



**Agenda Item 2: Follow-up to the implementation status of the performance based navigation systems plans for the CAR and SAM Regions and to the latest amendments to the ATM- and CNS-related SARPS**

**CONTRIBUTIONS FOR THE GNSS IMPLEMENTATION ACCORDING TO PBN PLAN AND BASED ON THE PROGRESS AND FIRST RESULTS OF SACCSA PROJECT – PHASE III-A**

(Presented by Project RLA/03/902 International Coordinator)

<b>SUMMARY</b>	
<p>This working paper, in view the results obtained by Phase III-A of SACCSA Project, proposes action in order to support the completion of this Project and to contribute of important way to the PBN regional implantation being made possible that the aeronautical and non-aeronautical sectors and users of the States obtain benefits.</p>	
<i>ICAO Strategic Objectives:</i>	A: Safety - Enhance global civil aviation safety D: Efficiency - Enhance the efficiency of aviation operations E: Continuity - Maintain the continuity of aviation operations
<i>Financial implications</i>	Derived from the end of Phase III and the implantation of the system.
<i>References:</i>	<ul style="list-style-type: none"><li>• GREPECAS/11, conclusions 11/45 and 11/46</li><li>• GREPECAS 12, conclusions 12/45 and 12/46</li><li>• FASE II and FASE III Project Description</li><li>• CNS/ATM/SG/1 Meeting, March 2010</li><li>• RCC/7 Meeting of the SACCSA Project, 11 - 15 October 2010</li></ul>

**1. Introduction**

1.1 The RLA/03/902Project, comes being developed from 2003 in compliance with the recommendations and decisions of the ATM/CNS Sub-group and the GREPECAS conclusions, therefore Project Phase I was based on GREPECAS Conclusions 11/45 and 11/46, that were formulated in December 2002. Later, the Third Meeting of the ATM/CNS/SG Sub-group, held in Rio de Janeiro, Brazil, in March 2004, supported the accomplishment of the second phase of the Project RLA/03/902 whose objective was: **“develop and plan technical, financial, operational and institutional aspects, of a SBAS system for CAR/SAM regions”**, with the last objective to arrange, when concluding this phase, of the necessary elements of judgment, to the decision making on the best model of the SBAS system to implement in these regions, and in this way to be able to come with necessary the international tender for the accomplishment of this implantation.

1.2 The GREPECAS Conclusions 12/45 and 12/46, formulated in June 2004, meant the beginning of the second phase of RLA/03/902 Project, inviting to the States and International Organizations to participate in this project. Consequently, and after the accomplishment of this Phase II, the necessity was determined to approach a third phase to have all data necessary to decide and to launch the SACCSA implantation; thus in October 2008 the GREPECAS by its Conclusion 15/43 supported to this Project and the accomplishment of its Phase III.

1.3 This Phase III, is studying and realizing demonstrations based on data real on viability of which CAR/SAM regions have a SBAS system, that allow to cover their needs and the ones with their users, all this on the basis of the results and approaches of Phase II. This system, is defining according to the special characteristics of both regions, adapting its configuration to the distribution of the airspace. Also, the bases for the management and operation of the same will settle down, defining the international organs to being created to carry out these actions. On the other hand, and given the cost that implies to SBAS implementation, an exhaustive analysis of the financial resources necessary and the way will be realized to obtain them, through the different sources and financial modalities available.

1.4 From his beginnings, RLA/03/902 - SACCSA Project, is an open project, that have been invited to participate to all States and International Organizations of CAR/SAM Regions and It has been invited to participate in the seminars/workshops, as well as in the meetings of the Committee of Coordination (RCCs) of the Project, like observers, of those States and International Organizations who having not subscribed the Project, but have been interested to know the project advances. Also, this Project is based on the application of ICAO SARPS and guidance materials and considering the GREPECAS conclusions and contributes with this Group for the adoption of a common regional position on the GNSS implementation.

1.5 The Seventh Meeting of the Coordination Committee (RCC/7) of the RLA/03/902 Project was held at San Carlos de Bariloche, Argentina, from 11 to 15 October 2010. The meeting among others aspects, deal with the first results that are being obtained in Project Phase III-A. The duration of this phase has been estimated in 24 months and its execution began in January 2010.

## 2. Discussion

2.1 The studies and demonstrations of Phase III on the viability to implement a SBAS in CAR/SAM regions are based on real data and this system is defining according to the particular characteristics of both regions, adapting its configuration to the distribution of the airspace in order to find the solutions that allow to give a SBAS Safety of Live (SoL) service in this regions on the basis of the current available constellation (GPS L1). For this purposes, tests and trials are included, as much in post-process as in real time, that contribute to reach these objectives. The approaches are based on the scenarios identified in the ionospheric analysis that covers different ionospheric situations: nominal, high solar activity, high geomagnetic activity, degraded, etc

2.2 The idea is to be able to have a system that behavior of adapted form in those cases, or their defect, that allow to mitigate situations in view of the degraded conditions. For it, a model of ionospheric algorithm is being developed adapted to the conditions of the CAR/SAM regions that allow covering all contingencies. This development is accompanied by tests that allow seeing in real time the benefits that are obtained, besides the monitoring continued in post processed.

2.3 The Project has been selected data of receivers that give the information obtained of the different available networks in these regions (IGS, NTRIP, TOWROPES, etc.), and that allow to draw a representative map than would be the network of SACCSA reference stations once implemented the system. On the other hand, all the information is processes in a prototype of the process center that can send the signal through Internet or by means of an access station, through a satellite GEO, as it became during the celebration of the RCC/7 Meeting at San Carlos de Bariloche, Argentina. This signal, allows seeing in real time the performance that the system provides. Additional information on the demonstration of transmission of SACCSA – SBAS signal that was carry out in test mode during the days 14 and 15 October 2010, appears in an Information paper of this Meeting.

2.4 The approach that are being followed by SACCSA, part of the use of a mono-frequency system that it can be updated to multi-frequency. However, one is due to consider that, before an important ionospheric disturbance, the first frequency in falling is the one of smaller level, that is the L5, and so it would be stayed as a mono-frequency system that must respond of suitable form. It is for this reason, that, to reach the multi-frequency solution this project considers that the capacity is due to pass and to maintain to be able to work in way mono-frequency. Also, SACCSA is studying the possibility of using multi-constellation receivers in their control centers and stations of monitoring, since it will allow controlling the ionosphere of more effective form.

2.5 Logically, all these trials are executed from a perspective of the effect of the ionosphere on the signals of the GPS satellites, but the effects on the GEO cannot be considered and the form to mitigate this effect. For this reason, it is made necessary to study this situation, including the optimization of the orbital position with respect to the user, so that in case a bubble begins to affect to one of them, the other sees frees by the angular distance between both, and when it begins to affect the second, first it would be seen frees of this effect.

2.6 In this sense, RCC/7 Meeting agreed to analyze the convenience of implementing a SACCSA – SBAS Test-bed that mainly allows covering the following aspects:

- a) To be able to provide non-aeronautical services and non SoL to other sectors and users, this is denominated “open service”, which will make possible the obtaining of numerous benefits.
- b) Have a multi-frequency and multi-constellation platform that allows to analyze the advantages and the comparison with different future technologies like the multifrequency (L1/L5) and the multi-constellation.
- c) Analyze the behavior of the model of ionospheric algorithm in conditions of greater solar activity that are waiting in the present cycle, towards the 2012 – 2013.
- d) Analyze the impact of the ionosphere on the GEO.
- e) To allow the Civil Aviation Authorities, companies, universities and users to deepen in the study and use of SBAS systems, including the development of procedures, applications and advanced services based on the GNSS.
- f) Provide an improvement service of the precision based on SBAS
- g) Other aspects.

2.7 Additionally, SACCSA Phase III will complete the studies of financial feasibility and institutional nature, in order to analyze the costs, formulas of return, possible operating institution and service supplier, as well as matters on the system property.

2.8 By means of the analysis of the results of Phase III the feasibility of the SBAS implementation in the CAR/SAM regions will be able to be determined confirming the technical – financier feasibility of the SACCSA Project that makes possible a solid base for the taking of decisions by the States and the International Organizations of these regions.

### **3. Conclusions**

3.1 The SBAS implantation in the Regions CAR/SAM will allow homogenizing and increasing the performance of the air navigation system, contributing of important form to the PBN implantation, making possible that the aeronautical and non-aeronautical sectors and users obtain benefits.

3.2 The SACCSA studies – Phase III try determine the possibility of implanting a SBAS with the capacities of available GPS constellation (GPS L1) that is mono-frequency and mono-constellation; but conditioned to that it can be updated to multi-frequency and multi-constellation maintaining the capacity for operates in the initial conditions in case of loss of frequencies and additional constellations. This strategy of development and implantation makes possible to foment the gradual use of the available GNSS capacities and the obtaining benefits in a short and medium terms by the States and Organizations and aeronautical and non-aeronautical sectors and users; also it would provide a robust experience and knowledge base in the GNSS use that also help to the fast use of future GNSS constellations and frequencies when they are available and then to increase the obtaining of his benefits.

3.3 The Phase II results and the first results obtained from the Phase III-A execution, including the studies of the ionosphere data of the last the eleven years, as well as the development of a prototype of ionospheric algorithm and the demonstrations executed recently with the broadcasting of the SACCSA SBAS signal by a satellite GEO and the disposition of performance through Internet, indicate that they are promising with respect to the SBAS implantation in the CAR/SAM regions.

3.4 In view the first results obtained by SACCSA Project – Phase III-A and in order to support the completion of this Project contributing to the PBN regional implementation that will make possible that aeronautical and non-aeronautical sectors and user of the States obtain benefits; the States and the International Organizations who have done not yet and who are in capacity to do, are urge to:

- a) facilitates the access to the networks of data from the monitoring GPS receivers with FTP or NTRIP access and RINEX files with observing intervals of one second;
- b) subscribes the Project and considers the capacity to realize extra contributions to position itself within the Project structure; and
- c) consider to participate in the SACCSA SBAS test-bed implementation.

### **4. Suggested action**

4.1 The Meeting is invited to:

- a) take note of the firsts results of the SACCSA Project III presented in this working paper;
- b) reviews the considerations expressed in this note and considers to formulate the actions that are indicated under paragraphs 3,1 to the 3,4 of this note related to the access to networks of takings of data of stations of receivers of monitoring GPS; the subscription and to realize extra contributions to the Project; as well as implantation of a regional test-bed SACCSA – SBAS; and
- c) consider other related aspects to this subject.