BOEING
CHIEF AEROSPACE
SAFETY OFFICE

Flight Data Monitoring (FDM) in Safety Oversight

Sharing Best Practices

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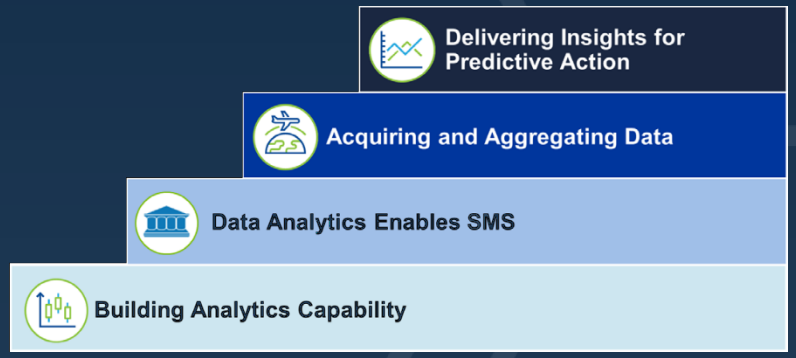
Boeing's Top-Level Commitment

Kelly Ortberg
CEO, The Boeing Company

*"Restoring trust starts with meeting our commitments to **build high quality, safe commercial aircraft** and service our products to keep our customers running 24/7. **People's lives depend on what we do** every day, and we must keep that top of mind with every decision we make."*

Data Analytics Enables FDM



Operator Safety Analytics

FDM-Oversight Maturity

Regulatory Data Safety Analytics

Source: ICAO Doc 10004 Global Aviation Safety Plan 2023-2025 & Asia-Pacific Regional Aviation Safety Plan 2023-2025 Chapter 1, 1.4.7

Regulatory Requirements and Guidance

3.3.2 All aeroplanes of a certificated take-off mass in excess of:

a) 27 000 kg; or

b) 15 000 kg with a passenger seating capacity greater than 19, and with a certificate of airworthiness first issued on or after 1 January 2027

shall be equipped with a means to support a flight data analysis programme.

3.3.3 The operator of an aeroplane equipped as described in 3.3.2 shall establish and maintain a flight data analysis programme as part of its safety management system.

3.3.4 The 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.— The 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.

3.3.5 A flight data analysis programme shall contain adequate safeguards to protect the source(s) of the data in accordance with Appendix 3 to Annex 19.

Note.— Guidance on the establishment of flight data analysis programmes is included in the Manual on Flight Data Analysis Programmes (FDAP) *(Doc 10000).*

ICAO Annex 6 Part I
International Commercial Air Transport – Aeroplanes

Hazard identification methodologies

2.5.2.10 The two main methodologies for identifying hazards are:

a) **Reactive**. This methodology involves analysis of past outcomes or events. Hazards are identified through investigation of safety occurrences. Incidents and accidents are an indication of system deficiencies and therefore can be used to determine which hazard(s) contributed to the event.

b) **Proactive**. This methodology involves collecting safety data of lower consequence events or process performance and analysing the safety information or frequency of occurrence to determine if a hazard could lead to an accident or incident. The safety information for proactive hazard identification primarily comes from flight data analysis (FDA) programmes, safety reporting systems and the safety assurance function.

ICAO Doc 9859 Safety Management Manual

Annex 13 — Aircraft Accident and Incident Investigation *Chapter 5*

Flight recorders — Accidents and incidents

5.7 Effective use shall be made of flight recorders in the investigation of an accident or an incident. The State conducting the investigation shall arrange for the read-out of the flight recorders without delay.

ICAO Annex 13 Aircraft Accident and Incident Investigation

1.4.7 Successful FDAPs encourage adherence to standard operating procedures (SOPs), and can detect non-standard behaviour, thereby improving safety performance. They can also detect adverse trends in any part of the flight and thus facilitate the investigation of events or incidents.

1.4.8 The FDAP can be used for identifying various operational issues, such as non-standard or deficient procedures, weaknesses in the ATC system or anomalies in aircraft performance. An FDA allows the monitoring of various aspects of the flight profile, such as the adherence to the prescribed take-off, climb, cruise, descent, approach and landing SOPs. Specific aspects of flight operations can be examined either retrospectively to identify problem areas, or proactively prior to introducing operational change, and subsequently to confirm the effectiveness of the change.

1.4.11 In summary, an FDAP offers a wide spectrum of applications for safety management. Furthermore, the benefit of improved operational efficiency outweighs the investment needed. In particular, an FDAP can support the following objectives:

a) determine operating norms;

b) identify potential and actual hazards in operating procedures, fleets, aerodromes, ATC procedures, etc.;

c) identify trends;

d) monitor the effectiveness of corrective actions taken;

e) provide data to conduct cost-benefit analyses;

f) optimize training procedures; and

g) provide actual rather than presumed performance measurement for risk management purposes.

ICAO Doc 10000 Flight Data Analysis Programmes Manual

Data Rich, Knowledge Poor

OEM Data

Safety Mgmt System (SMS)	Quality Mgmt System	Safety & Certification
Engineering	Configuration (As Built)	In-Service Safety Data

Public Data

Social Media	GPS/Flight Tracking	Weather
News	Research Publications	Industry Associations

Regulator

Compliance & Airworthiness	Airports & Operations	Voluntary & Mandatory Reports
Audit Programs	Regulations and Policy	Accident / Incident Reports

Airline

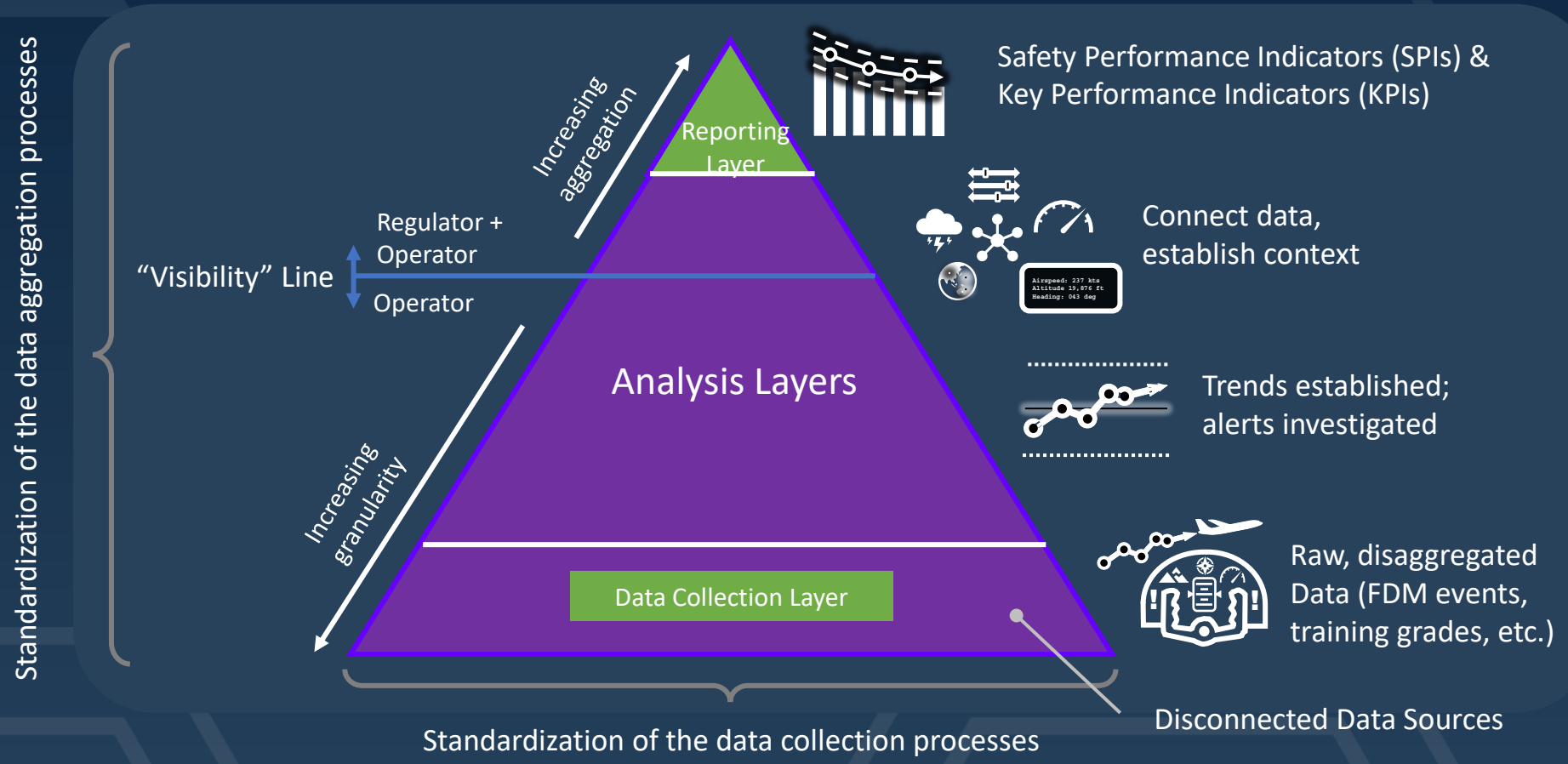
FOQA/FDM	AQP/CBTA	ADS-B
Configuration (As Operated)	Reliability & Maintenance	QMS/SMS

Flight Data Monitoring

General Process Used by Operators

Flight Data Monitoring

Regulator and Industry Roles



Flight Data Monitoring

Oversight Process – Key Elements

State Safety Objectives

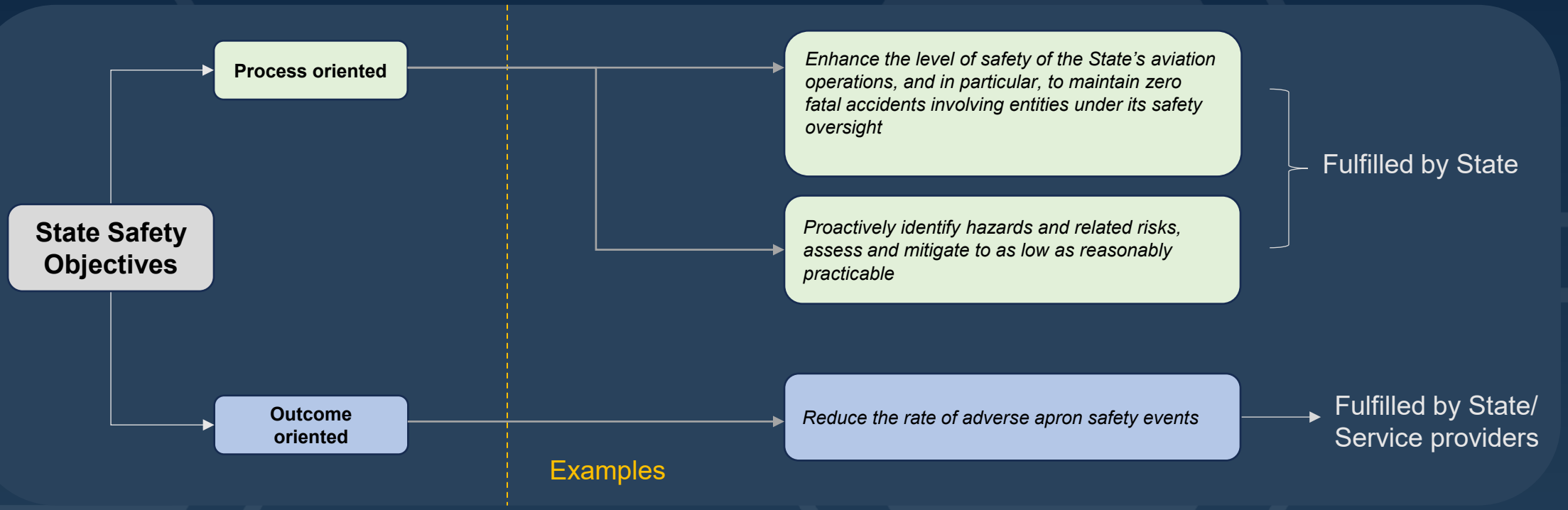
Acceptable Level of Safety Performance (ALoSP)

Safety Performance Monitoring

Regulatory Actions

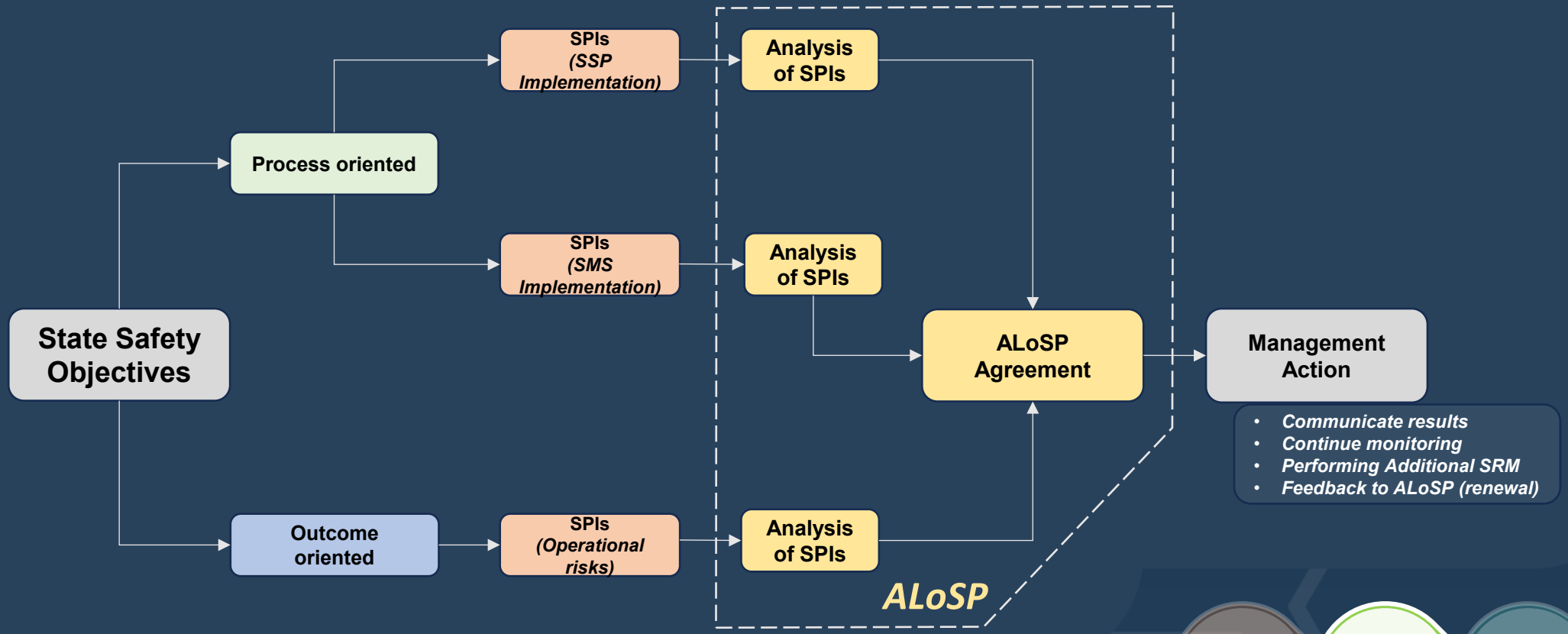
State Safety Objectives

Measures to Achieve Acceptable Level of Safety Performance (ALoSP)



Acceptable Level of Safety Performance

How State Safety Plans use Safety Performance Indicators (SPIs)



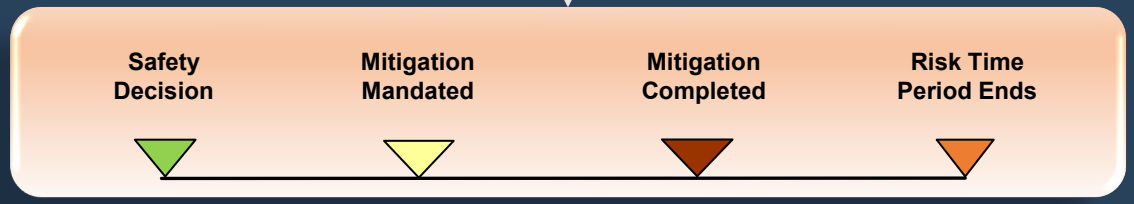
Source: https://www.easa.europa.eu/sites/default/files/dfu/2021-05-31_alosp_for_publication.pdf

Safety Performance Monitoring (SPM)

Verifying safety performance & validating safety risk control effectiveness

Safety Risk		*Severity*				
Probability		*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

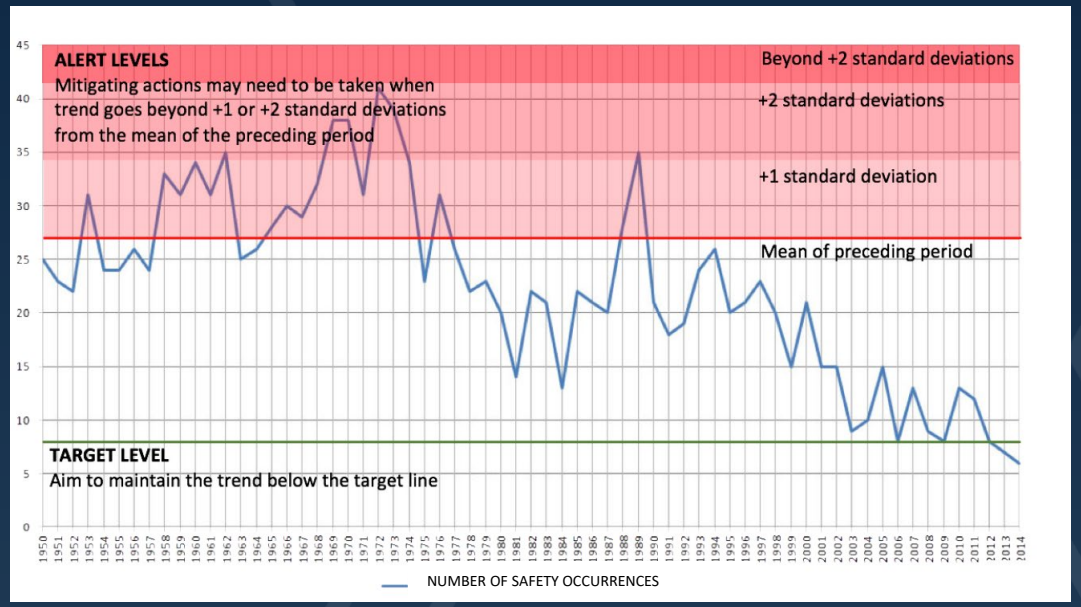
ALoSP ← **State Safety Objectives**



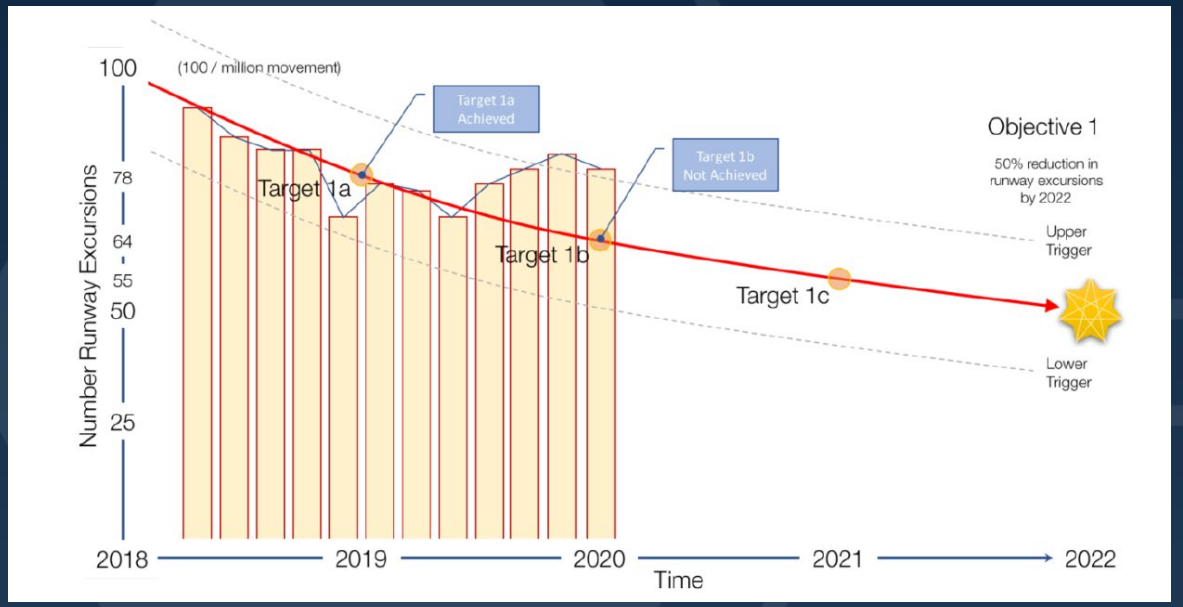
Source: ICAO Doc 9859 Safety Management Manual

Safety Performance Monitoring (SPM)

Examples



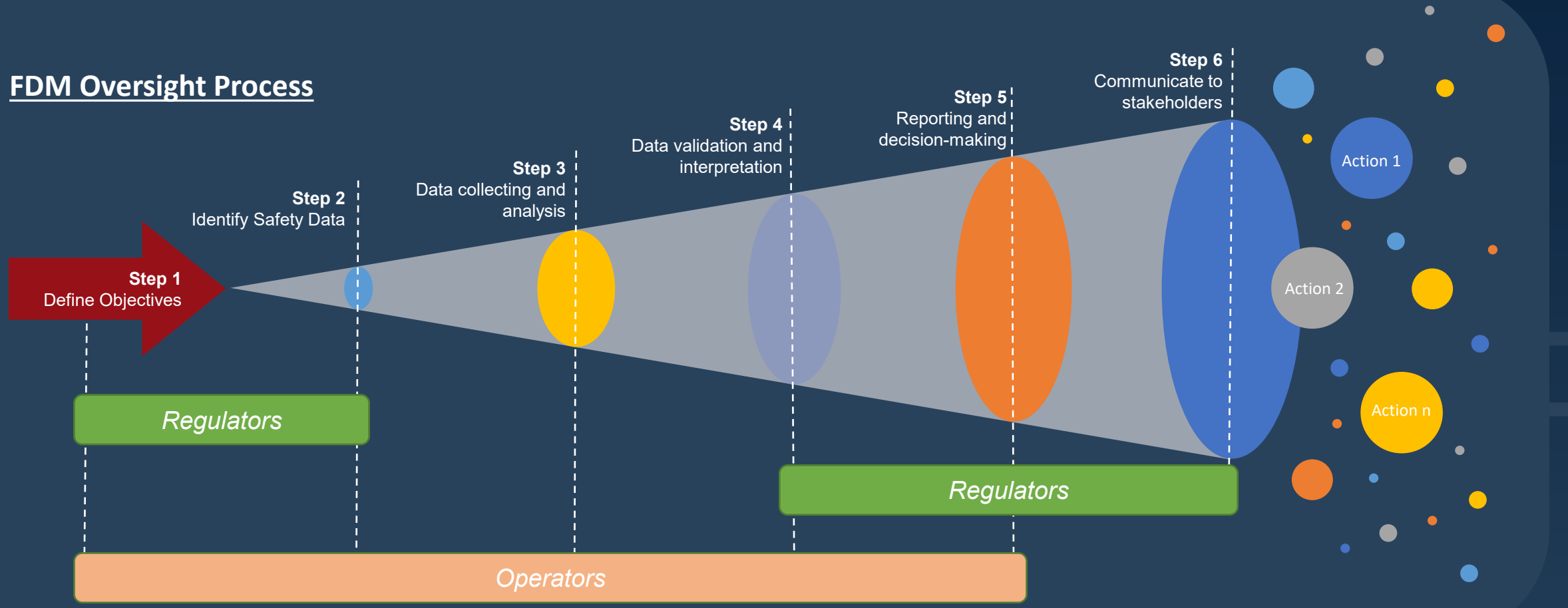
Using Standard Deviation



Monitoring Safety Performance Target

Source: ICAO Doc 9859 Safety Management Manual

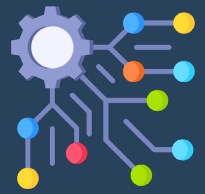
Regulatory Actions



Regulatory Actions

Implementation of Regulatory actions must consider change management:

Overall risk caused by the issue



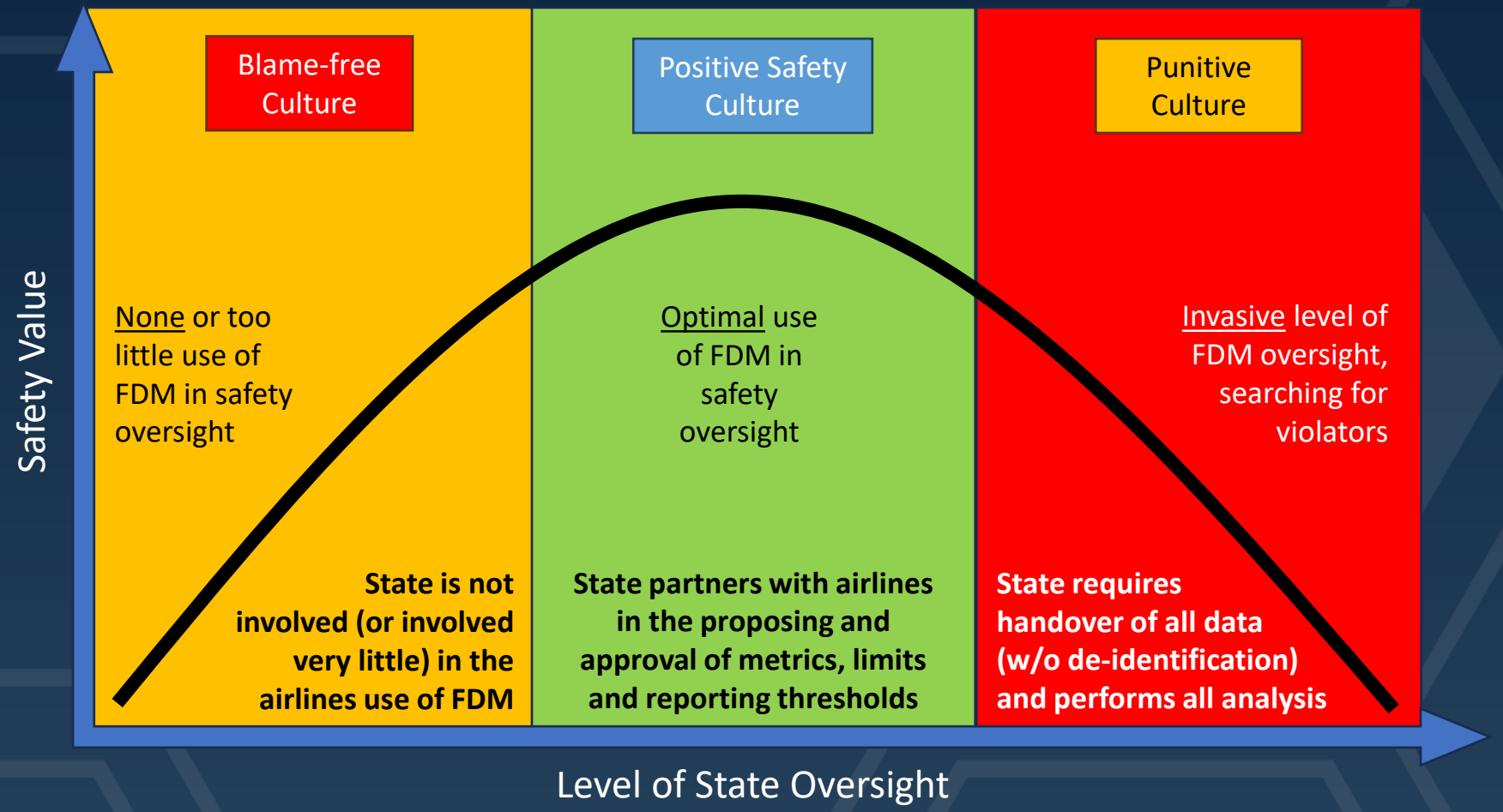
Complexity of the fix (change)

Operational Schedules

Time needed to develop, certify and incorporate

Source: ICAO Doc 9859 Safety Management Manual Chapter 6.5

Maximizing the Safety Value of FDM Oversight



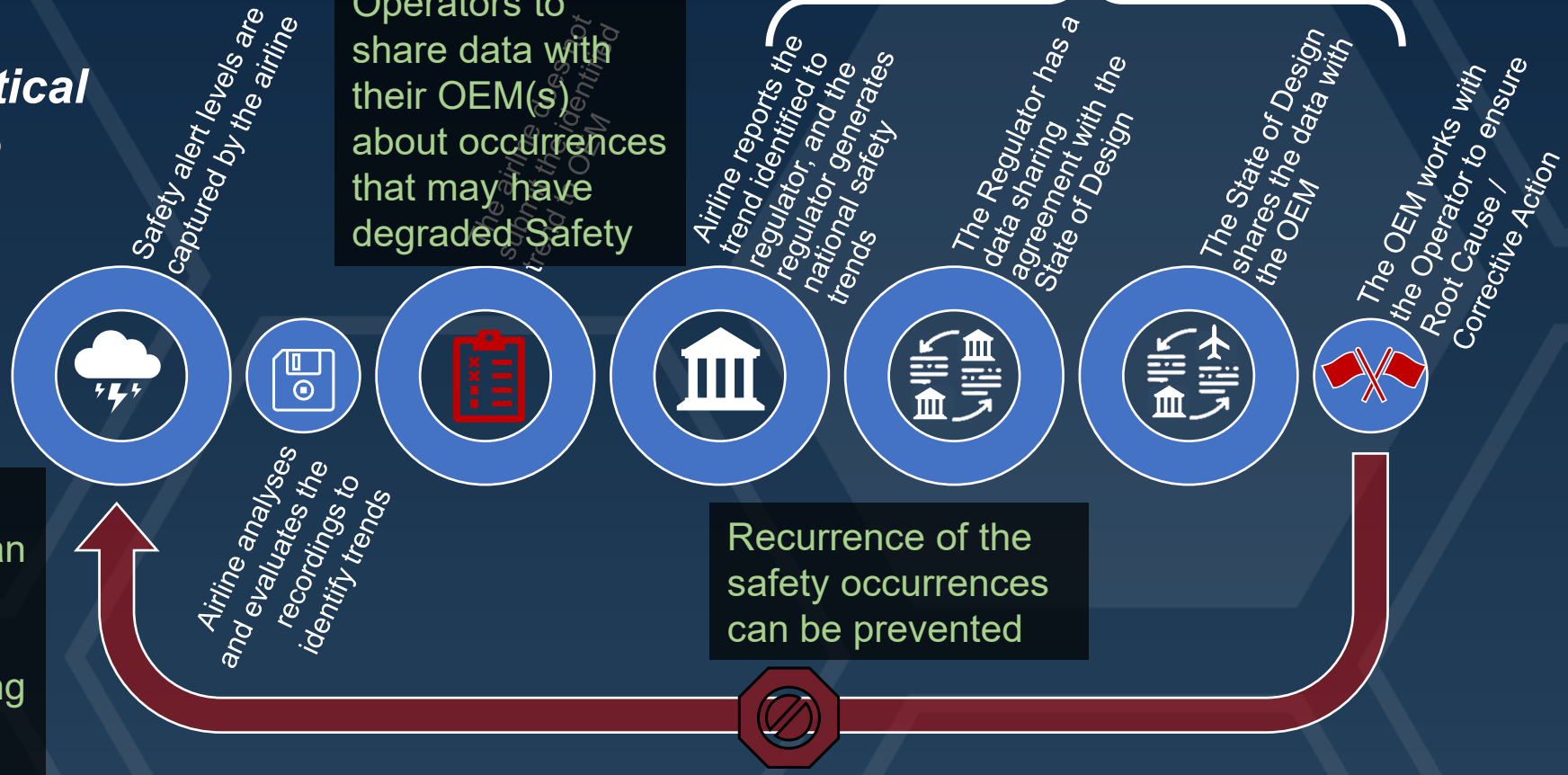
Vision for Data Partnership

Closing the Knowledge Gap

Hypothetical Scenario

Working together, the Regulators and OEM can serve as an additional “preventative barrier” if data sharing is enabled

We encourage all Operators to share data with their OEM(s) about occurrences that may have degraded Safety



Through data partnerships we can improve Root Cause / Corrective Action and reporting quality thereby improving Safety

Call to Action

1. Airlines and Regulators are encouraged to work collaboratively (e.g. performance-based compliance) to establish SPIs. Instead of mandating and directing all elements, focus on the desired outcome, not prescriptive methods.

2. Carefully consider whether a SPI is “simple” or “complex”. Avoid setting rigid thresholds for complex SPIs that are highly context dependent and technical.

   Example of a simple SPIs: high approach speed, excessive bank angle, or pitch-rate on takeoff
   Example of a complex SPI: use of *CG Load Factor* to set thresholds to define hard-landing occurrence

3. Airlines and Regulators are encouraged to carefully consider the potential outcomes of the SPIs they establish, continuously improve policies and regulations, looking for and eliminating unintended consequences.

Questions / Feedback