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Agenda Item 7: Air navigation services providers (ANSPs) en-route facility traffic data

NEW ICAO AIRCRAFT MOVEMENT DATA COLLECTION

(Presented by the Secretariat)

SUMMARY

This paper proposes a new collection of aircraft movement data, particularly to address the lacuna in Form L where the data currently reported precludes traffic analyses. Based on the conclusion of STAP/14 and the Working Group 1 Report, ICAO's Statistics Programme proposes, in the interest of avoiding duplication of efforts, to pool resources, explore synergies and seek collaboration from ICAO's Committee on Aviation Environmental Protection (CAEP) and its Modelling and Databases Task Force (MODTF). ICAO would be charged with the data collection, starting with 2010 data, and the MODTF would be updating their Common Operations Database (COD). The creation of a harmonized, global aircraft movement database would enable ICAO to perform traffic analyses that address the changing requirements in air traffic management and air navigation, such as safety and efficiency assessments in support of performance-based navigation (PBN) implementation. The implementation of the proposed data collection would require active support from Contracting States, air navigation services providers (ANSPs), their industry associations as well as additional resources.

Action by the division is in paragraph 4.

1. INTRODUCTION

1.1 In general, ANSPs perform traffic analyses for their managerial decision making, using operational procedural or radar data. If these are unavailable, they use filed flight plan data. Proprietary databases, including those of the largest ANSPs, have geographical limitations according to their airspace coverage. In contrast, ICAO is uniquely placed to collect aircraft movement data, seeking active support from its Contracting States for maximum participation among ANSPs, of which the overwhelming majority (82 per cent) in 2007 were governmental entities or State-owned autonomous entities according to an ICAO survey[1] among 101 States.

[1] See http://www.icao.int/icao/en/atb/epm/Ecp/Report_OwnershipStudy_en.pdf

2. LIMITATIONS OF CURRENTLY ACCESSIBLE EN-ROUTE TRAFFIC DATA

2.1 ICAO

2.1.1 The current collection of en-route traffic data across Flight Information Regions (FIRs) and Upper Flight Information Regions (UIRs), via Form L (see STA/10-WP/25), has limitations. The lack of contributions by Contracting States with major traffic volumes hampers the ability to arrive at a significant representation of traffic coverage, both at regional and global levels. Over the 2001 to 2007, on average, only around 34 per cent of global aircraft movements (number of departures) were reported due to the low participation by States as shown below.

No. of States reporting Form L	Years						
	2001	2002	2003	2004	2005	2006	2007
	49	46	49	44	60	23	48

2.1.2 Moreover, Form L asks States to report the number of flights for each FIR/UIR at an aggregate level (international, domestic, other and total flights). Since it does not reveal the actual route flown, the required traffic analyses cannot be performed, such as safety and efficiency assessments in support of performance-based navigation implementation as described in paragraph 4.

2.2 Commercial data sources

2.2.1 INNOVATA and OAG Aviation Solutions provide commercial databases based on air carriers' schedules, not actual flights. They include, among other items, detailed data per scheduled, commercial flight (air carrier, airport of origin, destination airport, aircraft type and scheduled times of departure and arrival). Thus, they are dysfunctional for the calculation of operational parameters.

3. PROPOSED NEW COLLECTION OF AIRCRAFT MOVEMENT DATA

3.1 Report of STAP/14 Working Group 1

3.1.1 STAP/14 established the STAP/14 Working Group (WG) 1[2] to propose a course of action for the ICAO Statistics Programme to collect aircraft movement data and arrive at one consolidated ICAO aircraft movement database for analyses of air navigation operations. This excluded data related to aviation environmental protection in order to avoid duplication of efforts.

3.1.2 The WG1 Report reinforced the STAP/14 conclusion that the ICAO Statistics Programme needed to be mandated with an annual FIR/UIR data collection from ANSPs with the active support of States. For the latter, it referred to RECOMMENDATION STAP/14-11, which endorses the creation of a focal point for airports and ANSPs in the national civil aviation authorities, who should report data and improve reporting coverage. The Recommendation stresses that ICAO needs to work out a protocol to collect these data in close collaborations with ANSPs.

3.1.3 The Report concluded that it was necessary to pool resources and updates the existing COD of ICAO's CAEP. It stipulated that the identification and definition of data fields would be a

[2] Comprised of members or their advisers and observers from Brazil, Egypt, India (Airport Authority of India), United States (DOT/FAA) and the European Organisation for the Safety of Air Navigation (EUROCONTROL), and the ICAO Secretariat.

simplified version of the CAEP COD. The required synchronization of national/sub-regional data could only be accomplished by COD experts of the MODTF of ICAO CAEP, in view of their vast experience in building the COD as one harmonized aircraft movement database on the basis of 2006 databases and resources supplied by both the United States' Department of Transportation/Federal Aviation Administration (DoT/FAA) and EUROCONTROL.

3.1.4 The COD was currently limited for use for supporting CAEP activities only. A revision of the legal agreement between the U.S. DoT/FAA and EUROCONTROL was required to alter this provision. Subsequently, an agreement would have to be forged that would allow for the planned COD updated with 2010 data to be made accessible both to CAEP and the ICAO Statistics Programme for their respective, mandated traffic analyses.

3.2 Potential Applications: Safety and Efficiency Assessments for Performance Based Navigation implementation

3.2.1 ICAO is committed, inter alia, to enhance civil aviation safety and operational efficiency worldwide. Towards these objectives, the Organization is instituting the PBN concept, which will enable the optimization of air traffic management (ATM) in terms of air routes and flight paths prescribed versus those actually flown. As a result, safety of aircraft operations will be enhanced and air space capacity improved as further described in **Appendix A**.

3.2.2 Potential applications of the updated CAEP MODTF COD by the ICAO Statistics Programme will develop analytical tools to measure the operational efficiencies of PBN implementation in order to monitor if the PBN initiatives have reached their targeted benefits, such as:

a) increased airspace safety through the implementation of continuous and stabilized descent procedures using vertical guidance;

b) the use of the RNAV and/or RNP capabilities that already exist in a significant percentage of the aircraft fleet flying in each regional airspace; and

c) implementation of more precise approach, departure, and arrival paths that will reduce dispersion and will foster smoother traffic flows.

3.3 Collaboration with ANSPs and their associations

3.3.1 ICAO intends to pool resources and explore synergies by building on the experiences of the U.S. DoT/FAA and EUROCONTROL. It is noteworthy that the CAEP MODTF and owners of the COD are willing to extend the geographical coverage of their harmonized aircraft movement database in order to enhance the effectiveness of the environmental models built for CAEP.

3.3.2 ICAO is uniquely placed to collect aircraft movement data from all seven ICAO statistical regions, by seeking active support from its Contracting States for maximum participation among ANSPs, in order to extend the geographical coverage. A successful implementation of the proposed data collection would require not only the active support from Contracting States but also from multinational air

navigation agencies, regional organizations and industry associations of ANSPs[3], as advocates of the data collection among their members.

3.4 Data sources, structure and collection

3.4.1 ANSPs track the flights they control. Initially, flight plans are filed by pilots. Moreover, air traffic control (ATC) generates flight progress strips each time an aircraft exits and enters an ATC sector. Aircraft cross one or several FIRs/UIRs. In a radar environment, a transponder onboard an aircraft transmits the flight number, altitude, airspeed and destination of a given flight. ICAO needs to collect these actual flight operations data from civil aircraft movements in the respective FIRs/UIRs, which ANSPs record, and, therefore, own.

3.4.2 The identification and definition of data fields to be collected for each flight would follow the CAEP COD, in a simplified version. They can not be revealed in this working paper due to reasons of confidentiality. For orientation purposes, **Appendix B** shows a typical structure of FIR/UIR data. It should be noted that, if an ANSP is using a different data structure, it can submit the data as is.

3.4.3 A protocol for electronic data transmission (internet file transfer, CD-ROM, DVD or other means) will have to be developed in close collaboration with ANSPs. The problem of data which is not homogeneous originating ideally from radar transmission but realistically also from filed flight plans, will have to be addressed for the validation procedure. ICAO has taken preparatory steps to have database and mining software tools available to verify and validate the data. However, active support by major stakeholders as identified by the STAP/14 WG1 would be essential in this endeavour.

3.4.4 Potential challenges for the proposed data collection are that some ANSPs may have reservations in sharing their actual civil aircraft movement data for reasons of data protection protocols and sensitivities due to security concerns. To address such reservations, ICAO, in close consultation with ANSPs, needs to develop a consultation mechanism to work out the terms of reference for this data collection, including a protocol to ensure appropriate safeguards of restricted data access and confidentiality as well as mandated purposes. All stakeholders/subscribers will have to underwrite such conditions in a formal agreement.

4. ACTION BY THE DIVISION

4.1 The division is invited to endorse that the ICAO's Statistics Programme will:

a) pursue the collection of aircraft movement data across FIRs/UIRs annually starting with 2010 data from ANSPs through States;

b) develop a protocol for the protection and electronic transmission of FIRs/UIRs data to be identified and defined in close collaboration with ANSPs;

c) pool resources, explore synergies and seek collaboration from ICAO's CAEP and its MODTF for an update of their COD with a view to avoiding duplication where 2010 data will be provided as specified under a); and

d) discontinue Reporting Form L once the proposed data collection is implemented.

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[3] Notably the Agence pour la Sécurité de la Navigation Aérienne en Afrique et à Madagascar (ASECNA), the Central American Corporation for Air Navigation Services (COCESNA); EUROCONTROL, Piarco FIR (in the Caribbean region), and Roberts FIR (Guinea Conakry, Liberia, Sierra Leone) as well as the Civil Air Navigation Services Organization (CANSO).

APPENDIX A

SAFETY AND EFFICIENCY ASSESSMENTS FOR PBN IMPLEMENTATION EXPLANATORY NOTES

Air traffic growth, combined with restrictions imposed by conventional air route configurations, established by ground-based and sensor-driven navigation aids (VOR, DME, NDB), have led to dangerously congested terminal areas and respective surroundings at many of the world's largest airports serving metropolitan centres. Aircraft operators face potential safety risks, delays and high operational costs as long as air navigation services providers (ANSPs) have to handle growing traffic understaffed with insufficient navigation system infrastructure, both in the terminal areas (TMA) and en-route.

Sensor-based air navigation has significant distinctions from PBN. The former has prescribed fixed routes joining ground-based navigation aids often in an inefficient zigzag formation, resulting in uneconomical flight paths. Flying on these routes is not only more costly but also less accurate when compared to the Area Navigation (RNAV)/Required Navigation Performance (RNP) procedures, which is the basis of the PBN concept. Within given air traffic control (ATC) parameters, RNAV allows an aircraft to operate on a desirable flight path and thereby fly on more direct routes independently of the location of ground-based navigation aids. RNP is RNAV with the additional component of monitored performance and additional avionics equipment of flight capacity alert.

With the partial or full implementation of reduced vertical separation minimum (RVSM) in all ICAO regions, further ATM optimisation depends on the capabilities of a significant portion of airspace users in ICAO regions to utilize RNAV/RNP procedures that should be implemented in TMAs of major international airports by 2010.

Aircraft-based RNAV systems have developed over a 40-year period and are applied through a large variety of specifications. Advanced RNAV systems perform at a predictable level of accuracy and allow for identification of the desirable flight path, and, thus, more efficient use of available airspace. Identifying navigation requirements rather than prescribing the means of meeting the requirements will allow use of the RNAV systems that meet these requirements.

ICAO's regional PBN implementation plans or roadmaps[4], *inter alia*, define generic navigation performance requirements based on established operational requirements. Performance requirements are defined in terms of accuracy, integrity, continuity, availability and functionality needed for the proposed operation in the context of a particular airspace concept. In terms of navigation specifications, they identify which navigation sensors and equipment may be used to meet the RNP. The plans/roadmaps guide the major stakeholders (ANSPs, airlines, airports, regulators, industry associations and other international organizations) on the potential application of RNAV systems and their RNP for aircraft operating along an air traffic services (ATS) route, in terminal as well as in en-route airspace.

[4] ICAO, Asia Pacific Office, Asia/Pacific Performance-Based Navigation Implementation Plan, Interim Edition, September 2008 as per Asia/Pacific Air Navigation Planning and Implementation Regional Group, APANPRIG/19, Appendix G to the Report on Agenda Item 3.4, and
ICAO, CAR/SAM Roadmap for Performance-Based Navigation, Lima November 2006 as per, GREPECAS/14-WP/14, Appendix B.

The completion of safety assessments for various air space categories are envisaged in the pre- and post-PBN implementation phases and are conceptualized short term (2008 – 2012) and medium term (2013 – 2016) in the different ICAO regions. In addition, efficiency assessments are recommended in order to check on those implementation targets that translate directly into economic benefits. One of the key aspects of the PBN concept is the development of measurable performance objectives with their associated metrics in terms of reduced flight distances and, consequently, durations. A basic prerequisite for a successful PBN implementation is effective performance management that starts with the ability to reach a consensus on desired/required and achievable results or measurable and quantifiable performance indicators with the stakeholders concerned.

Targeted benefits of PBN implementation are as follow:

a) increased airspace safety through the implementation of continuous and stabilized descent procedures using vertical guidance;

b) reduced aircraft flight time due to the implementation of optimal flight paths, with the resulting savings in fuel, noise reduction, and enhanced environmental protection;

c) the use of the RNAV and/or RNP capabilities that already exist in a significant percentage of the aircraft fleet flying in each regional airspace;

d) improved airport and airspace arrival paths in all weather conditions, and the possibility of meeting critical obstacle clearance and environmental requirements through the application of optimized RNAV or RNP paths;

e) more precise approach, departure, and arrival paths that will reduce dispersion and will foster smoother traffic flows;

f) reduced delays in high-density airspaces and airports through the implementation of additional parallel routes and additional arrival and departure points in terminal areas;

g) reduced lateral and longitudinal separation between aircraft to accommodate more traffic;

h) decreased ATC and pilot workload by utilizing RNAV/RNP procedures and airborne capability and reduce the needs for ATC-pilot communications and radar vectoring; and

i) increased predictability of the flight path.

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APPENDIX B

TYPICAL FIELDS OF AIRCRAFT MOVEMENT DATA

1. Date of flight
2. Call sign
3. Aircraft operator
4. Flight number
5. Aircraft registration
6. Aircraft type
7. Departure airport
8. Destination airport
9. Entry point
10. Entry time
11. Entry flight level (FL)
12. Exit point
13. Exit time
14. Exit flight level (FL)
15. ATA – actual time of arrival
16. STA – scheduled time of arrival
17. STD – scheduled time of departure
18. ATD – actual time of departure
19. ATS route
20. 20. Flight classification I: inbound/arrival (IN), outbound/departure (OUT), en-route (ENR)
21. 21. Flight classification II: scheduled (SCED), non-scheduled (NSCED), business (BUS), general aviation (GA)
22. . Flight classification III: passenger (PA), cargo (CA), other (OT).

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