



Agenda Item 2: Air Navigation Matters
2.2 Development of metrics and performance goals

PERFORMANCE MONITORING AND MEASUREMENT

(Presented by the Secretariat)

SUMMARY

One of the key aspects of the performance based approach for air navigation planning is the development of performance objectives with related measurable outcomes and metrics. This paper provides information on the formulation of metrics and proposes an initial set of key performance areas and associated metrics to be used as the basis for performance measurement of the implementation of the national performance-based air navigation implementation plans. It is expected that E/CAR States/Territories will provide information on performance measurement.

References:

- Doc 9854 - *Global Air Traffic Management Operational Concept*
- Doc 9750 - *Global Air Navigation Plan*
- Doc 9883 - *Manual on Global Performance of the Air Navigation System*
- Report of the GREPECAS/15 Meeting, Rio-de Janeiro, Brazil, 13 to 17 October 2008
- Report of the E/CAR/DCA/22 Meeting, Port of Spain, Trinidad and Tobago, 8 to 11 December 2009
- Report of the E/CAR/WG/31 Meeting, Antigua and Barbuda, 5 to 8 October 2009

**Strategic
Objectives**

This working paper is related to Strategic Objectives A, C, D and E.

1. Introduction

1.1 The ICAO planning objective is to achieve a performance based global air traffic management (ATM) system through the implementation of air navigation systems and procedures in a progressive manner. The top-down implementation approach at a global level and regional harmonization measures converge with the bottom-up approach constituted by States national planning.

1.2 To facilitate the implementation of a performance based global ATM system, ICAO has made significant progress in the development of relevant guidance material. The documents include: a) Global Air Traffic Management Operational Concept (Doc 9854); b) Air Traffic Management System Requirements (Doc 9882); c) Manual on Global Performance of the Air Navigation System (Doc 9883); and d) Global Air Navigation Plan (Doc 9750).

1.3 The GREPECAS/15 meeting, while adopting a regional performance framework (Conclusion 15/1 refers), invited States to adopt a national performance framework based on ICAO guidance material and in line with the regional performance objectives, the regional air navigation plan and the Global ATM Operational Concept.

1.4 As a follow-up to Conclusion GREPECAS 15/1, ICAO established a SIP consisting of a workshop for the States of the Caribbean Region in order to provide requisite training in the development of national air navigation performance framework. The workshop was held from 6 to 10 July 2009 in Mexico City.

1.5 Moreover, the E/CAR/WG/31 Meeting adopted the following Conclusion endorsed by the E/CAR/DCA/22 Meeting:

CONCLUSION 31/9 AIR NAVIGATION PERFORMANCE MONITORING AND MEASUREMENT

That the E/CAR States/Territories:

- a) assign the E/CAR/WG to establish a set of metrics related to key performance areas including access, capacity, cost effectiveness, efficiency, environment, flexibility, predictability and safety by the 32th E/CAR/WG meeting to be held in 2010;*
- b) incorporate agreed metrics into the performance monitoring process by the end of 2010, collect and submit relevant data to the ICAO NACC Regional Office on a regular basis; and*
- c) coordinate with the ATM community members to promote information and data collection.*

2. Analysis of Performance Monitoring and Measurement

2.1 *Data management:* Data collection, processing, storage and reporting are fundamental to the performance-based approach and form part of performance monitoring and management. Although re-use of data prepared by others is sometimes possible, the data reporting chain always starts at the “grass-roots level”, and properly setting up and managing the entire chain is an integral part of the approach.

2.2 A data reporting chain requires the establishment of a performance data reporting culture, the capability to successfully manage disclosure and confidentiality aspects, and deciding on a case-by-case basis which approach works best: mandatory or voluntary reporting. Data will be condensed into indicators reflecting the performance of the system.

2.3 *Terminology:* It is essential to use harmonized terminology for planning, implementation and air navigation systems performance measurement as follows:

- a) *Performance Indicator:* Current/past performance, expected future performance as well as actual progress in achieving performance objectives is quantitatively expressed by means of performance indicators (sometimes called Key Performance Indicators, or KPIs). To be relevant, indicators need to correctly express the intention of the associated performance objective. Since indicators support objectives, they should not be defined without having a specific performance objective in mind. These performance indicators are not often directly measured. They are calculated from supporting metrics according to clearly defined formulas, e.g. cost-per-flight-indicator= Sum(cost)/Sum(flights);
- b) *Performance target:* Performance targets are closely associated with performance indicators: they represent the values of performance indicators that need to be reached or exceeded to consider a performance objective as being fully achieved; and
- c) *Metrics:* Performance measurement is done through the collection of data for the supporting metrics (e.g. this leads to a requirement for cost data collection and flight data collection). Supporting metrics fulfil three functions. They form a basis for assessing and monitoring the provision of ATM services, they define what ATM service users value, and they can provide common criteria for cost benefit analysis for air navigation systems development. These metrics are used to calculate the values of performance indicators. In other words, metrics are quantitative measure of system performance – how well the system is functioning.

2.4 The increased demand for ATS has begun to focus attention on the performance rather than on of technological capabilities. As the investment decisions required to prove ATM services become more complex, the need for well defined metrics for ATM systems performance increases.

2.5 Performance monitoring and measurement of ATM systems calls for metrics in areas that cover access, capacity, cost effectiveness, efficiency, environment, flexibility, predictability and safety. In accordance with the Global ATM Operational Concept and the Manual on Performance of the Global Air Navigation System, sets of metrics are included in the **Appendix** to this working paper so E/CAR States/Territories can provide information as a result of their implementation activities. Metrics should be simple, easy to understand definitions.

2.6 It is noteworthy that the data needed for some of the metrics (e.g. fuel consumption or aircraft movements) are in the final phase of being officially collected by the Contracting States, in the context of the ICAO Statistics Programme, managed by the Economic Analyses and Databases (EAD) section at ICAO Headquarters.

3. **Action by the Meeting**

3.1 The Meeting is invited to:

- a) implement E/CAR/WG Conclusion 31/9 item a) and provide the metrics information for performance monitoring and measurement presented in the Appendix according to progress of implementation tasks in the E/CAR; and
- b) analyze other considerations in this respect that are considered necessary.

APPENDIX
LIST OF METRICS FOR PERFORMANCE MONITORING OF AIR NAVIGATION SYSTEMS

Key Performance Area	Corresponding proposed metrics
1. Access and equity	Civil flights using fixed airspace; Unusable airspace due to navigation restriction; Number of access denials; Number of airports with published approaches.
2. Capacity	Average daily airport capacity for a group of 35 airports measured as a 5 year moving average; Hourly number of IFR movements (departure + arrivals) during IMC; Total number of operations per day; Number of aircraft in a specified volume of airspace; Airspace throughput/TMA-number of aircraft per 100 nmi ³ ; Traffic density i.e. number of aircraft per 100 nmi ³ ; En-route utilization i.e. number of aircraft per 100 nmi ³ ; Airside Capacity i.e. number of operations per hour; Airborne delay i.e. minutes per flight; Arrival/departure delay i.e. minutes per flight.
3. Cost effectiveness	Total operating cost plus cost of capital divided by IFR flights; Average cost per flight at a system wide annual level; Investment cost; Cost per retrofit; Out of service cost; Operating and Maintenance cost.
4. Efficiency	Estimated fuel savings (year 2000 as baseline); Percent of flights departing on-time; Percentage of instrument runway ends with an approach procedure with vertical guidance (APV), (BARO-VNAV and/or augmented GNSS) either as the primary approach or as a back-up for precision approaches; PBN Routes implemented and published in en-route; Number of certified aircrafts and pilots for PBN operations for en-route and TMA; Percent of flights with normal flight duration; Traffic movements i.e. # of movements; Unused capacity i.e. # of movements; Number of ATC automated systems that are interconnected; Number of terminal areas with SID/STAR implemented.

Key Performance Area	Corresponding proposed metrics
5. Environment	Amount of emissions which are attributable to inefficiencies in ATM service provision; Pounds of fuel burn per operation; Local noise foot print; Number of noise complaints.
6. Flexibility	Proportion of rejected changes for which an alternative was offered and taken; En-route flight distance Percentage of flights off-on ATC preferred routes; Number of backups available for emergency; Flexibility in sequencing; Number of restrictions.
7. Predictability	Variability in delay for arrival time./departure time/en-route and Taxi time i.e. Minutes /flight; Number of aircraft held i.e. # Aircraft /hr; Number of cancellations/diversions/misconnections i.e. #of flights.
8. Safety	Number of runway incursions per year; Number of operational errors per year; Number of accidents per 100,000 departures; Number of fatalities per 100,000 departures; Number of LHD reports.