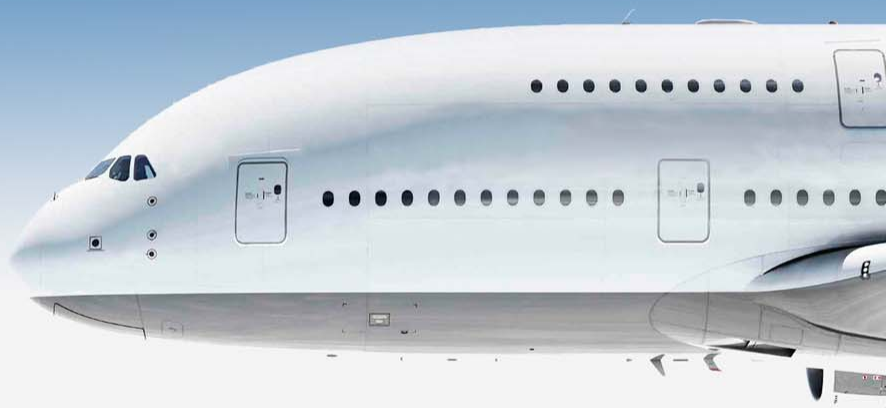
ICAO UNITING AVIATION

METHODOLOGY TO IDENTIFY SPIS-REGULATOR



Mohamed Chakib

Regional Officer, Safety Implementation,
International Civil Aviation Organization (ICAO), MID Office

Safety Summit
October 2018, KSA

Today's Meeting

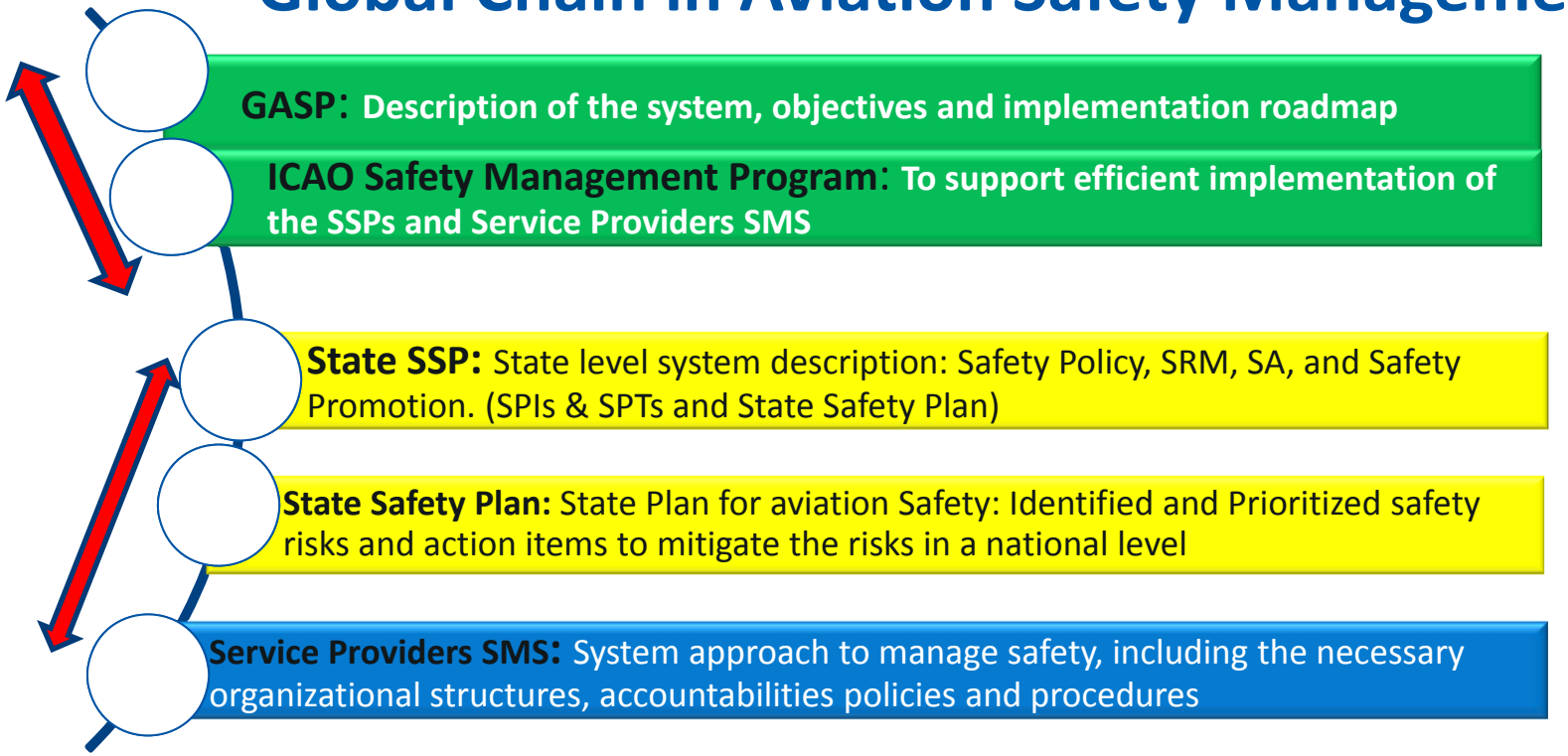
- Introduction
- SSP Implementation challenges
- Lagging Vs Leading indicators
- Acceptable Level of Safety Performance (ALoSP)
- Aviation Risk Management Framework
- Safety Performance Indicators (SPI's)

We need to manage safety, but....

…we can not manage what we can not measure, so …

…we need indicators to measure the system's performance.

Global Chain in Aviation Safety Management



SSP Implementation Challenges

Challenges in achieving effective safety management implementation have been identified and include:

- ✓ Putting in place appropriate legislation and supporting mechanisms for the protection of safety data and safety information
- ✓ Properly managing interfaces between SSP and SMS, and between the SMS of service providers and between the SMS of service providers and other third party organizations
- ✓ Identifying and addressing the safety management competencies needed across the organization
- ✓ Identifying appropriate safety performance indicators and targets

ICAO Annex 19- Safety management

3.4 Safety Assurance

3.4.2 State Safety performance

"State shall establish the acceptable level safety performance to be achieved through SSP"

- *An acceptable level of safety performance for the State can be achieved through the implementation and maintenance of the SSP*
- *as well as safety performance indicators and targets*
- *showing that safety is effectively managed and built on the foundation of implementation of existing safety-related SARPs*

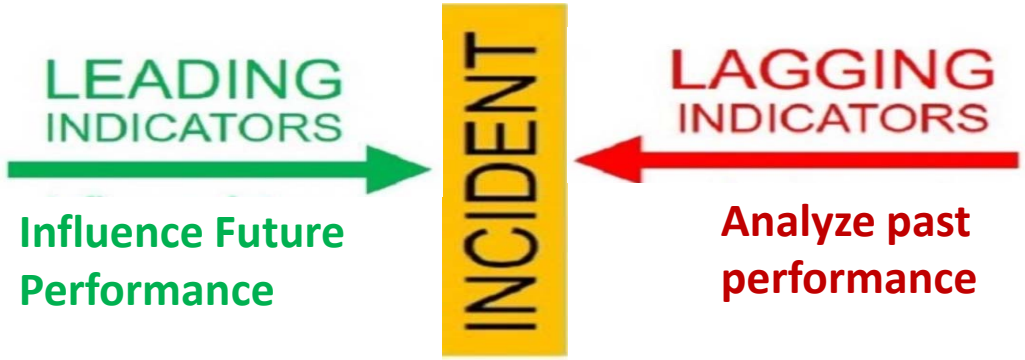
ICAO Annex 19 – Safety Management

Safety Performance: Safety achievement as defined by the safety performance targets and indicators.

Safety Performance Indicator: Data-base parameter used for monitoring and assessing safety performance

Safety Performance Target: Planned or intended objective for safety performance indicator over given period

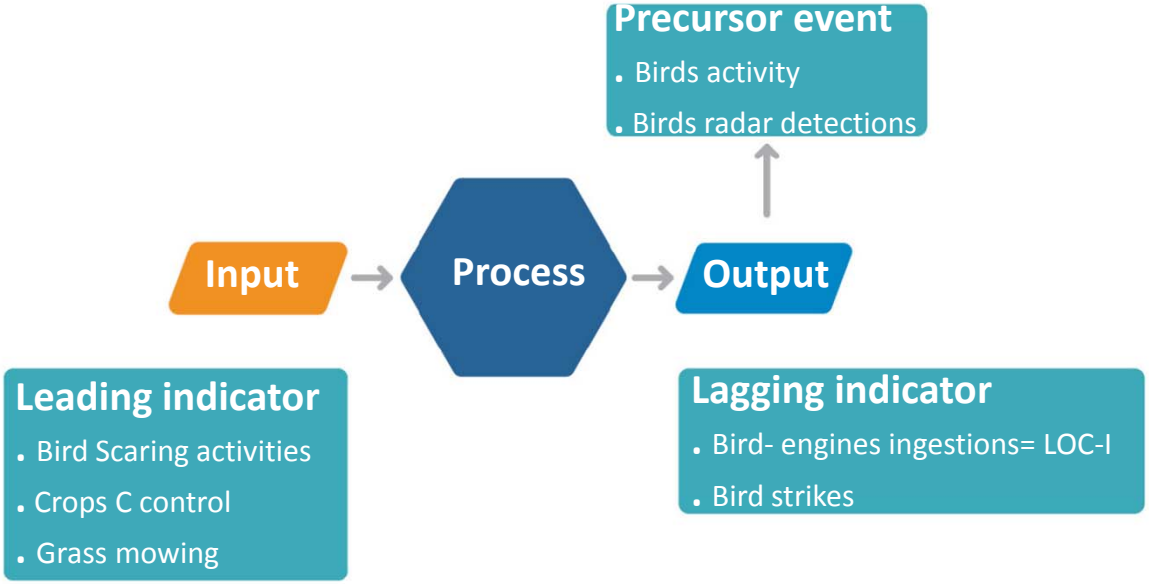
Lagging Vs leading indicators



Leading SPIs measure processes and inputs being implemented to improve or maintain safety. Also known "activity or process SPIs" as they monitor and measure conditions that have the potential to become or contribute To a specific outcome

Lagging SPIs measure events that have already occurred. They are also referred to as "outcome-based SPIs" and are normally the negative outcomes the organization is aiming to avoid

Lagging Vs leading indicators concept phases



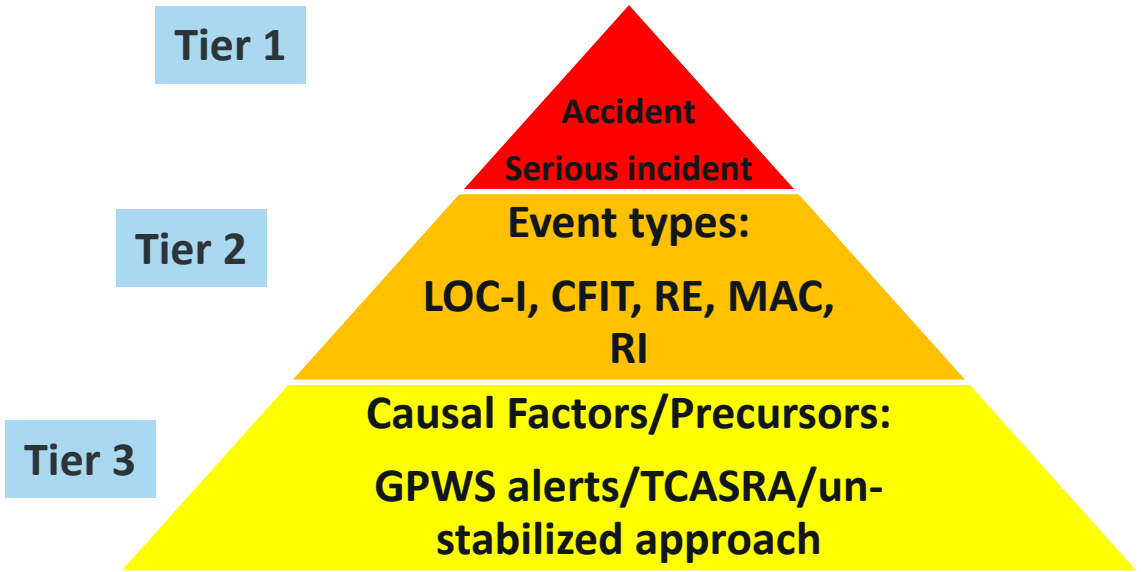
Lagging indicators

Lagging SPIs are divided into two types:

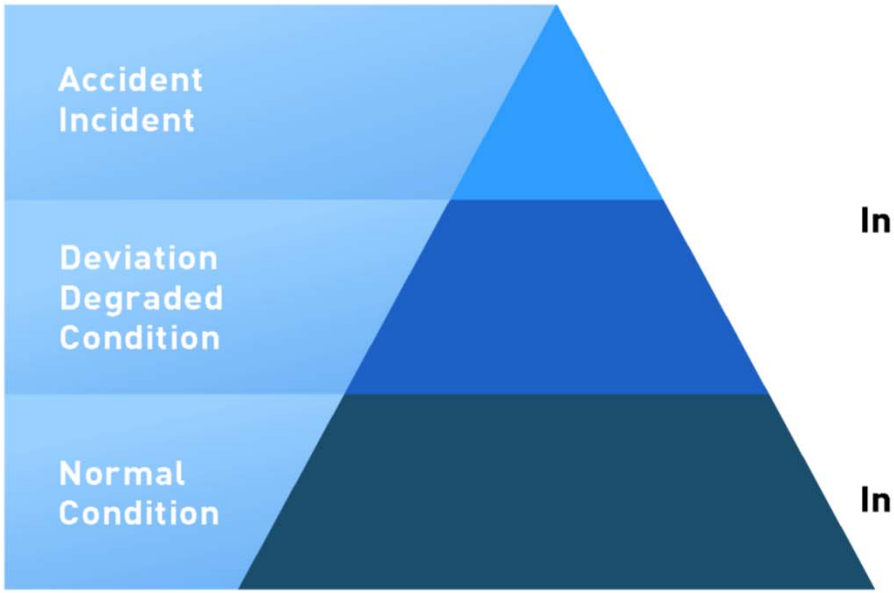
- **Low probability/high severity**: outcomes such as accidents or serious incidents.

- **High probability/low severity**: outcomes that did not necessarily manifest themselves in a serious incident or accident, these are sometimes also referred to as precursor indicators. SPIs for high probability/low severity outcomes are primarily used to monitor specific safety issues and measure the effectiveness of existing safety risk mitigations.

Lagging indicators



Examples of links between lagging and leading indicators



Lagging Indicators

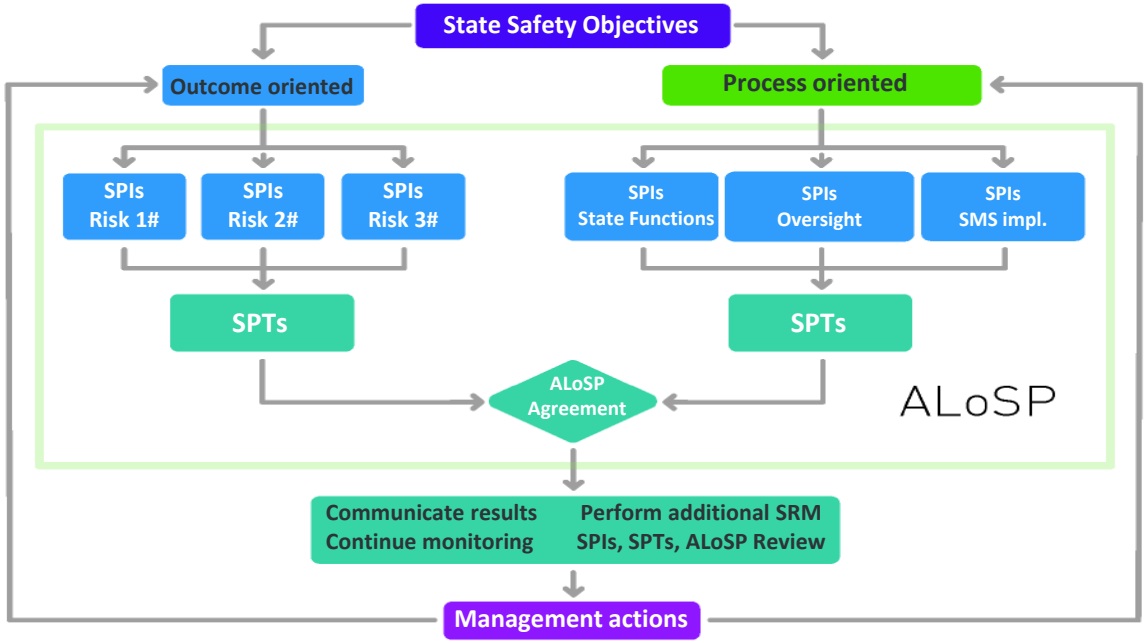
- Number of runway excursions/1000 landings
- Precursor Events
  - Number of unstabilized (or non-compliance) approaches/1000 landings

Leading Indicators

- Percentage of pilots who have received training in stabilized approach procedures

Combined leading and lagging indicators provide a more comprehensive and realistic picture of the organization's safety performance.

Acceptable level of safety performance (ALoSP)



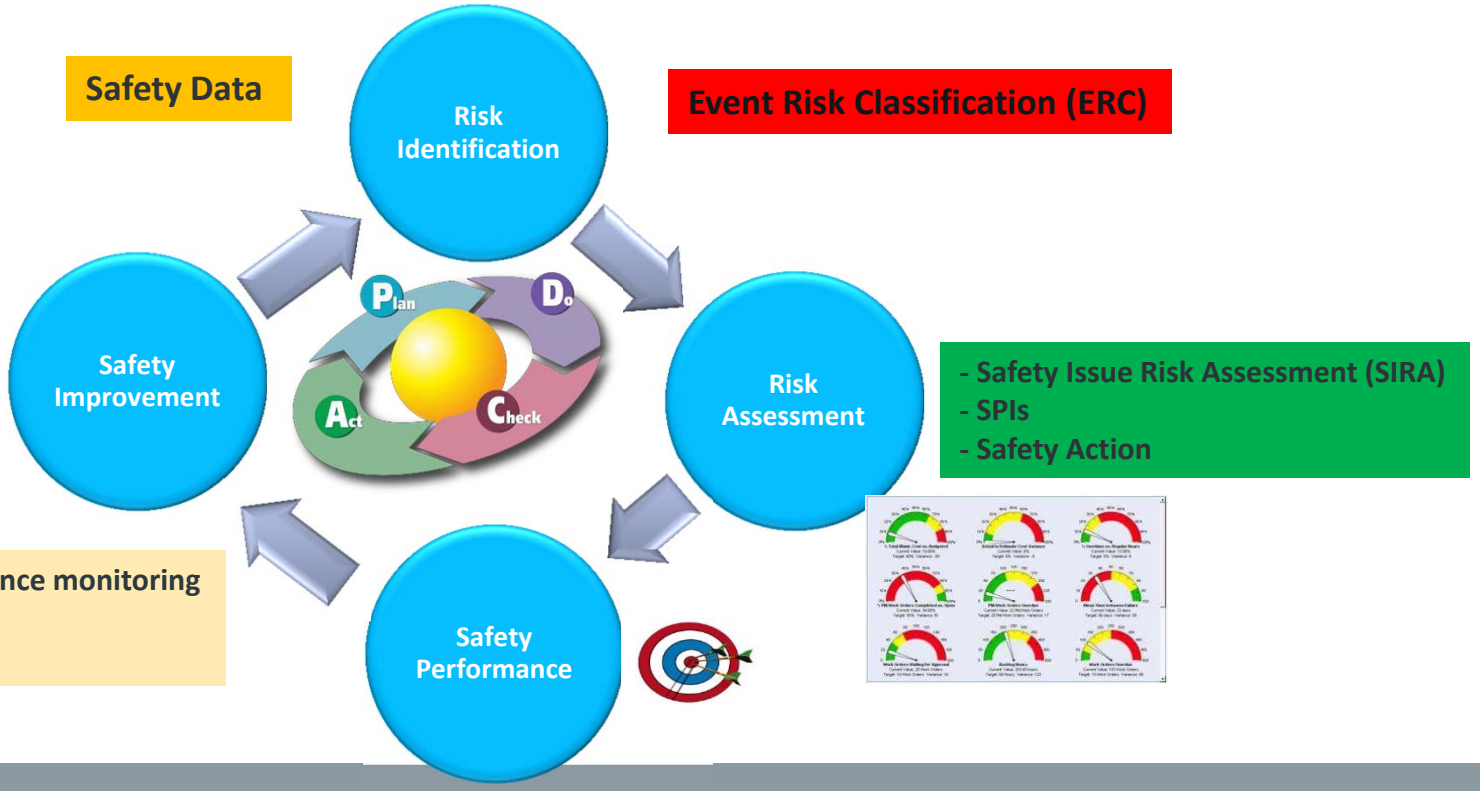
Objective: Aviation Safety Risk Management Picture

The vision is to be able to visualize a big picture of risks so that they could be compared side-by- side instead of treating different threats one by one separated in time. Such an integrated risk picture should enable identifying both critical issues and opportunities where safety could be improved significantly and by effectively using the resources

Deming Cycle

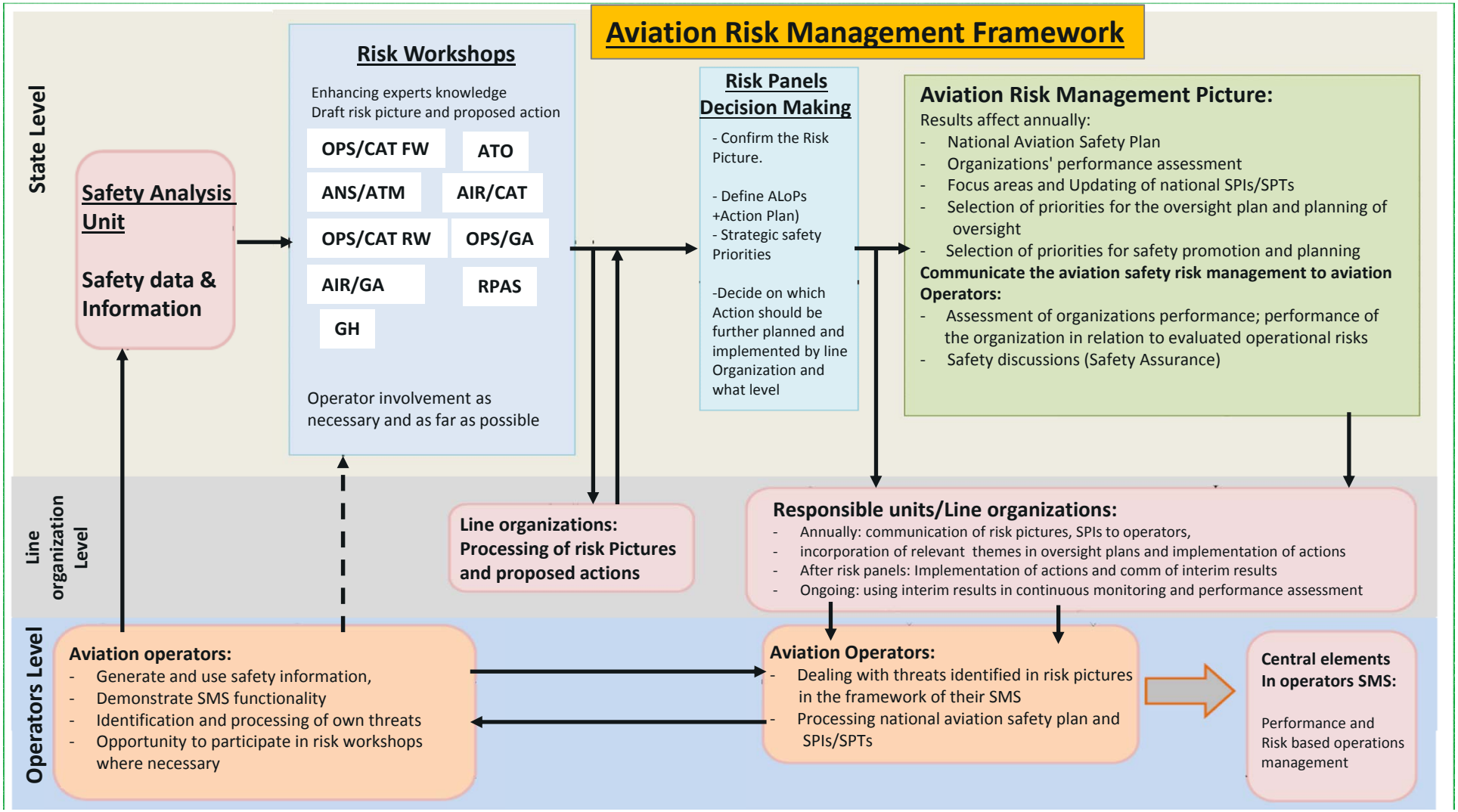
Safety Data

Event Risk Classification (ERC)



- Safety Issue Risk Assessment (SIRA)
- SPIs
- Safety Action

- Safety performance monitoring
- Oversight
- SPTs


Aviation Risk Management Framework
State Level
Safety Analysis Unit
Safety data & Information
Risk Workshops
Enhancing experts knowledge
Draft risk picture and proposed action
OPS/CAT FW
ATO
ANS/ATM
AIR/CAT
OPS/CAT RW
OPS/GA
AIR/GA
RPAS
GH
Operator involvement as necessary and as far as possible
Risk Panels Decision Making
- Confirm the Risk Picture.
- Define ALoPs +Action Plan)
- Strategic safety Priorities
-Decide on which Action should be further planned and implemented by line Organization and what level
Aviation Risk Management Picture:
Results affect annually:
- National Aviation Safety Plan
- Organizations' performance assessment
- Focus areas and Updating of national SPIs/SPTs
- Selection of priorities for the oversight plan and planning of oversight
- Selection of priorities for safety promotion and planning
Communicate the aviation safety risk management to aviation Operators:
- Assessment of organizations performance; performance of the organization in relation to evaluated operational risks
- Safety discussions (Safety Assurance)
Line organization Level
Line organizations: Processing of risk Pictures and proposed actions
Responsible units/Line organizations:
- Annually: communication of risk pictures, SPIs to operators,
- incorporation of relevant themes in oversight plans and implementation of actions
- After risk panels: Implementation of actions and comm of interim results
- Ongoing: using interim results in continuous monitoring and performance assessment
Operators Level
Aviation operators:
- Generate and use safety information,
- Demonstrate SMS functionality
- Identification and processing of own threats
- Opportunity to participate in risk workshops where necessary
Aviation Operators:
- Dealing with threats identified in risk pictures in the framework of their SMS
- Processing national aviation safety plan and SPIs/SPTs
Central elements In operators SMS:
Performance and Risk based operations management

ICAO UNITING AVIATION

Safety Analysis Unit- Capture of safety data

Analysis Unit

Safety data & Information

Reactive: Analysis of past events and outcomes	• ASR, MOR, VOR • Hazard Identification • Safety Investigation
Proactive: Analysis of present and real time events	• VOR, incident reports • Surveys, Audits • Compliance monitoring
Predictive: Forecast future events or outcomes	• FDM, Reliability Analysis • Process Monitoring • Statistical Analysis

Risk identification- ARMS Event Risk Classification

It can be applied to all safety data which describes individual events. This step called Event Risk Classification (ERC): The objective is twofold:

- First, to understand what was the risk involved in a specific historical event and;
- Second, being able to treat a large number of events through their cumulated risk rather than only counting numbers of events.

ERC-a matter of three steps

Question 2

What was the effectiveness of the remaining barriers between this event and the most credible accident scenario?

Effective	Limited	Minimal	Not effective
50	102	502	2500
10	21	101	500
2	4	20	100
1			

Question 1

If this event had escalated into an accident outcome, what would have been the most credible outcome?

		Typical accident scenarios
Catastrophic Accident	Loss of aircraft or multiple fatalities (3 or more)	Loss of control, mid air collision, uncontrollable fire on board, explosions, total structural failure of the aircraft, collision with terrain
Major Accident	1 or 2 fatalities, multiple serious injuries, major damage to the aircraft	High speed taxiway collision, major turbulence injuries
Minor Injuries or damage	Minor injuries, minor damage to aircraft	Pushback accident, minor weather damage
No accident outcome	No potential damage or injury could occur	Any event which could not escalate into an accident, even if it may have operational consequences (e.g. diversion, delay, individual sickness)

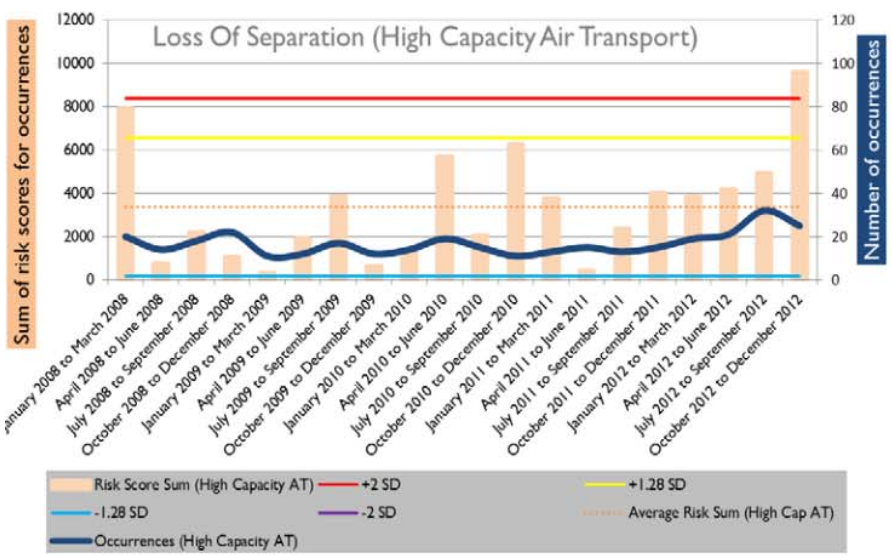
What are we achieving?

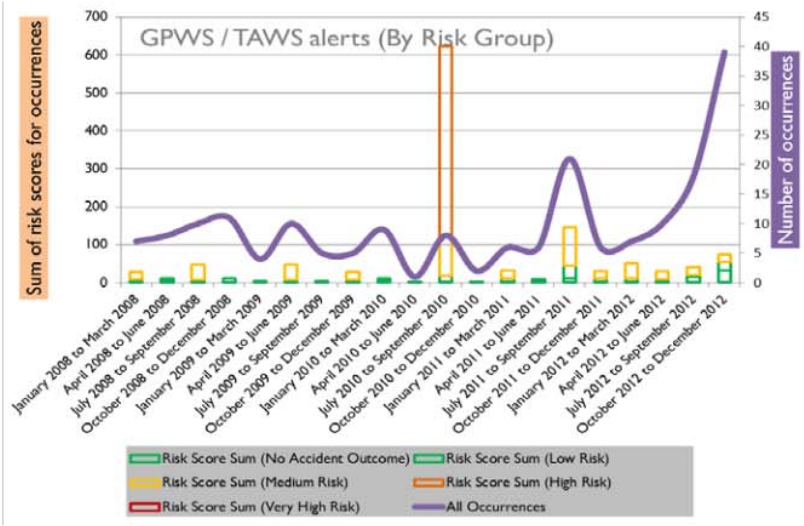
- Rapid risk assessment of aviation occurrences
- Focusing proactive activities such as trend monitoring and research investigation
- Identifying low frequency and high risk occurrences
- Documenting all likely situations that increase risk

What are we achieving?

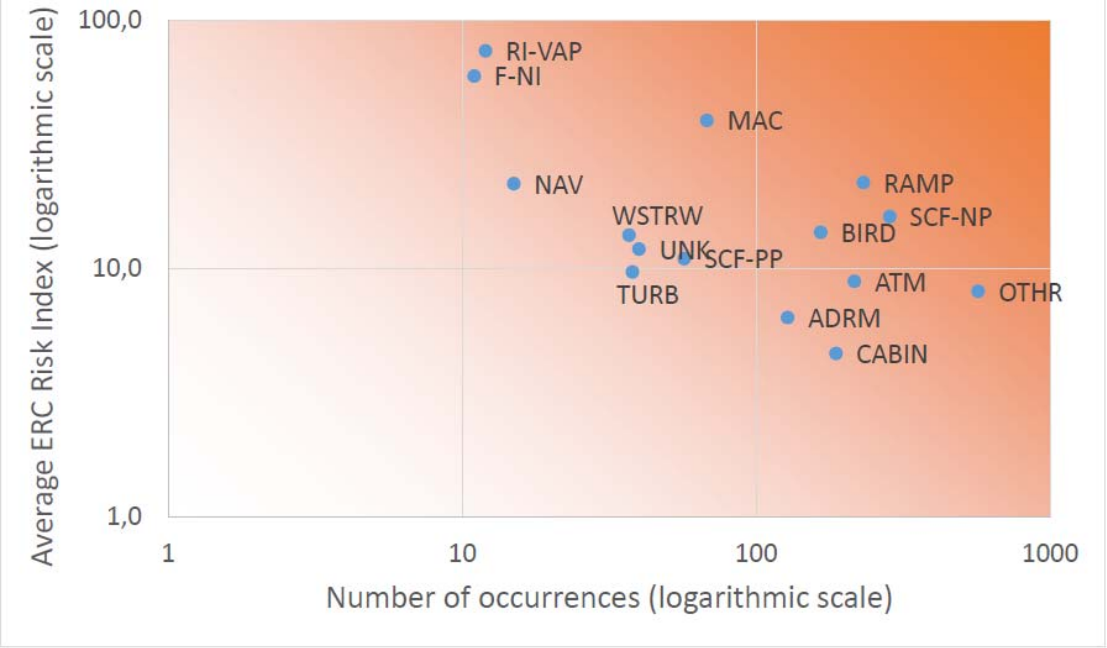
- ERC will produce a numerical Risk index value for each event
- Summing together the event risk values from different events gives cumulative event risk value which can be very useful in identifying threats and safety issues
- Graphical “risk picture” for occurrence type
- Pick out high risk occurrences at glanced

What we can do with ERC?





What we can do with ERC?



Support Role of the Safety Analysis Unit

Preparatory tasks to be done between the workshops:

- Proposing the agendas and the specific topics of focus.
- Assuring the analysis functions related to incoming data, including categorization and preliminary analyses, and event risk assessment .
- Carrying out risk identification and proposing new potential threats and safety issues to the risk workshop.
- Proposing a preliminary set of scenarios related to a new threat/safety issue.
- Maintaining the risk pictures.

Support Role of the Safety Analysis Unit

- Maintaining the links between safety events and the other elements in the risk picture.
- Helping the risk workshop to make sense of the risk picture by proposing appropriate ways to visualize it.
- Gathering information related to a safety issue on the agenda.
- Identifying the blind spots related to a threat or safety issue.
- Supporting the monitoring of ongoing actions through available data

Main tasks of the risk workshops

Process data integration to make sure that all relevant information contributing to risk assessment and decision making is gathered and that all different types of information are combined, enabling the shared understanding of risks and the creation of the risk picture.

Integrating the Source information

- **Events Data** are transformed into risk information using event risk assessment before it can enter the main risk analysis and evaluation process

- **Preliminary studies** and analyses from the operators, potentially benefiting from event risk assessment

- **Safety issues** are identified safety concerns which may be risk assessed using the Safety Issue Risk Assessment (SIRA).

Integrating the Source information

- **Oversight information:** The oversight activities produce information related to audits such as audit findings and audit reports. People who carry out the oversight activities know more than can be written down in reports.

- **Assumed Threats:** Information from relevant researches, studies and from experts experience and knowledge.

- **Future threats:** Collect different potential futures threats and try to pick the important threats that may be emerging.

Main tasks of the risk workshops

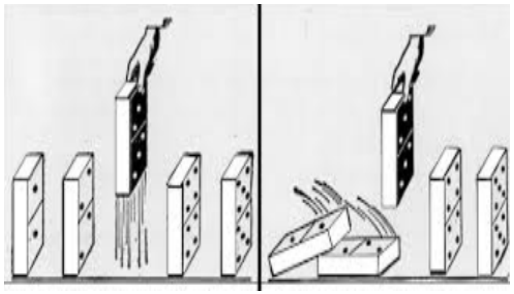
- Identify key hazards / threats/Safety issues in the relevant sector of aviation and define scenarios
- Risk assessments and Proposals on the need for further actions
- Studying the risk picture as a whole, both in terms of risks and potential mitigations
- Monitor and evaluate the implementation and effectiveness of actions
- Maintain the aviation risk picture annually

Identification of potential safety issues

- To maintain an overview it is necessary to apply a classification. Two criteria to be applied:

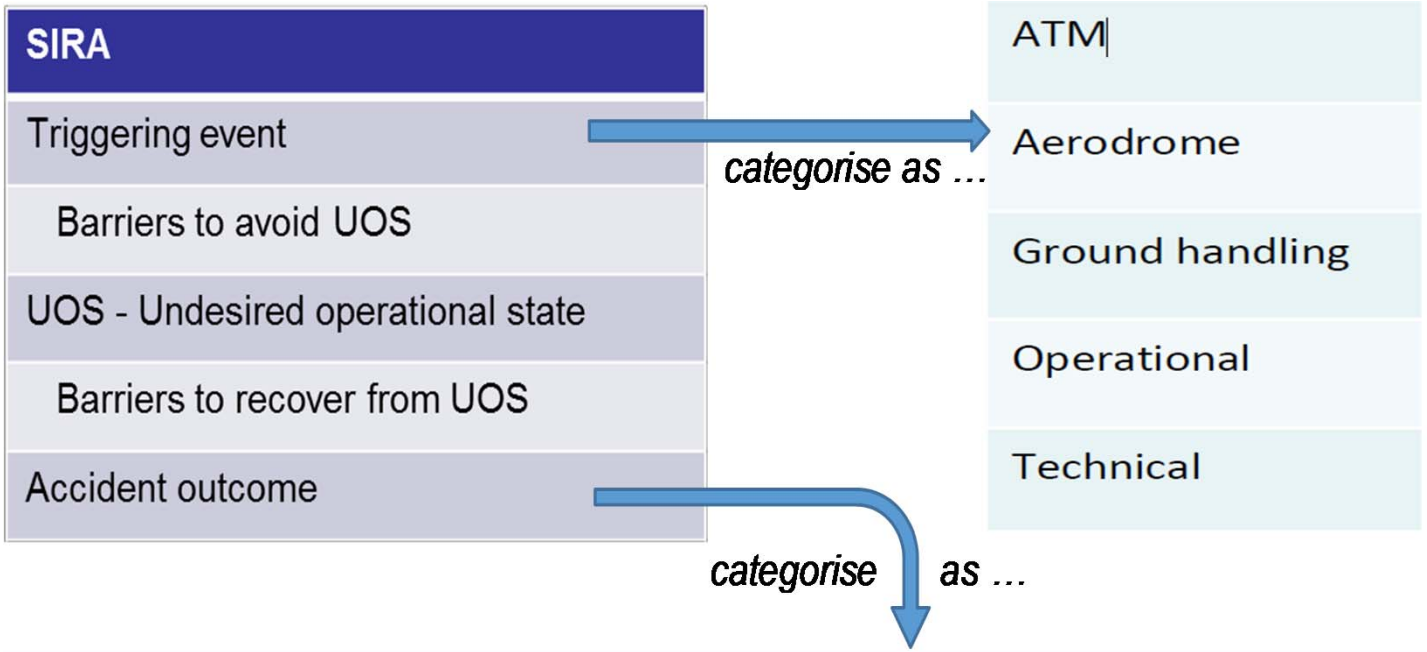
1- the domain of the triggering event:

  - ATM (Air traffic management)
  - Aerodrome
  - Ground handling
  - Operational
  - Airworthiness (technical)



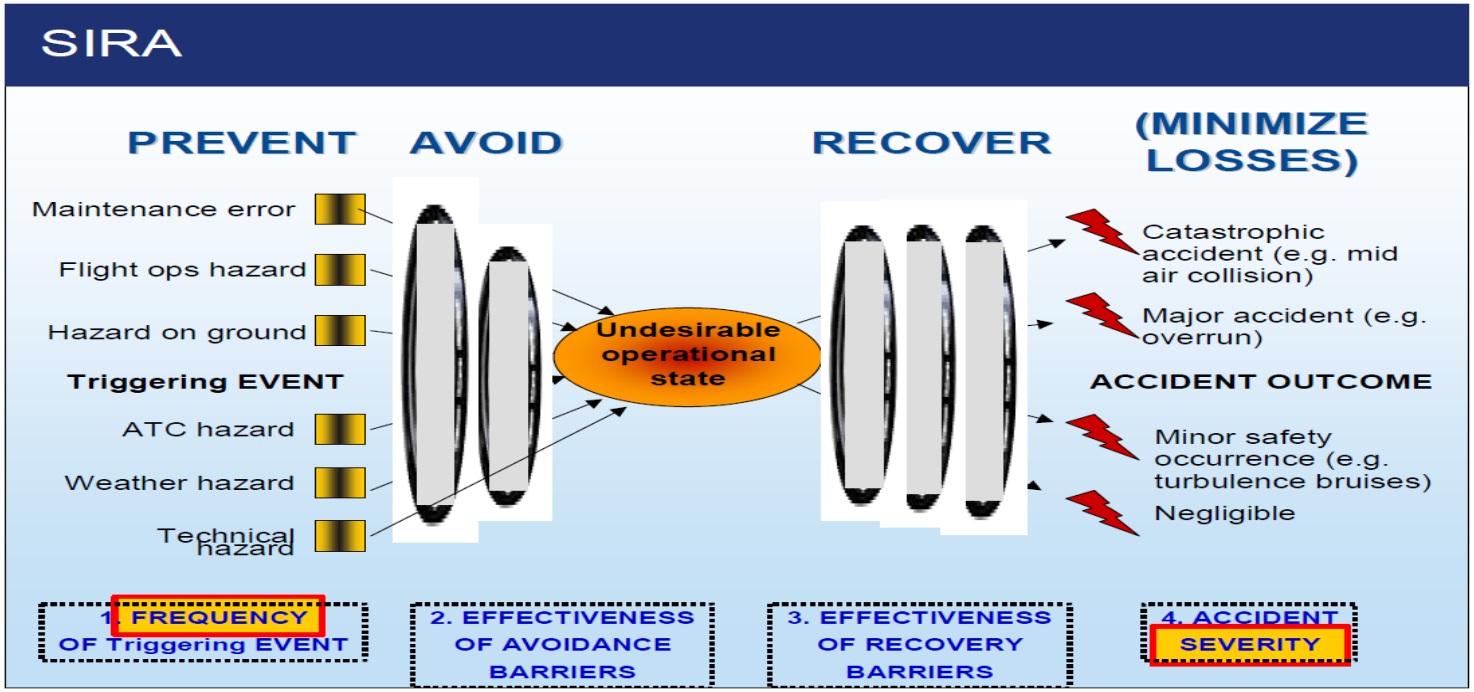
2- The type of potential accident outcome:

- 7 types been defined, corresponding to the “feared consequences” of the risk portfolio of DGCA France*.

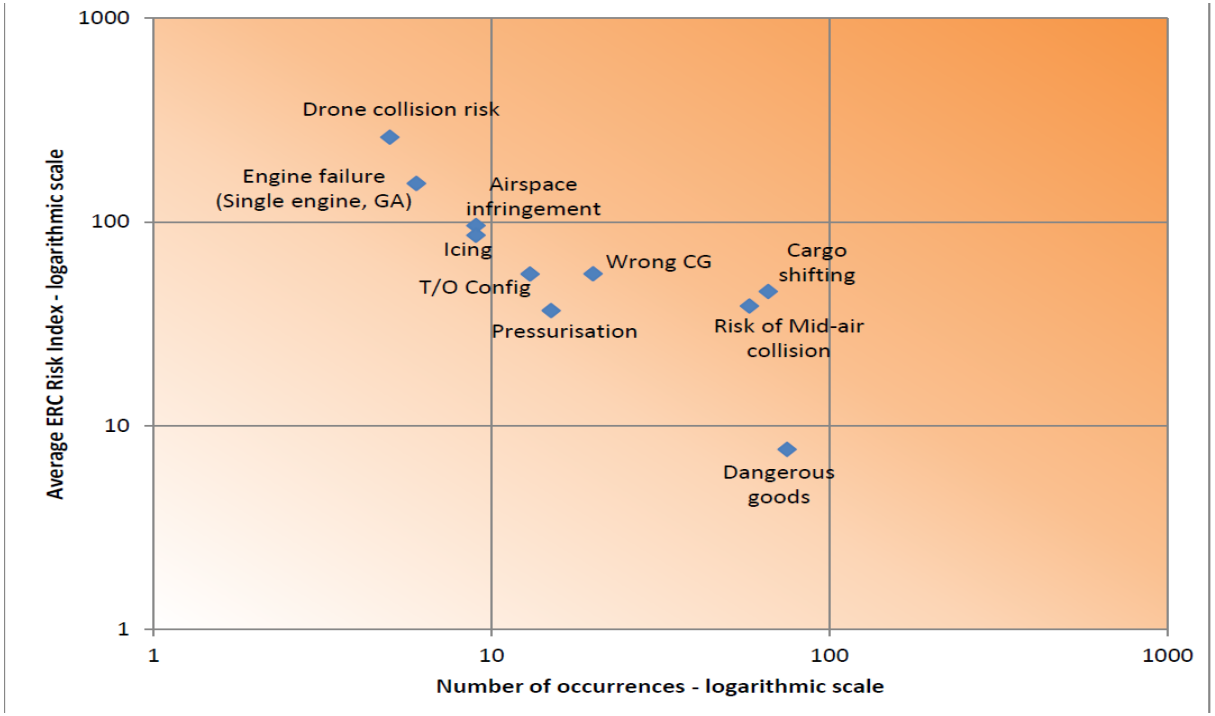


CFIT Controlled flight into terrain	LOC-I Loss of control in flight	MAC Mid-air collision	GCOL Ground collision	RE Runway excursion	Damage/ injury in flight	Damage/ injury on ground
catastrophic	catastrophic	catastrophic	catastrophic	major	minor	minor

Identification of potential safety issues



Safety Picture-Example



Potential Safety issues: Examples

Operational Safety Issues			Accident Outcome						
	SI Title	Accident Severity	CFIT	LOC-I	MAC	Collision on Ground	RE	Injury or Damage Inflight	Injury or Damage On Ground
	Risk of MAC	Catastrophic			X			X	
	Risk of collision with Drones	Catastrophic			X			X	X
	Mismatch Between calculated & actual CG	Catastrophic		X			X	X	

Potential Safety issues: Examples

Ground Handling Safety Issues			Accident Outcome						
	SI Title	Accident Severity	CFIT	LOC-I	MAC	Collision on Ground	RE	Injury or Damage Inflight	Injury or Damage On Ground
	Cargo moving/shifting during flight	Catastrophic		X				X	
	DG Handling	Catastrophic		X				X	X
	Mismatch Between calculated & actual CG	Catastrophic		X			X	X	

Potential Safety issues: Examples

Aerodrome Safety Issues			Accident Outcome						
	SI Title	Accident Severity	CFIT	LOC-I	MAC	Collision on Ground	RE	Injury or Damage Inflight	Injury or Damage On Ground
	Runway incursion by Vehicle	Catastrophic				X	X		
	Runway incursion by person	Major				X	X		
	Inadequate control and monitoring	Major					X		X

Potential Safety issues: Examples

Airworthiness Safety Issues			Accident Outcome						
	SI Title	Accident Severity	CFIT	LOC-I	MAC	Collision on Ground	RE	Injury or Damage Inflight	Injury or Damage On Ground
	Technical-Pressurization system	Catastrophic	X	X				X	X
	Technical- Flight controls	Catastrophic		X			X		X
	Technical- Malfunction of automatic flight management	Catastrophic		X				X	

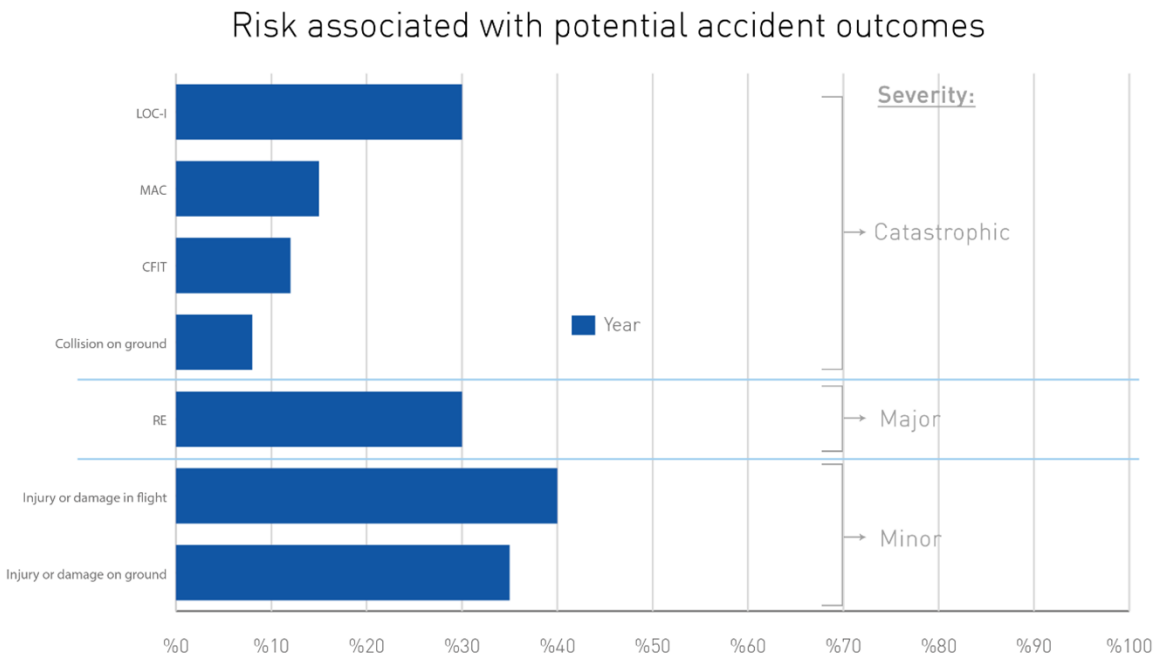
Potential Safety issues: Examples

ATM Safety Issues			Accident Outcome						
	SI Title	Accident Severity	CFIT	LOC-I	MAC	Collision on Ground	RE	Injury or Damage Inflight	Injury or Damage On Ground
	Loss of communication	Catastrophic			X	X			
	Level Bust/Altitude bust	Catastrophic	X		X				
	Risk of MAC	Catastrophic			X				

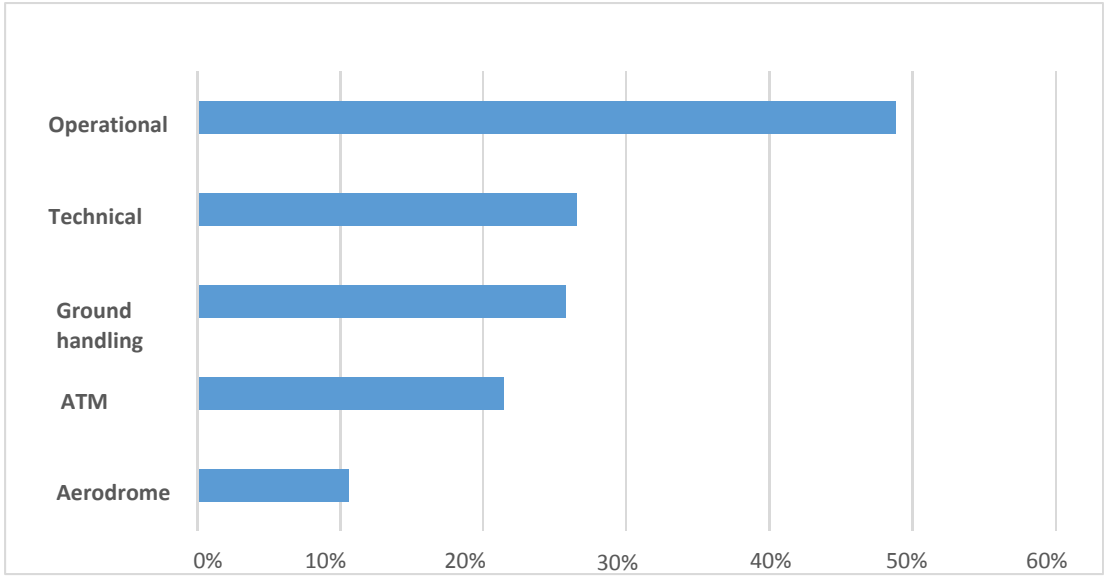
Potential Safety issues: Examples

General Aviation Safety Issues			Accident Outcome						
	SI Title	Accident Severity	CFIT	LOC-I	MAC	Collision on Ground	RE	Injury or Damage Inflight	Injury or Damage On Ground
	Engine Failure- Single Engine	Major		X			X		X
	Loss of control during landing	Major					X		
	Collision with obstacle during taxi	Minor				X			

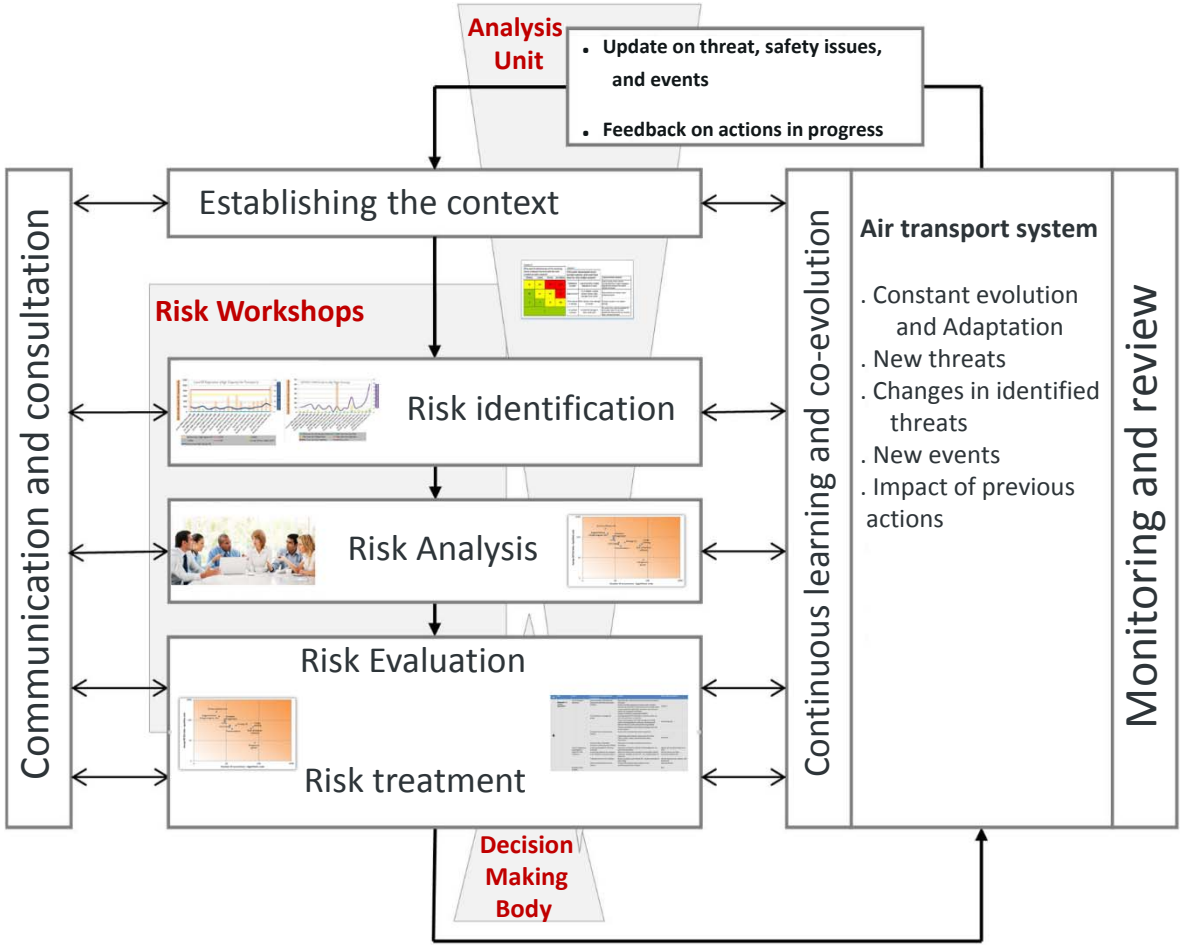
Distribution of the sum of the Risk indexes associated with potential accident outcomes



Distribution of the sum of the Risk indexes associated with each Domain



Risk management process presented in the form of the ISO 31000 framework.



SPIs at sector level

Overall event rates (e.g., Fatal and accident rates)

1. Number of fatal accidents
2. Rate of fatal accidents in scheduled commercial air transport (CAT) operations
3. Rate of accidents in scheduled CAT operations
4. Rate of accidents in helicopter operations
5. Number of fatalities in General Aviation operations

Identified SPIs by Domain

Commercial air transport , aeroplanes:

1. Aircraft upset in flight
2. TCAS RA
3. Fire, smoke, and fumes
4. Terrain conflict- EGPWS warning
5. Un-stabilised approach

Identified SPIs by Domain

Commercial Air Transport, Helicopters operations:

1. Loss of control- in flight
2. System failures (Technical)
3. CFIT

Identified SPIs by Domain

General Aviation operations:

1. Coping with weather
2. Airspace infringement
3. Safe transportation of DG in GA (Flight management)

Identified SPIs by Domain

ATM/Air Navigation Services (ANS):

1. Level busts
2. Minimum separation infringement
3. Loss of separation Aircraft deviation from ATM procedures
4. Runway incursion where avoiding action was necessary

Identified SPIs by Domain

Airworthiness commercial air transport: aeroplanes

1. Technical-Pressurization system
2. Malfunction of automatic flight management
3. In Flight Shut Down (IFSD)

ICAO UNITING AVIATION