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WORKING PAPER

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Agenda Item 11: Aircraft accidents and safety analysis

REFERENCE AND USE OF THE INTEGRATED STATISTICAL DATABASE (ISDB) FOR SAFETY DATA ANALYSES

(Presented by the Secretariat)

SUMMARY

In order to measure the progress of ICAO toward the achievement of the Strategic Objective of Safety, traffic exposure data extracted from the ICAO Integrated Statistical Database (ISDB) are linked to occurrence data from the European Coordination Centre for Accident and Incident Reporting Systems (ECCAIRS), and then associated with the Universal Safety Oversight Audit Programme (USOAP) databases in order to carry out more in-depth safety analysis. The ISDB plays a significant role by housing the data collected from States through the Statistics Programme. due to its extended reference files categories, the information contained in one table can be related to that contained in another one, enabling a wider range of analysis.This paper deals with the links between the ISDB, ECCAIRS and the USOAP databases and establishes the need to harmonize references using standardized coding structures, with a view to enabling the conduct of meaningful aircraft safety analyses for the Organization.

Action by the conference is in paragraph 3.

1. INTRODUCTION

1.1 The Air Navigation Bureau (ANB) collects data on civil aircraft accidents and incidents through the ECCAIRS database Data related to operational parameters of air carriers, airports and air navigation service providers are collected by the Air Transport Bureau (ATB) and stored in its Integrated Statistical Database (ISDB). Information from the ISDB is frequently used by the ANB and other stakeholders, such as the European Aviation Safety Agency (EASA), to conduct safety analyses. This paper establishes the need to harmonize the reference tables that facilitate the integration of the data from these various databases in order to carry out timely safety analyses without compromising the integrity of the data.

2. THE EXISTING TOOLS FOR SAFETY DATA ANALYSIS

2.1 European Coordination Centre for Aviation Accident Reporting System (ECCAIRS)

2.1.1 In 1976, ICAO established the Accident/incident Data Reporting (ADREP) system to collect information on accidents and incidents. From that time, the system has evolved to meet changes in information technology and the aviation industry.

2.1.2 In 2004, ICAO adopted the ECCAIRS software developed by the Joint Research Center of the European Union in Ispra, Italy, as a tool to operate the ADREP system. The ADREP/ECCAIRS system was developed in close cooperation with ICAO with the aim of implementing taxonomies developed in ICAO to facilitate the exchange of occurrence data between States, and between States and ICAO. The ECCAIRS software is available to all Contracting States at no charge.

2.1.3 In addition to the collection, storage and exchange of occurrence data, ADREP/ECCAIRS also provides users with the capability to exchange analysis tools. As a result, States establishing occurrence reporting systems in accordance with Standard 8.1 of Annex 13 can benefit from analysis tools developed elsewhere.

2.1.4 As of January 2009, some 45 States and 7 international organizations have installed the ECCAIRS software and have reported occurrences in the ECCAIRS format to ICAO. This process has permitted ICAO to have more complete and up-to-date data, and it will continue to benefit the States as there will no longer be a need for them to complete the ICAO ADREP reporting forms manually. In addition, closer cooperation through electronic communications with data providers has improved the classification of occurrences.

2.2 Universal Safety Oversight Audit Program (USOAP)

2.2.1 The main objective of USOAP is to promote global aviation safety by auditing Contracting States on a regular basis with a view to determining the States' capability for safety oversight. This objective is accomplished by assessing the effective implementation of the eight critical elements of a safety oversight system (see **Appendix A**) and the status of implementation of the safety related ICAO Standards and Recommended Practices (SARPs). The analysis of the audit results under the comprehensive systems approach of the USOAP makes a significant contribution to the understanding of the level of implementations of the ICAO SARPs.

2.3 Integrated Statistical Database (ISDB)

2.3.1 The ISDB is a repository of data captured from the statistical reporting Forms submitted to ICAO by Contracting States. In order to verify and validate the data received, the ISDB makes use of a number of reference tables which are part of this system. Details of these reference tables are provided in **Appendix B**.

2.4 Analyses with Integrated Data

2.4.1 ICAO has been generating different types of queries using the ISDB, which is used to arrive at exposure data by State, region and at the global level. Exposure data can be in terms of departures, passenger-kilometres performed or other operational parameters. The occurrence data from ECCAIRS are then used along with the exposure data to arrive at global or regional accident rates. The accident rates are then used to conduct analyses to discern and identify trends, and they can be merged with the USOAP

database to determine whether there is a correlation between the level of implementation of the critical elements and the accident rates. Some of these analytical queries are listed in **Appendix C**. Exposure data are provided every year by ICAO to agencies such as the European Aviation Safety Agency (EASA) which is using them to conduct their own safety analyses.

2.5 Reference and data tables linkages that are of common interest

2.5.1 The ADREP system makes use of a well developed ADREP taxonomy, thus establishing a common terminology to address the different attributes contained in the ADREP/ECCAIRS database. This taxonomy is being reviewed and further developed by the CAST/ICAO Common Taxonomy Team (CICTT).

2.5.2 Some of the data and reference tables in ISDB that are used for the aforesaid purposes are described here below:

Reference file/ATRF	Query/ Analysis	Deliverable
State and State history	State-wide accident rates	Trends of accidents by State and Category
State - Region	Region-wide accident rates	Trends of accidents by Region and Category
Air carrier	Accident rates by classification	Accident rates analysis between scheduled and non-scheduled operators.
Aircraft	Accident rates by category	Analysis by aircraft type, model and MTOM
Air carrier traffic (Form A)	Accident by exposure type i.e., departures, number of passengers, PKP, SKA	Accident rates, trends. audit coverage, correlation analysis, reporting culture of occurrences and occurrence projections.
Fleet and Personnel (Form D)	Personnel and aircraft data	Variances with State Safety Audit Questionnaire
Civil Aircraft on Register (Modified Form H)	Search by State, Operator, and aircraft type	Safety analysis

2.5.3 The information contained in ISDB, ECCAIRS and USOAP databases need to be shared and queried on a cross reference basis. Therefore it is essential that no ambiguity exists in the reference tables used by them, as any deviation due to lack of standardization would have a negative impact on the queries and the resultant analyses.

2.6 From Stand-alone to Integration with ISDB

2.6.1 Each of these ECCAIRS and USOAP databases can be individually searched for aircraft accident numbers, level of implementation of SARPs and other queries. However, to raise the level of analytical support and generate queries with more in-depth analysis capabilities, it is necessary to get these three databases integrated to a very great extent.

2.6.2 In order to conduct holistic queries and carry out analyses with the objective of identifying trends, risk areas and, where necessary, take the appropriate steps to further improve safety, the use of common reference files would be helpful to work towards integrating the traffic data with the

occurrence data. With regard to ECCAIRS, while it will not be possible to use the ISDB reference files on the spot as reference tables, a mapping between the ECCAIRS reference tables and the ones used in ISDB is being developed. When this is achieved, the user would be able to better use ICAO traffic data by assisting in measuring the efficacy of the various steps initiated to improve safety. Therefore, a global approach combining the resources of each of these databases would be generally desirable.

2.6.3 It is therefore of paramount importance as a first step that the common reference tables in place in the three databases are correctly interfaced so that, when they are queried, the reference tables point to the same items. Accordingly, the databases will be harmonized while at the same time, not disturbing the taxonomies and structures that are already in place for each of them. This commonality in the references files is crucial to ensure queries´ standardization when safety analyses are carried out by internal and external stakeholders.

2.7 Recommendation *of the Fourteenth Meeting of the Statistics Panel (STAP/14-13).* The panel endorsed the action taken by ICAO to harmonize these databases that are part of the safety analysis process. The Secretariat has taken necessary steps with the Air Navigation Bureau (ANB) and the European Aviation Safety Agency (EASA) to harmonize the ISDB reference files with ECCAIRS.

3. ACTION BY THE DIVISION

3.1 The division is invited to endorse the action taken by ICAO to harmonize these databases that are part of the safety analysis process.

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APPENDIX A

LIST OF CRITICAL ELEMENTS OF A SAFETY OVERSIGHT SYSTEM

General considerations

The Critical Elements (CEs) are essentially the safety defence tools of a safety oversight system required for the effective implementation of safety-related international standards and associated procedures. ICAO Contracting States, in their effort to establish and implement an effective safety oversight system that reflects the shared responsibility of the State and the aviation community, should address the eight CEs. The CEs encompass the whole spectrum of civil aviation activities, including personnel licensing, aircraft operations, airworthiness, air navigation services, aerodromes and aircraft accident and incident investigation. The level of effective implementation of the CEs is an indication of a State's capability for safety oversight.

ICAO has defined the following eight CEs of a State's safety oversight system (ICAO Doc 9734, Part A refers):

CE-1. Primary aviation legislation. The provision of a comprehensive and effective aviation law consistent with the environment and complexity of the State's aviation activity and compliant which is the requirements contained in the Convention on International Civil Aviation.

CE-2. Specific operating regulations. The provision of adequate regulations to address, at a minimum, national requirements emanating from the primary aviation legislation and providing for standardized operational procedures, equipment and infrastructures (including safety management and training systems), in conformity with the Standards and Recommended Practices (SARPs) contained in the Annexes to the Convention on International Civil Aviation.

Note.— The term "regulations" is used in a generic sense to include but is not limited to instructions, rules, edicts, directives, sets of laws, requirements, policies, and orders.

CE-3. State civil aviation system and safety oversight functions. The establishment of a Civil Aviation Authority (CAA) and/or other relevant authorities or government agencies, headed by a Chief Executive Officer, supported by the appropriate and adequate technical and non-technical staff and provided with adequate financial resources. The State authority must have stated safety regulatory functions, objectives and safety policies.

Note.— The term "State civil aviation system" is used in a generic sense to include all authorities with aviation safety oversight responsibility which may be established by the State as separate entities, such as: CAA, Airport Authorities, Air Traffic Service Authorities, Accident Investigation Authority, and Meteorological Authority.

CE-4. Technical personnel qualifications and training. The establishment of minimum knowledge and experience requirements for the technical personnel performing safety oversight functions and the provision of appropriate training to maintain and enhance their competence at the desired level. The training should include initial and recurrent (periodic) training.

CE-5. Technical guidance, tools and provision of safety-critical information. The provision of technical guidance (including processes and procedures), tools (including facilities and equipment) and safety-critical information, as applicable, to the technical personnel to enable them to perform their safety oversight functions in accordance with established requirements and in a standardized manner. In addition, this includes the provision of technical guidance by the oversight authority to the aviation industry on the implementation of applicable regulations and instructions.

CE-6. Licensing, certification, authorization and/or approval obligations. The implementation of processes and procedures to ensure that personnel and organizations performing an aviation activity meet the established requirements before they are allowed to exercise the privileges of a licence, certificate, authorization and/or approval to conduct the relevant aviation activity.

CE-7. Surveillance obligations. The implementation of processes, such as inspections and audits, to proactively ensure that aviation licence, certificate, authorization and/or approval holders continue to meet the established requirements and function at the level of competency and safety required by the State to undertake an aviation-related activity for which they have been licensed, certified, authorized and/or approved to perform. This includes the surveillance of designated personnel who perform safety oversight functions on behalf of the CAA.

CE-8. Resolution of safety concerns. The implementation of processes and procedures to resolve identified deficiencies impacting aviation safety, which may have been residing in the aviation system and have been detected by the regulatory authority or other appropriate bodies.

Note.— This would include the ability to analyse safety deficiencies, forward recommendations, support the resolution of identified deficiencies, as well as take enforcement action when appropriate.

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APPENDIX B

LIST OF REFERENCE FILES IN THE INTEGRATED STATISTICS DATABASE (ISDB)

1. **State and State History**: Contains information on State names and history that tracks changes that occurs in the State reference file.

2. **State – Region Table**: Contains information on statistical regions of the world and associates the States with the regions.

3. **Air Carrier and Air Carrier History**: Contains information on air carrier names, codes, type of operator and associates the same to States and thus to regions. The air carrier history file tracks changes that occur in the air carrier reference file.

4. **Aircraft**: Contains information on aircraft codes, names, manufacturer, model, engine type, wing type, number of engines, details on seats, payload and range.

5. **City**: Contains information on city codes, city names and associates the same to airports, State and thus to regions.

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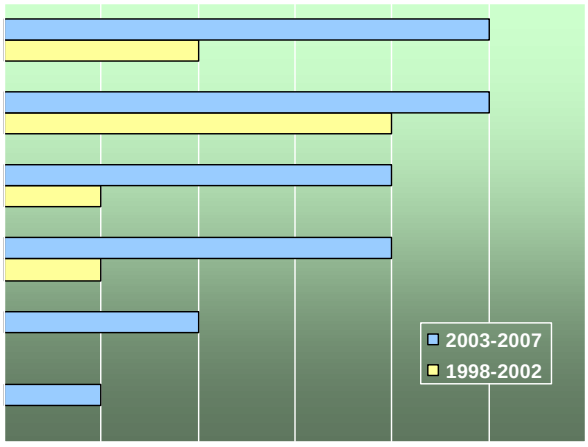
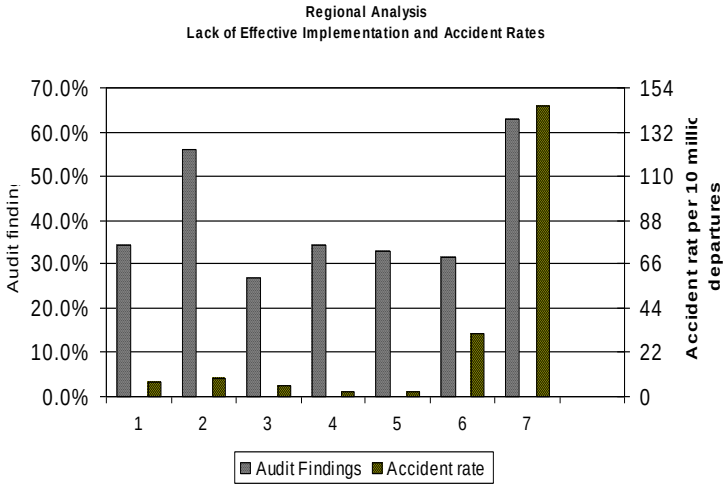
APPENDIX C

EXAMPLES OF QUERIES AND ANALYSES GENERATED USING REGIONAL ANALYSIS OF FATALITIES BY OCCURRENCE CATEGORIES



Relation between Critical Elements and Accident Rates

Critical Element	R^2 (Relationship)
CE8	0.96 (very strong)
CE6	0.95 (very strong)
CE3	0.95 (very strong)
CE7	0.93 (very strong)
CE2	0.76 (medium)
CE5	0.73 (medium)
CE4	0.72 (medium)
CE1	0.52 (weak)


Regional Analysis
Lack of Effective Implementation and Accident Rates
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
154
132
110
88
66
44
22
0
1
2
3
4
5
6
7
Audit Findings
Accident rate

— END —