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**WORKING PAPER**

# THIRTEENTH AIR NAVIGATION CONFERENCE

**Montréal, Canada, 9 to 19 October 2018**

**COMMITTEE B**

**Agenda Item 7: Operational safety risks**
**7.1: Facilitation of data-driven decision-making in support of safety intelligence to support safety risk management**

## FACILITATION OF DATA-DRIVEN DECISION-MAKING IN SUPPORT OF SAFETY RISK MANAGEMENT

(Presented by the Secretariat)

**EXECUTIVE SUMMARY**

This paper presents analysis solutions developed or proposed by ICAO that facilitate data-driven decision-making and assist stakeholders in identifying and managing safety risks in support of the development and dissemination of safety information and the implementation of State safety programmes (SSPs) and safety management systems (SMSs).

**Action:** The Conference is invited to agree to Recommendation 7.1/x – Data-driven decision-making, in paragraph 3.

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| *Strategic Objectives:* | This working paper relates to the Safety and Air Navigation Capacity and Efficiency Strategic Objectives. |
| *Financial implications:* | *Impact for the aviation community:*<br>The air navigation integration analysis solutions discussed in this paper have a significant impact and provide important benefits to stakeholders, with minimal financial implications, as the majority of discussed data, tools and methods are offered free of charge. Training and support are provided on a cost-recovery basis.<br><br>*Impact for ICAO (relative to the current Regular Programme Budget resource levels):*<br>The resources necessary for implementation can be accommodated within the current regular budget resource levels allotted to the Safety and Air Navigation Capacity and Efficiency Programme. However, States and stakeholders would need to provide experts and input to the ICAO effort, as needed. |
| *References:* | Annex 19 — *Safety Management*<br>Doc 9859, *Safety Management Manual*<br>Doc 9750, *Global Air Navigation Plan*<br>Doc 10004, *2017-2019 Global Aviation Safety Plan* |

## 1. INTRODUCTION

1.1 Annex 19 – *Safety Management* and the *Safety Management Manual* (SMM) (Doc 9859) contain Standards and Recommended Practices (SARPs) and guidance material, respectively, requiring States to establish safety data collection and processing systems (SDCPS) and conduct safety data analysis. ICAO's evolving safety strategy includes several analysis solutions and initiatives that support the effective implementation of State safety programmes (SSPs) and safety management systems (SMSs) by States and service providers while also contributing to increased levels of capacity and efficiency.

1.2 These solutions, collectively referred to as air navigation integration analysis solutions, include data, tools, methodologies and training that facilitate data-driven decision-making and help stakeholders identify and manage safety risks. These tools and methodologies also contribute to the development of safety information. In addition, they support the implementation of predictive risk management measures based on the objectives of the Global Aviation Safety Plan (GASP) and allow ICAO to monitor the achievement of targets outlined in the Global Air Navigation Plan (GANP).

## 2. DISCUSSION

2.1 The aviation system produces large volumes of data that need to be effectively collected and managed. For every flight hour, a modern quick access recorder (QAR) of an aircraft typically generates around 60 000 data points. At the same time, an aircraft equipped with automatic dependent surveillance-broadcast (ADS-B) also emits around 3600 data points. With over 32 million scheduled commercial flights a year, these two systems alone generate over 500 million data points every hour worldwide.

2.2 In addition to the data generated by the equipment, civil aviation authorities as well as other stakeholders generate additional data points through their oversight and surveillance systems. Data collected through audits, inspections, occurrence reports or investigations contribute to the growth of the aviation data lake.

2.3 The use of cutting edge technology, such as cloud computing, big data clusters or artificial intelligence, becomes crucial for processing safety and air navigation data and allows the extraction of actionable information.

2.4 Actionable information is the main input to an effective data-driven decision-making process which will allow Member States to evaluate risk, assess performance and take appropriate decisions. This information is key to implementing predictive risk management, one of the GASP objectives, as well as the performance-based approach of the GANP.

2.5 To help Member States make data-driven decisions, ICAO created the integrated Safety Trend Analysis and Reporting System (iSTARS) in 2010. iSTARS is a web-based system on the ICAO secure portal featuring a collection of applications and datasets that facilitate and assist users in conducting aviation safety, efficiency and risk analyses. As of 2018, the system has over 4 000 registered users from all ICAO Member States.

2.6 To further enhance iSTARS, ICAO is planning to organize annual iSTARS User Group meetings. These meetings will bring iSTARS users together for discussion and provide the opportunity to exchange experiences, innovations, needs and views related to safety and air navigation data, tools and methods for the collection, analysis, reporting and overall management of such data. A synopsis of the first meeting is available on https://www.icao.int/safety/iStars/Pages/iUG01.aspx.

2.7 Workshops on data analysis and data-driven decision-making have complemented the suite of analysis solutions available and offered to Member States. Since 2012, workshops have been conducted in ten Member States and all ICAO regional offices with over 430 participants.

2.8 The analysis workshops have highlighted the lack of capacity and competencies in data analysis within Member States. Member States generate and store a large quantity of data but often do not have the capacity to process this data and derive information from it as required by Annex 19. Under the TRAINAIR Plus programme, ICAO is currently developing new courses related to data-driven decision-making in aviation for aviation professionals to enhance their knowledge in the field.

2.9 Annex 19 requires States to establish and maintain a process to analyse the safety data and safety information from the SDCPS and associated safety databases. The Universal Safety Oversight and Audit Programme (USOAP) confirms that only forty-two per cent of all Member State authorities responsible for the implementation of the SSP analyse information from their State's accident and incident database (protocol question 6.511). Effective implementation of this protocol question varies widely from one regional aviation safety group to another.

2.10 Considering the issues discussed above and the complexity of developing and deriving meaningful information and useful insights from stored data, ICAO launched the new Safety Information Monitoring System (SIMS) project in 2017 (https://www.icao.int/safety/Pages/Safety-Information-Monitoring-Service.aspx). SIMS is built upon the iSTARS concept, with the difference that SIMS uses State data in addition to ICAO data. Member States can simply connect their own stored data (inspection results, occurrence reports, etc.) onto SIMS and generate safety information in the form of indicators, graphs and dashboards directly through the system.

2.11 SIMS is a cost-effective way for Member States to gain direct insight into their stored data without having to develop complex in-house information technology systems.

2.12 To get a complete picture of the risks and needs within a State's aviation system, only having access to the State's own information is, most of the time, insufficient. In this regard, SIMS also allows participating States to securely exchange the generated safety information with each other. ICAO has developed SIMS legal framework that addresses, among others, data privacy and safety data protection elements.

2.13 Indicators are a crucial requirement of data-driven decision-making for measuring the achievement of goals in various areas. Therefore, it is essential to develop, harmonize, formalize and manage indicators. Drawing from the work done by the United Nations Inter-Agency Expert Group on Sustainable Development Goals (IAEG-SDG), ICAO is building a framework for a harmonized approach to the development of indicators for safety and air navigation. States are invited to make use of this global indicator framework when building their own list of indicators. The first edition of a safety indicators catalogue will be available online by the end of 2018.

## 3. CONCLUSION

3.1 The task of drawing actionable information from data available through the aviation system is complex and Member States struggle to implement data-driven decision-making processes. USOAP data confirms that effective implementation in this area is problematic.

3.2 ICAO's air navigation integration analysis solutions support the effective implementation of SSP and SMS in States and industry while also contributing to an increased level of capacity and

efficiency. ICAO has a growing catalogue of available and planned analysis solutions which all stakeholders are invited to use. The Conference is invited to agree to the following recommendation:

**Recommendation 7.1/x – Data-driven decision-making**

That the Conference:

a) urge States to implement data-driven decision-making processes, taking into account the ICAO catalogue of safety and air navigation indicators, within their safety and air navigation activities and to build data analysis capacity;

b) urge States to consider using ICAO's air navigation analysis solutions, especially during the initial development of their State safety programmes (SSP), and joining the ICAO Safety Information Monitoring System (SIMS) project to better utilize their stored data;

c) invite States to exchange safety and air navigation information with other Member States through SIMS in support of safety risk management; and

d) request ICAO to further develop and promote iSTARS and SIMS and other analysis solutions and to conduct regular iSTARS User Group Meetings, so as to continually adapt to the changing safety environment.

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