Hazards & Risks

Hazard:
A condition or an object with the potential to cause or contribute to an aircraft incident or accident
- Bad weather, wires, fatigue, wildlife

Safety risk:
The predicted probability and severity of the consequences or outcomes of a hazard
- Increased risk of bird strike winter-time

Sources: Doc 9859, CASA, Marra et al., 2009, birdnote.org
What is a risk profile?

Quantitative analysis of the various types of threats faced

• Non-subjective

• Assists the organization to prioritize its mitigating and corrective measures

• Aids in identification of necessary resources to mitigate risk

Sources: Transport Canada, TechTarget
Components of a risk profile

Probability – likelihood that a safety consequence or outcome will occur

Table 1. Safety risk probability table

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>Meaning</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequent</td>
<td>Likely to occur many times (has occurred frequently)</td>
<td>5</td>
</tr>
<tr>
<td>Occasional</td>
<td>Likely to occur sometimes (has occurred infrequently)</td>
<td>4</td>
</tr>
<tr>
<td>Remote</td>
<td>Unlikely to occur, but possible (has occurred rarely)</td>
<td>3</td>
</tr>
<tr>
<td>Improbable</td>
<td>Very unlikely to occur (not known to have occurred)</td>
<td>2</td>
</tr>
<tr>
<td>Extremely improbable</td>
<td>Almost inconceivable that the event will occur</td>
<td>1</td>
</tr>
</tbody>
</table>

Sources: Doc 9859
Components of a risk profile

Severity – the extent of harm that might reasonably be expected to occur as a consequence or outcome of the identified hazard

<table>
<thead>
<tr>
<th>Severity</th>
<th>Meaning</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catastrophic</td>
<td>- Aircraft / equipment destroyed&lt;br&gt;- Multiple deaths</td>
<td>A</td>
</tr>
<tr>
<td>Hazardous</td>
<td>- A large reduction in safety margins, physical distress or a workload such that operational personnel cannot be relied upon to perform their tasks accurately or completely&lt;br&gt;- Serious injury&lt;br&gt;- Major equipment damage</td>
<td>B</td>
</tr>
<tr>
<td>Major</td>
<td>- A significant reduction in safety margins, a reduction in the ability of operational personnel to cope with adverse operating conditions as a result of an increase in workload or as a result of conditions impairing their efficiency&lt;br&gt;- Serious incident&lt;br&gt;- Injury to persons</td>
<td>C</td>
</tr>
<tr>
<td>Minor</td>
<td>- Nuisance&lt;br&gt;- Operating limitations&lt;br&gt;- Use of emergency procedures&lt;br&gt;- Minor incident</td>
<td>D</td>
</tr>
<tr>
<td>Negligible</td>
<td>- Few consequences</td>
<td>E</td>
</tr>
</tbody>
</table>

Sources: Doc 9859
Components of a risk profile

Tolerability – readiness to bear risk after treatment in order to achieve objectives

- Safety risk index rating is created by combining probability and severity scores

Table 4. Example of safety risk tolerability

<table>
<thead>
<tr>
<th>Safety Risk Index Range</th>
<th>Safety Risk Description</th>
<th>Recommended Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>5A, 5B, 5C, 4A, 4B, 3A</td>
<td>INTOLERABLE</td>
<td>Take immediate action to mitigate the risk or stop the activity. Perform priority safety risk mitigation to ensure additional or enhanced preventative controls are in place to bring down the safety risk index to tolerable.</td>
</tr>
<tr>
<td>5D, 5E, 4C, 4D, 4E, 3B, 3C, 3D, 2A, 2B, 2C, 1A</td>
<td>TOLERABLE</td>
<td>Can be tolerated based on the safety risk mitigation. It may require management decision to accept the risk.</td>
</tr>
<tr>
<td>3E, 2D, 2E, 1B, 1C, 1D, 1E</td>
<td>ACCEPTABLE</td>
<td>Acceptable as is. No further safety risk mitigation required.</td>
</tr>
</tbody>
</table>

Sources: Doc 9859, Marsden, 2015
Elements of a risk profile applied to aviation

Table 3. Example safety risk matrix

<table>
<thead>
<tr>
<th>Safety Risk</th>
<th>Probability</th>
<th>Catastrophic A</th>
<th>Hazardous B</th>
<th>Major C</th>
<th>Minor D</th>
<th>Negligible E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequent</td>
<td>5</td>
<td>5A</td>
<td>5B</td>
<td>5C</td>
<td>5D</td>
<td>5E</td>
</tr>
<tr>
<td>Occasional</td>
<td>4</td>
<td>4A</td>
<td>4B</td>
<td>4C</td>
<td>4D</td>
<td>4E</td>
</tr>
<tr>
<td>Remote</td>
<td>3</td>
<td>3A</td>
<td>3B</td>
<td>3C</td>
<td>3D</td>
<td>3E</td>
</tr>
<tr>
<td>Improbable</td>
<td>2</td>
<td>2A</td>
<td>2B</td>
<td>2C</td>
<td>2D</td>
<td>2E</td>
</tr>
<tr>
<td>Extremely improb</td>
<td>1</td>
<td>1A</td>
<td>1B</td>
<td>1C</td>
<td>1D</td>
<td>1E</td>
</tr>
</tbody>
</table>

Sources: Doc 9859
Risk Profiles and Indicators

INDICATOR CATALOGUE

USE ICAO’S INDICATOR CATALOGUE TO BUILD SAFETY PERFORMANCE INDICATORS FOR YOUR ORGANIZATION
Safety Performance Indicators (SPIs)

- A data-based parameter used for monitoring and assessing safety performance which can feed into the safety profile

  - Lagging - measure events that have already occurred; “outcome-based SPIs”
    - 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 accident or incident, these are sometimes also referred to as precursor indicators

  - Leading - measure processes and inputs being implemented to improve or maintain safety; “activity or process SPIs”

Sources: Doc 9859
iSTARS and SPIs

- Web-based system on ICAO Secure Portal
- Hosts web applications which detail SPIs as well as their respective targets
- Aids in making safety, efficiency and risk analyses
- Aligned to data driven decision making

Risk Profiles and Indicators
Datasets

Web applications are based on a collection of safety and efficiency datasets from various sources
Utilization by CAAs

CAAs can access a snapshot of their State’s performance/activities utilising indicators

- provide specific information on the status, level or condition of something

- expresses achievement, the attainment of a goal or the results of a specific change.
Utilization by Regulatory Bodies

Regulatory bodies such as ICAO can access a snapshot of a State’s performance/activities

- Some indicators are relevant to formulating the State safety risk profile

- Identify and prioritize Universal Safety Oversight Audit Programme (USOAP) Continuous Monitoring Approach (CMA) activities.
Utilization by Regional Bodies

- Cooperative Development of Operational Safety and Continuing Airworthiness Programmes (COSCAPs)
- Regional Safety Oversight Organizations (RSOOs)
- Regional Aviation Safety Groups (RASGs)
- Planning and Implementation Regional Groups (PIRGs)
Utilization by Regional Bodies

- collaborate and share resources, supporting No Country Left Behind (NCLB)
- analyze safety information and hazards to aviation at a regional level and reviewing the action plans
- global guidance and regional harmonization measures
- RASGs develop and implement work programmes that support a regional performance framework for the management of safety on the basis of the Global Aviation Safety Plan (GASP)
Indicators Featured on iSTARS applications
State and Regional Safety Briefings

Performance Dashboard

Provide a comprehensive overview of the state of aviation safety and air transport using indicators
State Safety Briefings

USOAP Results

Universal Safety Oversight Audit Programme (USOAP)

USOAP Results by Area and Critical Element

USOAP CAP Progress

Significant Safety Concerns (SSCs)

Indicators Featured on iSTARS
State Safety Briefings

SSP Foundation

SSP Implementation

Lead: Ruviana Zimmerman and Safety Management Section

Indicators Featured on iSTARS
State Safety Briefings

Global Aviation Training Activities

ICAO, through its Global Aviation Training Office, establishes coordinated, effective and efficient mechanisms to support the development of human resources in aviation, appealing to Member States and the industry. Its objective is to develop training to facilitate the global implementation of ICAO provisions, set up acceptable training qualifications processes and frameworks and provide guidance to States and industry in skills development.

Botswana has 1 TRAINAIR PLUS Member. No ICAO-recognized courses have been developed. No ICAO-recognized courses are under development. In total, 1 ICAO-recognized course was delivered with 21 participants.

Botswana has not developed or delivered any courses in the past 12 months.

Courses Delivered: 1
Courses Developed: 0
Training Centres: 1
Total Participants: 21

PBN Implementation

The implementation of Performance-Based Navigation (PBN) is currently the global aviation community’s highest priority. The PBN concept offers significant benefits including improved safety, increased operational efficiency, and reduced environmental impact. It enables operators to optimize routes and airspace, increase airport capacity, reduce noise emissions, and improve efficiency.

The PBN implementation is measured by the percentage of airports that have implemented PBN procedures. In 2018, 81% of airports worldwide had implemented PBN, with significant progress in regions like Europe and Asia.

Indicators Featured on iSTARS
State Safety Briefings

State Aviation Activity Overview

Indicators Featured on iSTARS
Regional Safety Briefings

USOAP Results and inter-State comparison

Universal Safety Oversight Audit Programme (USOAP)

Indicators Featured on iSTARS
Regional Safety Briefings

SSCs

Safety Partner Programmes

**Significant Safety Concerns (SSCs)**

SSCs indicate that a State is not providing sufficient safety oversight to ensure the effective implementation of applicable ICAO Standards. SSCs may be issued in the area of operations, air navigation services, aerodromes, airworthiness or licensing.

RASG-PA has 1 State with 1 SSC.

<table>
<thead>
<tr>
<th>State</th>
<th>SSCs</th>
<th>Airworthiness</th>
<th>Operations</th>
<th>Licensing</th>
<th>Aerodromes</th>
<th>Air Navigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surname</td>
<td>Yes</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Safety Partner Programs**

The Federal Aviation Administration (FAA) rates States through their International Aviation Safety Audit (IASA) programme. The FAA does not allow air carriers from category 2 States to operate to the United States of America.

In RASG-PA, 2 States are rated Category 2: Barbados, Uruguay.

The European Commission can decide to ban certain airlines from operating in European airspace, if they are found to be unsafe and/or they are not sufficiently overseen by their authorities.

In RASG-PA, 2 States have operational restrictions with regard to European airspace: Suriname, Venezuela (Bolivarian Republic of).
Regional Safety Briefings

Accident Statistics

Regional Priorities

Indicators Featured on iSTARS
Airport Briefings

Map

Performance Dashboard

Indicators Featured on iSTARS
Briefings: Airport

Traffic

- Grantly Adams Intl. is number 1 international airport in Barbados in terms of departures. The number of scheduled departures has increased over the last five years. The airport's compound annual growth rate (CAGR) is +1.52%.

Annual Departures

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Departures</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>10,188</td>
</tr>
<tr>
<td>2014</td>
<td>10,762</td>
</tr>
<tr>
<td>2015</td>
<td>10,314</td>
</tr>
<tr>
<td>2016</td>
<td>10,980</td>
</tr>
<tr>
<td>2017</td>
<td>11,182</td>
</tr>
</tbody>
</table>

International Operations

Grantly Adams Intl. is ranked 16th international airport in 2017 for domestic destinations. The next few international destinations are T.J. OSHA in Saint Kitts and Nevis, and with 4,502 departures per year.

Top 5 Destinations

- USA (4,240)
- UK (1,498)
- Canada (968)
- France (847)
- Germany (797)

International Destinations from Grantly Adams Intl. (42)
Runways and PBN

Safety Oversight and Aerodrome Certification

Indicators Featured on iSTARS
Briefings: Airport

Capacity and Usage

Terrain Challenge

Indicators Featured on iSTARS
Briefings: Airport

Meteorological Conditions

Wind conditions

Indicators Featured on iSTARS
Applications to Aid in Mitigating Risk

Apps to Aid in Risk Mitigation
Risk based surveillance

- Data-driven inspection schedules for operations
- By choosing an operator and filling out a questionnaire based on areas such as safety management and flight ops the following is calculated:
  - safety performance level
  - operational complexity level
  - surveillance intensity level
  - risk-based inspection schedule
Risk based surveillance

Safety Performance

Schedule

The schedule is defining a sample size for each inspection type based on the actual number of elements to be inspected.

<table>
<thead>
<tr>
<th>Activity Type</th>
<th>Related Population</th>
<th>Minimum Activities</th>
<th>Periodicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route Inspection - Cabin</td>
<td>Stations</td>
<td>8</td>
<td>2 months</td>
</tr>
<tr>
<td>Route Inspection - Flight Deck</td>
<td>Stations</td>
<td>8</td>
<td>2 months</td>
</tr>
<tr>
<td>Ramp Inspections</td>
<td>Aircraft</td>
<td>6</td>
<td>2 months</td>
</tr>
<tr>
<td>Station Inspections</td>
<td>Stations</td>
<td>8</td>
<td>2 months</td>
</tr>
<tr>
<td>Check Pilot Inspections</td>
<td>Check Pilots</td>
<td>2</td>
<td>6 months</td>
</tr>
<tr>
<td>Base inspection</td>
<td>-</td>
<td>1</td>
<td>18 months</td>
</tr>
</tbody>
</table>
Solution Centre

• View Protocol Question findings, priorities, and related guidance by State

• For each PQ:
  • a list of related ICAO documents
  • Trainair Plus Courses
  • States (and contact information) that have already solved this question which can help with the resolution of the finding.

• An AI has been developed to map training solutions against PQs, and will continue to evolve over time to better fit
Solution Centre

Unsatisfactory PQs by Area and CE

Click on an area to filter the PQ list

<table>
<thead>
<tr>
<th>LEG</th>
<th>ORG</th>
<th>AIG</th>
<th>PEL</th>
<th>OPS</th>
<th>AIR</th>
<th>ANS</th>
<th>AGA</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE-1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CE-2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CE-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CE-4</td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CE-5</td>
<td></td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CE-6</td>
<td></td>
<td>9</td>
<td>2</td>
<td>6</td>
<td>2</td>
<td></td>
<td></td>
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<tr>
<td>CE-7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>CE-8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

Licensing, Certification, Authorization and Approval Obligations (CE-6) in Operations (OPS) 9

4.147 - Does the flight operations inspection organization ensure that the air operator has requirements, in its operations manual, to establish flight time, flight duty period, duty and rest period limitations for flight and cabin crews, in accordance with state regulations?

- CE-6 - Operations
  - Unsatisfactory

4.149 - Does the flight operations inspection organization ensure that the air operator outlines, in its operations manual, standard operating procedures (SOPs) for each phase of flight?

- CE-6 - Operations
  - Unsatisfactory

4.151 - Does the flight operations inspection organization ensure that the air operator outlines, in its operations manual, instructions on the clarification and acceptance of air traffic control (ATC) clearances, particularly where terrain clearance is involved?

- CE-6 - Operations
  - Unsatisfactory

Apps to Aid in Risk Mitigation

Lead: Marco Merens and Dunia Abboud
4.147 - Does the flight operations inspection organization ensure that the air operator has requirements, in its operations manual, to establish flight time, flight duty period, duty and rest period limitations for flight and cabin crews, in accordance with State regulations?

Documentation
  

- Annex 1: Personnel Licensing Current edition (consolidated)

Trainair Plus Courses
- Aeronautical Information Officer Initial Training developed by Civil Aviation Authority Training Institute (CAATI)

Partners
In RASG-PA, the following States have solved this question. The States in bold have a comparable aviation activity.

Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Brazil, Chile, Colombia, Cuba, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, United States of America, Uruguay, Venezuela (Bolivarian Republic of)
Risk in a Broader Context
Air Transport Accessibility

- Measuring people's access to the international air transport system
- Illustrates the fraction of a State's population living within 100 km of an aerodrome

- Aligned to the UN Sustainable Development Goal Target 9.1: Resilient Infrastructure
  - development of reliable, sustainable and resilient regional trans-border infrastructure
  - economic development and human well-being
  - affordable and equitable access for all.
Air Transport Accessibility

State vs. Group Accessibility

Overall Aerodrome Accessibility by State

Lead: Marco Merens
Contingency Planning

- Contingency planning aid for airspace closures
- ICAO Annex 11 — Air Traffic Services, Section 2.31 - Contingency arrangements
  - in the event of air traffic services disruption in the airspace for which they are responsible for.
- Provides an indicative estimation of the effect on traffic flows when an FIR is closed.
Contingency Planning

The map below shows all traffic in and out of KABUL (KUL). Overflights are shown in orange, inbound/outbound flights in green, and internal flights in blue. Cluster points indicate the number of flights crossing a specific area of the boundary of the zone and give an indication of the major flow directions.

Zone Closure Simulation

Lead: Marco Merens
iSTARS apps allows for

- the multi-dimensional application of information and indicators to aviation system risk profiles
- organizations to enhance hazard identification by the use of both leading and lagging indicators, as well as select suitable actions which can help to substantially reduce risk
Learn more about iSTARS

• The Integrated Aviation Analysis Section offers an iSTARS and Data Analysis Workshop

• Get the most out of iSTARS and learn more about data driven decision making and statistics

• Target audience:
  • Safety analysts and managers
  • SSP/SMS Analysts
  • Accident Data Analysts
iSTARS and Data Analysis Workshop

**Agenda**

<table>
<thead>
<tr>
<th>Time</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:00</td>
<td>Opening</td>
<td>Management</td>
<td>Advanced Statistics</td>
<td>Basic Statistics</td>
</tr>
<tr>
<td></td>
<td>USQAP and SSP</td>
<td>Query and Filtering</td>
<td>Trending</td>
<td></td>
</tr>
<tr>
<td>10:30</td>
<td>Coffee break</td>
<td>SPI Review</td>
<td>Metrics Development</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Probabilities</td>
<td></td>
</tr>
<tr>
<td>12:00-13:00</td>
<td>Lunch break</td>
<td>SPI Review</td>
<td>Visualizations</td>
<td></td>
</tr>
<tr>
<td>14:30</td>
<td>Coffee break</td>
<td></td>
<td>Safety Briefing</td>
<td>Close</td>
</tr>
<tr>
<td>16:00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Cost**

US$ 5000.00 for the conduct of the workshop plus airfare and daily allowance for the facilitator(s) per ICAO travel rules. Facilities and internet access to be provided by the organizer.

For more information, please contact: iSTARS@icao.int