



WORKING PAPER

TWELFTH AIR NAVIGATION CONFERENCE

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Agenda Item 1: Strategic issues that address the challenge of integration, interoperability and harmonization of systems in support of the concept of “One Sky” for international civil aviation

1.1: Global Air Navigation Plan (GANP) – framework for global planning

DEVELOPMENT OF COMMON PERFORMANCE METHODOLOGIES AND METRICS TO SUPPORT THE FRAMEWORK FOR GLOBAL PLANNING

(Presented by the Presidency of the European Union on behalf of the European Union and its Member States¹; by the other Member States of the European Civil Aviation Conference²; by EUROCONTROL; and by the United States)

SUMMARY

This paper highlights the need for ICAO to revise the current edition of ICAO *Manual on Global Performance of the Air Navigation System* (Doc 9883) to support the framework for global planning. This would include an initiative to promote common performance indicators where feasible. This paper presents work which demonstrates that it is possible to update the methodology, metrics and indicators and potentially provide a standardized and sound basis for factual high-level performance comparisons between countries and regions.

This paper outlines that for several years, EUROCONTROL and FAA have been working together on producing predictability and efficiency indicators using similar data sources and data processing algorithms. The joint EUROCONTROL-FAA reports are publicly available and have been presented to ICAO and Civil Air Navigation Services Organization (CANSO) groups reviewing guidance on performance. This paper briefly describes the data and procedures used in these reports.

Action: The Conference is invited to agree with the recommendations in paragraph 6.

1. INTRODUCTION

1.1 Global aviation safety and air navigation efficiency are intrinsically linked, driven by a highly collaborative ‘system of systems’. ICAO works with its global aviation partners to organize these systems based on interdependent action cycles driving continuous improvement. This is reflected in the Global Aviation Safety Plan (GASP) and the Global Air Navigation Plan (GANP). This paper focuses on the air navigation planning and implementation framework proposed in the draft revised GANP (AN-Conf/12-WP/3), which prescribes

¹ Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom. All these 27 States are also Members of the ECAC.

² Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Croatia, Georgia, Iceland, Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

reporting, monitoring, analysis and review activities being conducted on a cyclical, annual basis. This is understood to rely on two distinct but complementary monitoring activity threads, i.e. the implementation status (planned delivery) as well as the overall performance outcome (actual achievements).

2. NEED FOR AN UPDATED GLOBALLY HARMONIZED MEASUREMENT APPROACH

2.1 The ICAO *Manual on Global Performance of the Air Navigation System* (Doc 9883), provides extensive guidance on how to set up a performance-based approach (PBA) for informed decision making. It highlights the value to organizations and provides steps for moving towards PBA. Key elements include: 1) defining policy in terms of qualitative performance objectives; 2) making the objectives measurable by defining appropriate indicators; 3) developing the data and methodologies necessary to calculate the indicators; and 4) having the expertise to maintain data quality and assessing the link between indicator trends and management actions.

2.2 For instance, Appendix E of ICAO Doc 9883 provides examples of possible performance indicators in the ICAO Key Performance Areas (KPA's). The Appendix is drawn largely from the experience of two organizations and provides a good starting point for any planning and implementation regional group (PIRG), State or air navigation service provider (ANSP) developing indicators for the purpose of the performance based approach. Providing information that allows identifying causal reasons for changes in performance is key to indicator development. Such indicators should provide clear direction for what an ANSP can influence through its investment, training or policy.

2.3 The current edition of Doc 9883 (2009) acknowledges in its Appendix E that more work is needed to move towards a globally harmonized measurement approach. It states “... *it (Appendix E) does not propose such a globally standardized or harmonized set of metrics and indicators. It illustrates the challenges associated with standardization by providing a number of examples from various organizations*”.

2.4 The descriptions of the aviation system block upgrade (ASBU) modules contain references to Doc 9883 as the reference document for the methodologies, metrics and indicators to be used. This indicates that there is value in furthering the work initiated in Doc 9883 which identified common elements in some measures and a process for further driving towards consensus in others. Given ASBU requirements, ICAO should re-launch work to evaluate current practice and where feasible, establish a set of common ANS performance metrics and associated guidance material. This effort would build on existing ICAO documentation (e.g. Doc 9883 and 9161) as well as on the experience of regions in applying the PBA. ICAO's recommended revisions should be set forth in a revised edition of Doc 9883.

2.5 The remainder of this paper is dedicated to assisting ICAO's effort by highlighting performance work carried out by both EUROCONTROL and the FAA on reporting common indicators. This work continues as both the underlying data and the needs of management evolve. However, the EU/US benchmark reports provide a real world demonstrated implementation of many of the concepts described in Doc 9883 and may be useful to ICAO in furthering its work on measuring the global performance of the air navigation system.

3. EUROCONTROL/FAA USE OF PERFORMANCE METRICS

3.1 As in any industry, comparisons and benchmarking, including data analysis can help optimize performance and identify best practices in air traffic management (ATM). Over the years, various groups have sought to estimate the amount of inefficiency that can be addressed by improvements in the ATM system.

3.2 With the exception of on-time performance, there is a lack of commonly agreed upon and comparable performance indicators world-wide. For example, there are multiple delay definitions even within ANSPs. Delay metrics and schedule padding by airlines can mask inefficiency in the system. To better account

for inefficiency, the EU/US work established idealized benchmark times by phase of flight. (i.e., pre-departure delay, taxi-out, en route, terminal arrival, taxi-in, and arrival delay).

3.3 These phase-of-flight efficiency indicators may be used to assess the role of ATM in meeting fuel efficiency goals. At the 37th Session of the ICAO Assembly in October 2010, ICAO established a global goal of 2 per cent annual improvement in fuel efficiency until the year 2020. For the purpose of assessing the contribution of ATM to the overall ICAO fuel efficiency goal, ANSPs could use efficiency indicators to estimate benefit pools similar to what is done in the EU/US benchmark reports.

3.4 Efficiency measures are also shown by facility. Both facility and phase-of-flight indicators can help an ANSP prioritize work efforts in improving system operations. For example inefficiencies seen in the terminal manoeuvring area (TMA) may suggest a need to improve flow control or arrival management. These inefficiencies may also have higher fuel consequences than inefficiencies observed in the taxi state.

3.5 Lastly, the US/EU benchmark reports strive to explain the relationship between ANSP performance and interdependencies that require cooperation with groups or events outside the ANSP. This may include competing goals within airlines, weather, or changes to airport infrastructure that affect capacity.

4. DATA REQUIREMENTS FOR BENCHMARKING

4.1 Industries that find value in performance analysis will develop the infrastructure necessary to implement the broad recommendations for PBA provided by ICAO in Doc 9883. The foundational requirements for PBA include both data collection and the analysis expertise to make use of the data and infer trends that improve management decisions and the overall efficiency of the system. Many of the measureable performance indicators are derived from two fundamental data sources. The first includes a database of actual trajectories complemented by flight plan data providing trajectory intent of the aircraft. The second involves data provided by airlines that provides key event times for the flight on the airport surface.

4.2 Both Europe and the US obtain key data from their respective traffic flow management systems (TFMS). For the US, data come from the TFMS. In Europe, data are derived from the enhanced tactical flow management system (ETFMS) of the central flow management unit (CFMU) – nowadays called the Network Manager – located in Brussels, Belgium. Both of these systems have data repositories with detailed data on individual flight plans and track points from actual flight trajectories. They also have built-in capabilities for tracking ATM related ground delays by airport and en route reference location.

4.3 Flight track data of actual trajectories are used for the calculation of flight efficiency in terms of great circle distance or planned routes against actual flown routings. For phase of flight calculation, this includes en route as well as the terminal manoeuvring area around an airport.

4.4 Both groups receive operational and delay data from airlines. This type of data is a more detailed subset of the traffic flow data described above and includes what is referred to as OOOI (Out of the gate, Off the runway, On the runway and Into the gate). OOOI data along with airline schedule times allows for the calculation of gate delay, taxi times, en route times and gate arrival delay on a flight by flight basis.

4.5 To better understand causal reasons for inefficiency, it is useful for performance data to be supplemented with airport capacity, airspace sector capacity, and weather data such as winds, visibility, freezing conditions and the presence of convective weather. Publically available METAR reports provide a source for weather whereas capacity values would need to be developed by the ANSP or regulating State.

4.6 Europe and the US represent broad geographical areas with millions of annual flights. The size of these geographical areas provides an economy of scale that supports a high level of performance analysis. For

other regions, it may be necessary for States to combine resources to support a broader effort. For its benchmark work, EUROCONTROL combines flight information for thirty-eight different States.

5. SUMMARY OF BENCHMARK REPORTS

5.1 EUROCONTROL and FAA have produced two editions of a benchmark report³ that demonstrate a real-world implementation of several of the measurable KPAs described in ICAO Document 9883. The reports use operational performance data current through calendar year 2010. A third update using data current through 2012 is under development with publication scheduled for spring of 2013.

5.2 Reporting key performance indicators (KPIs) using common definitions and derived from similar databases allows the aviation community to see the effects of different operational practices, demand trends, and scheduling policy on performance. The European system currently works with thirty-eight different ANSPs and most airports have schedule or slot limitations. This may be compared with the US single ANSP with far less schedule limitations and more variability in time by phase of flight.

5.3 The reports examine metrics for punctuality (delay against airline schedule) and track how airlines adjust block time in order to make schedules more predictable. A procedure for measuring predictability is provided. For ATM imposed delay, the reports track the constraining elements of both systems and whether the delay was imposed due to airport or airspace constraints. This type of detailed analysis of a delay/efficiency KPA requires specialized data reporting from the ANSP.

5.4 The reports conclude with measures of actual flight trajectories compared against ideal unimpeded trajectories. Single flight idealized trajectories are not always practical and aircraft must be separated for safety and must avoid severe weather or exclusionary airspace. Nevertheless, tracking efficiency as measured against an idealized benchmark can be a useful first step in determining if an observed inefficiency is actionable by current ATM or would require new generation technology.

6. CONCLUSION

6.1 The Conference is invited to:

- a) invite ICAO to revise *Manual on Global Performance of the Air Navigation System* (Doc 9883), in line with the ICAO global planning framework, to cover both the implementation status and the overall performance outcome. This would build on existing ICAO documentation as well as the experience of regions in applying the performance based approach;
- b) consider the US/Europe comparison of ATM-related operational performance (2009, updated in 2012) as a contribution to such work;
- c) note that the current edition of ICAO Doc 9883 does not yet propose an agreed list of metrics and indicators intended for global application; and
- d) recommend evaluating the feasibility and need for developing common air navigation services (ANS) performance metrics and indicators, with associated guidance material, to support the ICAO framework for global planning and other reporting requirements on similar data.

— END —

³ US/Europe Comparison of ATM-related Operational Performance (2009, updated in 2012).

See <http://www.eurocontrol.int/documents/useurope-comparison-atm-related-operational-performance-2010>