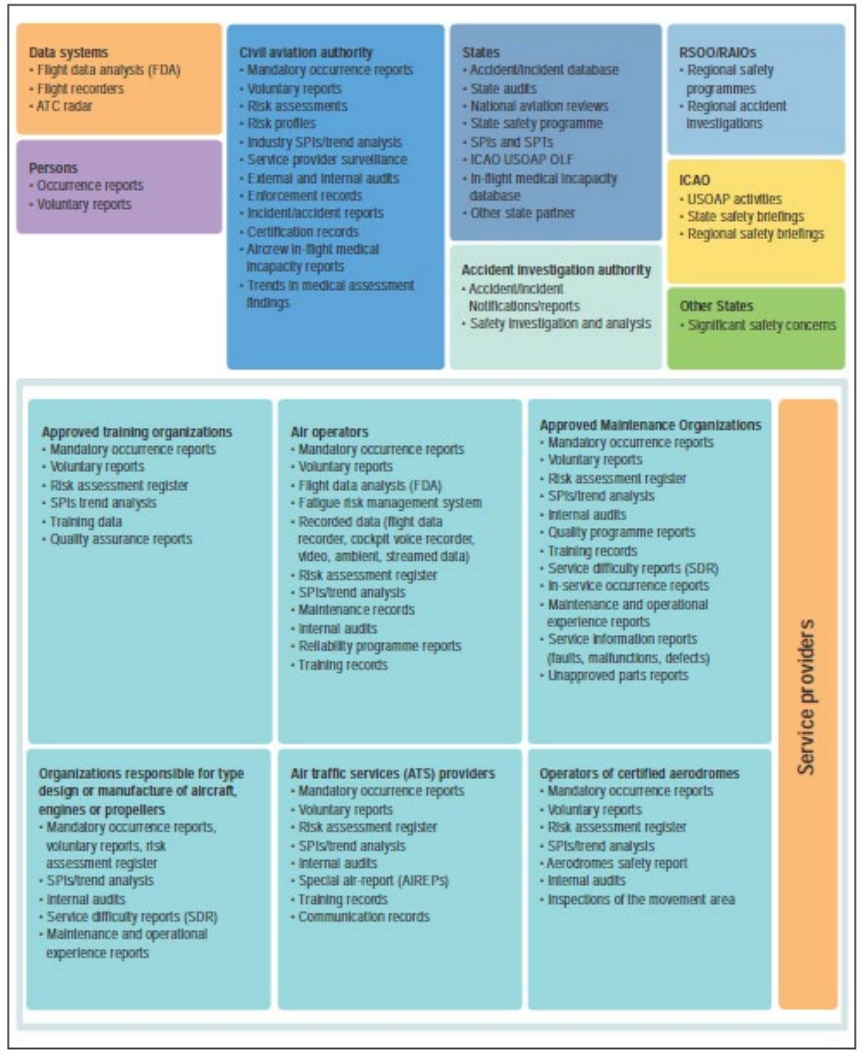
Building Resilience and Advancing Predictive Safety



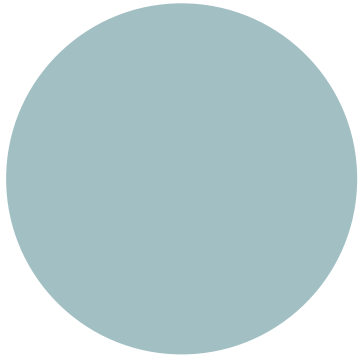
Carl Holt, Manager SMS, Group Safety

The Aviation ‘System’

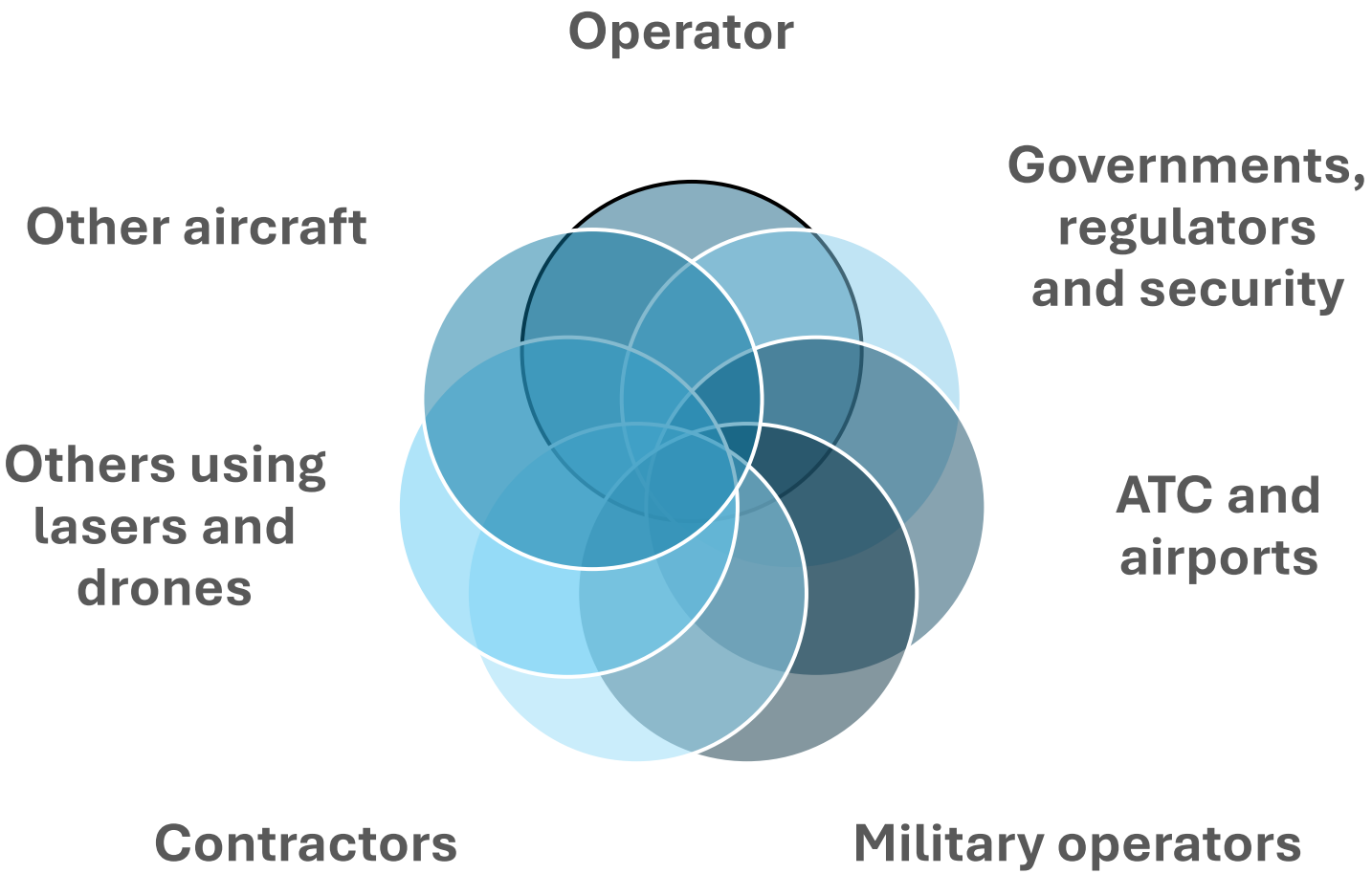


ICAO SMM Figure 5-1. Typical safety data and safety information sources

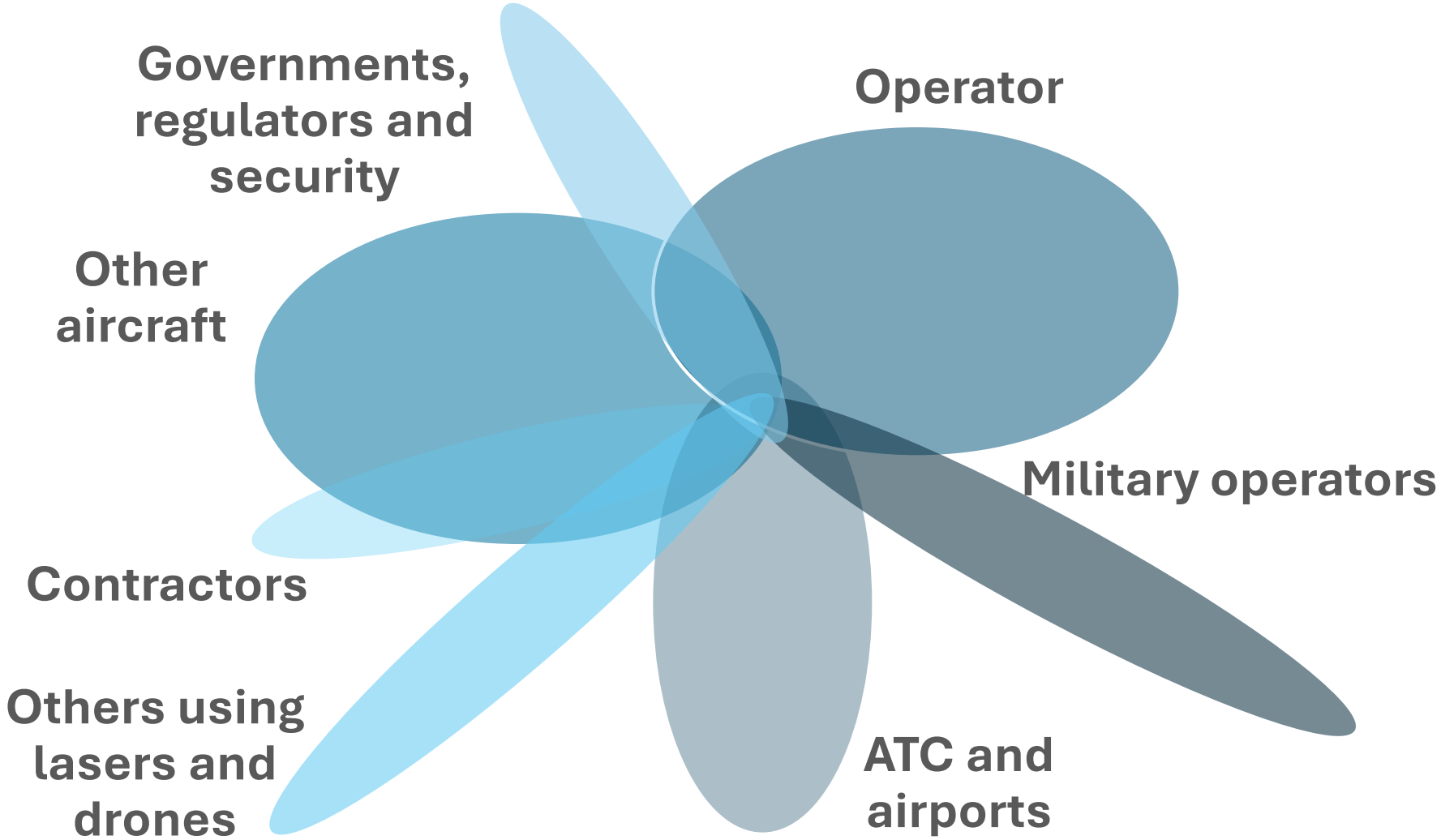
Operator



The Aviation ‘System’



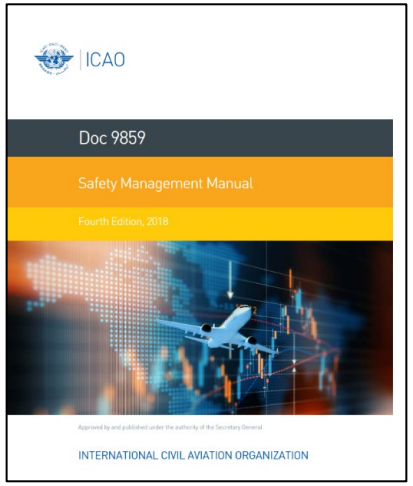
‘System’ Resilience



Advancing Predictive Safety

ICAO Doc 9859 Safety Management Manual (SMM) 6.2.3 'Predictive Analysis'

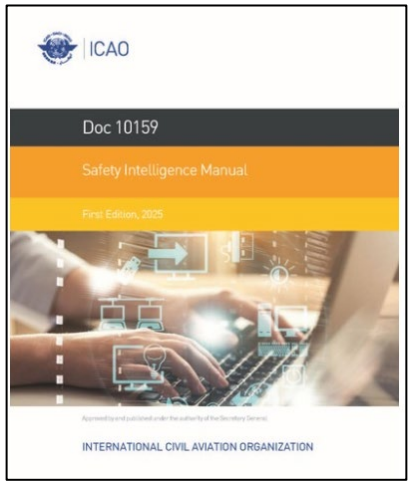
Other types of analyses include probability or predictive analyses that extract information from historical and current data and use it to predict trends and behaviour patterns. The patterns found in the data help identify emerging risks and opportunities. Often the unknown event of interest is in the future, but predictive analysis can be applied to any type of unknown in the past, present or future. The core of predictive analysis relies on capturing relationships between variables from past occurrences and exploiting them to predict the unknown outcome. Some systems allow users to model different scenarios of risks or opportunities with different outcomes. This enables decision makers to assess the decisions they can make in the face of different unknown circumstances and to evaluate how they can effectively allocate limited resources to areas where the highest risks or best opportunities exist.



ICAO DOC 10159 Safety Intelligence Manual 1-1-7 (Figure 1-1)

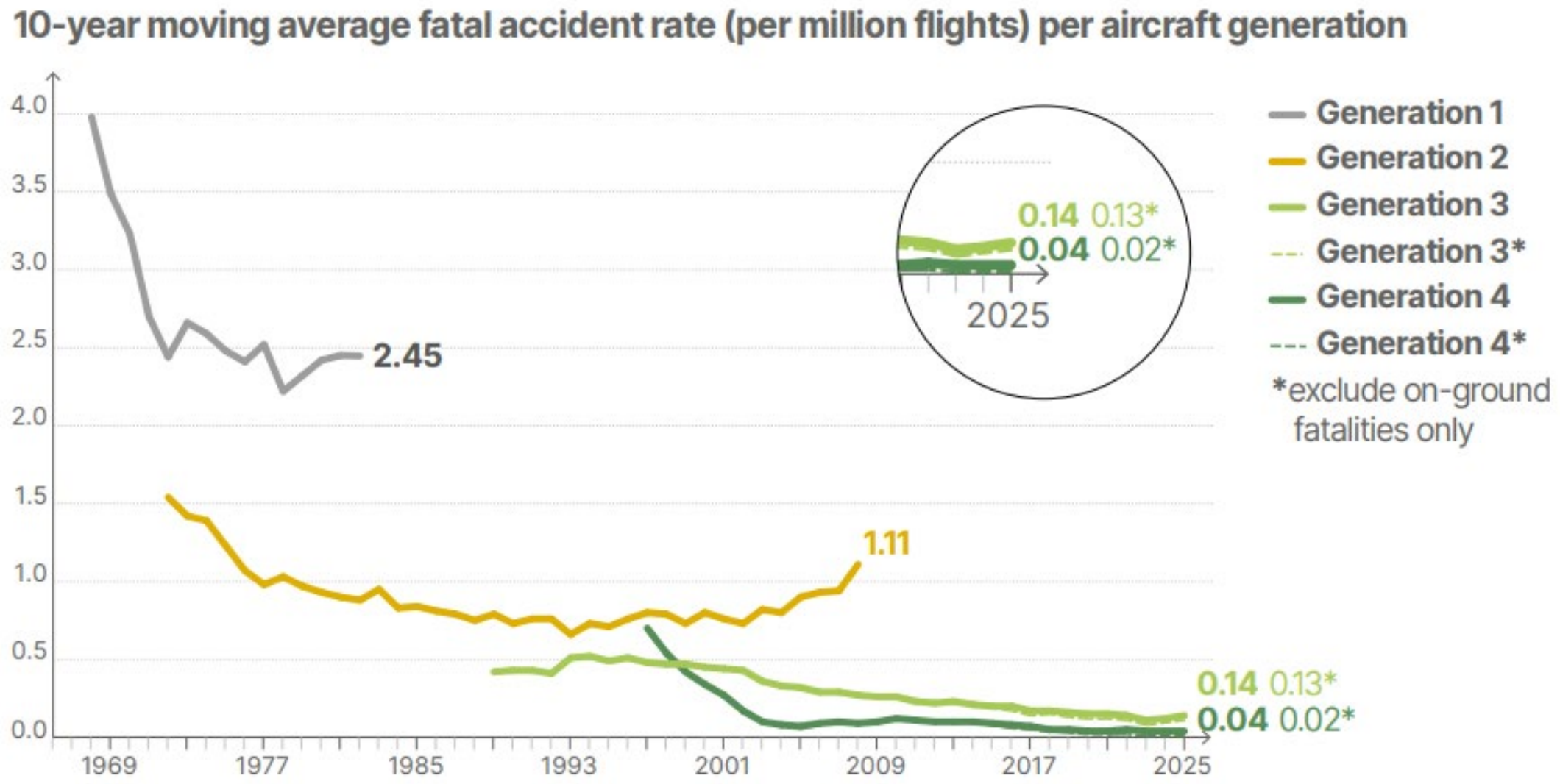
Data (facts) → **Information** (meaning) → **Intelligence** (Insight)

Intelligence: Results of data analysis and interpretation to uncover patterns, trends and relationships. Answers why and how things happen. Supports well-informed decision and effective actions and enables advanced analysis for example predictive analysis.



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Advancing Predictive Safety



Source: Airbus 'A Statistical Analysis of Commercial Aviation Accidents 1958 – 2025'

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Hazard Identification – Operators Perspective

Examples of Internal Hazard Identification Sources
• Normal operations monitoring including using observational techniques to monitor day-to-day operations and activities e.g. observation engagement activities; compliance monitoring audits and normal operations safety survey activities. • Workshops / meetings in which subject matter experts conduct detailed analysis scenarios. Such sessions can benefit from the contributions of a range of experienced operational and technical personnel. Existing safety review meetings (e.g. MSRC; Safety Boards; SAGs) can be used for such activities as well as also be used to assess associated safety risks. • Automated monitoring systems using automated recording systems to monitor parameters that can be analysed such as Flight Data Monitoring (FDM). • Voluntary and mandatory safety reporting systems and other sources feeding into the SDCPS with the aim to maximise the sources of information so providing everyone, including staff from external organisations, with opportunities to report hazards and other safety issues to the organisation. • Safety surveys and audits can be used to identify hazards in the task or process being audited. Such activities should also be coordinated with organisational changes to identify hazards related to the implementation of the change. • Feedback from training including, where conducted, interactive (two way) training enabling the facilitation to identify new hazards from participants; and • The investigation and follow-up of reports on accidents/incidents including hazards identified in internal safety investigations and follow-up reports on accidents/incidents.

Examples of External Hazard Identification Sources
• Aviation accident reports with the reviewing of such accident reports across a global perspective to seek to identify similar aircraft type(s), Human Factors and organisational challenges, geographical or operational environments. • Accident / incident reports across other nonaviation but high-risk industries can provide useful insights into Human Factors and organisational challenges that may have application to assist is aviation hazard identification and safety risk management. • GCAA mandatory and voluntary safety reporting systems as is available to operators. • GCAA oversight audits and third-party audits where-by such external audits can sometimes identify hazards - these may be documented as an unidentified hazard or captured less obviously within an audit finding. • Trade associations (e.g. IATA) and other industry groups (e.g. Gulf Flight Safety Association; UAE Collaborative Safety Team (CST)) provide forums to share safety data / safety information that may include identified hazards.

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Advancing Predictive Safety

Internal qualitative and quantitative data / information

Subject Matter Expert (SME) / Team Engagement Inputs

External qualitative and quantitative data / information

Future Projected Operational Activities and Environment

<u>Safety Risk Assessor / Tolerability Decision Maker</u>

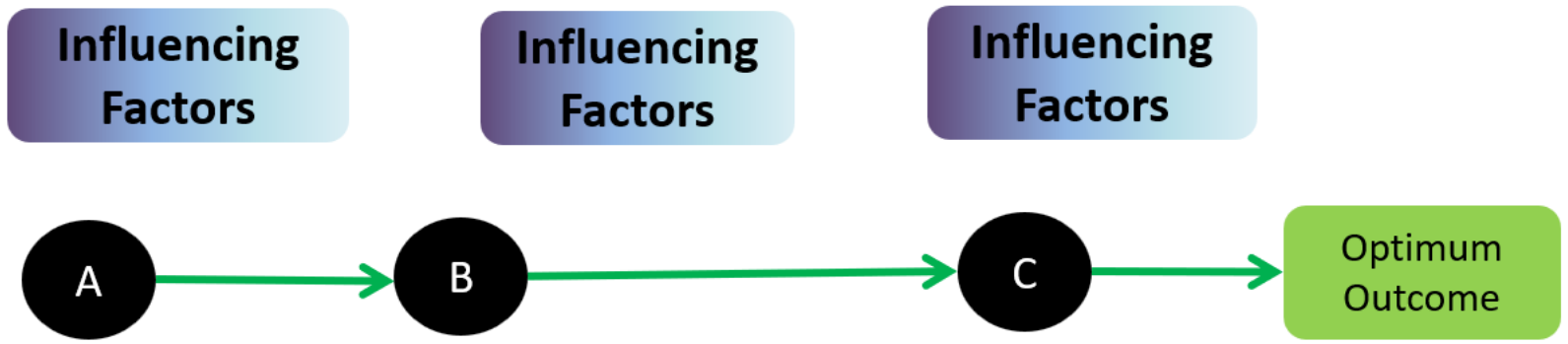
Review of available information / data sources including expected effectiveness of barriers / mitigations and projection of future operational activities and environment

Probability Linked to Severity for Potential Decision(s)



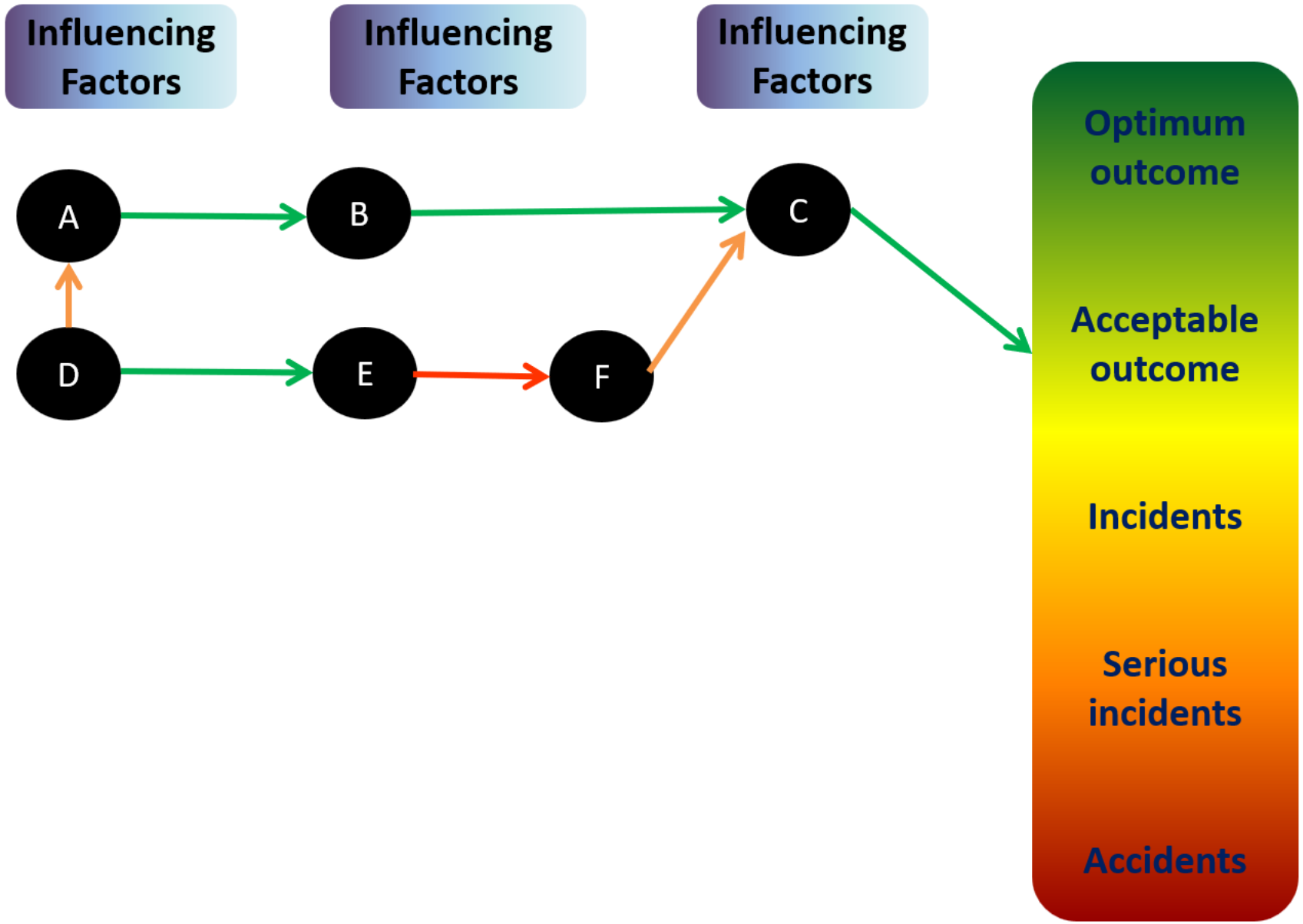
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Causality Network



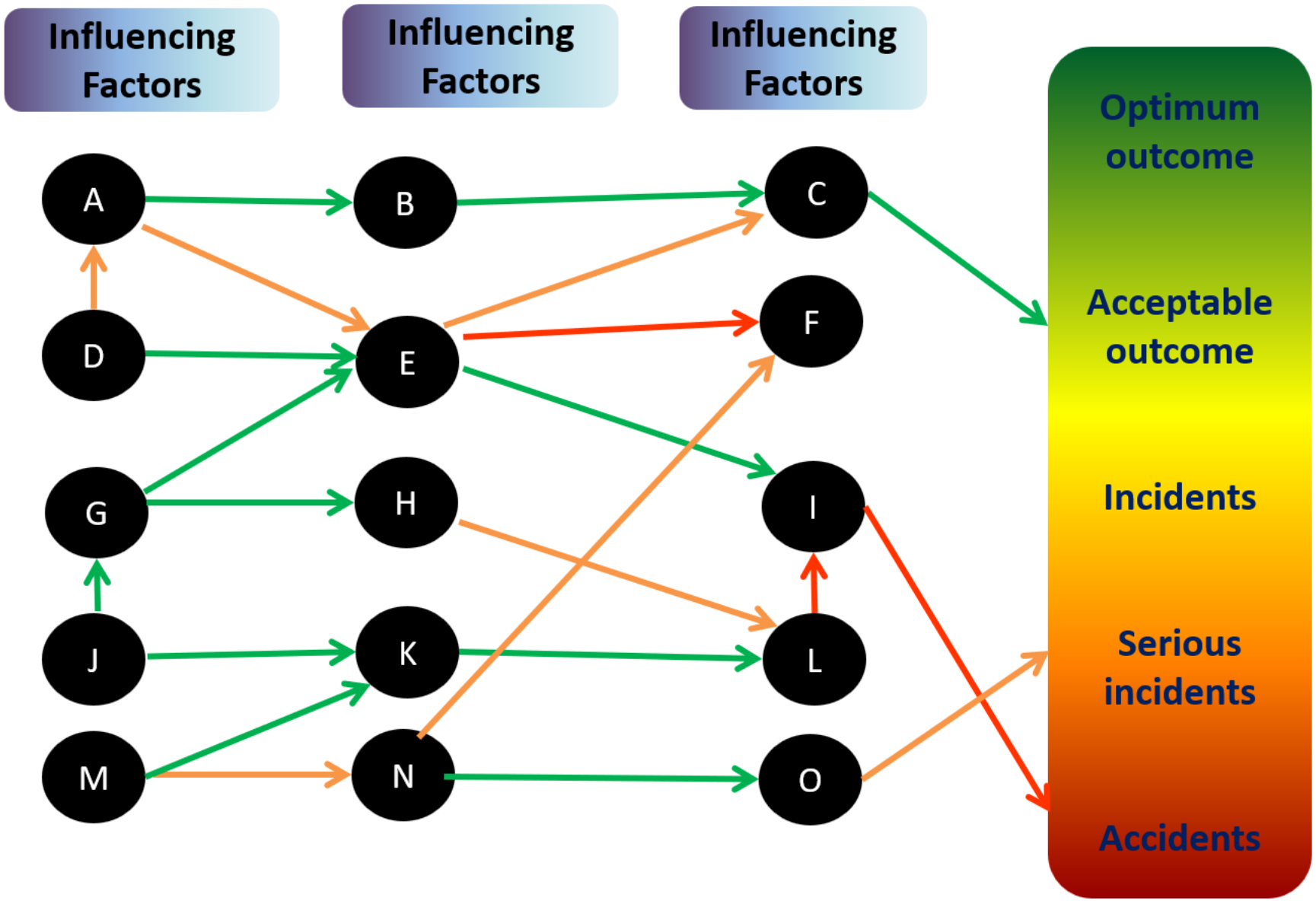
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Causality Network



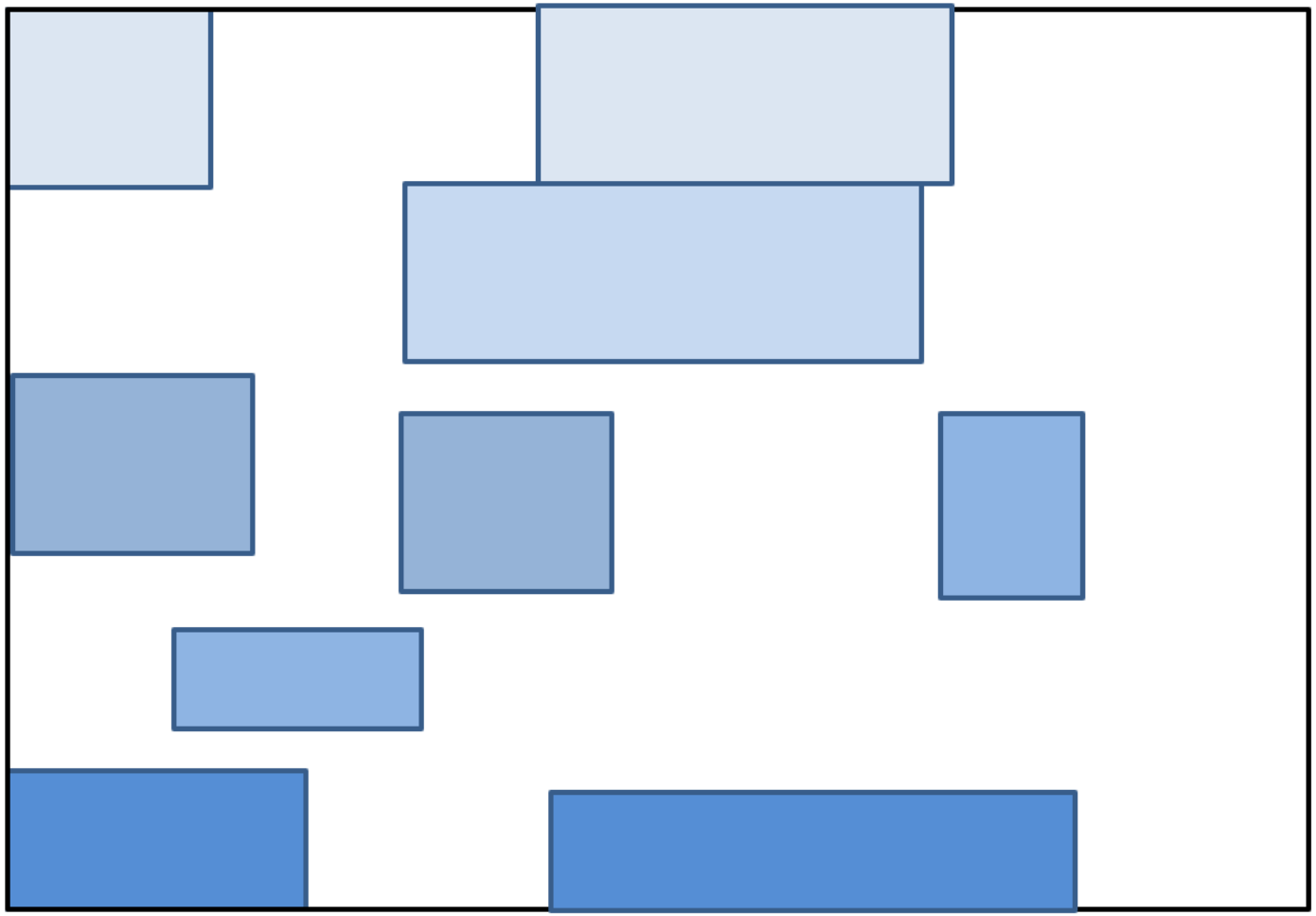
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Causality Analysis Limitations



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Causality Network Reality

Influencing Factors

Influencing Factors

Influencing Factors



Optimum outcome

Acceptable outcome

Incidents

Serious incidents

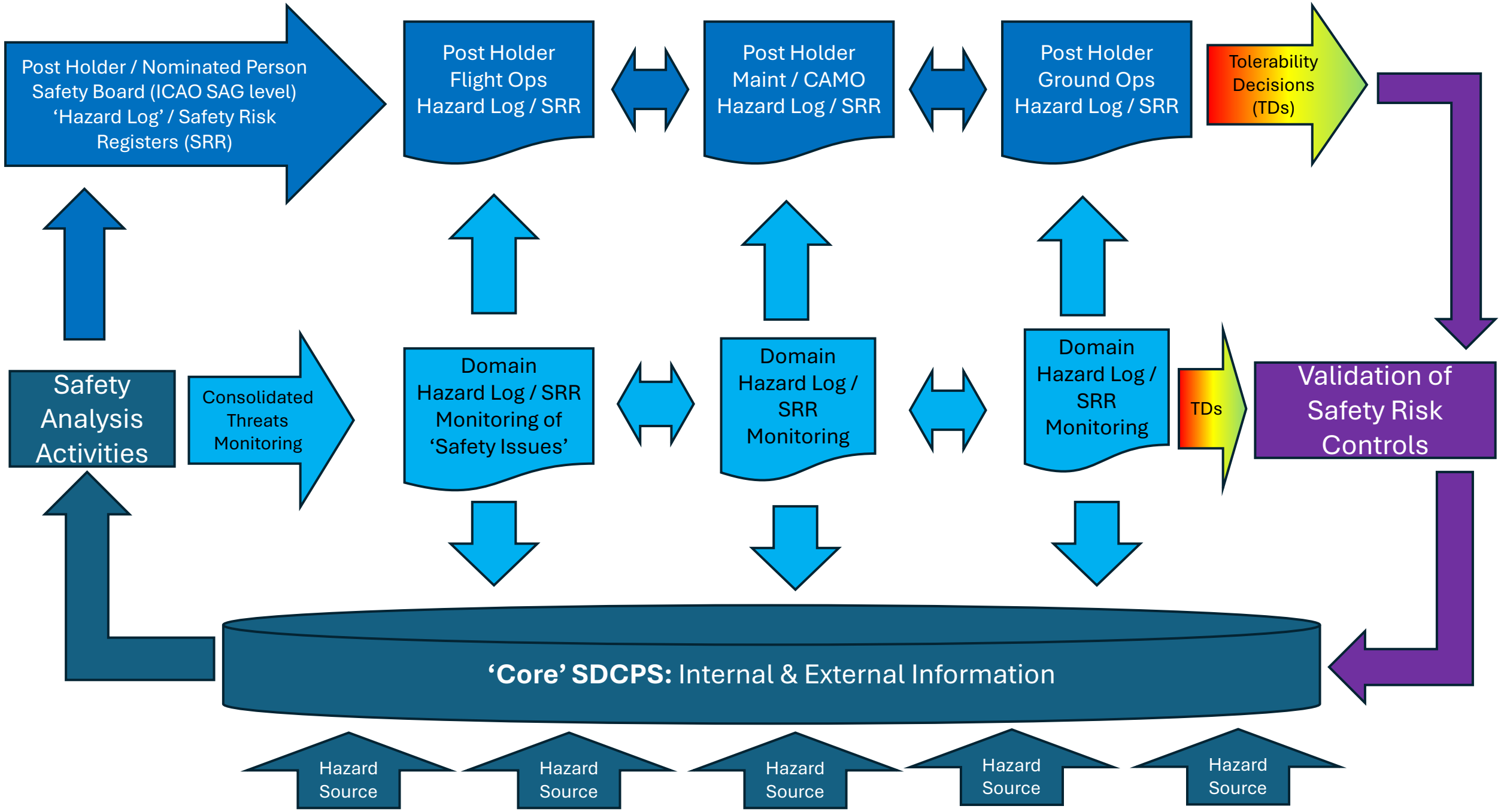
Accidents

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A Practical Approach - Hazard Logs



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Combining Hazard Logs

Data systems
- Flight data analysis (FDA)
- Flight recorders
- ATC radar

Persons
- Occurrence reports
- Voluntary reports

Civil aviation authority
- Mandatory occurrence reports
- Voluntary reports
- Risk assessments
- Risk profiles
- Industry SPIs/trend analysis
- Service provider surveillance
- External and internal audits
- Enforcement records
- Incident/accident reports
- Certification records
- Aircrew in-flight medical incapacity reports
- Trends in medical assessment findings

States
- Accident/incident database
- State audits
- National aviation reviews
- State safety programme
- SPIs and SPTs
- ICAO USOAP OLF
- In-flight medical incapacity database
- Other state partner

Accident investigation authority
- Accident/incident Notifications/reports
- Safety investigation and analysis

RSOO/RAIOs
- Regional safety programmes
- Regional accident investigations

ICAO
- USOAP activities
- State safety briefings
- Regional safety briefings

Other States
- Significant safety concerns

Approved training organizations
- Mandatory occurrence reports
- Voluntary reports
- Risk assessment register
- SPIs trend analysis
- Training data
- Quality assurance reports

Air operators
- Mandatory occurrence reports
- Voluntary reports
- Flight data analysis (FDA)
- Fatigue risk management system
- Recorded data (flight data recorder, cockpit voice recorder, video, ambient, streamed data)
- Risk assessment register
- SPIs/trend analysis
- Maintenance records
- Internal audits
- Reliability programme reports
- Training records

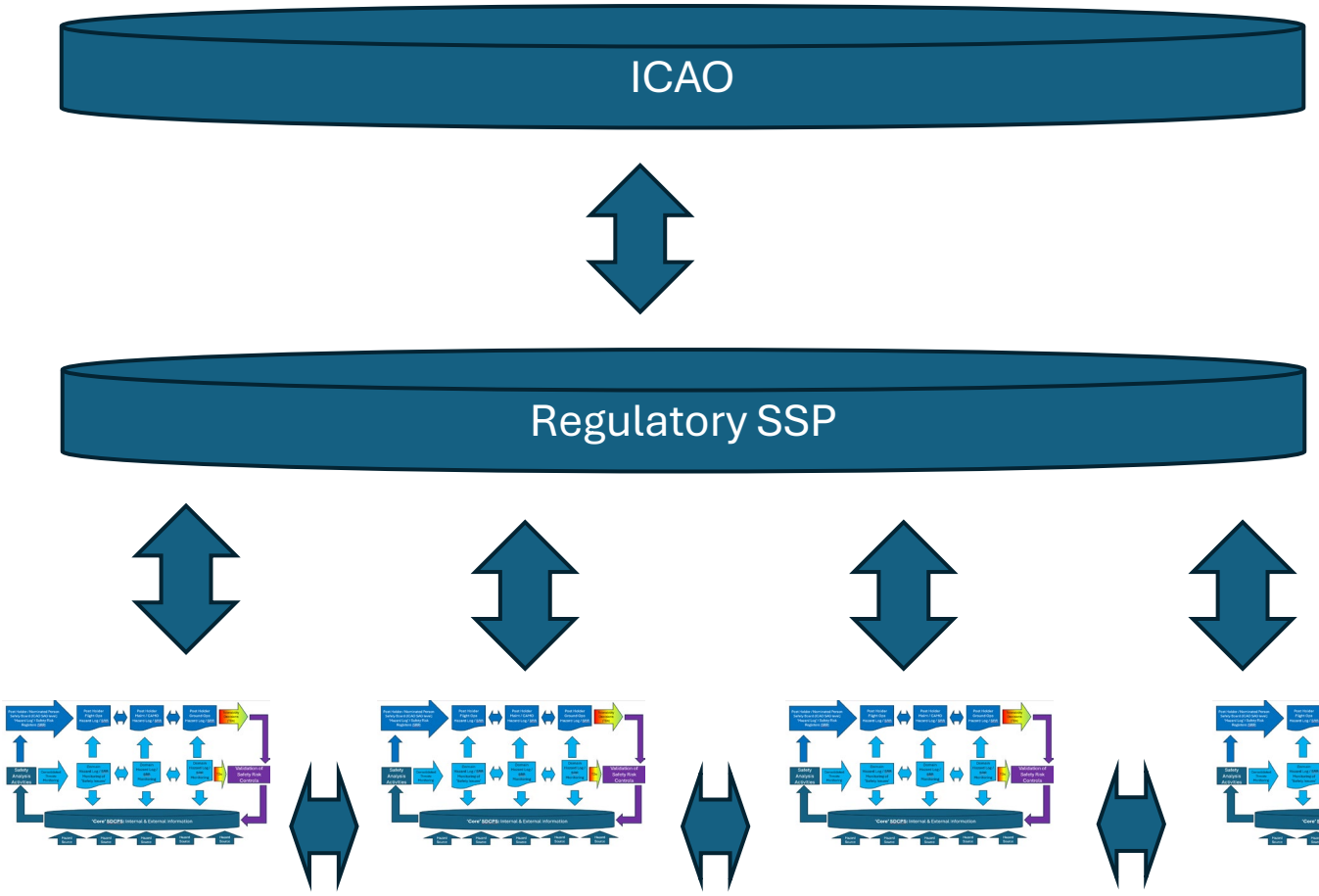
Approved Maintenance Organizations
- Mandatory occurrence reports
- Voluntary reports
- Risk assessment register
- SPIs/trend analysis
- Internal audits
- Quality programme reports
- Training records
- Service difficulty reports (SDR)
- In-service occurrence reports
- Maintenance and operational experience reports
- Service information reports (faults, malfunctions, defects)
- Unapproved parts reports

Organizations responsible for type design or manufacture of aircraft, engines or propellers
- Mandatory occurrence reports, voluntary reports, risk assessment register
- SPIs/trend analysis
- Internal audits
- Service difficulty reports (SDR)
- Maintenance and operational experience reports

Air traffic services (ATS) providers
- Mandatory occurrence reports
- Voluntary reports
- Risk assessment register
- SPIs/trend analysis
- Internal audits
- Special air-report (AIREPs)
- Training records
- Communication records

Operators of certified aerodromes
- Mandatory occurrence reports
- Voluntary reports
- Risk assessment register
- SPIs/trend analysis
- Aerodromes safety report
- Internal audits
- Inspections of the movement area

Service providers



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Thank You

