International Civil Aviation Organization

MIDANPIRG/20 and RASG-MID/10 Meetings

(Muscat, Oman, 14-17 May 2023)

Agenda Item 5.2: Outcomes of the SEIG

ADVANCED DATA ANALYTICS IN AVIATION SAFETY

(Presented by The United States)

SUMMARY

States of Design (SoD) need safety data for their products from other States of Registry (SoR) in order to effectively comply with their obligations under the Convention on International Civil Aviation and to support SoR in managing their fleets. Regulators also need tools to efficiently interpret large amounts of safety data that inform safety decisions. This paper highlights the urgency in strengthening safety data sharing internationally and how the United States (U.S.) Federal Aviation Administration (FAA) is building capabilities in this area and exploring opportunities for global engagement.

REFERENCES

- Annex 8 — Airworthiness of Aircraft Doc 9760, Airworthiness Manual Circular 95, The Continuing Airworthiness of Aircraft in Service
- ICAO General Assembly A41 WP/556 TE/207 - ADVANCED DATA ANALYTICS IN AVIATION SAFETY

1. INTRODUCTION

1.1 Annex 8 — Airworthiness of Aircraft Part II, Chapter 4 states that SoR shall ensure that there exists a system whereby information on faults, malfunctions, defects and other occurrences that cause or might cause adverse effects on the continuing airworthiness of the aircraft is transmitted to the organization responsible for the type design of that aircraft.

1.2 Annex 8, Part II, Chapter 4 further states that SoD shall collect information on faults, malfunctions, defects and other occurrences, analyse this data, develop any necessary airworthiness actions and communicate this safety information to the States of Registry. Additionally, it requires both SoD and SoR to implement a system to share such safety data, which allows Member States to ensure the ongoing safety of aircraft operating within their national aerospace systems. These expectations are also included in ICAO Doc 9760, Airworthiness Manual, and ICAO Circular 95, The Continuing Airworthiness of Aircraft in Service. Currently, the standard method established in Circular 95 includes a list of State focal points for the transmission of safety information concerning Mandatory Continuing Airworthiness Information (MCAI). This list, however, is not complete nor updated regularly. Exchanges of safety information also occur through bilateral means, such as ad-hoc communication between subject matter experts (SME), email notifications, peer-to-peer working relationships and legacy coordination mechanisms.

1.3 Strengthening the requirements to exchange aviation safety data between Member States will enable a SoD to assess risks more accurately with their products and develop any necessary airworthiness actions. The SoD ensures the availability of MCAI so the SoR can take appropriate action in addressing safety issues. The SoD, however, may not always be receiving important operational safety data for products that it certified and are operating in world- wide fleets.

1.4 Under the direction of the U.S. Department of Transportation, the FAA has been tasked with improving international data sharing practices and expanding and strengthening its enterprise-level data collection and analytics. The FAA also recently announced a strategic framework that emphasizes the use of data analytics to proactively identify and take action to reduce emerging safety risk and promote global safety information sharing. However, the benefits of advanced data analytics can only be realized with a reinvigorated determination in facilitating and promoting the transmission of safety information globally.

1.5 Within the FAA, the Aircraft Certification Service (AIR) is responsible for the Continued Operational Safety (COS) process for U.S. aircraft, engines, propellers and articles, and the issuance of all Type Design approvals for domestic products and validation of foreign products. In support of improving safety data sharing internationally, AIR is building capabilities in advanced data analytics to maximize the technical output of our engineering workforce through established COS processes that leverage integrated data, including data from foreign operators and other external safety stakeholders.

2. DISCUSSION

2.1 The global aviation regulatory community lacks a functional infrastructure for communicating operational safety data such as faults, malfunctions, defects and other occurrences that cause or might cause adverse effects on the continuing airworthiness of the aircraft. While each State may have a domestic system for collection of such safety data, this data is not consistently transmitted to Member States that are SoDs and that need the data to conduct a comprehensive safety analysis and determine if any continuing airworthiness action is required. Global data for a given product may present a greater spectrum of operational experience, thus yielding more accurate and consistent safety information. The FAA has begun taking initial steps toward the development of a global safety information management platform to allow the intake and integration of safety data from a variety of sources, empowering the global aviation community to make timely and effective safety decisions.

2.2 Along with greater intake of safety data, the FAA is also increasing its analytical capabilities in response to U.S. Congressional mandates and departmental findings that highlight gaps in the FAA's ability to collect, integrate, and analyze data. In 2019, the U.S. Secretary of Transportation launched a "Special Committee to Review the Federal Aviation Administration's Aircraft Certification Process". This Committee concluded that the FAA needs to "expand its engagement, policies, technical assistance, and training efforts to foster higher international safety standards and practices for aircraft certification, operations, and maintenance," and further "propose to the International Civil Aviation Organization the sharing of operational data internationally, to enhance safety initiatives."

2.3 In addition to the Annex 8 and Doc 9760 requirements mentioned above, Annex 19 provides the framework for a State Safety Programme that describes the components and elements that form a robust Safety Management System, including safety assurance measures based on data collection, analysis and exchange, data-driven targeting of oversight, and dissemination of safety information.

2.4 The FAA, as the U.S. aviation safety regulator, is responsible as SoD for its globally-operated aircraft, and as the SoR for non-U.S. SoD aircraft. Many ICAO Member States bear SoR responsibility for U.S. aeronautical products on their registry. With the continuing expansion and globalization of aviation, both in manufacturing and operations, increasing amounts of U.S. products are

operated outside of the United States. The FAA and other Civil Aviation Authorities (CAAs) need to close the information gap by implementing data sharing best practices and deploying associated technological solutions that enhance data analytics in aviation safety. Member States with SoD responsibilities need access to safety data to better support fleets and products worldwide and SoR States need to gain greater safety insights into regional/national COS issues.

2.5 Increased access to safety data, matched by the ability to interpret information and identify emergent safety issues, is essential to the FAA and other CAAs in fulfilling national regulatory requirements and enhancing global civil aviation safety as ICAO Member States. The FAA is taking concrete steps in this area by augmenting, maturing and promoting its advanced analytics capabilities to meet the challenges of enhanced safety data collection practices.

2.6 The FAA is embracing a safety data strategy that encourages widespread access to data sources and information across the Agency, fostering informed safety decisions and actionable insight on emerging safety issues. For example, in the FAA, AIR has deployed a platform that meets this data strategy and that is capable of data preparation and integration from a variety of discrete data sources, both internal to FAA and external. The platform already includes daily failures, malfunctions, and defects data per Title 14 of the U.S. Code of Federal Regulations § 21.3 (internal source) and the Service Difficulty Reporting (SDR) system and is connecting to a variety of external sources that create a data-rich resource in a controlled governance environment. End users have a suite of advanced analytical tools at their disposal in a central location within the platform.

2.7 The AIR user base, consisting of engineers, safety inspectors, data scientists, and other SMEs, is currently using this highly integrated system to apply advanced data analytics techniques in meeting COS objectives, such as: a) using in-service data from multiple sources (approximately 1.8 million records) to investigate and evaluate Airworthiness Directives effectiveness and fleet risk; b) collaborating with U.S. aerospace manufacturers to study and compare machine-learning algorithms and assist in identifying depressurization events in SDR data; and c) evaluating Automatic Dependent Surveillance-Broadcast to understand global fleet usage and airspace routing from an operational perspective and more accurately calculate our safety probability occurrence.

2.8 The deployment of this capability in AIR is removing information barriers between the workforce and policy makers. Engineers are able to derive safety insight from what were previously disparate data streams and use established COS workflows to take action on safety findings with increased speed and accuracy. For example, in just a few weeks, AIR personnel were able to develop a suite of applications in a common workspace to evaluate 5G cell tower activation and aircraft radio altimeter interference issues. By connecting data sources in this common environment, AIR SMEs, air traffic controllers, safety inspectors, spectrum technology engineers, and data scientists, collaborated to develop Notices to Air Missions; approved alternative methods of compliance for operators and manufactures to mitigate unsafe conditions; analyzed radio altimeter field reports; developed mapping tools; and accessed airport and cell tower location analysis.

2.9 In parallel to the domestic effort to implement advanced data analytics, the FAA is also reaching out to the international community via the Global Safety Information Management Exchange Initiative (GSIME) to promote safety data exchange, including CAAs that wish to collaborate on use cases that test advanced analytics. The FAA's outreach strategy is not platform-centric and does not promote any specific data analytics products or solutions. The GSIME initiative seeks to close the operational safety gap through sharing safety information and data among international aviation partners resulting in improved operational insights for timely, actionable and aligned safety outcomes.

2.10 The FAA's data strategy exemplifies its commitment to advance global safety by enriching SoD domestic data with SoR/CAA data and strengthening SoRs' safety information ecosystems as required

by ICAO. Robust collaboration on data analytics will also give SoRs additional insight on local and regional safety issues. This exchange could have immediate application at the practical level, such as in measuring the effectivity of Airworthiness Directives on a global scale. Through concurrent outreach efforts the FAA wishes to promote a productive dialogue among SMEs around the world to test advanced analytics in a data-enabling environment and to explore ways of augmenting data sharing practices internationally.

3. ACTION BY THE MEETING

3.1 The RASG-MID/10 is invited to:

a) Note the information provided in this paper; and

b) Agree to promote safety data exchange to collaborate on use cases that test advanced analytics.

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