Safety Performance Monitoring & Measurement

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civil air navigation services organisation

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Safety Management System (SMS) Implementation Workshop for Air Navigation Service Providers (ANSPs)
Mexico City, Mexico– August 2019

Safety Performance Monitoring

- Determine whether levels of operational safety performance are consistent with agreed upon levels
- Assess levels of compliance
- Verify whether practice is consistent with the organization's safety policy and safety objectives

Measures, Metrics and Indicators

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Measure

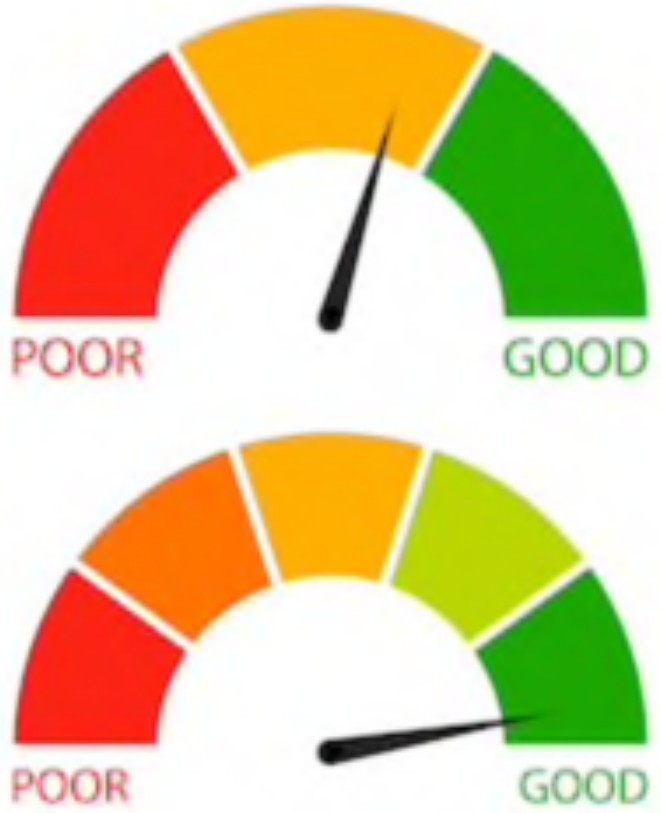
- Value that is quantified against a standard point in time
- A single measure usually has little value without some context

Metric

- Degree to which a particular subject possess the quality that is being measured
- Based on two or more measures

Indicator

- What should be measured
- SMART
- Performance
- Qualitative vs Quantitative
- Leading vs Lagging



Measures, Metrics and Indicators

Term	Explanation	Example
Measure	A measure is a value that can be quantified at a point in time (e.g., number of LOSs on 21 September). It therefore has no value in performance monitoring unless there is a reference against which the measure can be assessed.	Number of LOSs in September 2014
Indicator	An indicator, as the name says, indicates what should be measured.	Total LOSs against target between January 2014 through January 2015
Metric	The metric is the measure of the indicator. There may be more than one metric for a single indicator, which is why much care is needed when selecting them.	Total LOSs between January 2014 and January 2015

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Leading vs Lagging Indicators

- ***Leading*** - aim to provide insight into current behaviours, actions or other characteristics of the organisation.
- ***Lagging*** – viewed as indicators of something that has already happened.

Examples of Indicators

Type	Example	Benefits	Problems
Lagging	Accidents attributed to ANSP	Measures significant safety outcome, which is well understood by all stakeholders	These types of accidents are very infrequent and are not an effective measure of how well the ANSP may be performing (i.e., absence of accidents does not mean that the ANSP is safe).
Lagging	Incidents (e.g., LOS, runway incursions)	• Are likely to be collected as part of the organisation's SMS • Are linked to the role of the ANSP as defined by ICAO • Are well understood by industry partners • Are used to benchmark performance with other ANSPs	Measures over time may be affected by factors such as: • Traffic growth (i.e., a greater number of flights leads to an increase in potential for occurrences). This issue could be countered by the presentation of the number of occurrences as a rate, but this relies upon access to information such as aircraft movements or flight hours. • Reporting culture. The number of occurrences may not change over time, but willingness to report may increase as the safety culture of the organisation improves. ANSPs may then see that the number of less severe incidents increases at a rate greater than the number of incidents that have high safety impact or were known to other stakeholders (e.g., a commercial aircraft having to reject a take-off at high speed following a runway incursion, as opposed to a delay caused by transferring information to an adjacent air traffic control unit). • Automated detection. Implementation of systems that automate the detection of incidents may increase the number of reported occurrences, although the actual number of occurrences remains the same. • Criteria changes. Changes in numbers of occurrence may alter if the definition of an incident changes or the criteria for reporting are modified (e.g., reporting of LOS events changes from being 75% of the separation standard to all losses). In such a case a new baseline may be needed.
Leading	Failures to comply with regulations	• Aviation regulations address safety requirements. As such, failures to comply with regulations may be viewed as a proactive indicator of the safety health of the organisation. • Internal monitoring by the organisation would unable to perform breach identification ahead of reporting through another assurance mechanism (e.g., internal/external audit)	The number of operational audits is likely to influence the number of regulatory breaches (i.e., if no audits are conducted, no breaches will be identified, even though there may be a significant number). • The ANSP can internally monitor its own compliance with regulations and may be able to track this number even in the absence of external audits, which then become a simple checkpoint.

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Examples of Indicators

Type	Example	Benefits	Problems
Leading	Safety climate measures	A link between the safety culture of the organisation and accidents is believed to exist. Measuring safety climate provides direct insights from operational staff into their view of the levels of safety and how safety is managed. This information can assist in the continuous improvement of safety management practices within the organisation.	Resource implications associated with organisational surveys are considerable. Thus, those organisations that conduct such surveys usually only conduct them on a two or more–year cycle, meaning that information on this leading indicator is not frequently updated. Trend data are therefore slow to develop, and benchmarks for safety culture within ANSPs are not currently available.
Leading	Workload measures	Extremes of workload (both overload and underload) will lead to a greater number of errors; as such, workload measures provide information about where the performance of the system may degrade.	Credible, quantifiable workload measures are hard to find and may be difficult to implement. An ANSP may therefore be reliant upon self-reported workload issues; these are likely to be related to high levels of task load.
Leading	Unmitigated high-level risks	If an organisation has recognised and documented that it has a high level of risk associated with a particular operation or change, and that it has done little to influence the risk level, this is a good indicator of the organisational safety culture.	This relies upon the organisation having an embedded risk management and safety assurance process.
Leading	Staff turnover	Low morale can be associated with staff turnover, which in turn may lead to reduction in standards of job performance.	External reasons may account for staff resignations (e.g., high international demand for controllers).
Leading	Day-to-day safety measures	Day-to-day safety measure programmes aim to provide information about the number and type of threats and errors occurring within the system. These measures are undertaken on a frequent basis, often daily, hence the phrase 'day-to-day'.	These programmes are resource-intensive and reliant upon an open culture.
Leading	Normal Operating Safety Surveys	Normal Operating Safety Surveys provide information about the number and type of threats and errors occurring within the system.	These surveys are resource-intensive and reliant upon an open culture. In addition, there are considerable intervals between surveys.

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Examples of Indicators

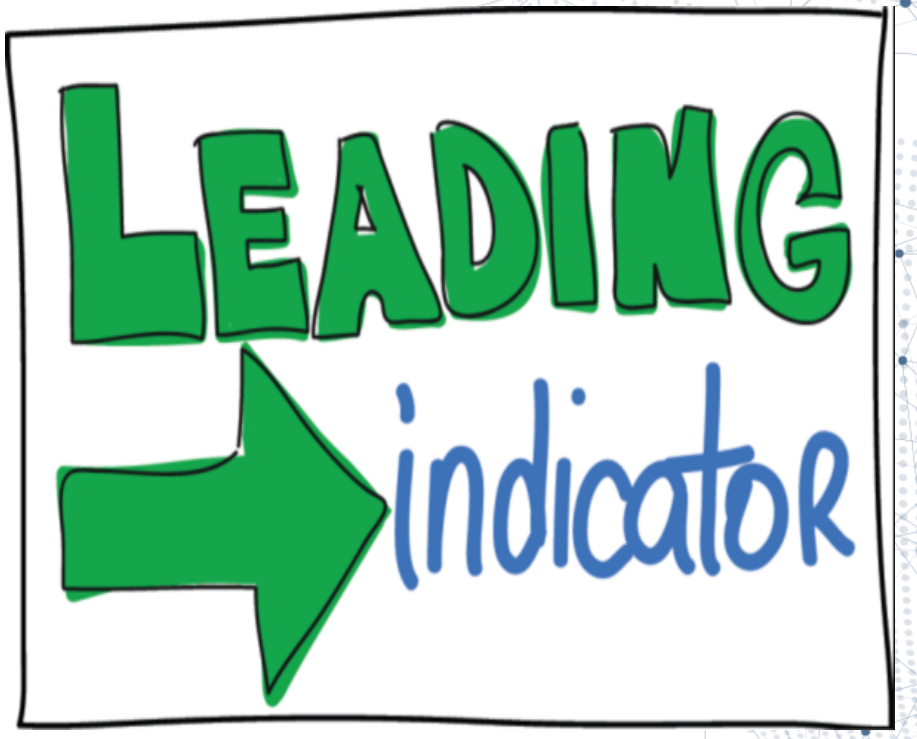
Type	Example	Benefits	Problems
Leading	Mean time between failures	Equipment failures may provide an insight into maintenance standards, equipment age and reliability.	Equipment may be so reliable that no trends can be identified.
Leading	SMS Maturity Metric	The SMS Maturity Metric is a measure of the maturity of safety management practices when referenced against the CANSO SoE in SMS.	For comparisons with other ANSPs, an external independent party may need to be involved.

Lagging Indicators

Role	Examples of Lagging Indicators
Prevention of collision between aircraft in the air	Mid-air collision, LOS
Prevention of collision with other aircraft or objects on the ground	Collision with another aircraft/object, runway incursion
Prevention of collision with terrain	Controlled Flight into Terrain accidents, Ground Proximity Warning System incidents
Provision of communication, navigation and surveillance services	Service interruptions due to facility failures

Leading Indicators Selection

- Understand the link between the indicator and safety performance.
- Assure that the data to support the implementation of the metric are available.



Benchmarking

- **Internal**
- **Regional**
- **International**
  - IFR-to-IFR LOSs per 100,000 movements
  - IFR-to-IFR LOSs per 100,000 flight hours
  - Runway Incursions per 100,000 movements
  - Absolute # of RIs categorised by the ICAO RI Severity Scheme
  - SMS Maturity

Types of Safety Performance Targets

Target Type	Description
Aspirational	The target may not be attainable but is viewed as a strategic performance driver. An extreme example would be a goal of no air traffic services–attributed LOSs by 2012 across the globe. The measure of success is significant.
Performance improvement–oriented	The target may require the organisation to improve performance by a standard increment over a set timeframe. For example, from 2009 to 2012, the air traffic services–attributed runway incursion rate must drop by five percent (5%) each calendar year.
Hard	The target requires the organisation to meet a prescribed performance level. For example, each month to June 2010, the runway incursion rate will not exceed 1 incident per 100,000 movements. Failure to meet these targets may have implications for the organisation and its staff.

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Presenting Safety Indicators

Air Traffic Services–attributed Loss of Separation Rates			
Service Segment	**Target Rate**	**2014-2015 Year-to-Date**	**January 2015**
Tower	1.50	0.63	0.00
Terminal Manoeuvring Area	1.50	1.16	2.08
En Route	1.25	0.80	0.00

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Lessons Learned with SPM&M

- Start with simple, easily collected information.
- Collect information that will assist in calculating incident rates.
- Recognise that ANSPs may never be able to see a link between lagging and leading indicators.
- ANSPs should continually evaluate how they can improve measurement and monitoring processes.

CANSO Standard of Excellence in SMS

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What is Safety Management?

- A ***proactive, structured*** approach to ***mitigate safety risks*** before they result in aviation accidents and incidents
- Through the implementation of safety management, ANSP's can manage their safety activities in a more ***disciplined, integrated and focused manner***
- Having a clear understanding of its role and contribution to a safe operations enables an ANSP to better ***prioritize safety risks*** and ***more effectively manage its resources*** for the optimal benefit of ***increased safety performance***

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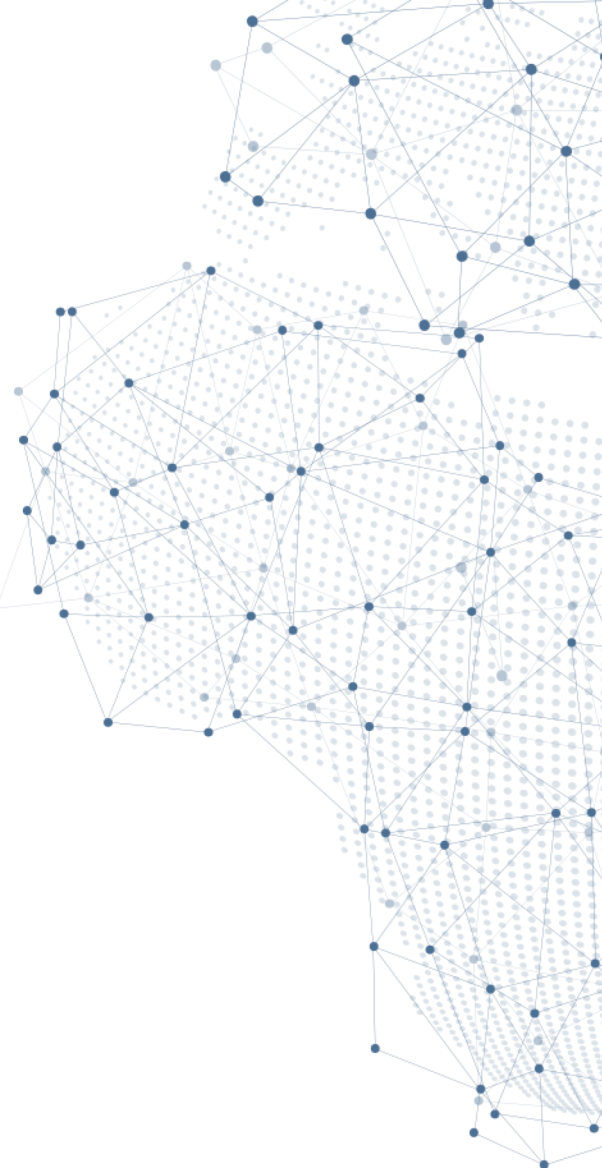
Benefits of Safety Management

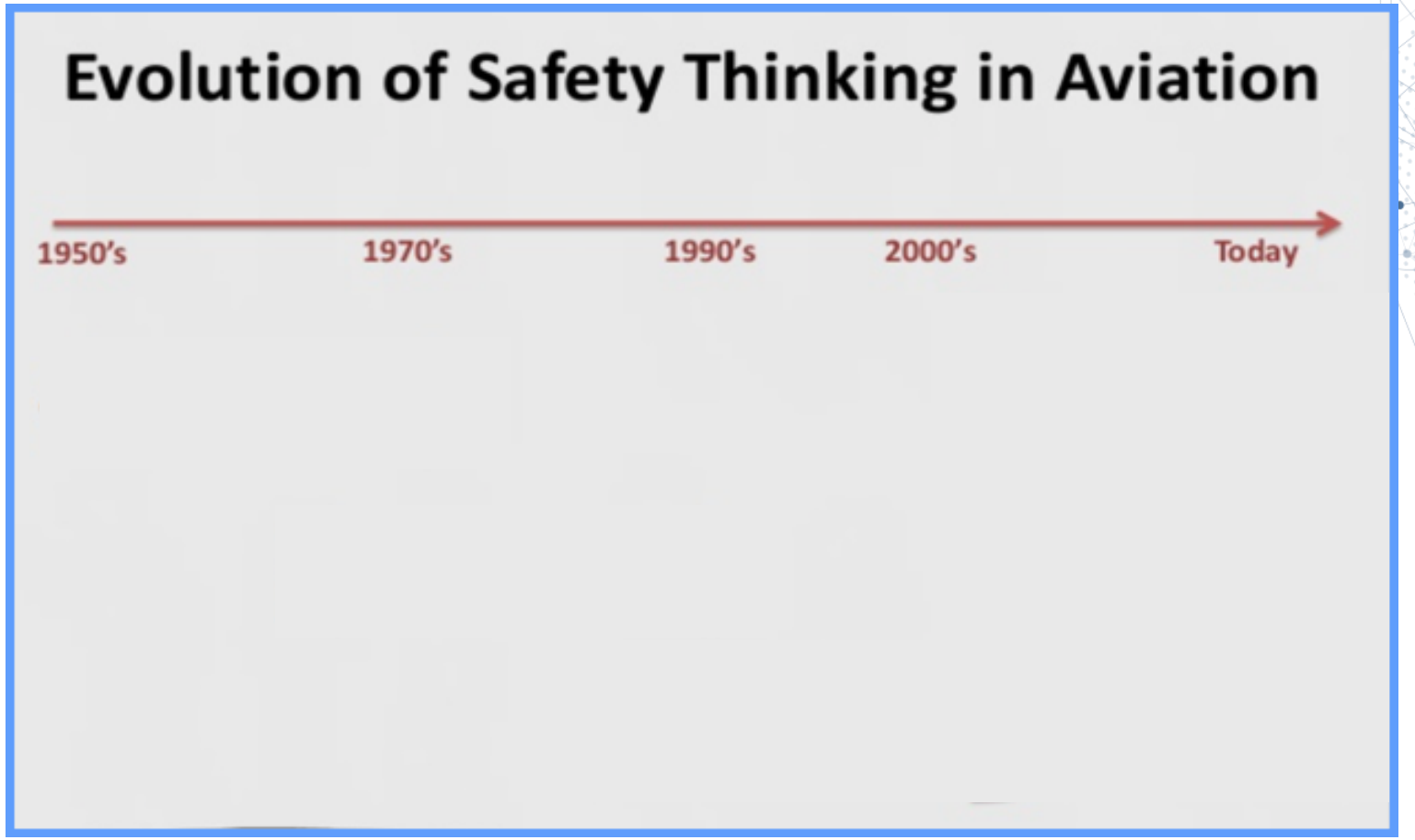
- Strengthened safety culture
- Documented, process-based approach to assure safety
- Better understanding of safety-related interfaces and relationships
- Enhanced early detection of safety hazards
- Safety data-driven decision making
- Enhanced communication of safety



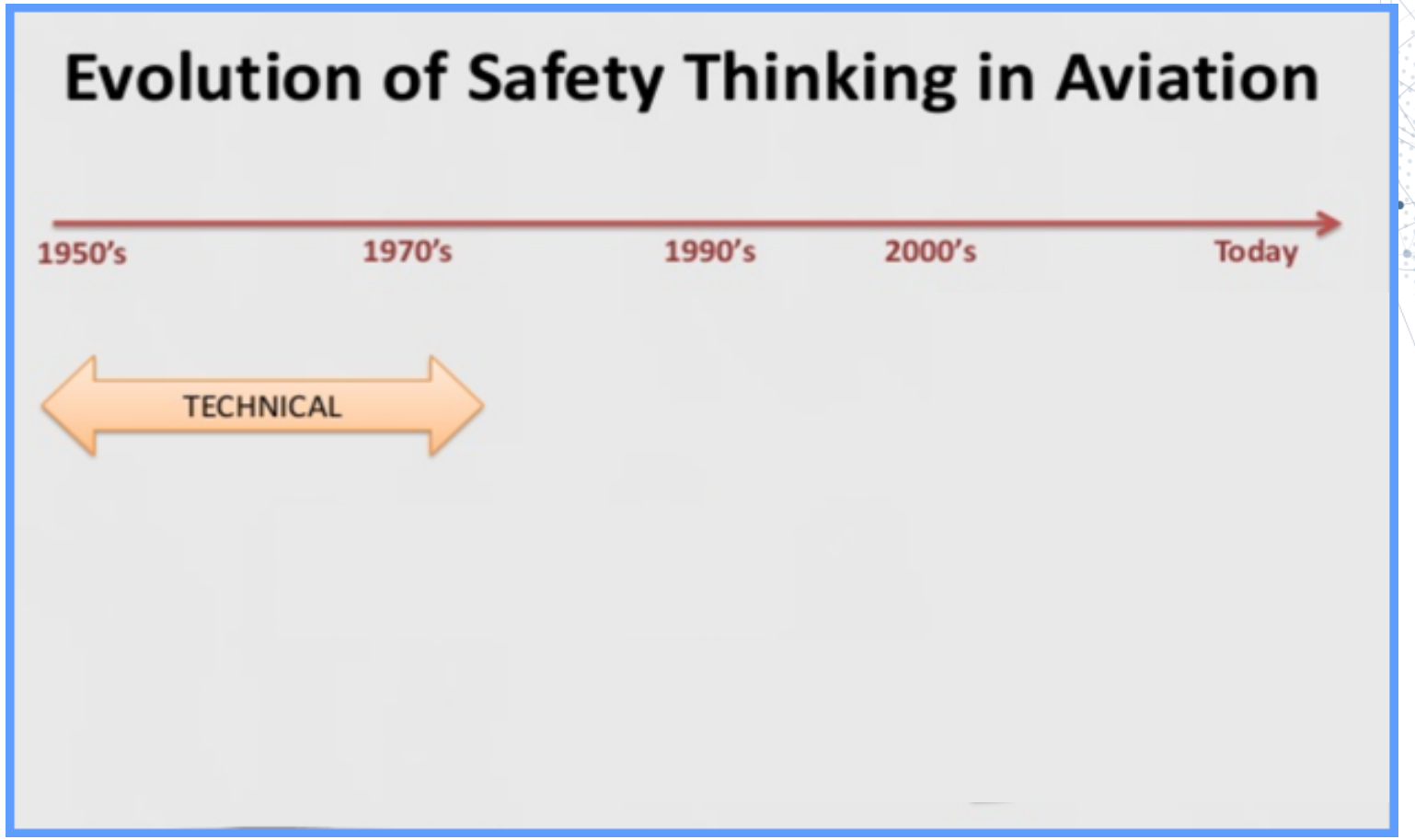
Benefits of Safety Management

- Evidence that safety is a priority
- Possible financial savings
- Improved efficiencies
- Cost avoidance

Evolution of Aviation Safety



Evolution of Aviation Safety



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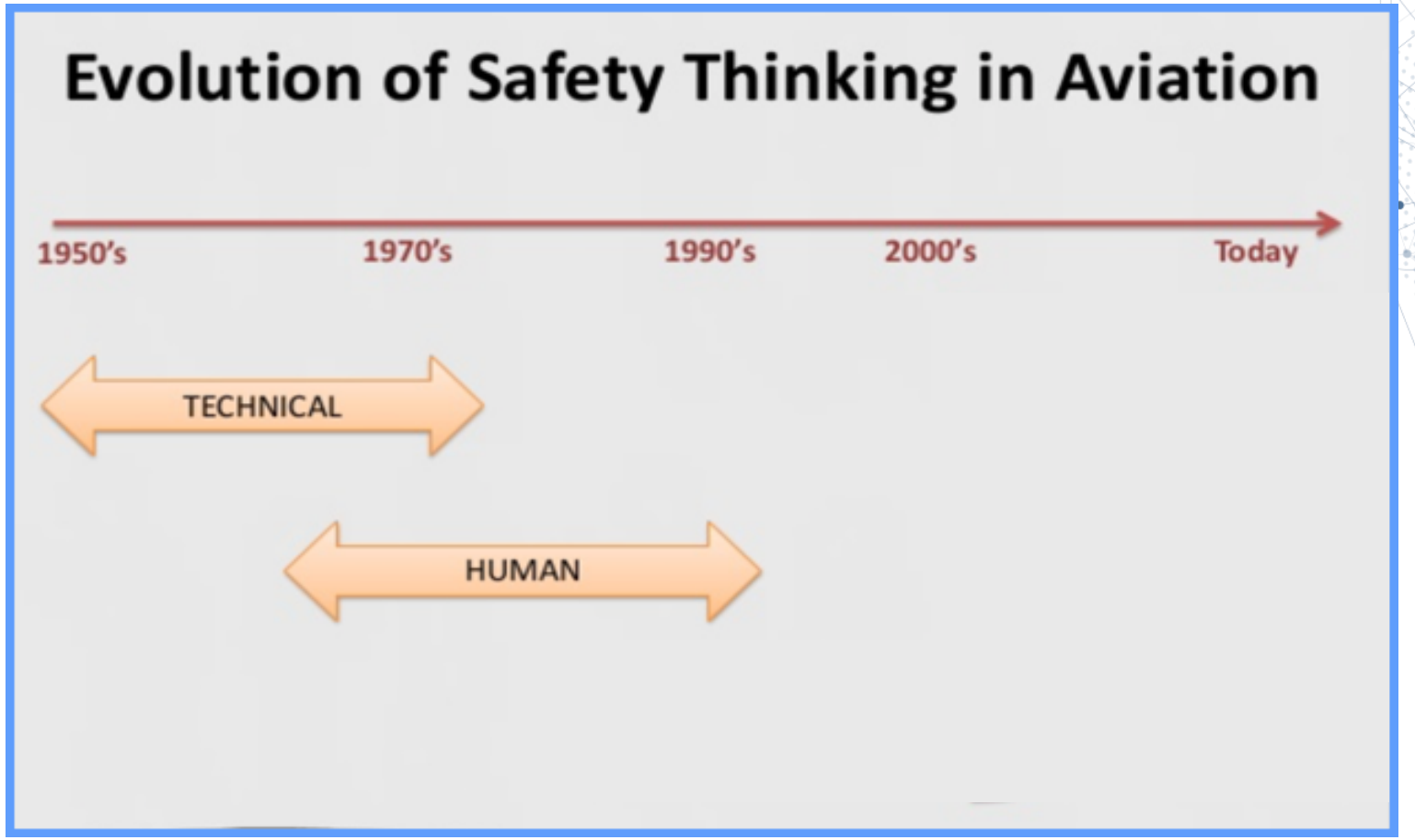

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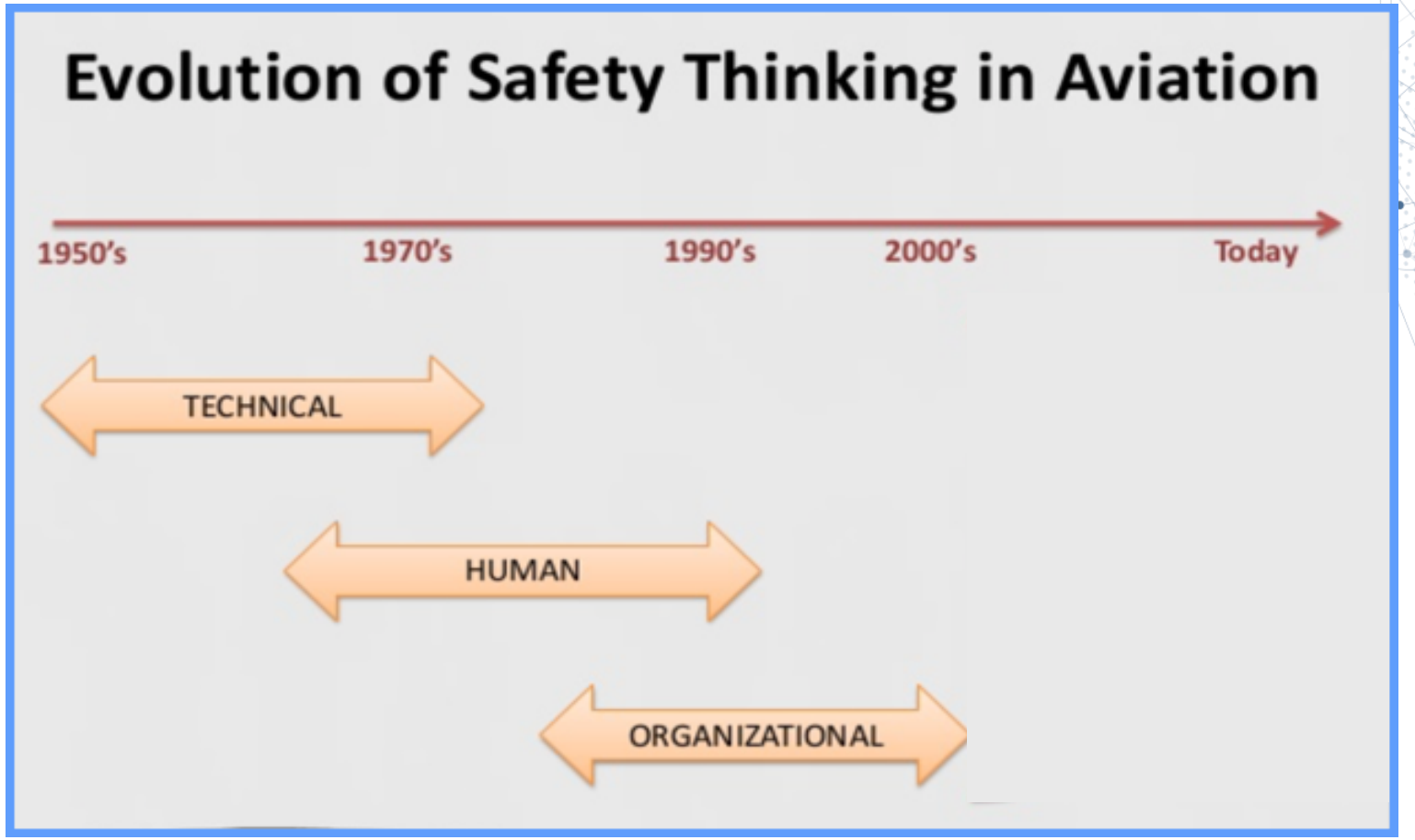

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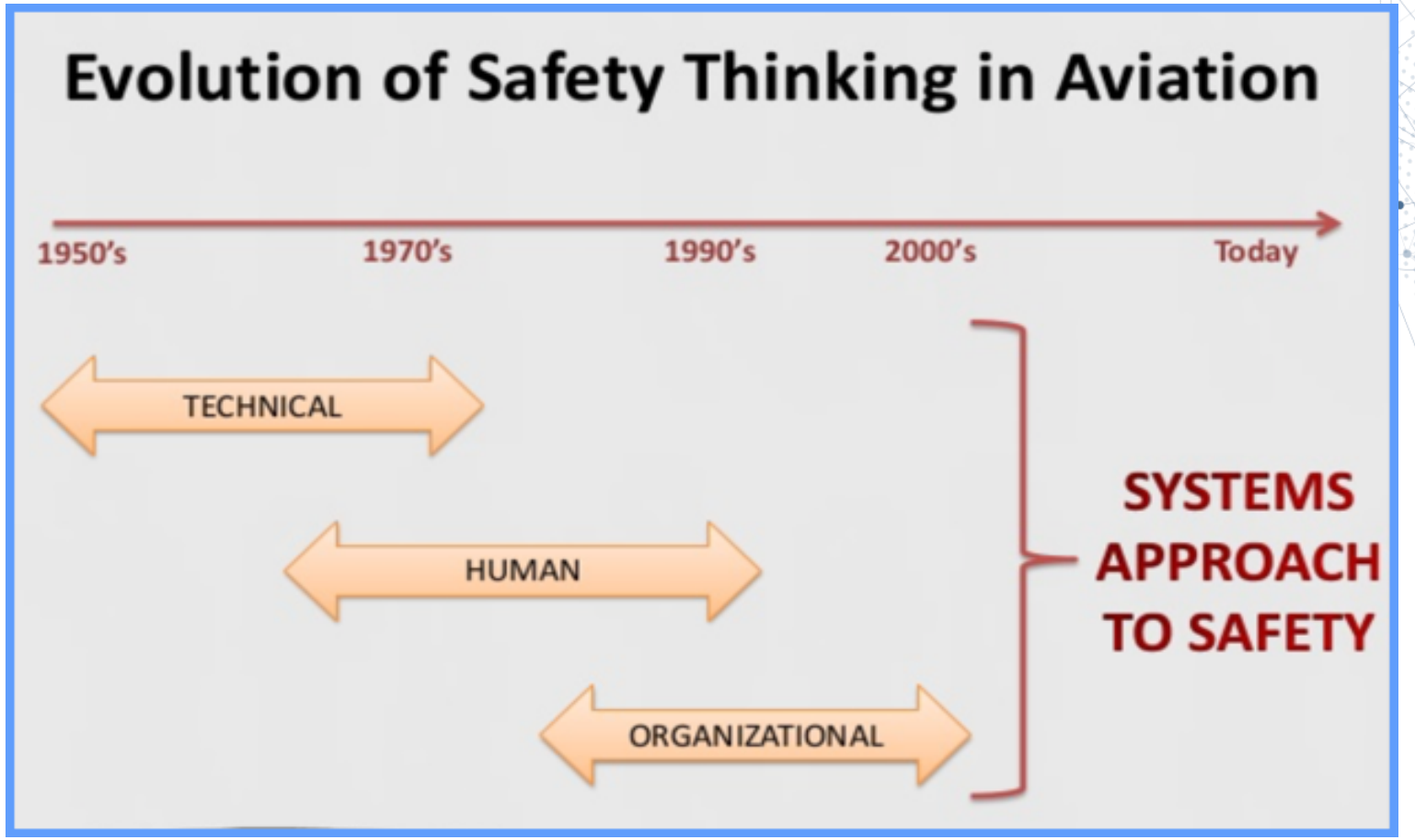
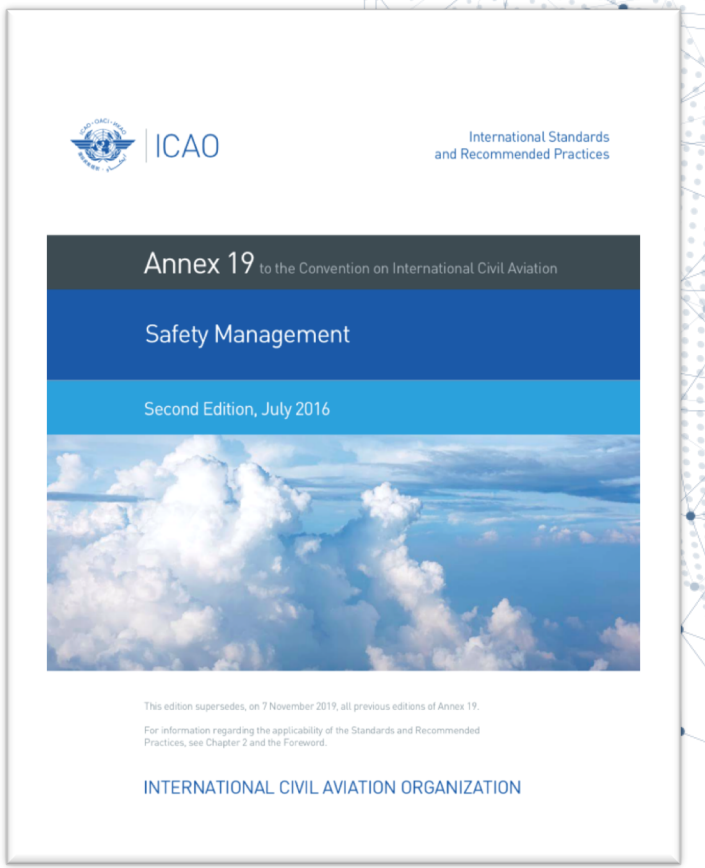


Understanding SMS Requirements

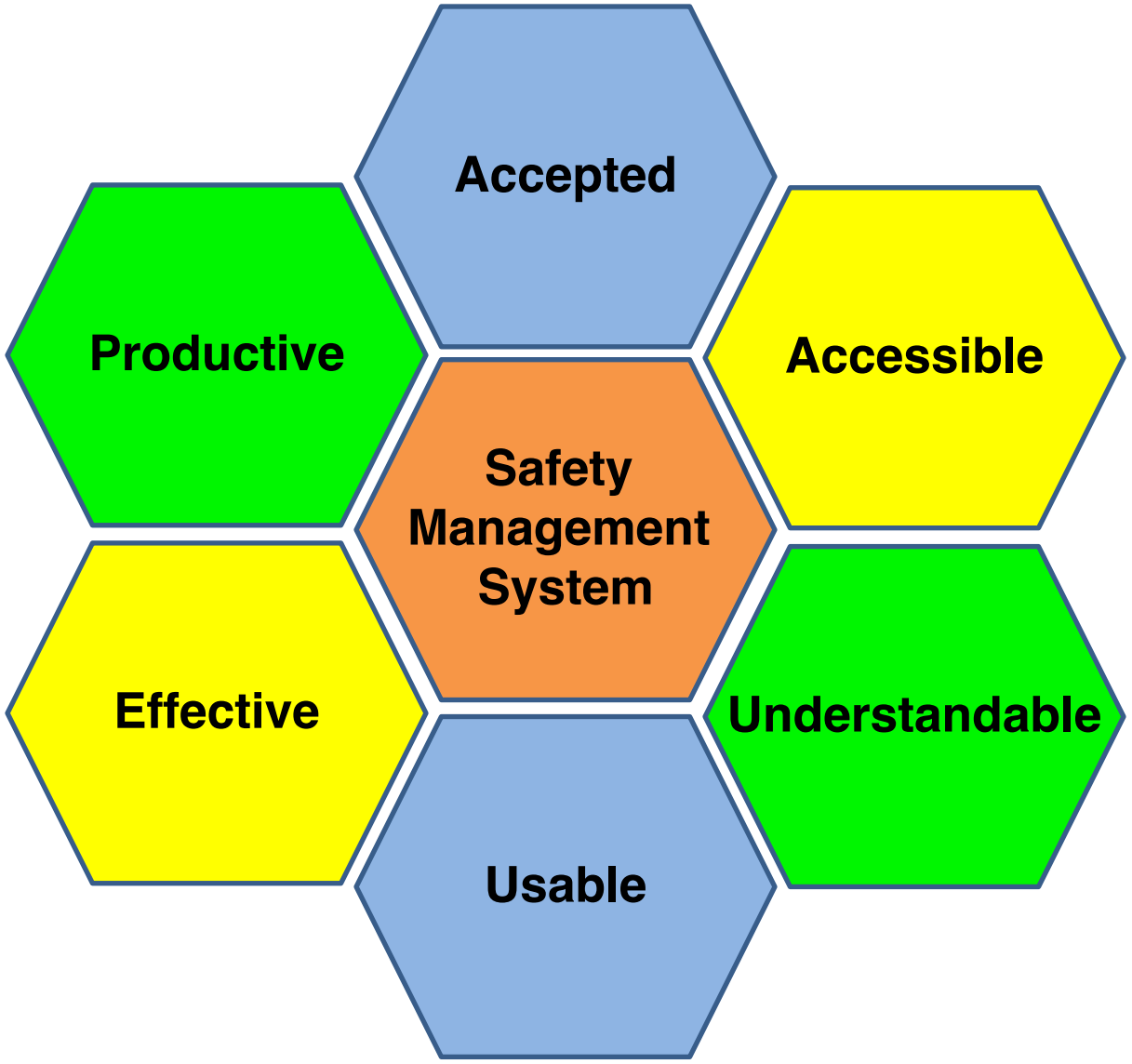
In order to ensure the SMS meets all applicable safety and regulatory requirements, it is necessary to understand the scope of international and domestic regulations

- ***ICAO Annex 19*** details the SARPs applicable to the safety management functions related to, or in direct support of, the safe operation of aircraft

- ***Additional SMS*** requirements my be placed on ANSPs by their state or other regulatory or advisory organisations



Developing SMS Attributes



SMS Framework – ICAO Annex 19

Safety Policy and Objectives	Safety Risk Management	Safety Assurance	Safety Promotion
1) Management commitment and responsibilities 2) Safety accountabilities 3) Appointment of key safety personnel 4) Coordination of emergency response planning 5) SMS documentation	1) Hazard identification 2) Risk assessment and mitigation	1) Safety performance monitoring and measurement 2) The management of change 3) Continuous improvement of the SMS	1) Training and education 2) Safety communication

CANSO SoE in SMS Framework

SAFETY CULTURE

Defining Safety Culture

- Refers to the enduring ***value, priority and commitment*** placed on safety by every ***individual*** and every ***group*** at ***every level*** of the organisation
- Reflects the individual, group and organisational ***attitudes, norms and behaviours*** related to the ***safe provision*** of air navigation services

Safety Culture Objectives

- A just, flexible and informed safety culture, led by management, that supports positive and pro-active reporting and learning
- Regular measurements of safety culture and an improvement program
- An open climate for reporting and investigating occurrences

Components of a Healthy Safety Culture

- Protection from disciplinary proceedings
- Confidentiality or de-identification
- Separation from information collectors from those that discipline
- Rapid, useful and intelligible feedback
- Ease of reporting

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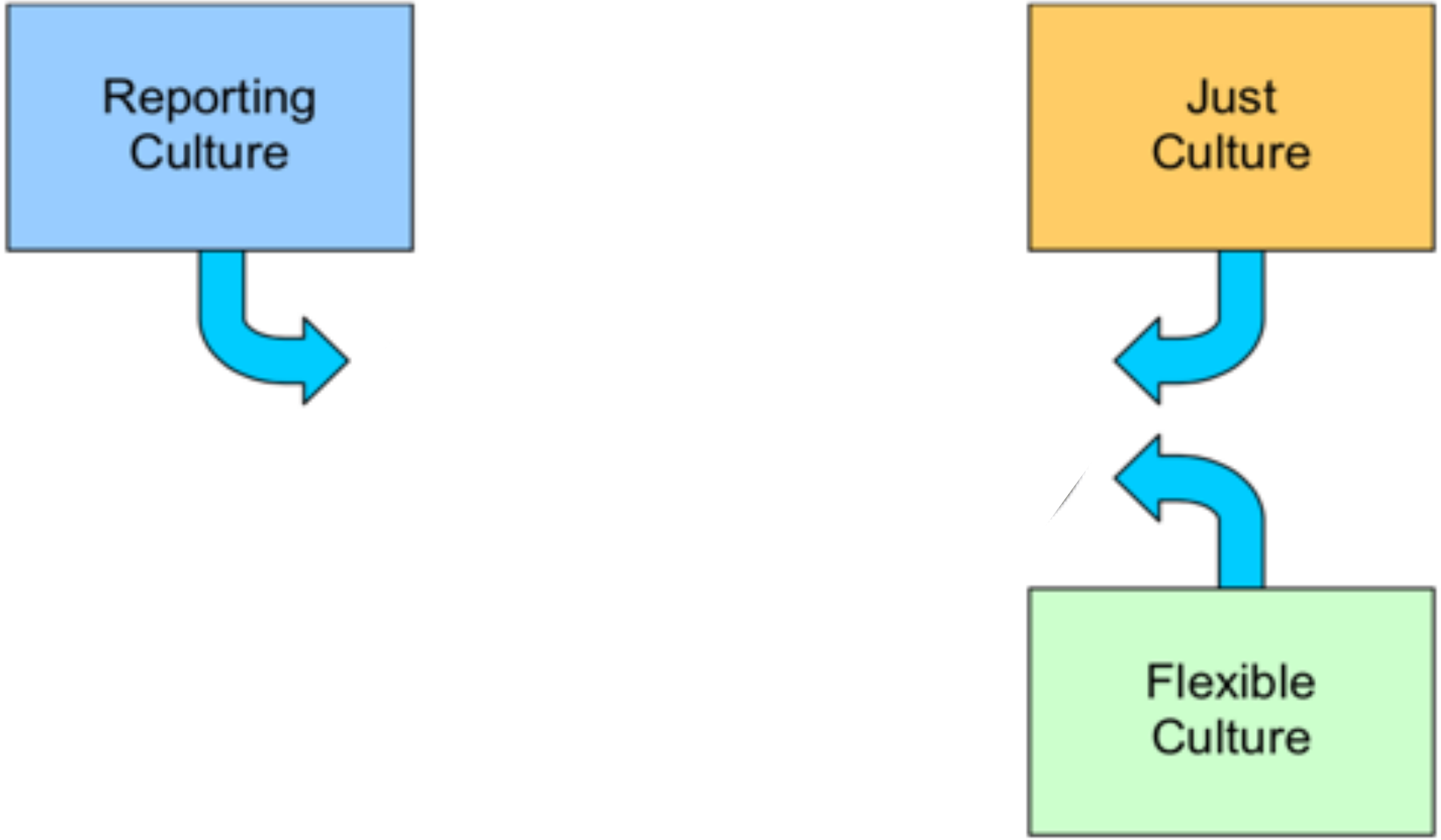
Components of a Healthy Safety Culture

Components of a Healthy Safety Culture

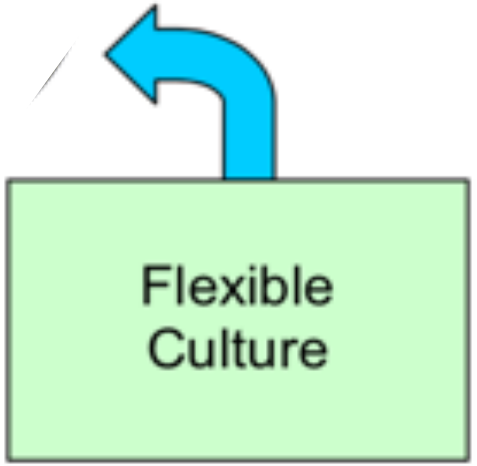
- Employees are held accountable for deliberate violations of rules
- Encouraged to provide essential safety-related information
- Rewarded for doing so
- An atmosphere of trust is the single most important element

Components of a Healthy Safety Culture



Components of a Healthy Safety Culture

- Allows employees to question procedures and behaviours
- Operational roles and responsibilities become less centralized and more fluid
- All employees feel a shared responsibility for the success and positive safety performance of the organisation



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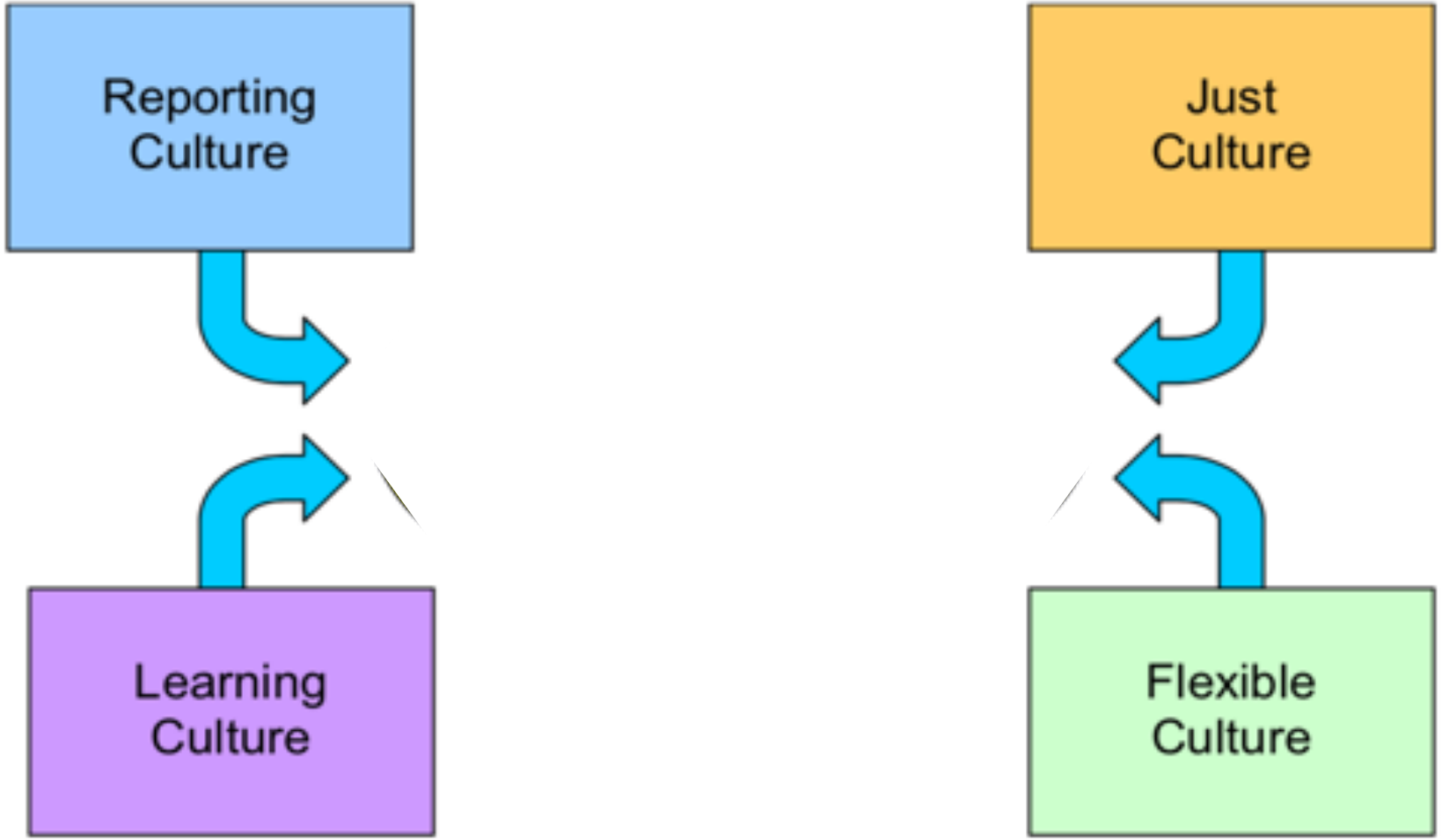

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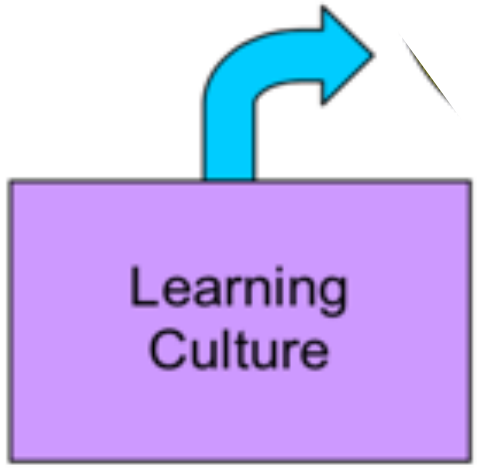
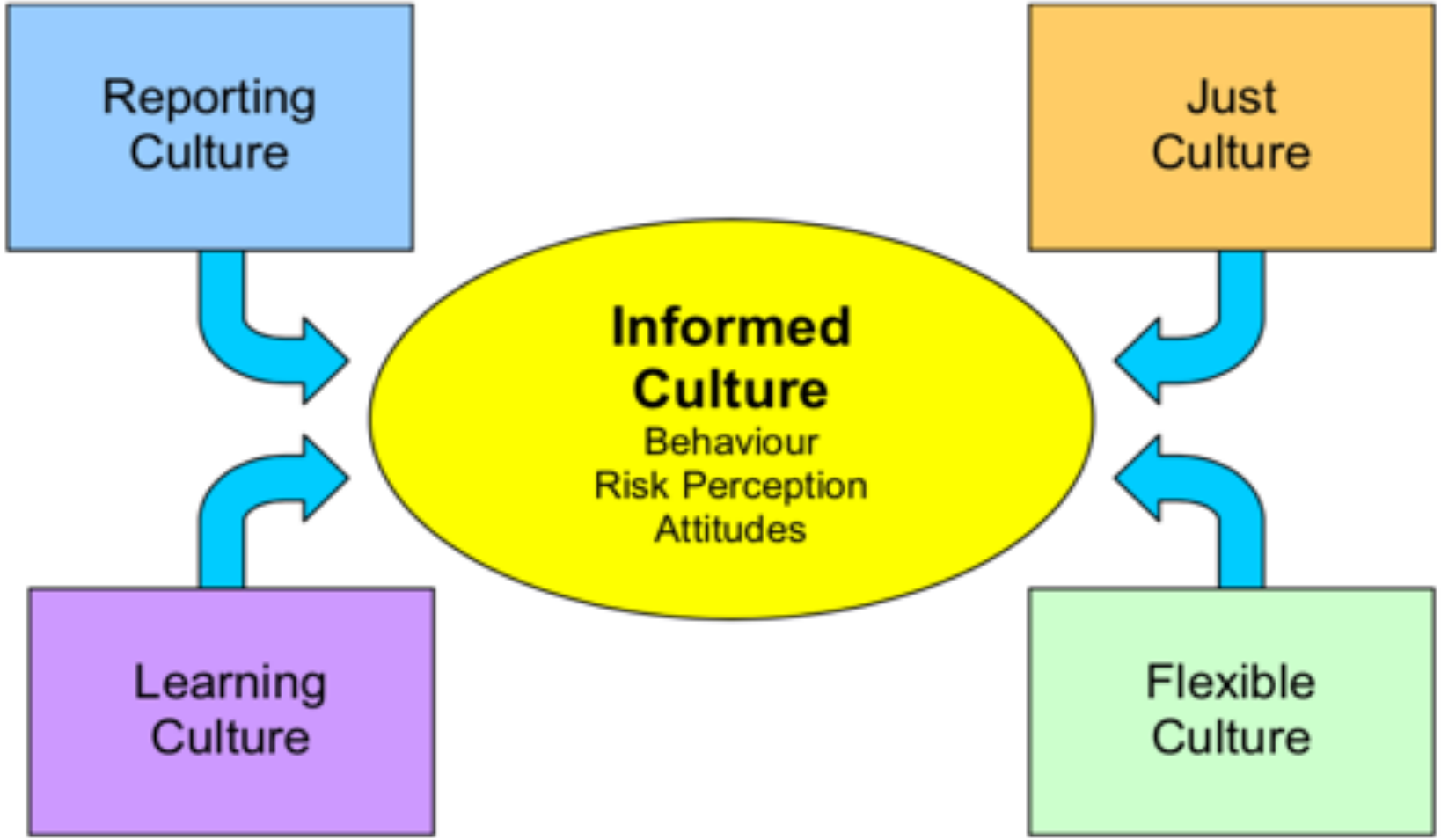


- Organisation is willing to change based on safety indicators and hazards
- Proactive observation and evaluation can help identify vulnerabilities or weaknesses
- Enables continuous learning and improvements to safety

Components of a Healthy Safety Culture



Components of a Healthy Safety Culture

- Safety Consciousness
- Leadership commitment
- Open Communication
- Just Environment

- Involvement of everyone at all levels
- Learning throughout the organisation
- Effective decision-making process
- Reporting, follow-up, feedback and continuous improvement

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Characteristics Mapped Against SMS Elements

Informed Culture Characteristic	SMS Element
Safety consciousness	All, with emphasis on: • Organisational and individual safety responsibilities • Training and education • Risk management process
Leadership commitment	• Organisational and individual safety responsibilities
Open communication	• Organisational and individual safety responsibilities • Safety interfaces • Safety communication
Just environment	• Safety reporting, investigation and Improvement
Involvement of everyone at all levels of the organisation	• Organisational and individual safety responsibilities • Safety interfaces
Learning throughout the organisation	• Safety reporting, investigation and improvement
Effective decision-making processes	• Risk management process • Safety performance monitoring and measuring • Operational safety surveys and SMS audits • Training and education • Safety interfaces
Reporting, follow-up, feedback and continuous improvement	• Safety reporting, investigation and Improvement • Safety performance monitoring and measuring

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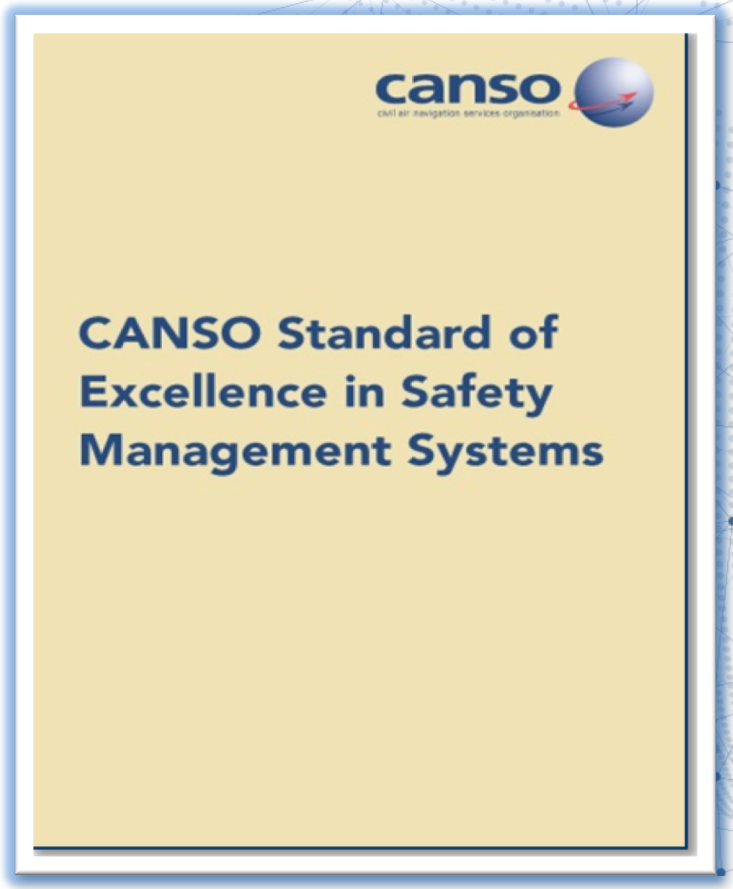
CANSO Standard of Excellence

- In July 2018, CANSO published an updated version of the ***CANSO Standard of Excellence in Safety Management Systems (SoE in SMS)***
- Draws on ***experiences*** of CANSO Members to develop a framework that helps ANSPs ***continually improve*** their efforts to manage safety
- Aligns with the ***ICAO's Annex on Safety Management (Annex 19)***
- Incorporates the latest developments in ***safety management thinking and practice***



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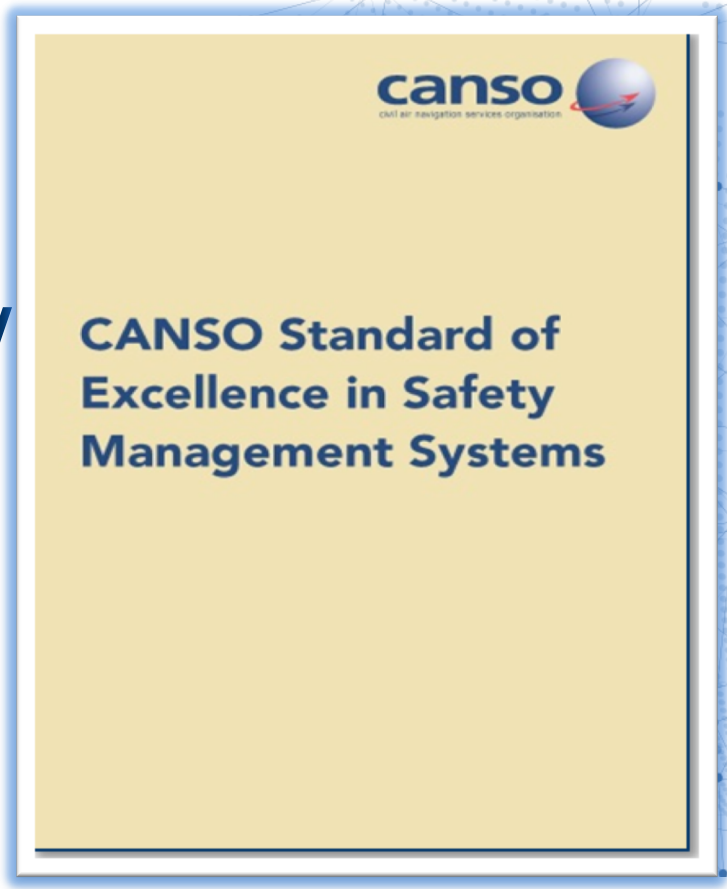
Objectives of the CANSO SoE in SMS

- Encourage ***improvement within and transfer learning across*** the CNS industry
- Help CANSO Members demonstrate alignment with ***SMS aspects of Annex 19***, and build an SMS that ***fits the size and complexity*** of its operation
- Provides a path for ***continuous improvement beyond*** the requirements set by regulators
- Enables ANSP management to ***directly and deliberately plan*** for safety ***at all levels***, thereby ensuring risks to operational service delivery are minimised



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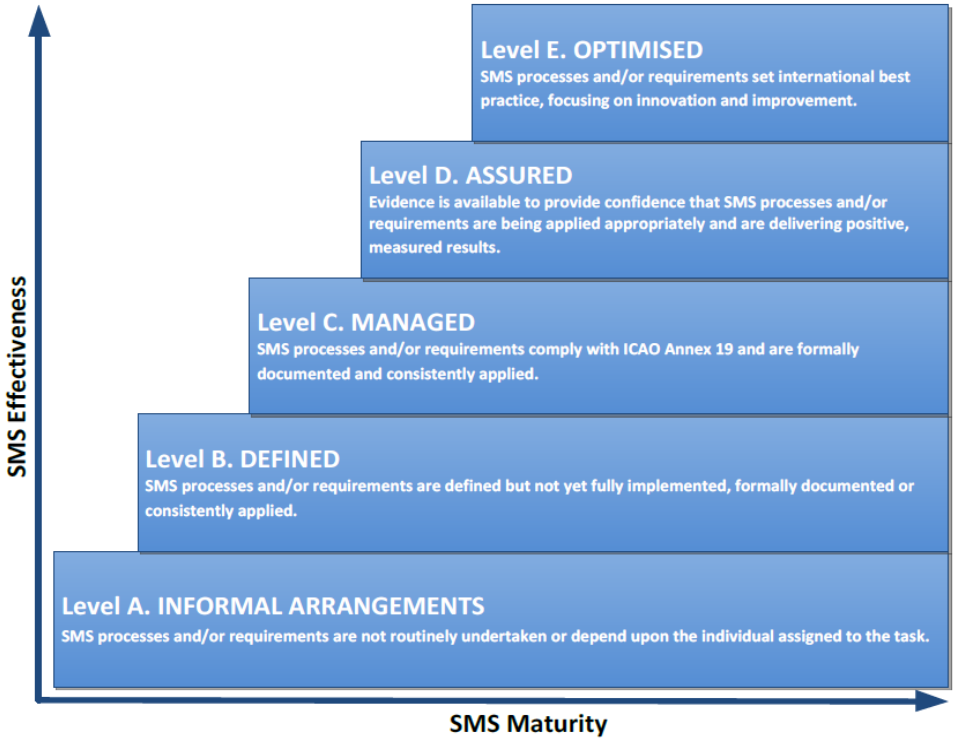
Utility and Benefits of CANSO SoE in SMS

- Emphasises a ***phased, step-by-step approach*** to implementing an SMS
- Identifies ***5 distinct levels***, starting from the most basic, informal arrangements, and works toward optimised systems
- Allows safety managers to ***prioritise their safety efforts*** and to initially focus on fundamentals
- Enables ANSP management to ***measure and understand SMS maturity in their organization***, as well as be measured against the CNS industry standard



Self-Assessment Tool and Annual Survey

To allow individual ANSPs to conduct a self-assessment of their SMS against the SoE in SMS, CANSO partnered with EUROCONTROL to administer the ***EUROCONTROL/CANSO Standard of Excellence in Safety Management Systems Questionaire***

- Walks user through specific questions about their SMS covering the 17 study areas in the SoE in SMS
- By answering the questionnaire, the ANSP is able to ***identify areas of strength***, as well as areas that ***need improvement*** in their SMS
- Issued by CANSO in April/May of each year
- Answers are due in June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EUROCONTROL

RELEASED ISSUE

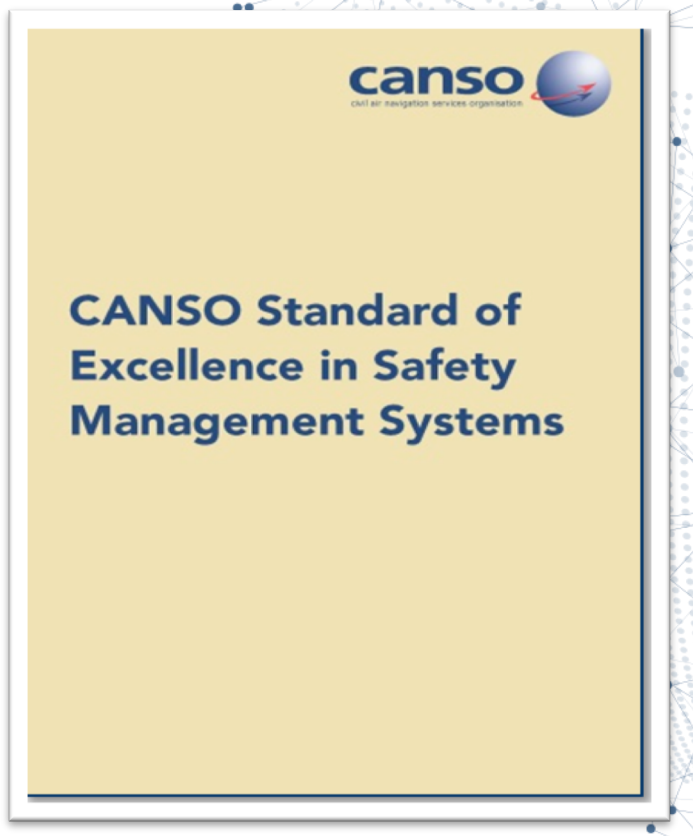
EUROCONTROL/CANSO
SMS Standard of Excellence
2014 Measurement
Overall Status of ANSPs

Edition Number:	1.0
Edition Date:	05/02/2015
Status:	Released Issue
Intended for:	Restricted Audience

EUROPEAN AIR TRAFFIC MANAGEMENT

CANSO Expert Assessment Programme

- ***SEANS-Safety*** provides an independent, expert assessment and validation of the SMS maturity levels of CANSO Member ANSPs
- The ***CANSO Standards of Excellence in Safety Management Systems*** is the guidance for all SEANS-Safety assessments
- SEANS-Safety assessments are ***confidential***
- Assessments can be used to determine compliance with ***ICAO Annex-19***



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