Safety Performance Indicators & Targets

CAAS
Civil Aviation Authority of Singapore

Annex 19

- SSP Element 2.2

  The State has agreed with individual service providers on the safety performance of their SMS. The agreed safety performance of an individual service provider's SMS is periodically reviewed to ensure it remains relevant and appropriate to the service providers.

- SMS Element 3.1.2

  The service provider's safety performance shall be verified in reference to the safety performance indicators and safety performance targets of the SMS.

SMM 9859 Edition 3

- High consequence indicators:

  Safety Performance Indicators pertaining to the monitoring and measurement of high consequence occurrences, such as accidents or serious incidents.

  High-consequence indicators are sometimes referred to as reactive indicators

- Lower-consequence indicators:

  Safety performance indicators pertaining to the monitoring and measurement of lower-consequence occurrences, events or activities such as incidents, non-conformance findings or deviations.

  Lower-consequence indicators are sometimes referred to as proactive/predictive indicators

Indicators

	Leading Indicators	Lagging Indicators	
ICAO 9859 Ed 3	Lower Consequence	Lower consequence & high consequence	
Process perspective	Process Input	Process Output	
Measurement focus	Conditions of key processes	Pre-cursors to incidents/accidents	Incidents / accidents
Indicators	Activity metrics	Quantified events (or group of events)	Mandatory indicators & regulatory recommended indicators
Source of information for selecting indicators	Deriving Common contributing factors: i) Investigation reports ii) Expert Team study iii) industry common practice	i) Operations performance ii) Operations report iii) Industry practice or experience	Authority

Steps

- Step One: Identify Key Issues or desired outcome of Safety Concerns
- Step Two: Define Outcome Indicators and related metrics
- Step Three: Define Activities Indicators and related metrics

- Air Operator Example

Step One: Key Issues or Concern

1. Regulator's incidents list:
   I. Runway excursion (runway collision concern)
   II. Loss of Separation (airborne collision concern)
   III. TCAS R(A) (airborne collision concern)
   IV. Minimum Safety Altitude Warning (terrain collision concern)
   V. EGPWS activation (Terrain collision concern)
2. Airline's list
   1. Laser illumination (security concern)
   2. Disruptive passenger (security concern)
   3. Aircraft Maintenance (equipment performance concern)
   4. UAS strike (airborne collision concern)
   5. Entry of aircraft performance data (equipment performance concern)

Step Two – Outcome Indicators

What are the events that are yet to develop into an accident?

- Incidents related to runway excursion
  - ✓ Abnormal runway contact
  - ✓ Loss of control on ground
  - ✓ Long and fast landing
  - ✓ Occurrence of crosswind
  - ✓ High speed rejected take-off
  - ✓ Landing gear system defects

Investigate related incidents events.

What are the contributing factors for these events?

Have metrics to measure these events as lagging indicators

Identify the repetitive contributing factors and implement mitigating programmes to reduce the events.

Step Three – Activities Indicators

Which factors are repetitive?
Implement programmes to reduce the events caused by the factors
Measure outcome of programmes (indicator)

- Crew
  - ✓ Handling of technical failures
  - ✓ Approach path management
  - ✓ Handling and execution of Go-around
  - ✓ Entry of aircraft performance
  - ✓ Taxi speed
  - ✓ Fatigue
  - ✓ Personal Pressure and Alertness
  - ✓ Experience, training & competence
- Technical
  - ✓ Disrupted ILS capture
  - ✓ Aircraft system maintenance
- Environmental
  - ✓ Turbulence
  - ✓ Windshear
  - ✓ Crosswind
- Procedure
  - ✓ Flight Manual Procedures

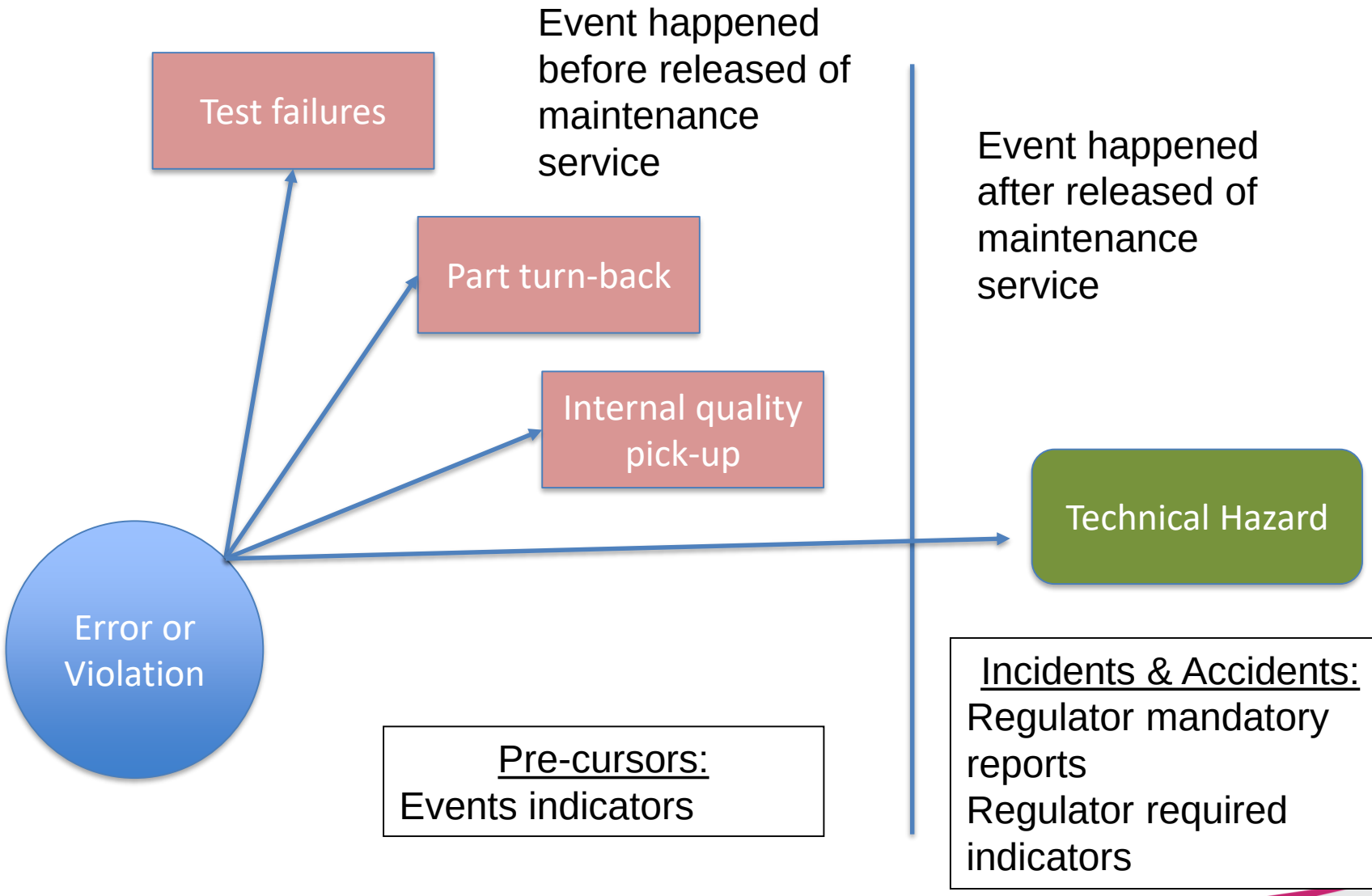
- AMO Example

Step One - Key Issues or Concern

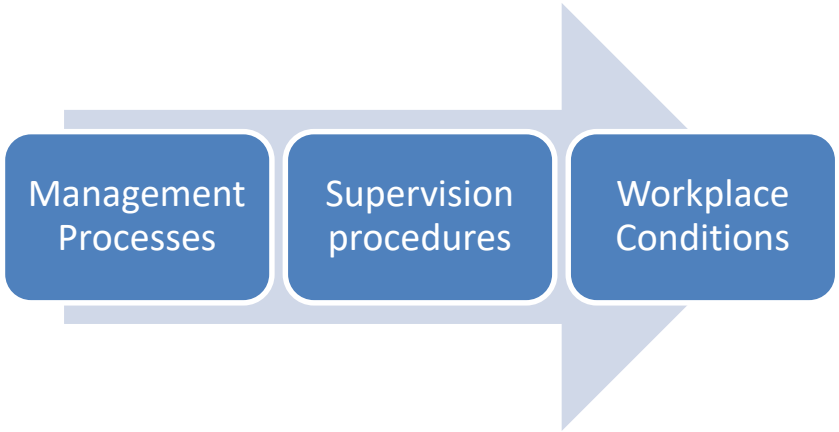
1. Regulator's incidents list addressing concern on equipment performance in flight
   i. Flight abortion due maintenance
   ii. Recall of components / parts
   iii. Inoperable system due maintenance

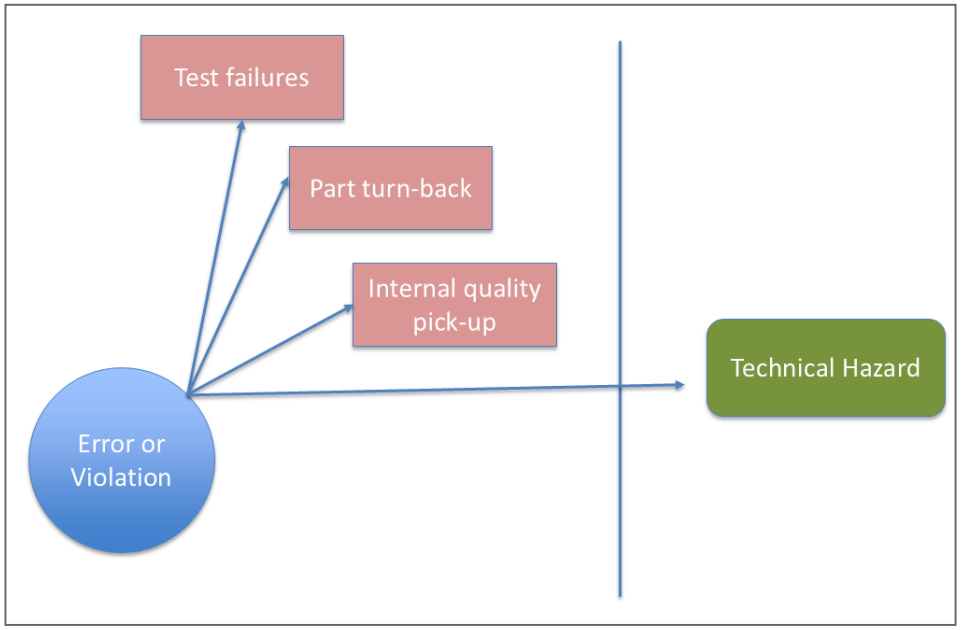
2. AMO's list
   i. Errors and violations (equipment performance concern)
   ii. Test failures due maintenance (equipment performance concern)
   iii. Quality pick-up (equipment performance concern)
   iv. Part-turn back rate (equipment performance concern)

AMO Lagging Indicators



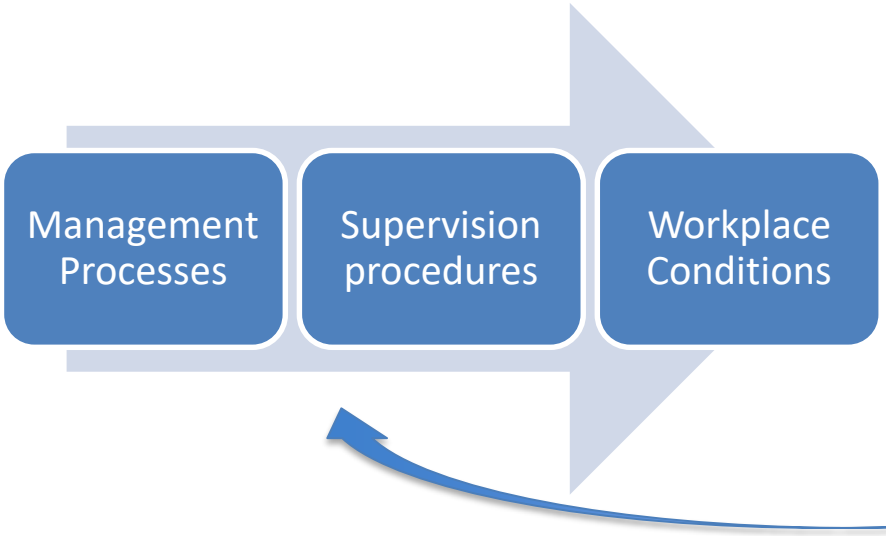
AMO Leading Indicators

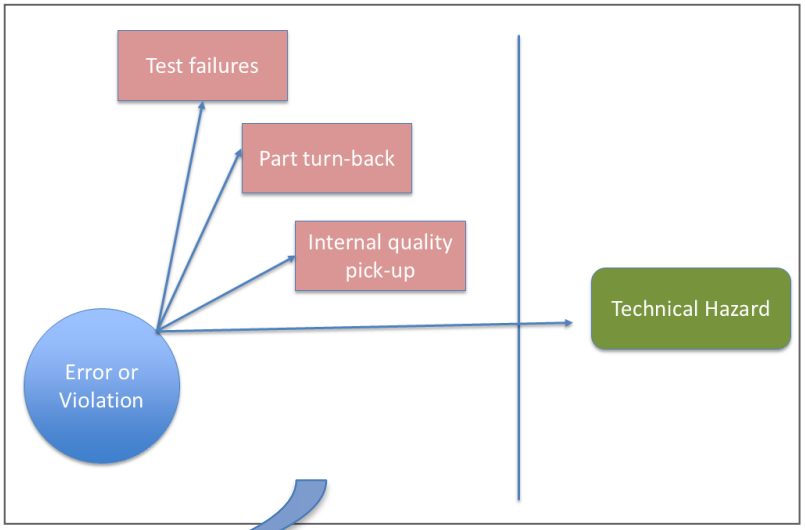




Leading indicators Lagging indicators

Leading Indicators





Investigate & identify contributing factors

Are there common factors?
Are there factors that led to high consequences?
What are the activities that can mitigate the risk of these factors?
Identify indicators to measure the performance of these activities.

Contributing Factors:

i. Conditions that led to event
ii. Supervision & organisation of workplace
iii. Management processes on organisation of workplace

Step Two – Outcome Indicators

What are the events that are yet to develop into an event?

- Incidents related to errors / violations
  - ✓ Signoff without check/work
  - ✓ FOD left in hardware
  - ✓ Missed critical task
  - ✓ Procedures not followed
  - ✓ Incorrect maintenance (slip)
  - ✓ Incomplete maintenance (lapse)
  - ✓ Incorrect hardware installed
  - ✓ Missed safety procedures

Investigate related incidents events.
What are the contributing factors for these events?
Have metrics to measure these events as lagging indicators
Identify the repetitive contributing factors and implement mitigating programmes to reduce the events.

Step Three – Activities Indicators

- Crew (human)
  - ✓ Complacency
  - ✓ Exceed authorisation
  - ✓ Reliant on other crew
  - ✓ Disruption / inattention
  - ✓ Night shift
  - ✓ Fatigue
  - ✓ Physical attributes
  - ✓ Miscommunication
  - ✓ Personal pressure
  - ✓ Supervisor pressure
  - ✓ Norm
  - ✓ Experience, training & competence
- Technical
  - ✓ Complex task
  - ✓ Equipment faulty
  - ✓ Unfamiliar task
- Environmental
  - ✓ Confined space
  - ✓ Lighting
  - ✓ Noise
  - ✓ Access difficulty
- Procedure
  - ✓ Hand-over procedure
  - ✓ Published procedure

Contribution Factors

Events

Contributing Factors

				Internal Escape			Safety Escape		
				Event classification					
	Risk rank	Probably	Event	Quality	Turn-back	Test failure	Low	Moderate	High
			Error						
			Violation						
			Signoff w/o work						
			FOD in hardware						
			Missed critical task						
			Incorrect maint.						
			Incomplete maint.						
			Incorrect hardware						
			Missed safety procedure						
			Not follow procedure						
			Contributing Factors						
Human			Complacency						
			Exceed authorisation						
			Reliant on others						
			Disruption / inattention						
			Night shift						
			Physical attributes						
			Miscommunication						
			Personal pressure						
			Supervisor pressure						
			Norm						
			Experience & competence						
Technical									
			Complex task						
			Equipment faulty						
			Unfamiliar task						
			Hardware not available						
Environmental									
			Confined space						
			Lighting						
			Noise						
			Access difficulty						
Procedural									
			Hand-over procedure						
			Published procedure						
			Documentation						

Populate the table
Which are factors high probability or high risk?
Implement programmes to reduce these factors probability.
Measure outcome of programmes & events (indicators)

CAAS

- Target setting

ICAO Guidance Doc 9859 (2.16.7)

- Performance-based monitoring and measurement
  - In conjunction with indicators, alert as well as desired improvement target levels should be set for each indicator where applicable.
  - Targeted improvement level is to achieve the desired improvement level within a defined future milestone or monitoring period.

Targets are meant to drive improvement.

Too focused on meeting targets for example number of findings per audit or number of voluntary report received per year.

Targets

- Which indicators should have targets on?
  - Outcome indicators or
  - Activities indicators

- What should the target improvement be?
  - Should be achievable based on the resources available
  - Do we have action plan to improve the performance?
  - Activity indicators would see larger improvement than outcome indicators

- How long should the time frame used for achieving the target?
  - Activities indicators tend to see larger performance improvement earlier
  - Outcome indicators are lagging.

Target – an Absolute Number or a Rate?

- Absolute number - example 5 events a year
  - More commonly used in maintenance organisation
  - Not good for case where production varies a lot
  - Not effective where services is broad – wide product range
  - Trending is not representative of system performance
  - Watch number of events accumulated over the months

- Rate – example 5 events / 10000 man-hrs or flight hours
  - Watch monthly event rate
  - Data assumes a projected annual total man-hrs or flight hours.
  - (or ratio of event / hours to date)

- 9.5.5.18 The development of SPIs should be linked to the safety objectives and be based on the analysis of data that is available or obtainable. The monitoring and measurement process involves the use of selected safety performance indicators, corresponding SPTs and safety triggers.
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- 9.5.5.19 The organization should monitor the performance of established SPIs and SPTs to identify abnormal changes in safety performance. SPTs should be realistic, context specific and achievable when considering the resources available to the organization and the associated aviation sector.
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- 9.5.5.20 Primarily, safety performance monitoring and measurement provides a means to verify the effectiveness of safety risk controls. In addition, they provide a measure of the integrity and effectiveness of SMS processes and activities.

Thank you

SINGAPORE AVIATION ACADEMY

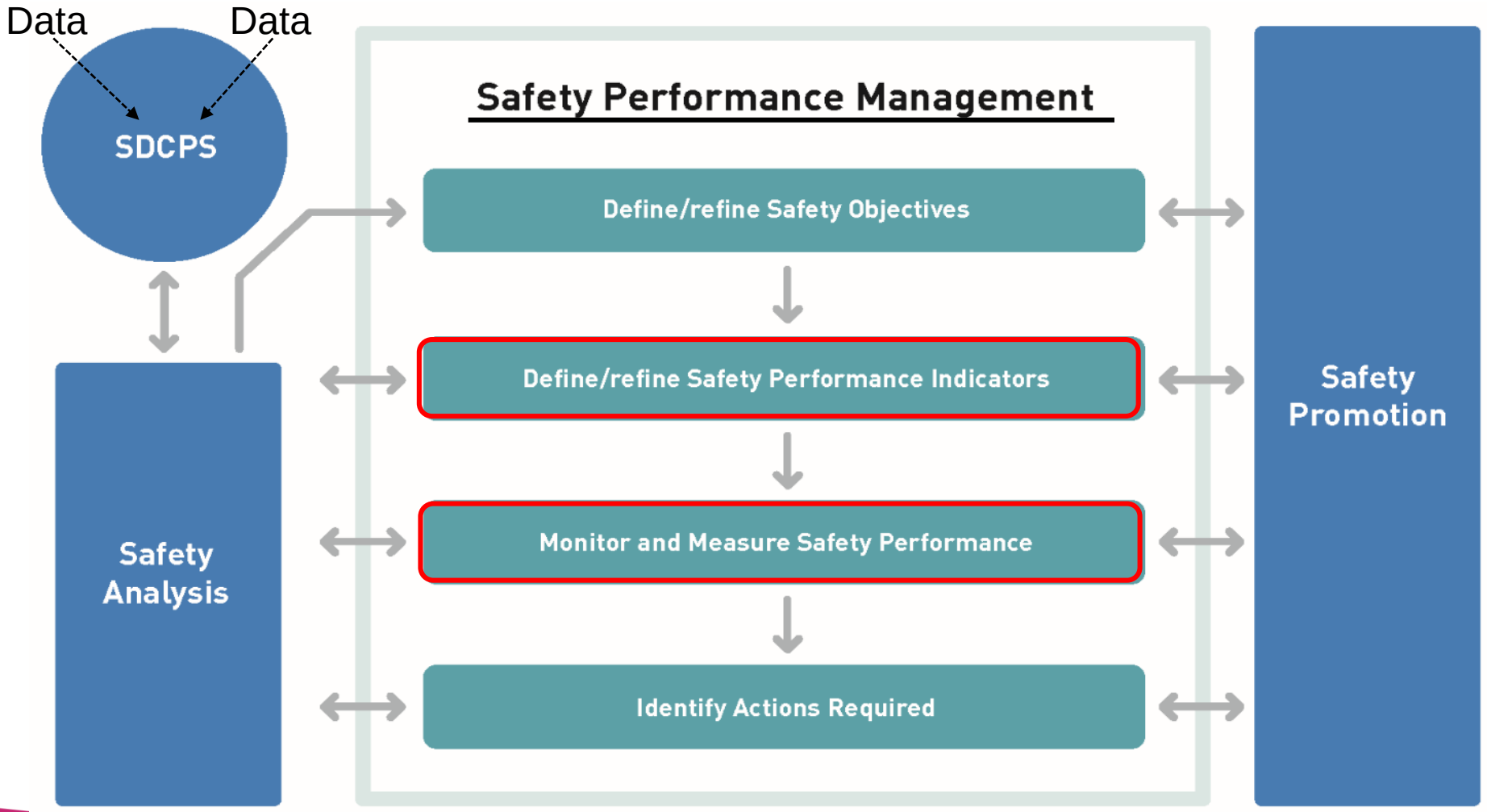
Sharing How Organisations Development their (i) Safety Performance Indicators (ii) Safety Targets

8 March 2018

Acceptable level of safety performance (ALoSP)

The level of safety performance agreed by State authorities to be achieved for the civil aviation system in a State, as defined in its State safety programme, expressed in terms of *safety performance targets* and *safety performance indicators*.

Safety Performance Management



Safety Performance Indicators

Interactive Sharing:

- How you derive your SPIs?
- Do you have a mixture of both quantitative and qualitative SPIs?
- Are your SPIs a combination of lagging and leading indicators?
- Any challenges in developing SPIs?

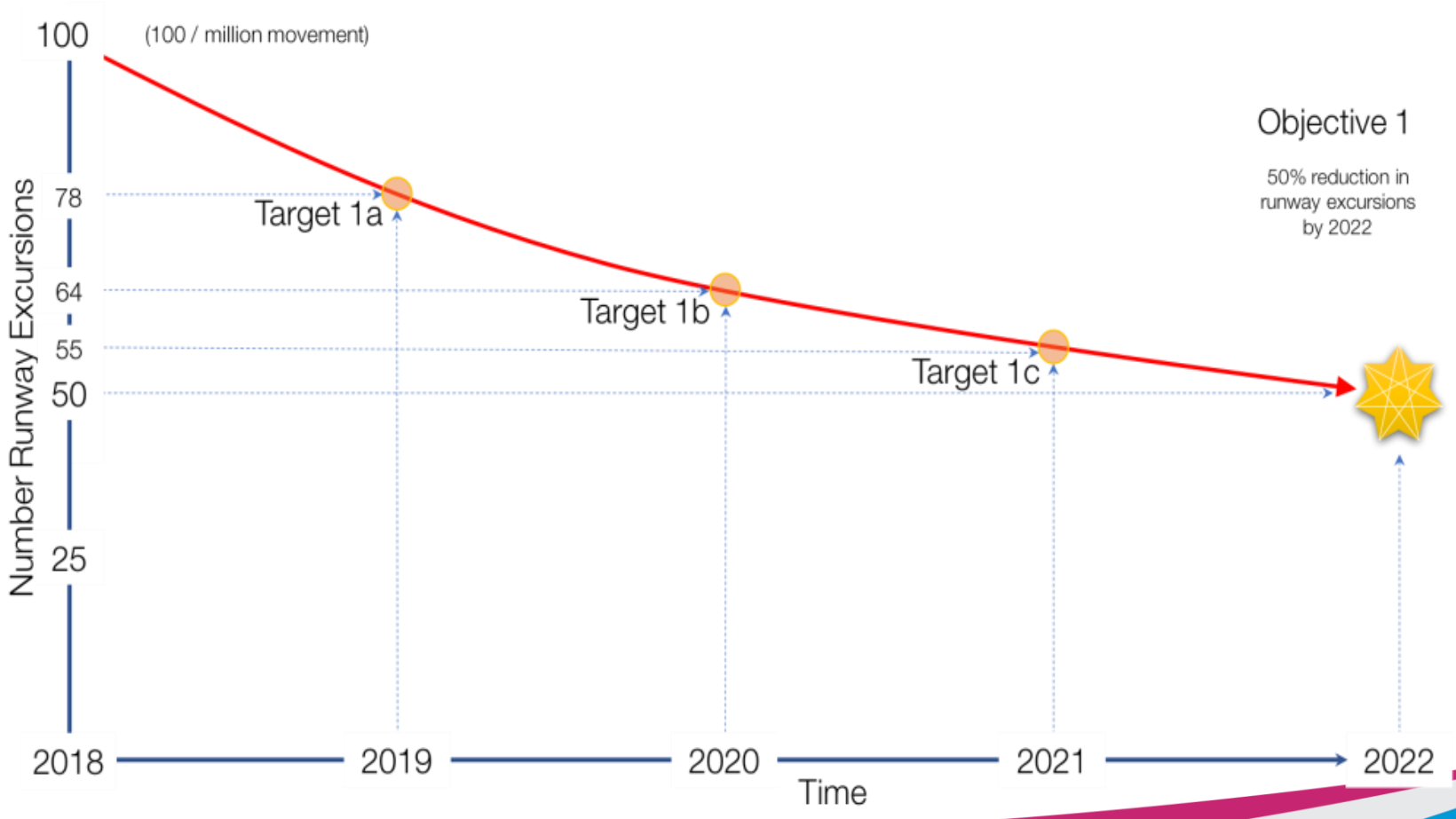
Safety Targets

- Safety Performance Targets (SPTs) provide a measurable way of verifying the effectiveness of safety performance management activities.

- The setting of SPTs should be determined after considering what is realistically achievable for the associated aviation sector and recent performance of the particular SPI, where historical trend data is available.

- SPTs define short-term and medium-term safety performance management desired achievements.

Safety Targets



Safety Targets

Interactive Sharing:

- How you derive your safety targets?
- How many years of historical trend data are you using?
- How often do you achieve your safety targets?
- Do you adjust your targets if you couldn’t achieve them?
- Any challenges in developing safety targets?

Safety Performance Outcome