International Civil Aviation Organization
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CAR/SAM Regional Planning and Implementation Group (GREPECAS)
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Punta Cana, Dominican Republic, 28 March – 1 April 2011

Agenda Item 3: Performance framework for Regional Air Navigation Planning and Implementation

3.1 Global, inter-regional and intra-regional activities concerning air navigation systems in the CAR/SAM Regions

ACTIVITIES UNDERTAKEN BY BRAZIL FOR THE DEPLOYMENT OF GBAS (GROUND BASED AUGMENTATION SYSTEM)

(Note presented by Brazil)

SUMMARY

This information paper aims to introduce participants to an overview of the deployment of GBAS (Ground Based Augmentation System) for precision approach in Brazil.

References:

- Annex 10, vol. 1 - ICAO
- Non-Fed Specification FAA-E-AJW44-2937A

1. Introduction

1.1 After identifying that the ionosphere over the Brazilian territory showed behaviors that hindered the use of a SBAS (Satellite Based Augmentation System) and the consequent decision not to develop this project in Brazil, and with the need for improved levels of accuracy and integrity specially of the GPS signals for use in approach and landing procedures, as of 2000, a cooperation programme was established between DECEA (Department of Airspace Control) and the FAA (Federal Aviation Administration), so as to find joint technical solutions for the development of the GBAS system (Ground Based Augmentation System).

1.2 In 2003, a GBAS (under development by the FAA) prototype station was installed at the International Airport of Rio de Janeiro Galeão Antônio Carlos Jobim (SBGL) and H-800XP aircraft from GEIV (Special Flight Inspection Group) were equipped with the multi-mode Rockwell-Collins GNLU-930 receiver, which is capable of receiving information from the GBAS station and provide indications to the pilots.

1.3 Since then, several flights were made by these aircraft to assess the capabilities of the GBAS system under the conditions found in Rio de Janeiro.

1.4 In addition, GPS receivers were installed at fixed sites around the International Airport of Rio de Janeiro, to collect data in L1 and L2 frequencies and assist in assessing the impacts of the ionosphere on the operations of the GBAS system.

1.5 The activities developed so far allowed the production of knowledge required for the specification of a certified GBAS system that was purchased and is being installed at the International Airport of Rio de Janeiro.

2. Analysis

2.1 The Department of Airspace Control (DECEA) published in 2008 the DCA 351-2 - National ATM Concept of Operations approved by the Brazilian Aviation Authority, which, among other things, provides for the installation of the GBAS system to make precision approaches in categories I, II and III for operations at any time, supported by real-time differential corrections of the GPS signals.

2.2 In September 2009, a Project Charter (TAP) was signed for the purchase of a GBAS station, with the aim of "deploying a CAT I GBAS station at the Airport Antônio Carlos Jobim - Galeão, with a view to defining the technical and operational requirements for implementing future CAT I GBAS stations at airports wherein there is sufficient operational demand, considering the environmental conditions and the particularities of SISCEAB (Brazilian Airspace Control System)."

2.3 The technical, logistical and industrial requisites were developed for the acquisition of a CAT I GBAS system already certified by an internationally recognized body, and, in July 2010, Honeywell won the bid with the SLS-4000 system.

2.4 The SLS-4000 system is being installed at the International Airport of Rio de Janeiro and will be ready for flight tests from early April 2011.

2.5 For the tests, GEIV aircraft will be used, being equipped with the new Flight Inspection System UNIFIS 3000, capable of performing inspection of GBAS systems, using the GNLU-930 receiver.

2.6 The station being installed is considered pre-operational and will be thoroughly tested during the next period of maximum solar activity, which will occur from mid-2012 through 2014, as shown in Figure 1.

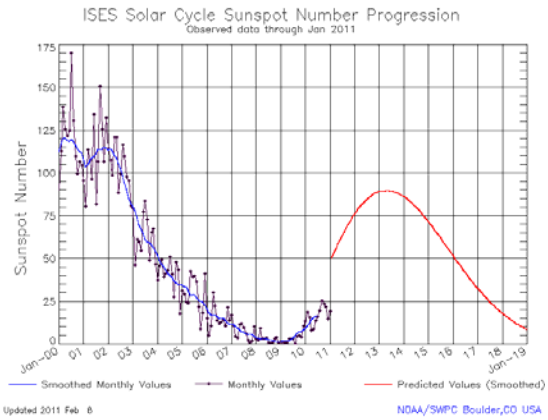

Figure 1 - Solar Cycle
Source: http://www.swpc.noaa.gov/SolarCycle/ (FEB 11 2011)

2.7 For the tests, the participation of GEIV aircraft and commercial aviation is planned, and these results will be decisive for decision-making regarding the acquisition of new systems.

2.8 The need for performing tests on a certified GBAS station derives from the location of Brazil in the range of the Geomagnetic Equator, where the behavior of the ionosphere distorts and delays the signals from GNSS satellites, especially at the peak of solar activity (see Figure 2).

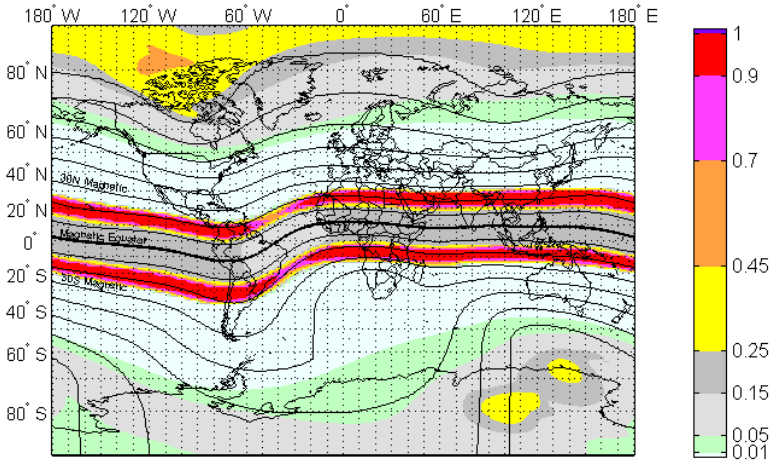

Figure 2 - Delays of GPS signals

2.9 The SLS-4000 station has incorporated the risk model developed by Stanford University and published in the article "Position-domain geometry screening to maximize LAAS availability in the presence of ionosphere anomalies", by Jiyun Lee, Ming Luo, Sam Pullen, Young Shin Park and Per Enge (available at http://waas.stanford.edu/~wwu/papers/gps/PDF/LeeIONGNSS06.pdf). (See Figure)

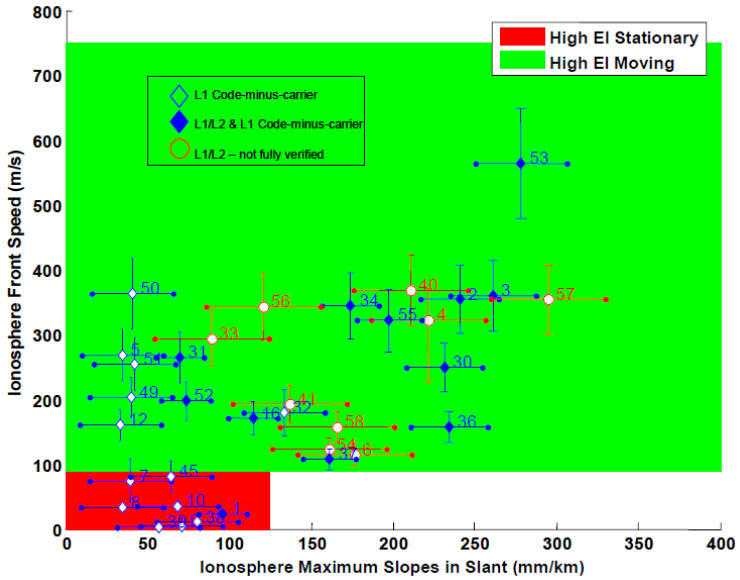

Figure 3 - Risk model of the SLS-4000 station
Source: http://waas.stanford.edu/~wwu/papers/gps/PDF/LeeIONGNSS06.pdf

2.10 This risk model implemented in the SLS-4000 station was developed based on data collected in the Northern hemisphere, where the ionospheric conditions are less severe than close to the

geomagnetic equator. Although the expectation is that this risk model will be suitable for the CAR/SAM Regions, the tests to be conducted in the period between 2012 and 2014 will provide data for a definitive evaluation.

2.11 Brazil has been closely following the development of the GBAS system in various international forums, especially as a participant of the IGWG (International GBAS Working Group), coordinated by EUROCONTROL and the FAA, which provides its members with an exchange of knowledge concerning experiences with the deployment and certification of the Member States and requirements for the avionic systems to be developed and installed in the aircraft.

2.12 Brazil also participates in the ICAO NSP (Navigation Systems Panel), where "Standard and Recommended Practices" (SARPs) are developed for the GBAS system.

3. Conclusion

3.1. Brazil has been developing efforts to use the GBAS system as a way to increase the landing capacity at airports.

3.2. The installation of a certified GBAS station in the city of Rio de Janeiro will allow the evaluation of the impacts of the ionosphere on this system in a region where its behavior is more severe and the performance of tests that will enable decisions to be made on the deployment of new stations.

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