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WORKING PAPER

ASSEMBLY — 41ST SESSION

ECONOMIC COMMISSION

Agenda Item 37: Aviation Data — Monitoring and Analysis

ICAO STATISTICS PROGRAMME AND BIG DATA ANALYTICS

(Presented by the Council of ICAO)

EXECUTIVE SUMMARY

This working paper reports on the ICAO Statistics Programme, as well as activities related to big data, including details of the data sets and on-going analyses carried out in collaboration with other United Nations agencies, international organizations, etc. This paper also presents ICAO's plan for future work related to the Statistics Programme and big data analytics (a part of the ICAO Business Plan 2023–2025 Operating Plan Output DEV 5 – Enhanced skills of States to implement and manage aviation-related big data solutions and take stock of innovations in support of data driven policies), which aims to support States and aviation stakeholders in using a data driven decision- and policy-making approach to improving safety, operational and economic efficiency of air transport. The planned activities that will be carried out pursuant to the recommendations of the Eleventh Session of the Statistics Division (STA/11) are also presented.

Action: The Assembly is invited to:

a) acknowledge the work accomplished by ICAO in paragraphs 2, 3, 4 and 5;
b) endorse the Organization's work programme as presented in paragraph 7; and
c) consider the information contained in this paper for the update of Assembly Resolution A40-9, Consolidated statement of continuing ICAO policies in the air transport field

Strategic Objectives:	This working paper relates to Strategic Objective — Economic Development of Air Transport.
Financial implications:	The ICAO activities referred to in this paper are expected to be undertaken within the resources available in the 2023-2025 Regular Budget and/or from extra-budgetary contributions as guided by the ICAO Business Plan 2023-2025.
References:	Doc 10140, *Assembly Resolutions in Force* (as of 4 October 2019) Doc 10139, *Report of the Economic Commission of the 40th Session of the Assembly Reports of ADAP/3 and STA/11* A41-WP/14-EC/4, Report on the updated long-term traffic forecast with post-COVID-19 scenarios A41-WP/17-EC/7, Consolidated Statement of Continuing ICAO Policies in the Air Transport Field ICAO Business Plan 2023–2025

1. BACKGROUND

1.1 In accordance with Assembly Resolution A40-9 (Appendix E), the Secretariat has been coordinating with Member States, the United Nations (UN), its agencies and other international organizations on collecting, processing and analyzing aviation data, including big data. Efforts were also made to ensure the harmonization of aviation data and statistics from different sources to facilitate the provision of accurate, reliable and consistent data required for informed decision-making by States.

2. ICAO STATISTICS PROGRAMME

2.1 The ICAO Statistics programme continued to benefit from the re-engineering process that was achieved in 2018 by utilizing new technologies and the Enterprise Data Management (EDM) architecture for the Integrated Statistical Database (ISDB). This resulted in several benefits, mainly: a) increased coverage and quality of data; b) reduced processing time; c) greater interoperability; and d) improved integration of data for meaningful analysis.

2.2 Furthermore, the existing EDM architecture under the ICAO Statistics Programme has been significantly enhanced using cloud computing and multi-node processing for the storage, processing and analysis of different big data sources. The cloud computing architecture allows for cross referencing and combining official data with big data sources, making it a powerful repository of information for States, international organizations and other stakeholders.

2.3 At the Third Meeting of the Aviation Data and Analysis Panel (ADAP/3) held in June 2021, several recommendations were made on ICAO's statistical activities, including: a) the collection of data on cybersecurity incidents; b) the survey on the licensed aviation personnel by gender; and c) the statistical definition of non-scheduled all-cargo traffic. The recommendations of ADAP/3 were presented to the Eleventh Session of the Statistics Division (STA/11) in April 2022, following which work has been carried out on the collection of new and/or additional data through the ICAO Statistics Programme including the Air Transport Reporting Forms and surveys.

3. BIG DATA SOURCES

3.1 Continued efforts have been made to enhance the Organization's capacity and capability in managing, processing and analyzing big data through advanced technology including cloud computing, artificial intelligence and machine learning. The big data sources used by ICAO, i.e. a) Market Intelligence Data Transfer (MIDT); b) Automatic Dependent Surveillance-Broadcast (ADS-B); and c) Commodity and Trade (COMTRADE) and e-commerce transactional data (E-com), represent an all-encompassing coverage of traffic and operational data at a very high level of granularity.

3.2 The MIDT contains passenger booking data of the Global Distribution Systems (GDS) supplemented with the direct sales of air carriers, providing true origin-destination records of more than four billion passengers and 36 million departures annually (in 2019).

3.3 The ADS-B data on aircraft positions (departure, en-route and arrival in intervals of one minute), approximately 600 million rows are recorded monthly, covering a vast majority of scheduled passenger and freighter operations, as well as charter, business jets and other commercial operations.

3.4 The algorithms developed by ICAO verify and complement the data with additional information such as carrier code, aircraft type, Flight Information Region (FIR), type of operation, distance flown and spread between planned route, shortest route and actual paths while the ADS-B data is streamed into the Cloud.

3.5 The COMTRADE data provided by the UN contains billions of records of commodity movements while the E-com records provided by the Universal Postal Union (UPU) contains e-commerce parcel transactions data.

4. COLLABORATION ON BIG DATA ANALYTICS

4.1 ICAO has been increasingly exploiting the big data and expanding its activities using big data. The aforementioned big data sets have been processed and analyzed in close collaboration with other UN agencies and international organizations. In addition, internal collaboration within the Organization is ongoing to support other activities. Highlights of these collaborations are presented below.

4.2 The MIDT data was provided to the World Bank along with the methodology to calculate an air connectivity index by State. The data and methodology is also provided to the International Air Transport Association (IATA) and the Air Transport Action Group (ATAG) to arrive at the air connectivity index and ranking by State through the *Aviation: Benefits Beyond Borders*[1] report.

4.3 The ADS-B along with the metadata was provided to the members of the Committee on Aviation Environmental Protection (CAEP), to assist their validation of the Common Operations Databases (COD). The ADS-B data was also provided to the Environment Branch of ICAO for developing a process to fulfil the requirement on Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) by filling data gap using ADS-B data in combination with other datasets and environmental tools.

4.4 In coordination with the European Organisation for the Safety of Air Navigation (EUROCONTROL), the ADS-B data has now been integrated with the ICAO Aero-Tariffs Application and made available to Member States and Air Navigation Services Providers (ANSPs) through the iCADS platform (https://data.icao.int/AeroTariffs/).

4.5 Regarding the COMTRADE and E-com data, ICAO and the UPU, under the Memorandum of Understanding between the Organizations, have commenced using these big data sources and the ADS-B data to conduct a joint project on *Analyzing International Logistics Constraints for E-commerce.*

4.6 In addition, ICAO is the custodian agency of the Sustainable Development Goal (SDG) indicator 9.1.2 on passengers and freight volumes, by mode of transport (air, maritime, inland waterways, road and rail). The integration of official statistics with big data sources of different international organizations is reflected in the annual global SDG report. Using the online UN SDG platform[2], States can monitor progress towards achieving SDG goal 9.1.2 and benchmark their air transport infrastructure to facilitate related investments.

[1] https://aviationbenefits.org/downloads/aviation-benefits-beyond-borders-2020/
[2] https://unstats.un.org/sdgs/dataportal/database

5. BIG DATA DASHBOARDS

5.1 ICAO worked with the United Nations Global Big Data Group to develop business intelligence dashboards for data driven decision making. The ICAO dashboards cover a wide array of analytics ranging from operations, fleet usage, passenger carried, Flight Information Region (FIR) traffic, and revenue impact on airlines, airports and ANSPs at different levels of granularity. They allow for the visualization and download of data by State, region, route group and FIR.

5.2 The exclusive licence to access these big data dashboards has been provided to all Member States. Information contained in the dashboards are continuously updated. These dashboards will be extremely valuable to the Member States in their recovery, planning and implementation efforts.

6. BIG DATA FOR PASSENGER FLOW ANALYSIS DURING PUBLIC HEALTH EMERGENCIES

6.1 During ADAP/3, the Panel discussed the possibility to monitor connectivity of international passengers in real time during times of public-health emergencies, using the potential of big data, particularly the Central Reservation Systems (CRS) and Passenger Name Record (PNR) data. It was recommended that internal coordination with the Facilitation Panel (FALP) should be carried out to determine the feasibility, benefits, and risks of using big data to assist in passengers flow analysis during public-health emergencies.

6.2 Subsequently, at the Eleventh Meeting of the Statistics Division (STA/11) in April 2022, support was given to this initiative and coordination to explore the potential future discussions with the relevant meetings of FALP in 2023 and onwards.

7. FUTURE WORK

7.1 The ICAO Business Plan 2023-2025 identified the role of big data analytics in leveraging and unlocking the potential value of such data to improve safety and operational efficiency of aviation, allowing States and the industry to make more informed decisions and policymaking. ICAO will continue to provide aviation-related big data solutions, algorithm based technologies including artificial intelligence and machine learning to provide data visualizations, identify trends, make predictions, and conduct related big data analysis to assist States in their recovery, planning and implementation efforts.

7.2 In accordance with the ICAO Business Plan 2023–2025 Operating Plan Output DEV 5 – Enhanced skills of States to implement and manage aviation-related big data solutions and take stock of innovations in support of data driven policies, the focus and priority of future work of the ICAO Statistics Programme and big data analytics will be placed on:

a) collecting new and additional data through the ICAO Statistics Programme including the Air Transport Reporting Forms and surveys;

b) continuously enhancing the Organization’s capacity and capability in processing and analyzing big data and conducting analysis on emerging issues of global importance jointly with States, UN agencies and other international organizations; and

c) disseminating and sharing aviation big data dashboards and analysis with Member States, thus serving Member States and aviation stakeholders in their recovery, planning and implementation needs.

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