International Civil Aviation Organization
CAR/SAM Regional Planning and Implementation Group (GREPECAS)
Seventh Meeting of the GREPECAS Aerodromes and Ground Aids/Aerodrome Operational Planning Subgroup (AGA/AOP/SG/7)
Buenos Aires, Argentina, 9 to 13 November 2009

Agenda Item 3 **Review of Deficiencies and Air Navigation subjects in the AGA Field**
3.5 AGA related performance objectives contained in the NAM/CAR Regional Performance-Based Air Navigation Implementation Plan

REGIONAL PERFORMANCE OBJECTIVES IN THE AGA FIELD

(Presented by the Secretariat)

SUMMARY

One of the key aspects of the performance based approach to air navigation planning is the development of performance objectives with related measurable indicators and metrics. This paper proposes an initial set of key performance areas and associated metrics to be used as the basis for performance measurement of the regional air navigation work programme.

References:

- GREPECAS 15/ WP37 and GREPECAS/15 Report
- Doc. 9854 - *Global Air Traffic Management Operational Concept*
- Doc. 9883 - *Manual on Global Performance of the Air Navigation System* and
- Doc. 9750 - *Global Air Navigation Plan*

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

1. Introduction

1.1 *Air Navigation Planning process*: 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, cost-effective and cooperative manner. The regional planning and implementation process is the principal engine of ICAO's planning framework. It is here that the top-down approach comprising global guidance and regional harmonization measures converge with the bottom-up approach constituted by national planning by States.

2. Transition to a Performance Based Air Navigation Planning

2.1 *Basis*: The notion of a performance based air navigation system emanated from good industry practices that have emerged over many years. As the aviation industry evolved into a less regulated and more corporatized environment with greater accountabilities, the advantages of transitioning from systems based to performance-based planning are apparent.

2.2 *Principles:* The performance-based approach (PBA) adheres to the following principles: strong focus on results through adoption of performance objectives and targets; collaborative decision making driven by the results; and reliance on facts and data for decision making. In PBA methodology the assessment of achievements is periodically checked through a performance review, which in turn requires adequate performance measurement and data collection capabilities.

2.3 *Advantages*: The advantages of PBA methodology include: Result oriented, transparent and promotes accountability; shift from prescribing solutions to specifying desired performance; employs quantitative and qualitative methods; avoids a technology driven approach; helps decision makers to set priorities, makes the most appropriate trade-offs, and allows optimum resource allocation.

2.4 *Guidance:* To facilitate the realization of a performance based Global ATM system, ICAO has made significant progress in the development of relevant guidance material.

3. Regional and National Performance Planning for Air Navigation Systems

3.1 *Outcome of GREPECAS/15*: The GREPECAS/15 meeting held in Rio de Janeiro, Brazil from 13 to 17 October 2008, while adopting a regional performance framework (Conclusion 15/1 refers), invited States to adopt a national performance framework on the basis of ICAO guidance material and aligned with the regional performance objectives, the regional air navigation plan and the Global ATM Operational Concept. The performance framework should include identification of national performance objectives taking into consideration user expectations and completion of national performance framework forms (**Appendix A** to this WP refers) for all air navigation areas.

3.2 *Regional workshops*: As a follow-up to the GREPECAS 15/1 Conclusion, the Secretary General, in January 2009, established a SIP consisting of two workshops, one for the States of the South American and another for the NAM/CAR Regions in order to provide requisite training in the development of national air navigation performance framework. The workshops were held from 13 to 17 April 2009 in Lima, Peru and from 6 to 10 July 2009 in Mexico City, Mexico.

4. Air Navigation Performance Monitoring and Measurement

4.1 *Data management*: Data collection, processing, storage and reporting are fundamental to the performance-based approach and form part of performance monitoring and management. It should not be assumed that all data which is needed is simply available "somewhere" and only needs to be copied. 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. Establishing a data reporting chain usually involves participation from many ATM community members. Their willingness to participate requires the establishment of a performance data reporting culture, a capability to successfully manage disclosure and confidentiality aspects, and deciding on a case-by-case basis which approach works best: mandatory or voluntary reporting. In the end, data will be condensed into a few indicators which represent the high level knowledge about the performance of the system.

4.2 *Terminology*: It is essential to use harmonized terminology in applying performance based approach to planning and implementation of air navigation systems. For performance measurement three basic terms are explained. 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 services user 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.

5. Choosing Metrics for CAR/SAM Regions

5.1 *Methodology*: The increased demand for ATS services has begun to focus attention on the performance rather than capabilities of technologies. As the investment decisions required for providing ATM services become more complex, the need for well defined metrics for ATM systems performance increases.

5.2 *Metrics:* The performance monitoring and measurement of ATM systems calls for metrics in area that envelopes access, capacity, cost effectiveness, efficiency, environment, flexibility, predictability and safety. On the basis of the Global ATM Operational Concept and the Manual on Performance of the Global Air Navigation System, a sample set of metrics is listed in **Appendix B** to this working paper. It should be noted that the list in Appendix B hereto is not exhaustive. The region/subregion, on the basis of its experience, could determine the appropriate metrics applicable to its situation. Agreement on the metrics would necessitate common definitions and understanding.

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

6. Conclusion

6.1 *Evolutionary approach:* The global ATM system will emerge through the implementation of many initiatives over several years on an evolutionary basis. At first, the planning and implementation activities begin with application of available procedures, processes and capabilities. The evolution progresses to the application of emerging procedures, processes and capabilities and ultimately, migrates to the ATM system based on the operational concept.

6.2 Recommendation: Taking into account the need of counting with a clearly defined strategy for the implementation of the ATM systems, as well as the need to align the work programmes of States, regions and ICAO Headquarters, CAR/SAM States should adopt a national performance framework on the basis of ICAO guidance material, and guarantee its alignment with regional performance objectives, the regional air navigation plan, and the global ATM operational concept.

6.3 In addition, the Meeting is informed on the proposal of two regional performance objectives presented to the C/CAR/WG/7 and E/CAR/WG/31 Meetings: the first relates to the Implementation of Aerodrome Certification and the second refers to the Elimination of identified deficiencies, such as wildlife and bird hazard reduction, rescue and fire fighting services and aerodrome emergency planning. For this AGA/AOP/SG/7 Meeting it is proposed as a strategic operational improvement a regional performance objective: Enhance aerodrome capacity, which contains several relevant projects including wildlife hazard management for consideration and approval by the Meeting.

7. Action suggested:

7.1 The Meeting is invited to:

a) Take note of the information presented regarding the Global Air Navigation Plan;

b) Review the regional work programme in the AGA field, on the basis of the global air navigation plan, following performance objectives taking into account the forms referred to performance framework included in this working paper.

c) establish a set of metrics related to key performance areas including access, capacity, cost effectiveness, efficiency, environment, flexibility, predictability and safety;

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APPENDIX A

Enhance safety and efficiency of aerodrome operations **(**Enhance aerodrome capacity**)**	
Benefits	
Safety Efficiency Environment	• Through better situational awareness and conflict detection tools. • Enhance safety, access, efficiency and capacity of aerodrome operations in the States. • Uniform implementation of ICAO SARPS in the CAR/SAM States. • Efficient use of aerodrome resources, • Reduced wildlife / bird strikes, • Reduction in delays, • Maximize aerodrome capacity in all weather conditions, • Safely manoeuvre in all weather conditions, • Precise surface guidance to and from a runway, • Reduced noise impact, • Reduced incident/accident factors, • Reduced number of deficiencies, • Increased runway usability factor. • Reduction in fuel consumption.
Metrics	• Number of runway incursions and excursions per year. • Number of bird/wildlife strikes per year. • Number of total operations per hour at the aerodrome. • Total time an aerodrome is closed due to bad weather conditions. • Arrival / departure aircraft delay, minutes per flight. • Number of operational errors per year. • Number of accidents per 100,000 operations.

Strategy *Short Term (2011)* *Medium Term (2011 - 2014)*

ATM OL COMPONENT	PROJECT / TASK DESCRIPTION	TIMEFRAME START-END	RESPONSIBILITY	STATUS
	a) Improve Runway safety: Runway incursions and excursions are extremely hazardous and have resulted in a number of very serious incidents and actual collisions over the last few years.		States	
	b) Wildlife Hazard Management. Effective wildlife control policies and programmes should be administered by the national authority responsible for airports.		States	
AO	**c) Improve Runway capacity**: Uncertainty of an aircraft or vehicle position during reduced visibility, at night or when traffic is distant.		States	

ATM OL COMPONENT	PROJECT / TASK DESCRIPTION	TIMEFRAME START-END	RESPONSIBILITY	STATUS
	d) Minimizing the Effects of Weather on Capacity. Risk of significant reduced throughput due to reduced visibility. Poor situational awareness and high workload are contributing factors to reduction in traffic throughput.		States	
	e) Separation and improved situational awareness on taxiways & apron. - Risk of incident or accident on the taxiway and apron – misunderstood Air Traffic Control (ATC) instructions, particularly at night or in reduced visibility, can lead to an accident or incident.		States	
	f) Turn-Round and Variable Taxi Times. The turn-round process of an aircraft is a complex process involving many individual operations. It can be difficult to keep an overview of this process and obtain accurate information of when an aircraft will be ready for departure from the gate.		States	
	g) Apron Congestion (Stand and Gate Congestion). Apron (stand and gate) congestion is becoming more of a challenge every day, with aircraft waiting for stands, or being delayed on stands.		States	
	h) The addition of rapid exit taxiways to the runway configuration increases airport operational efficiency by allowing the runway to realize its maximum capacity potential.		States	
	i) Airport and flight information sharing. Airport operators to participate in airport information sharing and improve the planning of their resources by using real time flight information accessible via CDM.		States	
	j) Situational awareness for aerodrome ground operations. Conflict detection and resolution should be provided on all aerodrome movement areas, including runways, taxiways and aprons.		States	
	k) Support and follow-up States activities on aerodrome planning for NLA and their actions to ensure safe and effective operations of future aircraft generations at existing aerodromes.		States	
GPIs	GPI/6 Air traffic flow management; GPI/9 Situational awareness; GPI/13 Aerodrome design and management; GPI/14 Runway operations; GPI/15 Match IMC and VMC operating capacity; GPI/18 Aeronautical information			

PERFORMANCE FRAMEWORK FORM - EXPLANATORY NOTES

1. **Performance framework form:** This form is an output and management form which is applicable to both regional and national planning and includes references to the Global Plan. Other formats may be appropriate but should contain as a minimum the elements described below.

2. **Performance objective:** Regional /national performance objectives should be developed using a performance based approach that best reflects the necessary activities needed to support regional/national ATM systems. During their life cycle, performance objectives may change depending on the ATM system's evolution; therefore, throughout the implementation process, these should be coordinated with and be available to all interested parties within the ATM Community. The establishment of collaborative decision making processes ensures that all stakeholders are involved in and concur with the requirements, tasks and timelines.

3. **Regional performance objective:** Regional performance objectives are the improvements required to the air navigation system in support of the global performance objectives, and are related to the operating environments and priorities applicable at the regional level.

4**.** **National performance objective:** National performance objectives are the improvements required to the air navigation system in support of the regional performance objectives, and are related to the operating environments and priorities applicable at the State level.

5**.** **Benefits:** The regional/national performance objectives should meet the expectations of the ATM community as described in the operational concept and should lead to benefits for stakeholders and be achieved through operational and technical activities aligned with each performance objective.

6. **Strategy:** ATM evolution requires a clearly defined progressive strategy including tasks and activities which best represent the national and regional planning processes in accordance with the global planning framework. The goal is to achieve a harmonized implementation process evolving toward a seamless global ATM system. For this reason, it is necessary to develop short (1 to 5 years) and medium term (6 to 10 years) work programmes, focusing on improvements to the system indicating a clear work commitment for the parties involved.

7. **ATM operational concept components;** Each strategy or set of tasks should be linked with associated components of the ATM operational concept. The designators for ATM components are as follows:

- AOM – Airspace organization and management
- DCB – Demand and capacity management
- AO – Aerodrome operations
- TS – Traffic synchronization
- CM – Conflict management
- AUO – Airspace user operations
- ATM SDM – ATM service delivery management

8. **Tasks:** The regional/ national work programmes, using these PFF templates, should define tasks in order to achieve the said performance objective and at the same time maintain a direct relation with ATM system components. The following principles should be considered when developing work programme:

- The work should be organized using project management techniques and performance-based objectives in alignment with the strategic objectives of ICAO.

- All tasks involved in meeting the performance objectives should be developed using strategies, concepts, action plans and roadmaps which can be shared among parties with the fundamental objective of achieving seamlessness through interoperability and harmonization.

- The planning of tasks should include optimizing human resources as well as encouraging dynamic use of electronic communication between parties such as the Internet, videoconferences, teleconferences, e-mail, telephone and facsimile. Additionally, resources should be efficiently used, avoiding any duplication or unnecessary work.
- The work process and methods should ensure that performance objectives can be measured against timelines and the national and regional progress achieved can be easily reported to PIRGs and ICAO Headquarters respectively.

9. **Timeframe:** Indicates start and end time period of that particular task(s).

10. **Responsibility:** Indicates the organization/entity/person accountable for the execution or management of the related tasks.

11**.** **Status:** The status is mainly focused on monitoring the progress of the implementation of that task(s) as it progresses toward the completion date.

12**.** **Linkage to global plan initiatives (GPIs)*:*** The 23 GPIs, as described in the Global Plan, provide a global strategic framework for planning for air navigation systems and are designed to contribute to achieving the regional/national performance objectives. Each performance objective should be mapped to the corresponding GPIs. The goal is to ensure that the evolutionary work process at the State and regional levels will be integrated into the global planning framework.

2009-2011
FOLLOW-UP AND IMPLEMENTATION ACTION PLAN
AERODROMES AND GROUND AIDS (AGA)

No.	Performance Objective Task	Action Description	Responsible	Begin date	End date	Deliverables	Observations
1	2	3	4	5	6	7	8
1	a)	Implement an action plan for the prevention of runway incursions.	States / Territories	Dec 2009	Dec 2010	• Establish a specific set of recommendations to implement for aerodrome community involved in runway operations.	
2	b)	Wildlife hazard reduction.	States / Territories	Dec 2009	Dec 2010	- Organize an Airport Wildlife Control Programme. - Use of dispersal methods. - Organization of a National Committee, including major aircraft operators and airports, pilots association, engines manufactures and Departments of the Environment and Agriculture.	
3	a), c)	Implement Advanced Surface Movement Guidance and Control System (A-SMGCS)	States / Territories	Dec 2009	Dec 2014	• The implementation of A-SMGCS Level 1 gives accurate surveillance picture of the traffic on and adjacent to the runway, including the position and identify all known traffic and unknown traffic (or intruders). • Detect when a landed aircraft has vacated the runway. • Know when a departure starts rolling on the runway • By observing the speed of a landed aircraft, decide if another departure is possible or not before the next landing • Detects when a vehicle is on the runway.	

No.	Performance Objective Task	Action Description	Responsible	Begin date	End date	Deliverables	Observations
1	2	3	4	5	6	7	8
	d)					• The implementation of A-SMGCS will provide controllers with an accurate picture of the traffic situation under all weather conditions. This will enable the controller to maintain situational awareness under all conditions. In poor weather it will help to reduce workload and improve planning through knowledge of the actual and pending traffic situation.	
	e)					• Will ensure complete situational awareness under all conditions and enable controllers to detect aircraft and vehicles diverting from given clearances.	
4	d)	Implement the Airport airside Capacity analysis, Enhancement and planning (ACE) procedure.	States / Territories	Dec 2009	Dec 2014	• Accurate assessment of capacity in reduced weather conditions. • Implementation of best in class practices based upon existing ICAO criteria.	
5	d)	Implement Airport Collaborative Decision Making (A-CDM) recovery of adverse conditions procedure.	States / Territories	Dec 2009	Dec 2014	• The Collaborative Decision Making (CDM) in Adverse Conditions consists of a collaborative management of the capacity of a CDM Airport during periods of a predicted or unpredicted reduction of capacity.	
6	f)	Implement the Airport Collaborative Decision Making Turn-Round process.	States / Territories	DEC 2009	Dec 2014	• The Collaborative Decision Making turn-round process identifies significant steps from which it is possible to accurately monitor the progress of an aircraft. This permits common and accurate situational awareness of all involved in the process, plus the availability of accurate departure times which can be provided to air traffic control.	

No.	Performance Objective Task	Action Description	Responsible	Begin date	End date	Deliverables	Observations
1	2	3	4	5	6	7	8
7	f)	Implement the Airport Collaborative Decision Making Variable Taxi Time procedure.	States / Territories	Dec 2009	Dec 2014	• Variable taxi time calculation consists of calculating and distributing the actual times it will take an aircraft to taxi from each parking stand to the runway, a time which can vary significantly depending on the taxiway used. The goal is to improve the traffic predictability.	
8	g)	Implement Airport Collaborative Decision Making (A-CDM).	States / Territories	Dec 2009	Dec 2014	• By linking Air Traffic Control (ATC), Airport and Aircraft Operators, and Ground Handlers together, through the application of Airport Collaborative Decision Making (A-CDM), elements like information sharing and the turn-round process, will give airport partners a clearer operational picture.	

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APPENDIX B

**A SAMPLE LIST OF METRICS
FOR PERFORMANCE MONITORING OF AIR NAVIGATION SYSTEMS**

Key Performance Area	Corresponding 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 100nmi3; Traffic density i.e. number of aircraft per 100 nmi3; Enroute utilization i.e. number of aircraft per 100nmi3; 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.

Key Performance Area	Corresponding metrics
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 enroute; Number of certified aircraft and pilots for PBN operations for enroute 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.
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; Enroute 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/enroute 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.