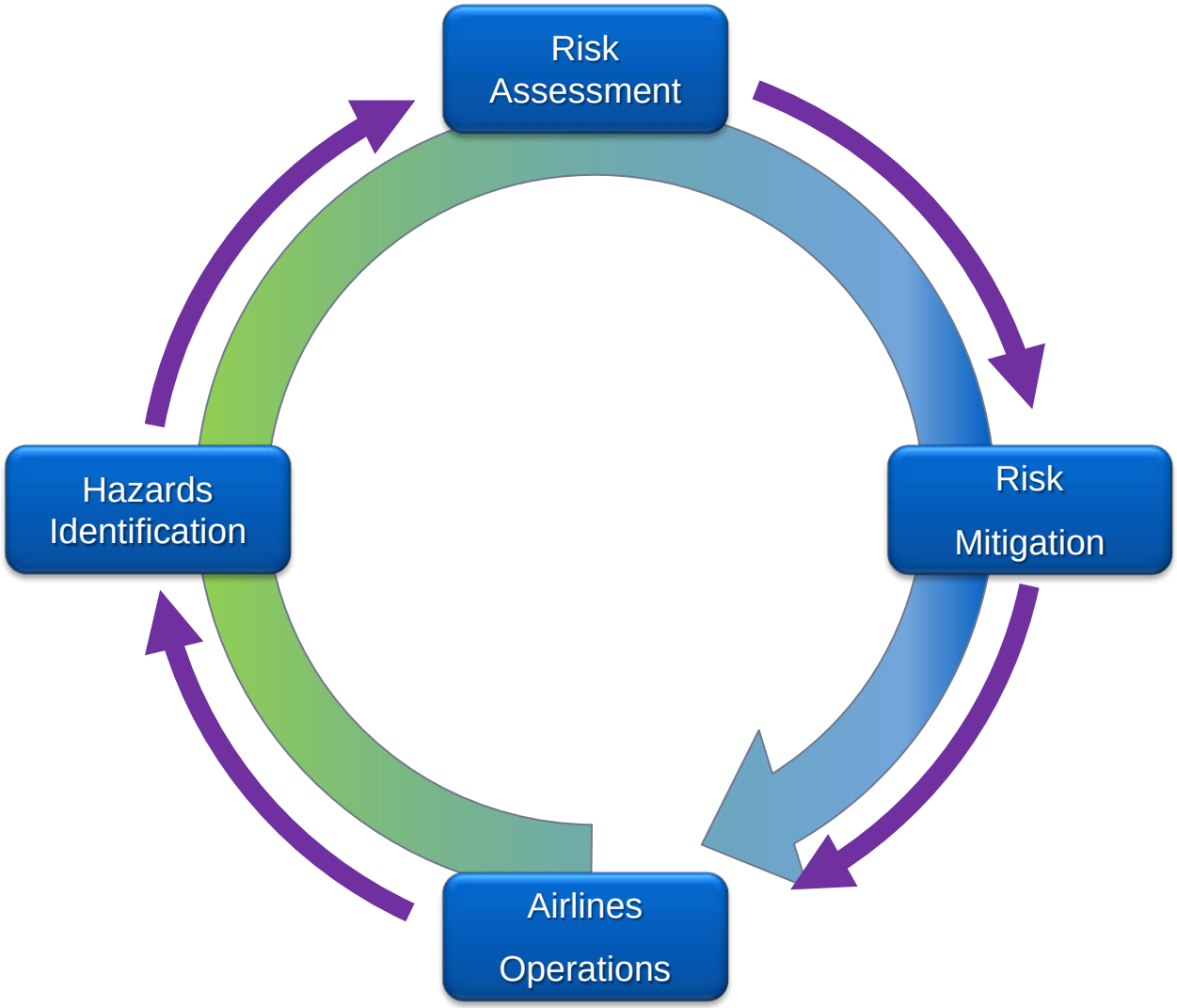
What is the Hazard?

- Traffic on the road to be crossed

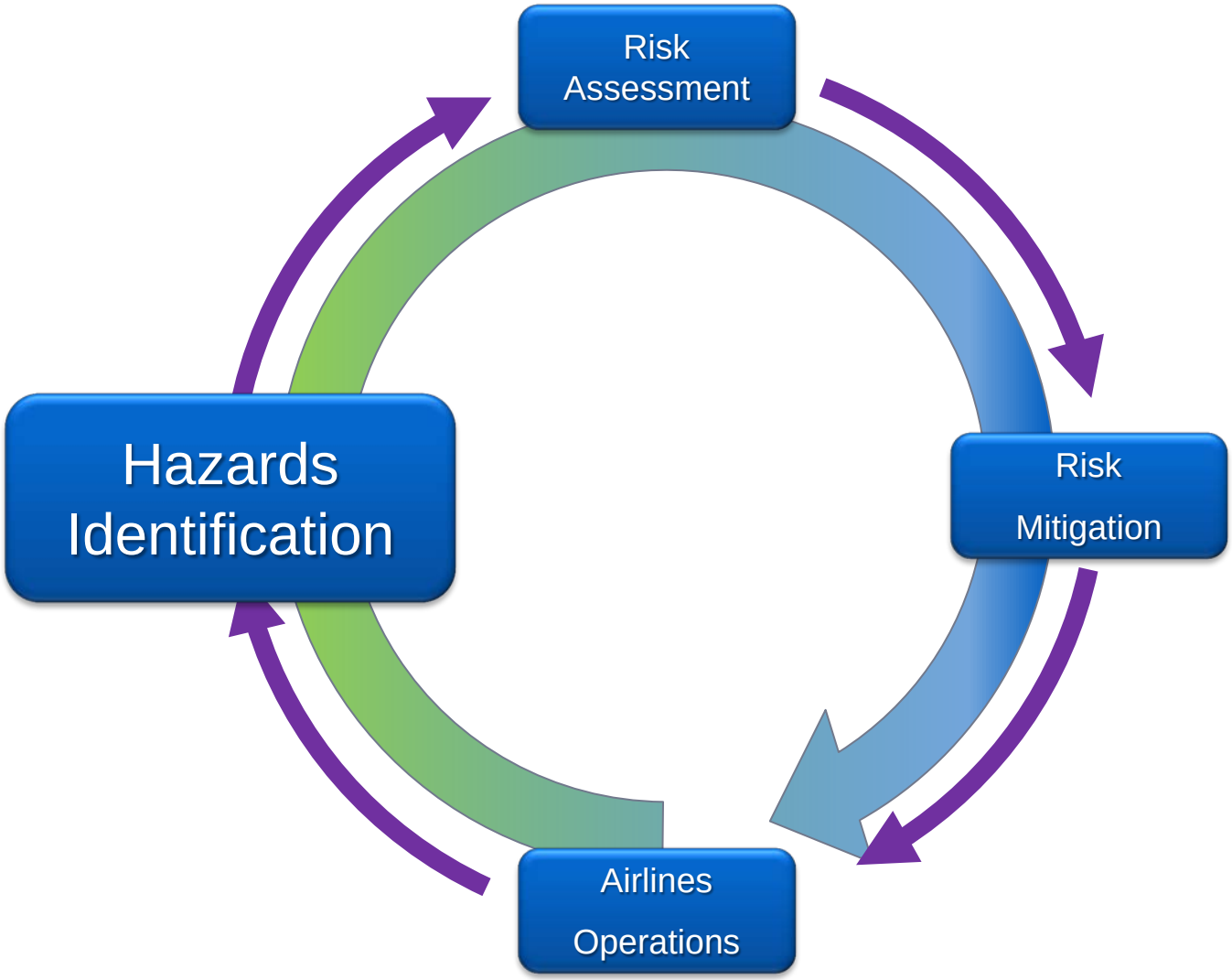
What is the Risk?

- To be hit by a car

FDA Within SMS - Safety Risk Management



FDA Within SMS - Safety Risk Management



FDA Within SMS - Safety Risk Management

Hazards Identification ?

Activity where hazards are detected, using systematic processes and tools.

How to Identify Hazards ?

By collecting and analysing data

FDA Within SMS - Safety Risk Management

Reactive Method

- Accident reports
- Incident reports
- MOR

Proactive Method

- Surveys
- Audits
- Volontary hazard reporting
- Flight Data Analysis

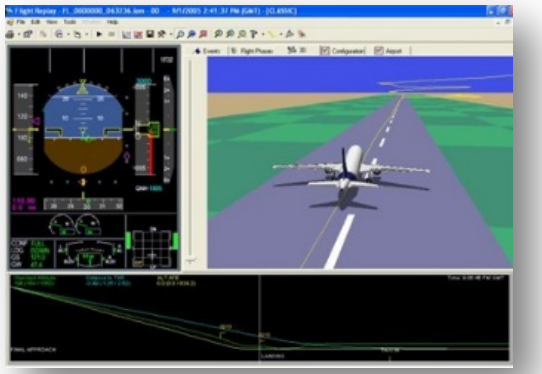
ICAO (FDAP doc 10000)

Predictive Method

- Flight Data Analysis
- Direct Observation Systems

ICAO (SMM 3rd version)

FDA Within SMS - Flight Data Analysis Programme



FDA provides a systematic tool for the proactive & predictive identification of hazards

FDA Within SMS - Safety Risk Management

FDA Within SMS - Safety Risk Management

How to assess the risk ?

By assessing for each hazards

- The severity of the potential outcomes
- The probability that they will occur

Assessing the Severity

Severity	*Meaning*	*Value*
Catastrophic	— Equipment destroyed — Multiple deaths	A
Hazardous	— A large reduction in safety margins, physical distress or a workload such that the operators cannot be relied upon to perform their tasks accurately or completely — Serious injury — Major equipment damage	B
Major	— A significant reduction in safety margins, a reduction in the ability of the operators to cope with adverse operating conditions as a result of an increase in workload or as a result of conditions impairing their efficiency — Serious incident — Injury to persons	C
Minor	— Nuisance — Operating limitations — Use of emergency procedures — Minor incident	D
Negligible	— Few consequences	E

Assessing the Probability

Likelihood	*Meaning*	*Value*
Frequent	Likely to occur many times (has occurred frequently)	5
Occasional	Likely to occur sometimes (has occurred infrequently)	4
Remote	Unlikely to occur, but possible (has occurred rarely)	3
Improbable	Very unlikely to occur (not known to have occurred)	2
Extremely improbable	Almost inconceivable that the event will occur	1

Probability X Severity = Safety Risk Index

Risk probability	Risk severity				
	Catastrophic A	Hazardous B	Major C	Minor D	Negligible E
Frequent 5	5A	5B	5C	5D	5E
Occasional 4	4A	4B	4C	4D	4E
Remote 3	3A	3B	3C	3D	3E
Improbable 2	2A	2B	2C	2D	2E
Extremely improbable 1	1A	1B	1C	1D	1E

FDA Within SMS - Safety Risk Management

Safety Risk Index → Tolerability

Risk index range	Description	Recommended action
5A, 5B, 5C, 4A, 4B, 3A	High risk	Cease or cut back operation promptly if necessary. Perform priority risk mitigation to ensure that additional or enhanced preventive controls are put in place to bring down the risk index to the moderate or low range.
5D, 5E, 4C, 4D, 4E, 3B, 3C, 3D, 2A, 2B, 2C, 1A	Moderate risk	Schedule performance of a safety assessment to bring down the risk index to the low range if viable.
3E, 2D, 2E, 1B, 1C, 1D, 1E	Low risk	Acceptable as is. No further risk mitigation required.

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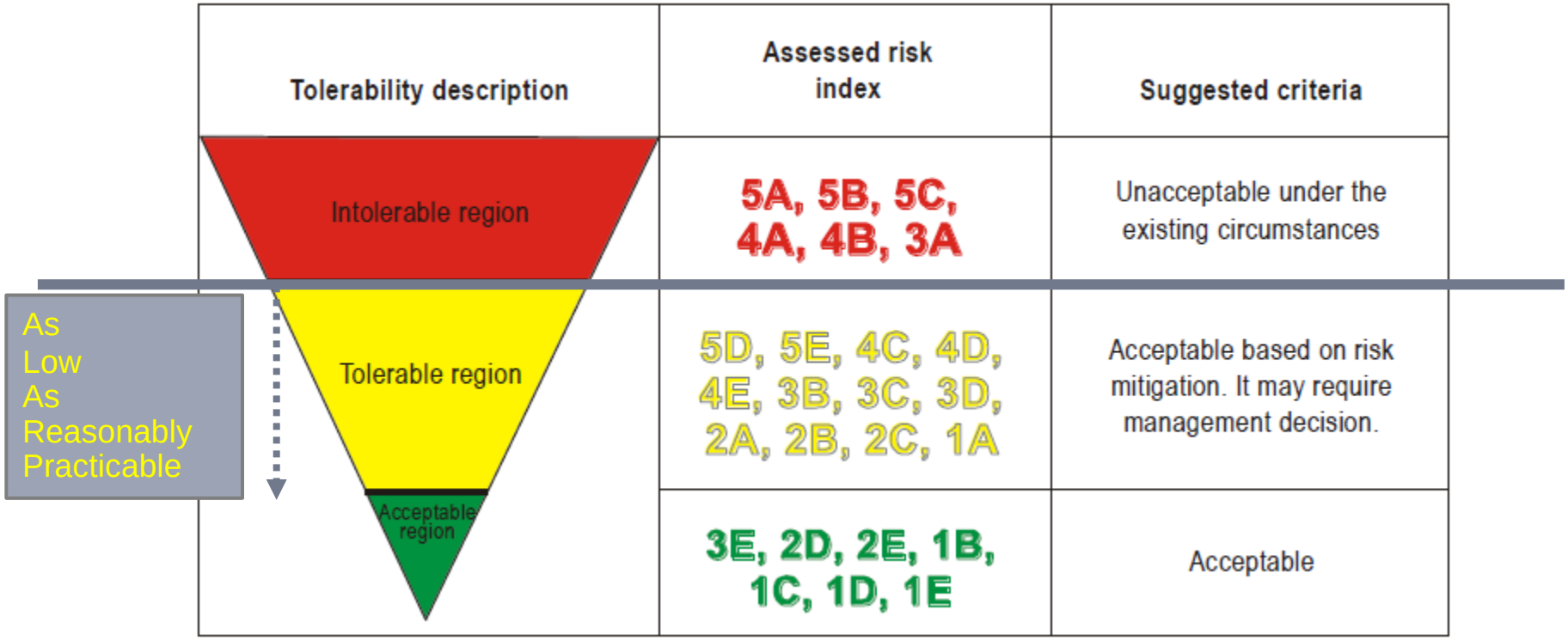
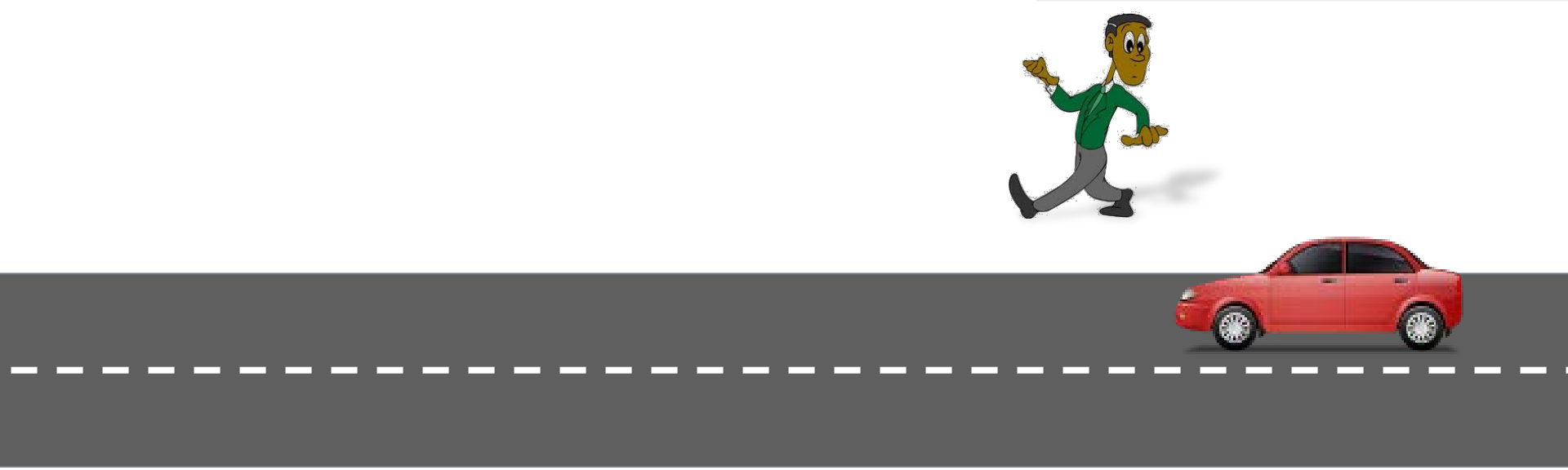
FDA Within SMS - Safety Risk Management

Safety Risk Index → Tolerability

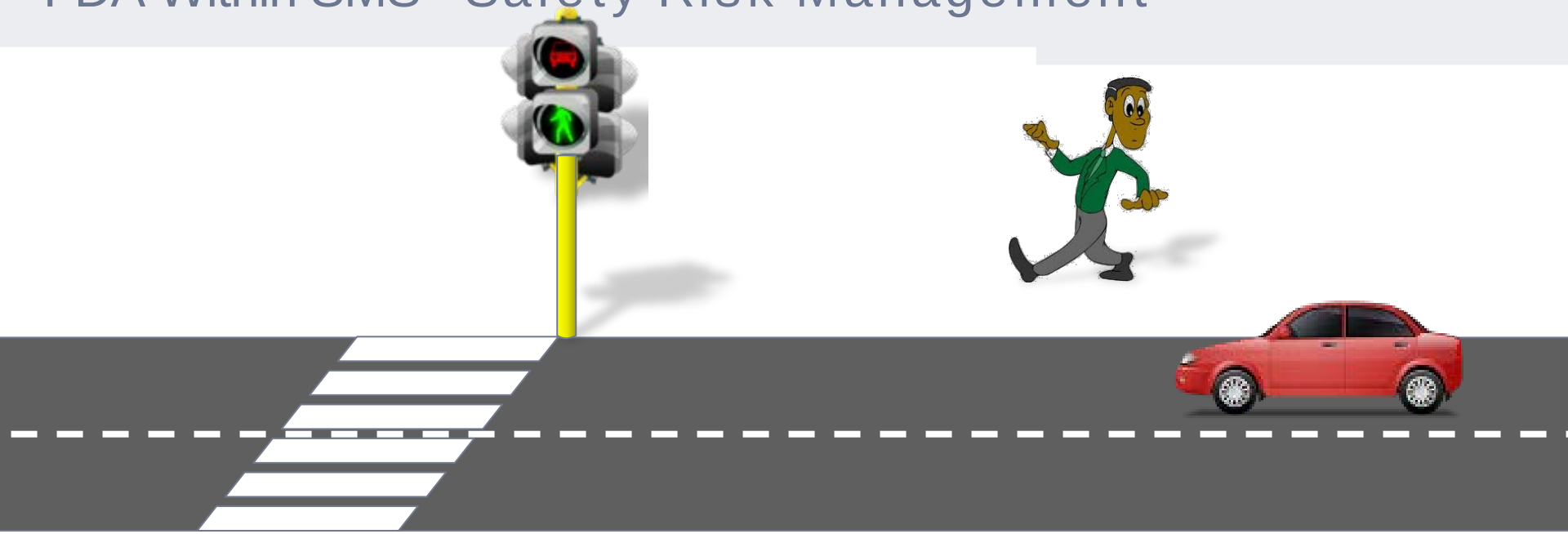


FDA Within SMS - Safety Risk Management



Risk Probability		Risk Severity				
		Catastrophic A	Hazardous B	Major C	Minor D	Negligible E
Frequent	5	5A	5B	5C	5D	5E
Occasionnal	4	4A	4B	4C	4D	4E
Remote	3	3A	3B	3C	3D	3E
Improbable	2	2A	2B	2C	2D	2E
Extremely Improbable	1	1A	1B	1C	1D	1E

FDA Within SMS - Safety Risk Management



Risk Probability		Risk Severity				
		Catastrophic A	Hazardous B	Major C	Minor D	Negligible E
Frequent	5	5A	5B	5C	5D	5E
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Remote	3	3A	3B	3C	3D	3E
Improbable	2	2A	2B	2C	2D	2E
Extremely Improbable	1	1A	1B	1C	1D	1E

What does FDA monitor?

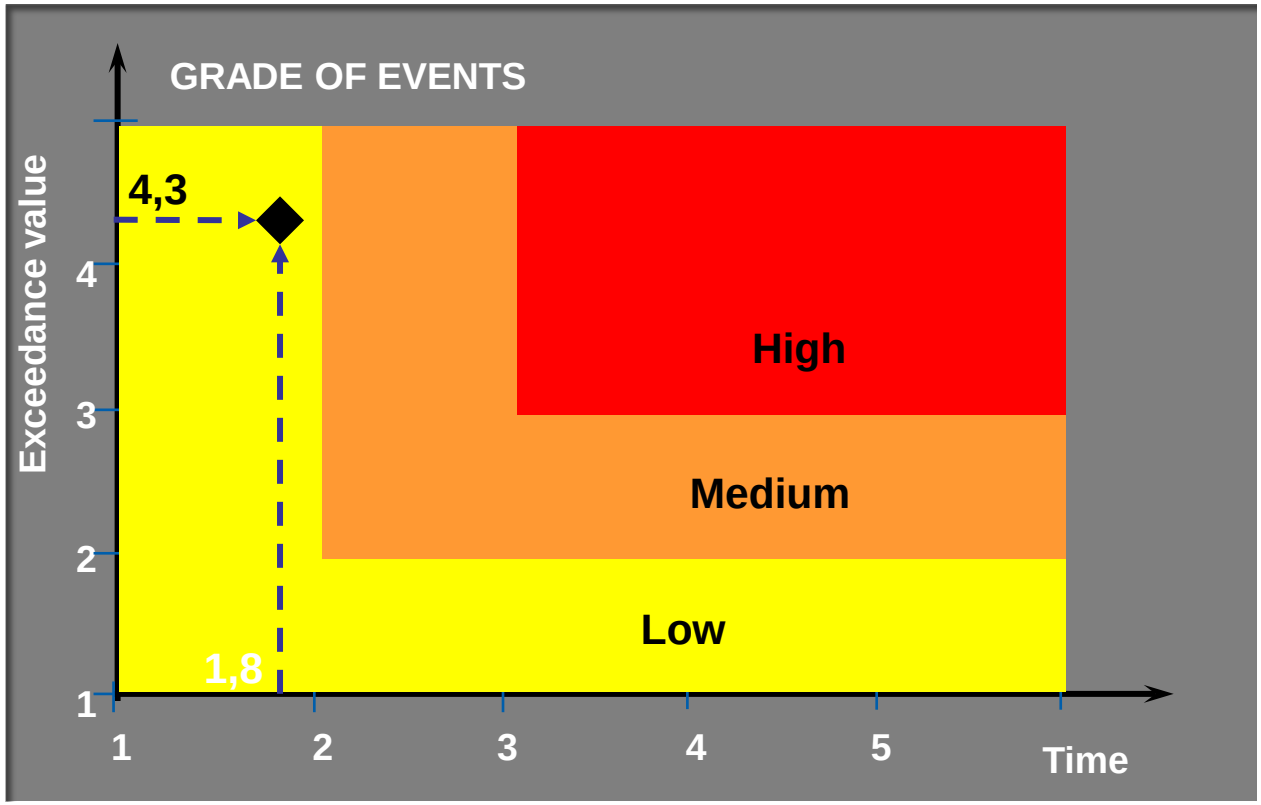
"Deviation of more than certain predetermined values, called "exceedances" are flagged and evaluated"

"Exceedance detection, such as deviations from flight manual limits or SOPs"

ICAO (FDAP doc 10000)

FDA Within SMS - Safety Risk Management

EVENT programming is based on two basic attributes Magnitude and Duration



FDA Within SMS - Safety Risk Management

For the risk assessment we need

To identify the risk associated with the long flare event

- Runway excursion

To assess the severity of the potential outcome

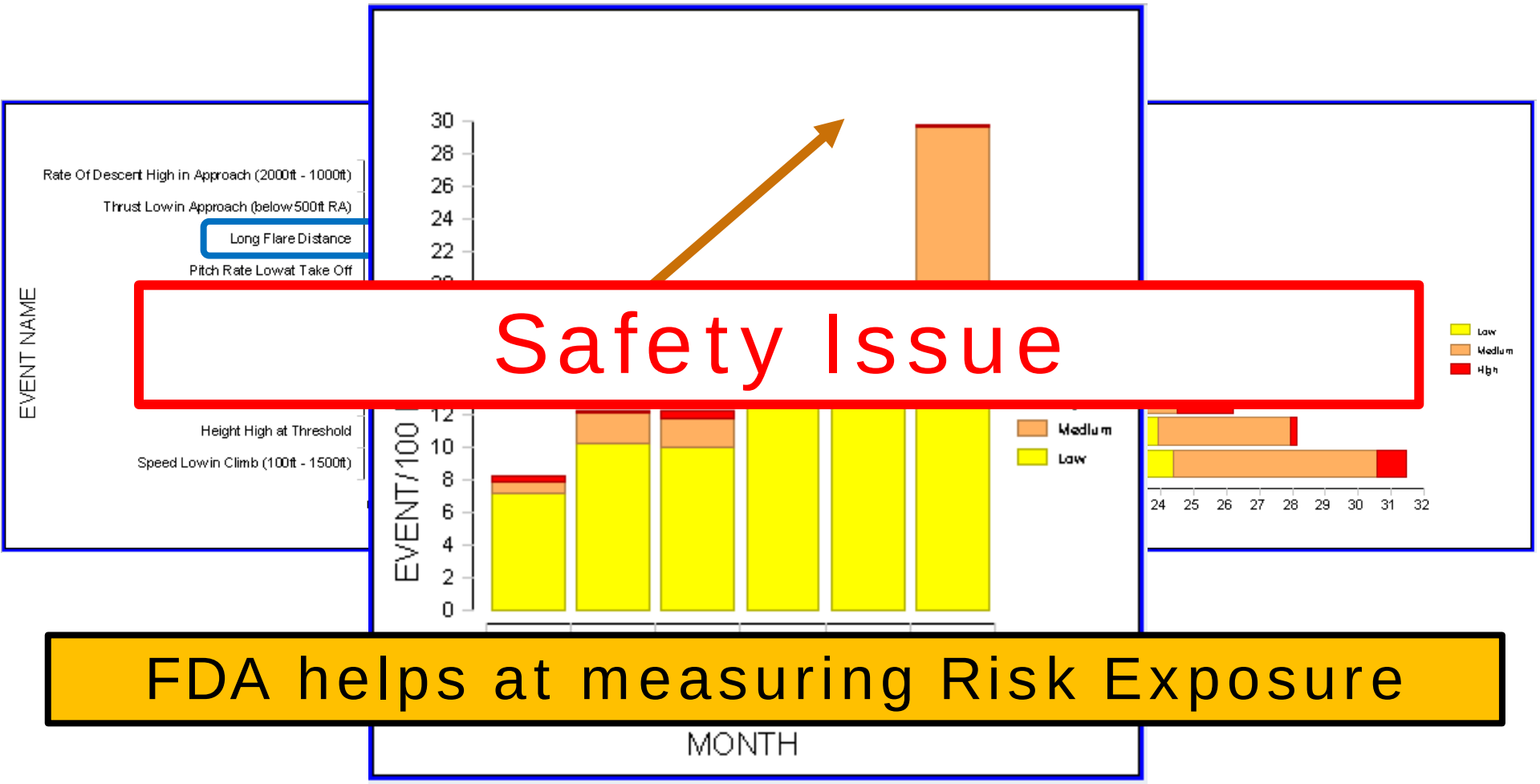
- Aircraft damage / injury to personnel

To assess the probability that it will occur

- Existing barriers?

Risk Assessment requires Human analysis

FDA Within SMS - Safety Risk Management



FDA Within SMS - Safety Risk Management

FDA Within SMS - Safety Risk Management

Mitigation
=
Remedial Actions
to maintain an acceptable level of Safety

Prevention

Protection

Safety Action Group (SAG)

Operational Managers

Safety Review Board (SRB)

FDA Within SMS - Safety Risk Management

« FDA involves promoting action to correct potential problems ».

« FDA team will propose and evaluate corrective actions, as well as produce exceedances aggregation over time to determine and monitor trends ».

ICAO (FDAP doc 10000)

FDA Within SMS - SMS Framework

Safety Assurance

« as part of an operator's SMS safety assurance processes, an FDAP will have identified indicators or parameters chosen for measuring and monitoring the operator's safety performance ».

FDA Within SMS - Safety Assurance

Safety Performance Indicators

- Monitor known safety risk
- Detect emerging safety risks
- Identify need of any necessary corrective actions

Provide objective evidence for the authorities

- To assess the effectiveness of the service providers' SMS
- To monitor achievement of its safety objectives.

FDA Within SMS - Safety Indicators

What kind of indicators ?

FDA Within SMS - Safety Indicators

ICAO

Doc 10004

2017-2019 Global Aviation Safety Plan

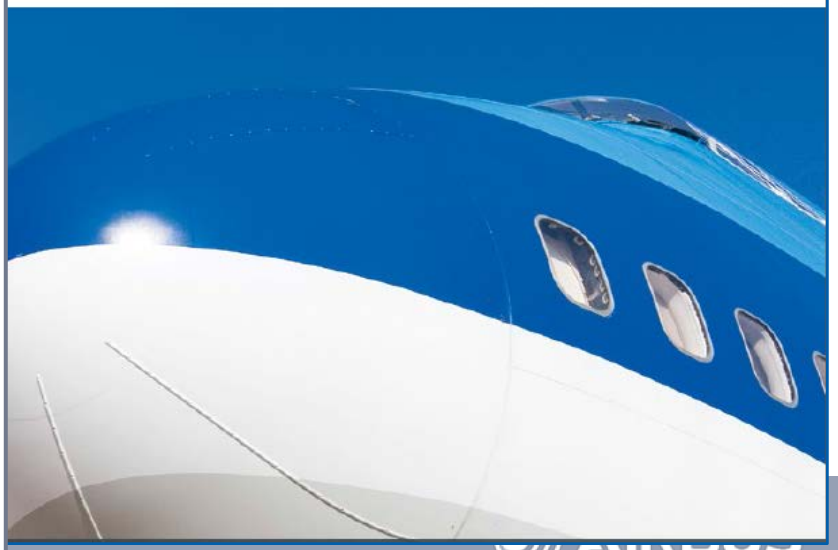
Second Edition, 2016

INTERNATIONAL CIVIL AVIATION ORGANIZATION

ICAO

SAFETY

2014–2016
Global Aviation Safety Plan



FDA Within SMS - Safety Indicators

Global Priorities

ICAO continues to prioritize action in three areas of aviation safety – improving runway safety, reducing the number of Controlled Flight Into Terrain (CFIT) accidents and reducing the number of loss of control in-flight accidents and incidents. All of these actions will contribute to the overarching priority of the GASP to continually reduce the global accident rate.

Figure 2: Overview of strategy to achieve GASP objectives

Global Aviation Safety Priorities

Three areas of aviation safety continue to be global priorities – improving runway safety performance, reducing Controlled Flight into Terrain (CFIT) accidents and reducing the number of loss of control in-flight accidents and incidents. These priorities should be addressed at a global, regional and State level.

Effective actions against each of these priority areas will contribute to the overarching priority of the GASP to continually reduce the global accident rate.

Improving Runway Safety Performance

ICAO is coordinating a global effort to improve runway safety performance. This programme has involved substantial collaboration with partner organizations including: the International Air Transport Association; Airports Council International; the Civil Air Navigation Services Organisation; the European Aviation Safety Agency; EUROCONTROL; the U.S. Federal Aviation Administration; the Flight Safety Foundation; the International Business Aviation Council; the International Coordinating Council of Aerospace Industries Associations; the International

the Flight Safety Foundation; the International Business Aviation Council; the International Coordinating Council of Aerospace Industries Associations; the International

FDA Within SMS - Safety Indicators

ICAO

Chapter 3

FOCUS AREAS TO IMPROVE SAFETY

3.1 GLOBAL SAFETY PRIORITIES

3.1.1 As mentioned in Chapter 2, the universal safety oversight audit programme (USOAP) audits have identified that States' inability to effectively oversee aviation operations remains a global safety concern. This GASP provides a detailed strategy to achieve improvements. In addition to the GASP objectives, ICAO has identified high-risk accident categories. These categories were initially determined based on an analysis of accident data, for scheduled commercial air transport operations, covering the 2006–2011 time period. Feedback from the regional aviation safety groups (RASGs) indicates that these priorities still applied during the development of the 2017-2019 edition of the GASP.

3.1.2 Runway safety events were identified as one of the main high-risk accident categories. Runway safety-related events include the following ICAO accident occurrence categories: abnormal runway contact, bird strikes, ground collision, runway excursion, runway incursion, loss of control on the ground, collision with obstacle(s) and undershoot/overshoot.

3.1.3 Controlled flight into terrain (CFIT) and loss of control in-flight (LOC-I) were identified as the other two high-risk accident categories. These types of accidents account for a small portion of accidents in a given year but are generally fatal and account for a large portion of the total number of fatalities.

2017-2019 Global

a) the three high-risk accident categories account for 60.57 per cent of all fatalities worldwide;

f) in North American, Central American and Caribbean (NACC), the three categories accounted for 100 per cent of all fatalities;

a) runway safety was the main accident category for all the regions;

b) in Asia and Pacific regions (APAC), the three categories accounted for 87.91 per cent of fatalities;

c) in Eastern and Southern Africa (ESAF), 80.95 per cent of all accidents involved runway safety events, over a third of which were fatal. No CFIT or LOC-I accidents were recorded in the region during the timeframe;

d) in European and North Atlantic (EUR NAT), the three categories accounted for 26.81 per cent of fatalities; runway safety events accounted for 57.62 per cent of all accidents in the region;

3-1

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FDA Within SMS - Safety Indicators

EUROPEAN
COMMISSION

Brussels, 7.12.2015
COM(2015) 599 final

ANNEX 1

ANNEX

The European Aviation Safety Programme Document
2nd edition

to the

REPORT TO THE EUROPEAN PARLIAMENT AND THE COUNCIL

The European Aviation Safety Programme

European Aviation Safety Agency

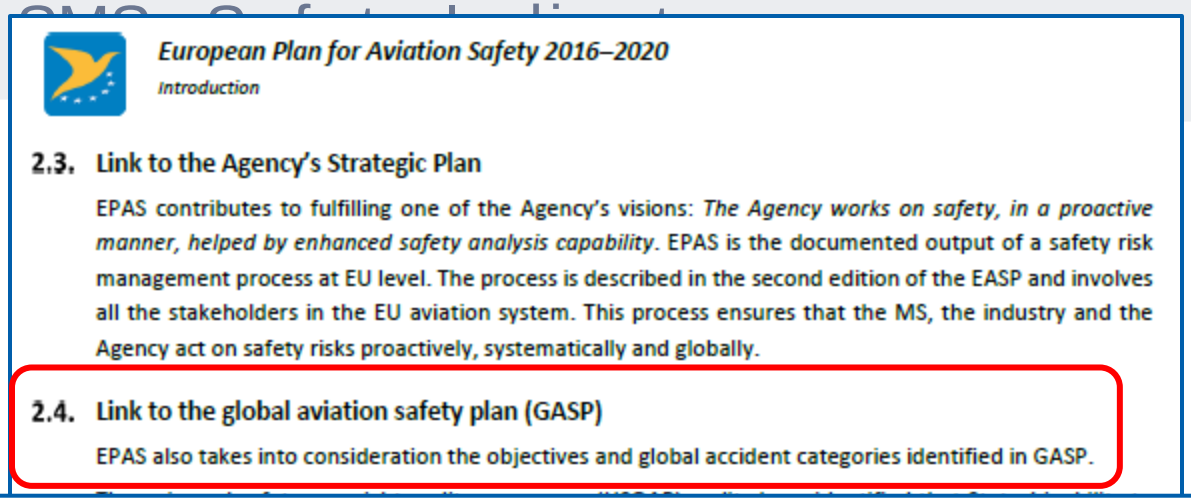
European Plan for Aviation Safety

2016–2020

Final

25 January 2016

FDA Within SMS – Safety Indicators



European Plan for Aviation Safety 2016–2020

Introduction

2.3. Link to the Agency's Strategic Plan

EPAS contributes to fulfilling one of the Agency's visions: *The Agency works on safety, in a proactive manner, helped by enhanced safety analysis capability*. EPAS is the documented output of a safety risk management process at EU level. The process is described in the second edition of the EASP and involves all the stakeholders in the EU aviation system. This process ensures that the MS, the industry and the Agency act on safety risks proactively, systematically and globally.

2.4. Link to the global aviation safety plan (GASP)

EPAS also takes into consideration the objectives and global accident categories identified in GASP.

In addition to the GASP objectives, ICAO has identified **high-risk accident categories**. These categories were initially determined based on an analysis of accident data, for scheduled CAT operations, covering the 2006–2011 time period. Feedback from the regional aviation safety groups (RASGs) indicates that these priorities still applied during the development of the 2017–2019 GASP edition.

Runway safety events were identified as one of the main high-risk accident categories. Runway safety-related events include but are not limited to: abnormal runway contact, bird strikes, ground collisions, events related to damage from ground handling operations, REs, runway incursions (RIs), loss of control on the ground, collision with obstacle(s), and undershoots and overshoots. These safety issues are addressed in sections **5.1.4. Runway safety** and **5.1.5. Ground safety** of EPAS.

Controlled flight into terrain (CFIT) and loss of control in-flight (LOC-I) were identified as the other two high-risk accident categories. These types of accidents account for a small portion of accidents in a given year but are generally fatal and account for a large portion of the total number of fatalities. These safety issues are addressed in sections **Controlled flight into terrain**, and **Loss of control in flight** of EPAS.

FDA Within SMS - Safety Assurance

European Plan for Aviation Safety 2016–2020

Strategic safety priorities — Update 2015

3. Strategic safety priorities — Update 2015

Driver	Issue category	Action area	
Safety	Systemic issues	Safety management Aviation personnel **Aircraft tracking, rescue operation and accident investigations**	
	Operational issues	**Commercial air transport by aeroplanes**	Loss of control in-flight **Design and maintenance improvements** Mid-air collisions Runway safety **Ground safety** Controlled flight into terrain Fire, smoke and fumes
		Helicopter operations	
		General Aviation	
	Emerging issues	New products, systems, technologies and operations Regulatory and oversight considerations **New business models**	

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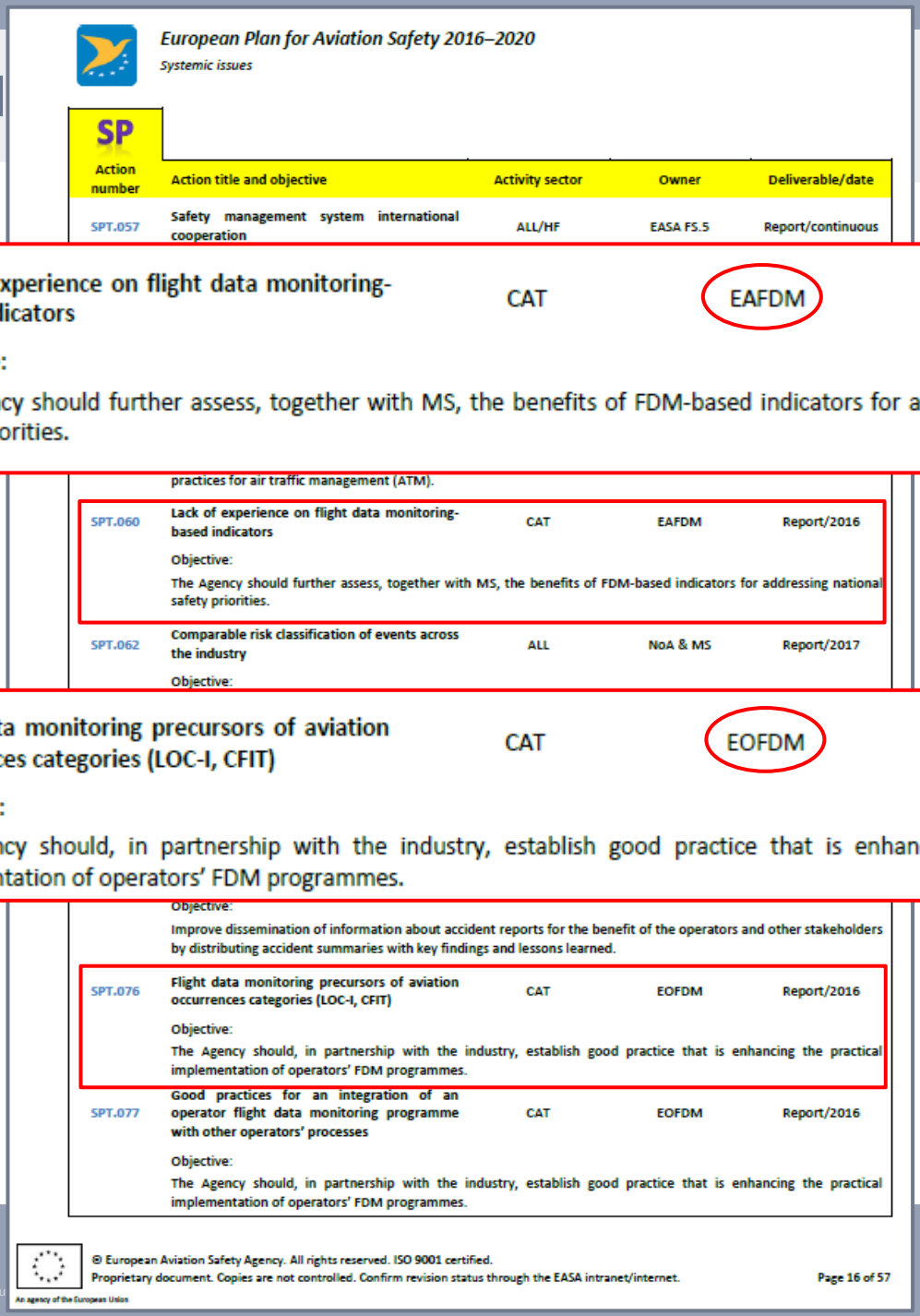
FDA Within SM



European Plan for Aviation Safety 2016–2020

Systemic issues

SP

Action number	Action title and objective	Activity sector	Owner	Deliverable/date
SPT.057	Safety management system international cooperation	ALL/HF	EASA FS.5	Report/continuous

practices for air traffic management (ATM).

SPT.060	**Lack of experience on flight data monitoring-based indicators** Objective: The Agency should further assess, together with MS, the benefits of FDM-based indicators for addressing national safety priorities.	CAT	EAFDM	Report/2016
SPT.062	**Comparable risk classification of events across the industry** Objective:	ALL	NoA & MS	Report/2017

Objective:

Improve dissemination of information about accident reports for the benefit of the operators and other stakeholders by distributing accident summaries with key findings and lessons learned.

SPT.076	**Flight data monitoring precursors of aviation occurrences categories (LOC-I, CFIT)** Objective: The Agency should, in partnership with the industry, establish good practice that is enhancing the practical implementation of operators' FDM programmes.	CAT	EOFDM	Report/2016
SPT.077	**Good practices for an integration of an operator flight data monitoring programme with other operators' processes** Objective: The Agency should, in partnership with the industry, establish good practice that is enhancing the practical implementation of operators' FDM programmes.	CAT	EOFDM	Report/2016

SPT.060 Lack of experience on flight data monitoring-based indicators CAT EAFDM Report/2016

Objective:

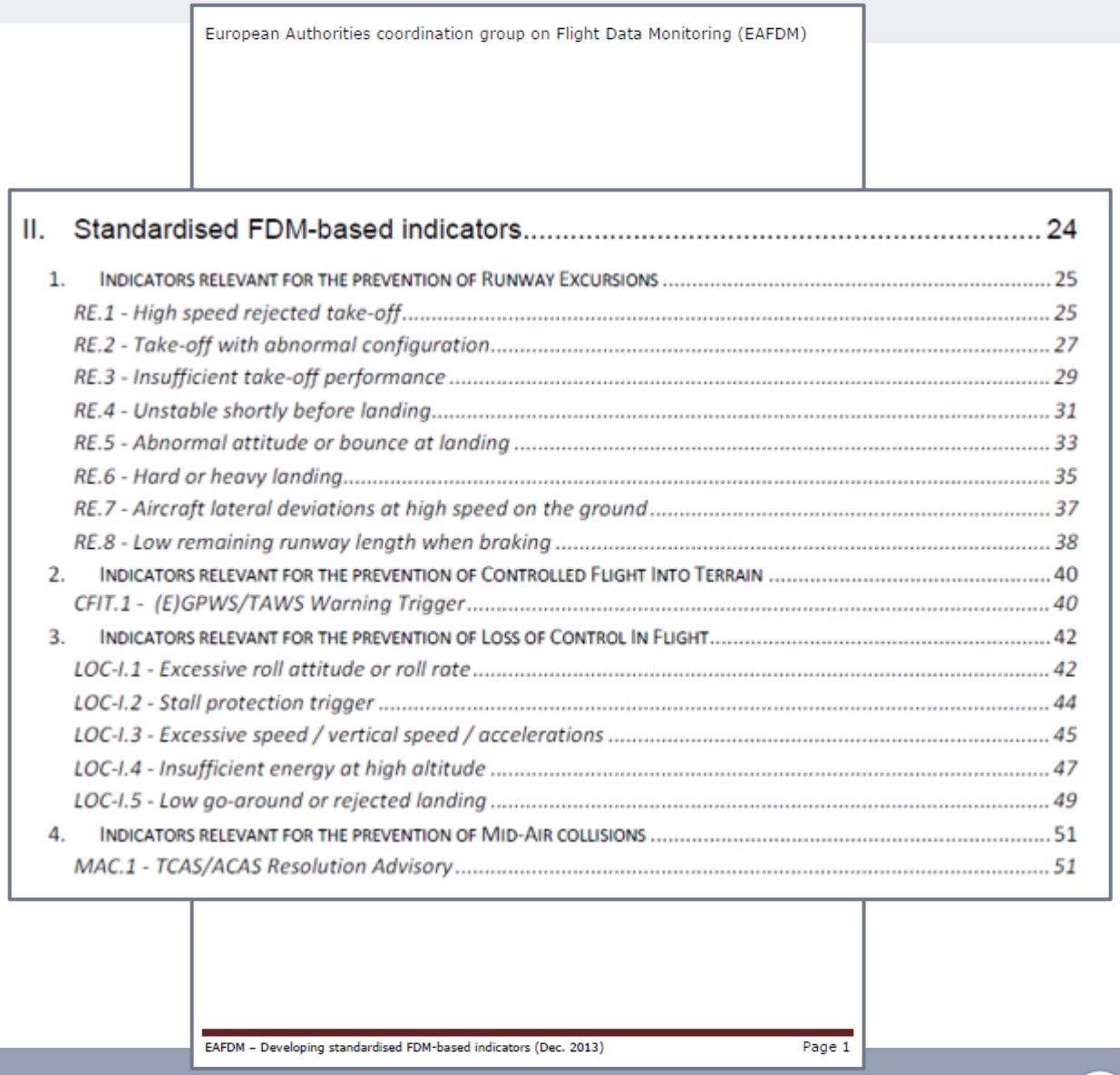
The Agency should further assess, together with MS, the benefits of FDM-based indicators for addressing national safety priorities.

SPT.076 Flight data monitoring precursors of aviation occurrences categories (LOC-I, CFIT) CAT EOFDM Report/2016

Objective:

The Agency should, in partnership with the industry, establish good practice that is enhancing the practical implementation of operators' FDM programmes.

FDA Within SMS - Safety Assurance



European Authorities coordination group on Flight Data Monitoring (EAFDM)

FDA Within SMS - Safety Indicat

Review of Accident Precursors

For

Loss of Control In Flight

EOFDM Working Group A

CONSOLIDATED PRECURSORS AND RECOMMENDATIONS FOR EOFDM WORKING GROUP B

Based on the previous discussion the following possible precursors result as recommendation to being monitored using Flight Data Monitoring Systems.

	LOC categories					
Precursor	**1**	**2**	**3**	**4**	**5**	**Recommendation**
Fire, smoke and fumes	x			x		LOC01
Press. System Malfunction	X					LOC02
Press. System Misuse	X					LOC03
						Reserved
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

EXPECTED RESULT

LOC01 Fire, smoke or fumes: Develop means to detect the presence of fire, smoke or fumes in the cabin, cargo compartment, engines, and landing gear bay.

LOC02 Pressurization system malfunction: Develop means to identify malfunctions of the pressurization system which could cause crew incapacitation or discomfort. System malfunctions

FDA Within SMS - Safety Indicators

EUROPEAN OPERATORS

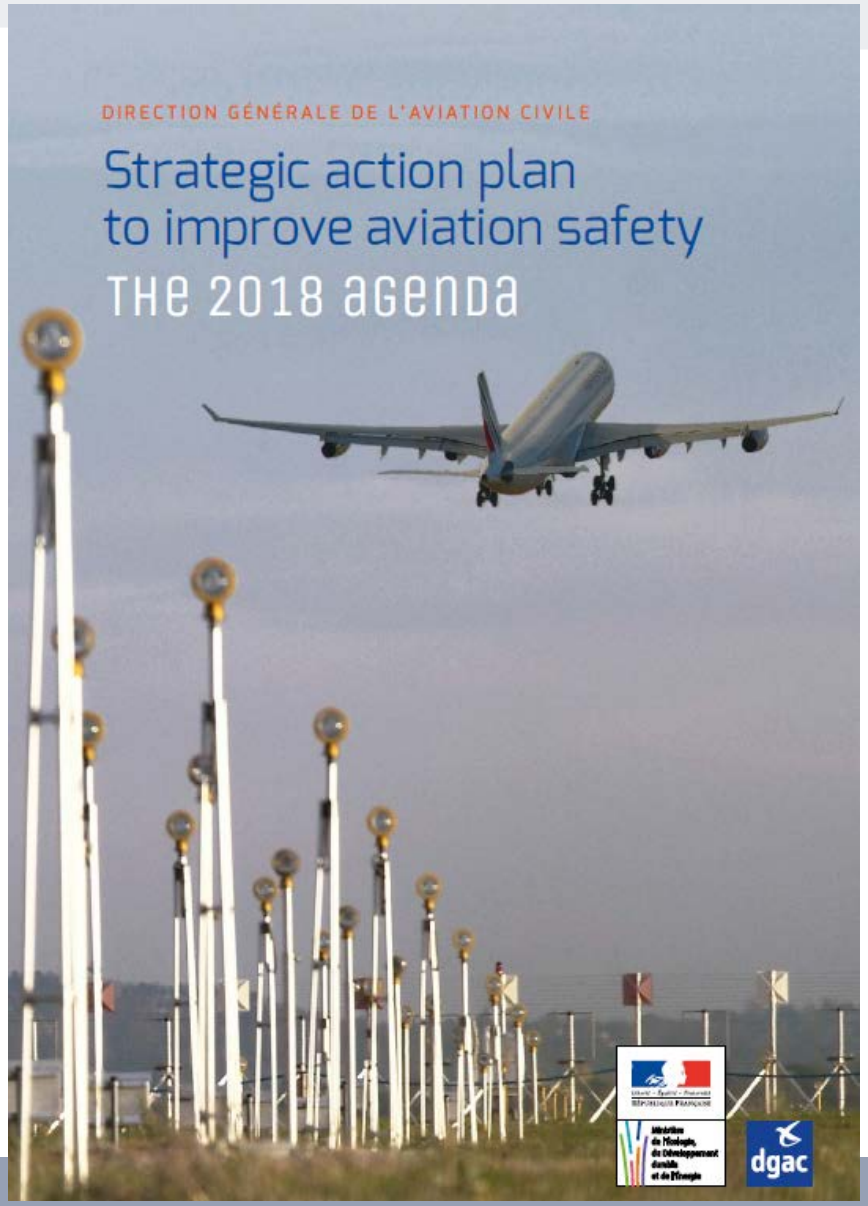
KEY PERF

MONITORING PROGRAMME

Non Operational Indicators:

- Flight Collection Rate
- Time from occurrence to detection
- FDM coverage of safety issues identified in the SMS
- Invalid events
- Missing events
- Etc…

FDA Within SMS - Safety Indicators



Commercial air transport risk portfolio

This is the risk portfolio related to commercial air transport, managed by the DGAC within the framework of the State Safety Programme (SSP) and does not affect operators' risk portfolio.

It is noteworthy that in the context of the State Safety Programme:

- An feared consequence (FC) (in the causal chain) is an accident in the sense of ICAO Annex 13;
- An undesirable event (UE) is an unwanted event in view of the services expected. An undesirable event may be technical, procedural or human.

In the analysis model used by DGAC, which is close to the «bowtie» model, the feared consequence is placed on the right side, and the undesirable event at the centre.

N°	IDENTIFICATION OF UNDESIRABLE EVENT	CFIT	LOC-I	IN-FLIGHT COLLISION	GROUND COLLISION	RWY-EXC	ACFT DAMAGE OR IN-FLIGHT POB	ACFT DAMAGE OR IN-FLIGHT POB ON GROUND
UE3.1	Non-stabilised or non-compliant approach	■	■			■		■
UE3.2	Unusual flight attitude (pitch, bank angle, angle of attack....)		■				■	
UE3.8	Runway incursion		★		■	■		■
UE3.9	Loss of separation in flight and/or airspace infringement		★	■			■	
UE3.10	Wildlife hazard, including bird hazard		■		■	■	■	■
UE3.11	Ground-onboard interface failure (misunderstanding, unsuitability of transmitted information, etc.)	■	■	■	■	■	■	■
UE3.12	Aircraft maintenance event	■	■		★	■	■	■
UE3.13	Fire/smoke in flight	★	■			★	■	■
UE3.14	Aircraft system failure resulting in flight management disturbance	■	■	★	★	■	■	■
UE3.15	Loss of cabin pressure		■	★			■	
UE3.16	Aircraft damage due to FOD		■			■	■	■

Commercial air transport risk portfolio

This is the risk portfolio related to commercial air transport, managed by the DGAC within the framework of the State Safety Programme (SSP) and does not affect operators' risk portfolio.

CAPTIONS :

■ the undesirable event leads to a significant increase in the probability of the occurrence of a feared consequence.

★ the undesirable event leads exceptionally to a feared consequence.

Column : colour code according to the severity of individual feared consequences.

AIRBUS