

**61ST CONFERENCE OF
DIRECTORS GENERAL OF CIVIL AVIATION
ASIA AND PACIFIC REGION**

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AGENDA ITEM 3: AVIATION SAFETY

**AI-SUPPORTED STATE SAFETY INTELLIGENCE
ANALYTICS FOR RISK-BASED OVERSIGHT OF AOC AND
AMO OPERATIONS**

(Presented by the Republic of the Philippines)

SUMMARY

This paper discusses the limitations faced by many civil aviation authorities (CAAs) in using safety data from air operators (AOCs) and approved maintenance organizations (AMOs) to support risk-based oversight that evolves from reactive, to proactive, to predictive. It proposes an integrated use of Artificial Intelligence (AI) to enable a shorter, fact-finding and evidence-based approach to root cause safety evaluation, using advanced safety analytics on existing MOR and related data to support realistic and attainable, timebound safety recommendations. This shift strengthens the link between safety investigation and the State's certification and safety surveillance oversight functions, and is intended to eliminate investigative activities that consume resources without adding safety value from the perspective of aviation stakeholders, while remaining consistent with recognized safety standards and recommended practices.

AI-SUPPORTED STATE SAFETY INTELLIGENCE ANALYTICS FOR RISK-BASED OVERSIGHT OF AOC AND AMO OPERATIONS

1. INTRODUCTION

- 1.1 Mitigating aviation hazards is a central responsibility of States. Annex 19 and State Safety Programme (SSP) frameworks expect civil aviation authorities (CAAs) to use safety data from air operators and approved maintenance organizations (AMOs), including SMS reports, mandatory occurrence reports and flight data analysis, to support reactive, proactive and predictive risk-based safety oversight.
- 1.2 Mandatory occurrence reports (MORs) from AOC holders and AMOs are one of the primary inputs to safety oversight, but investigations can be slow and resource intensive when each report is treated in isolation and analysis is mostly manual. This limits the State's ability to obtain a consolidated picture of operational risk and to implement genuinely risk-based and predictive oversight in line with global aviation safety plan (GASP) objectives.
- 1.3 Recent advances in artificial intelligence (AI) and data analytics provide an opportunity for States to strengthen their safety intelligence capability by applying advanced analytical techniques to de-identified safety data from AOC holders and AMOs. When implemented within a robust safety data protection framework, and with outputs reviewed and interpreted by qualified safety inspectors, AI-supported safety intelligence can help States classify and prioritize MORs by risk and context, shorten the time from occurrence to initial safety assessment, and support the development of safety recommendations that are both proportionate and practicable for the operator and other stakeholders.
- 1.4 This paper describes a conceptual approach for the use of AI-supported safety intelligence by States in aviation safety and presents a high-level model for integrating AI-enabled analytics into CAA safety oversight processes while responsibly adopting such capabilities.

2. DISCUSSION

- 2.1 Most CAAs already hold substantial volumes of safety-relevant data on air operators and AMOs. Experience shared by Transport Canada Civil Aviation at an ICAO risk-based surveillance workshop has highlighted that the foundation of effective surveillance is not the volume of data collected, but whether that data is reliable and meaningful enough to support sound safety decisions.
- 2.2 Within the framework of the SSP, States receive mandatory occurrence reports from AOC holders and AMOs under national regulations. In practice, these data are often stored in separate, poorly integrated systems and analyzed largely on a manual basis. Data formats and taxonomies used by AOC holders and AMOs frequently differ, and some reports still arrive in paper or basic spreadsheet form, with limited validation. This fragmentation makes it difficult for the authority to build a complete picture of operational risk.
- 2.3 As a result, many CAAs remain structurally reactive, which limits the practical implementation of risk-based and predictive oversight envisioned under ICAO's safety oversight and RBS frameworks.
- 2.4 **Using AI-supported safety intelligence to accelerate MOR-based investigations**
- 2.5 In this context, AI-supported safety intelligence offers a means for CAAs to make better use of the safety data they already receive, particularly MORs, by enhancing analysis rather than expanding reporting obligations. AI-supported analytics applied to MORs, within defined investigation timelines, can help the authority rapidly identify similar events, recurring patterns and contributing factors. It reduces the time needed to scope an investigation and to formulate realistic, targeted safety recommendations for the operator and other concerned stakeholders,

supporting a shift from predominantly reactive oversight toward more proactive and predictive practices

- 2.6 Beyond simply accelerating the process, this integrated use of AI supports a more structured, fact-finding and evidence-based approach to root cause analysis, allowing investigators to move from raw occurrence data to a defensible understanding of contributing and systemic factors within a shorter and more predictable timeframe.
- 2.7 **AI-supported safety intelligence for State oversight**
- 2.8 The limitation identified above demonstrates not a scarcity of data, but a shortage of analytical capacity to turn existing AOC and AMO data into usable safety intelligence. Artificial intelligence (AI) and machine learning techniques applied to occurrence reports, FDA/FOQA outputs and maintenance records can process volumes and combinations of data beyond manual analytical capacity, surfacing patterns, correlations and emerging hazards that would otherwise remain hidden across disconnected systems.
- 2.9 AI-supported analytics can strengthen the State's regulatory functions by extracting more from safety data the State already holds. However, it should be treated as a decision-support capability and does not replace regulatory judgment. AI outputs such as flagged patterns, risk scores, anomaly alerts, should still be reviewed and interpreted by qualified safety inspectors and analysts before informing surveillance planning, investigations or regulatory action, consistent with a human-centric approach to AI in aviation.
- 2.10 For this capability to be reliable, it must operate within the safety data protection principles of Annex 19, including safeguards for just culture, restricted use of safety data, and controls that preserve the integrity of data from collection through analysis.
- 2.11 These capabilities shift the regulator's position from reactive to anticipatory by enabling action on evidence of emerging risk before it accumulates into findings. By shortening the time needed to move from raw occurrence reports to an evidence-based understanding of the underlying hazards, States can focus investigations on issues with the highest safety impact and develop recommendations that are attainable within the operator's context while still aligned with the State's safety objectives and the GASP.
- 2.12 The intent is not the automation of regulatory judgment, but augmentation of the State's capacity to see risk earlier and act on it with evidence, in line with ongoing ICAO work on the responsible integration of artificial intelligence into aviation safety management and oversight.

3. ACTION BY THE CONFERENCE

- 3.1 The Conference is invited to:
- a) note the limitations many States face in using fragmented safety data from air operators and AMOs to support risk-based and predictive safety oversight under their State Safety Programme;
 - b) encourage States to explore the establishment and/or strengthening of AI-supported safety intelligence capabilities within their civil aviation authorities, using de-identified safety data from AOC holders and AMOs to support hazard identification, trend analysis and surveillance prioritization, consistent with Annex 19 and the Safety Management Manual; and
 - c) request ICAO APAC to consider facilitating regional exchange of experience, guidance and, where appropriate, regional or multi-State initiatives on the use of AI-enabled analytics for State aviation safety oversight, including practical implementation support for resource-constrained authorities and governance models for data integrity, just culture and the protection of safety information.

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