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North American, Central American and Caribbean Office

INFORMATION PAPER

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Fourteenth Directors of Civil Aviation of the Central Caribbean Meeting (C/CAR/DCA/14)
Kingston, Jamaica, 11 to 13 May 2015

Agenda Item 7: Regional Cooperation and Training Matters
7.4 Other Regional Cooperation and Training Matters

STUDY OF AN OWN SATELLITE BASED AUGMENTATION SYSTEM (SBAS) FOR THE CAR/SAM REGIONS - PROJECT RLA/03/902– TRANSITION TO GNSS/SBAS IN THE CAR/SAM REGIONS - AUGMENTATION SOLUTION FOR THE CARIBBEAN, CENTRAL AND SOUTH AMERICA - (SACCSA) – PHASE III

(Presented by the Secretariat)

EXECUTIVE SUMMARY

This information paper presents the result of the SACCSA Project with respect to the study of an own SBAS system for the CAR/SAM Regions, detailing activities carried out, the conclusion of the Work Packages and compliance with objectives.

Strategic Objectives:	• Safety • Air Navigation Capacity and Efficiency • Environmental Protection
References:	• Report of the Tenth Meeting of the Project RLA/03/902 Coordination Committee/Closing Meeting of Project RLA/02/902 (Bogotá, Colombia, 9 to 13 February 2014)

1. Introduction

1.1 The trials conducted with the Wide Area Augmentation System (WAAS) and European Geostationary Navigation Overlay Service (EGNOS) determined that their extension was not feasible in the CAR/SAM Regions due to the particular ionospheric behavior experienced, which suggests the development of an own Satellite Based Augmentation System (SBAS) with algorithms adapted to the needs of the CAR/SAM Regions, known as the Caribbean, Central America and South America Augmentation Solution (SACCSA) whose main purpose is to develop and plan the technical, financial, operational and institutional aspects of a SBAS system for the CAR/SAM Regions. As shown in Figure 1, the project has had several phases, finalizing at this time the execution of the Project.

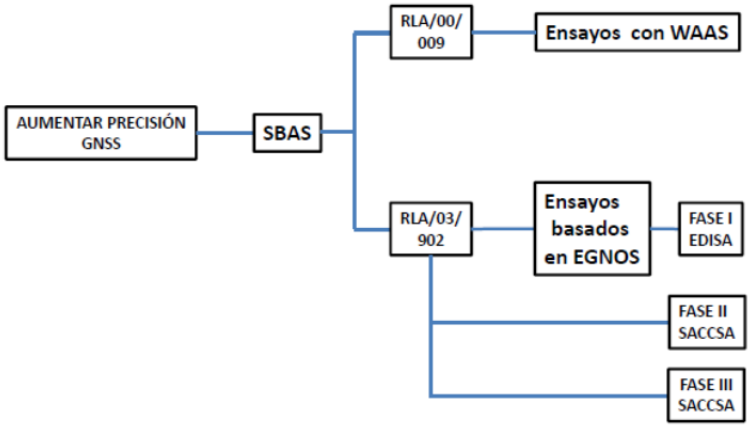


Figure 1
SACCSA Origin and Phases

2. Description of the SACCSA Project – Study delivered

2.1 The SACCSA Project – RLA/03/902 was created as a result of the Regional Planning and Implementation Group (GREPECAS) conclusions on the transition process to the Global Navigation Satellite Systems (GNSS) with SBAS augmentation, for the CAR/SAM Regions, with the purpose of developing a Technical Feasibility, Cost/Benefit and Financial Study of the Augmentation Based on Satellites for the CAR/SAM Regions. The project is coordinated by the ICAO Technical Cooperation Bureau (TCB).

2.2 The States/International Organization that have participated in SACCSA include (all phases): Argentina, Bolivia, Chile, Colombia, Costa Rica, Guatemala, Panama, Spain, Trinidad and Tobago, Venezuela and COCESNA.

2.3 The SACCSA Project began with previous analysis since 2003 and started since 2005 through RLA/03/902 and RLA/00/009 Conclusions related to the subject that neither EGNOS nor Wide Area Augmentation System (WAAS) may adequately be extended in the CAR/SAM Regions.

2.4 The objective of the Project was "to develop and plan technical, financial, operational and institutional aspect of a SBAS system for the CAR/SAM Regions" referred as a whole as the Study for an own SBAS in the CAR/SAM Regions [Reference: GREPECAS ATM/CNS/SG/3 Meeting in Rio de Janeiro, Brazil, March 2004].

2.5 Based on the positive results of SACCSA Phase II, it was decided to start a phase III to complete the studies of the phase II. The working packages contemplated in Phase II were:

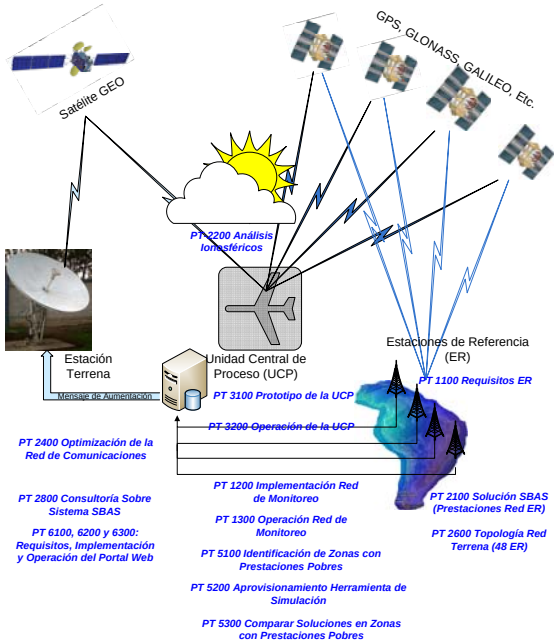
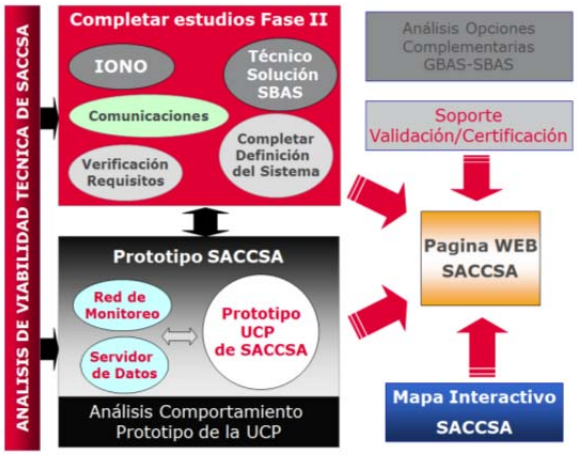
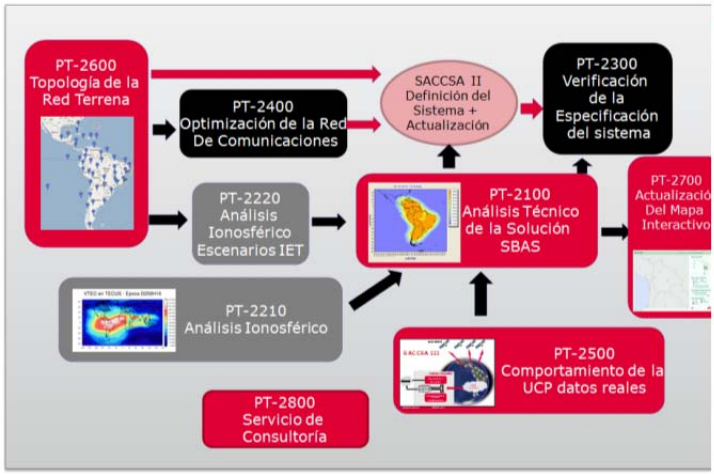


Figure 2
Phase III Scheme

- Interactive database (PT-1000)
- System definition: Spatial, terrain and user segment.
- Requirements/specifications (PT-5000)
- Design (PT-3000)
- Analysis SACCSA terrain topology (PT-2000)
- Ionospheric Study (PT-4000)
- SACCSA Management model, Operation/Exploitation model, Service Provider Model (PT-7000)
- Analysis of the Needs and GNSS Training Levels (PT-8000)
- Cost/Benefit Analysis (PT-9000)
- Financial Aspects

2.6 Due to the complexity of Phase III and cost of the tasks to contract TCB, and in compliance with its procedures, in August 2009 ICAO invited some companies to participate in the Phase III offer process selecting the consortium formed by GMV (principal contractor), plus INDRA, SENASA, Raytheon, GESA-La Plata and CENAT. The following figures show the functional relation of the Project's activities/working packages contained in the study, as well as the numbering for their execution.



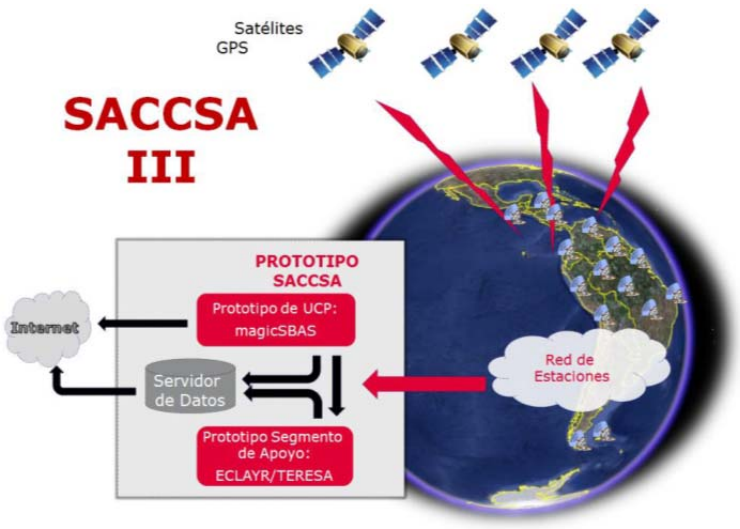


2.7 In order to manage the tasks related to this third phase, a working group was created under the ICAO direction and international coordination initially with AENA and later on with the Civil Aviation-Colombia, as technical coordinator for the implementation of the technical activities. The following figure shows the coordination of the Project:

2.8 For phase III, the execution strategy consisted of two main activities plus a series of complementary tasks:

- Study to complete the results obtained in the previous phase, as part of the technical feasibility analysis.
- Complement the technical feasibility analysis by developing an UCP SACCSA prototype, based on the GMV magicSBAS tool and adapted to the CAR/SAM Regions, having special attention to the ionospheric aspects.

2.9 By agreement of the Project for Phase III, only the working packages to complete the study were carried out, not performing the necessary working packages to validate the study nor the part of the cost/benefit detailed study. Therefore the working packages contracted were:



- PT 1300: Monitoring Network Operation – only for the use of the Process Central Unit
- PT 3200: Processing Central Unit Prototype Operation
- PT 5200: Simulation Tool Supply
- PT 5300: Solution comparison in zones of poor output
- PT 6300: Website portal operation and maintenance – 3 months and transition to a new website supported by States
- Management

2.10 The technical coordination presented the following considerations for the results of the Project:

- The multiconstelation (GPS+GLONASS) and the mutifrequency (dual frequency) to minimize the solar activity impacts in the ionosphere and the SBAS signal affectation.
- Compliance of the SBAS technical feasibility indicated in ICAO Annex 10 Volume I, which has been demonstrated by GMV, in real time the performance and coverage up to APV-I in the CAR/SAM Regions.
- Satisfactory results of the approach path scenarios analysis for El Dorado, Bogota and San José, Costa Rica airports.
- Results of the coverage limitations (La Patagonia) and poor performance in some regions (part of Brazil) of the CAR/SAM Regions.

2.11 The GMV company, the Project contractor, set up a platform that in real time analyzes the SACCSA performance through the GMV magicSBAS and MagicGemini tools in real time, taking advantage to this effect of the reference stations installed for other purposes by universities, geographic institutes, etc. The results are available in the following link: http://magicgnss.gmv.com/sam/. The horizontal and vertical mistakes, as well as the associated protection levels could be observed in real time. The following Figure shows the reference stations source of the magic SBAS.

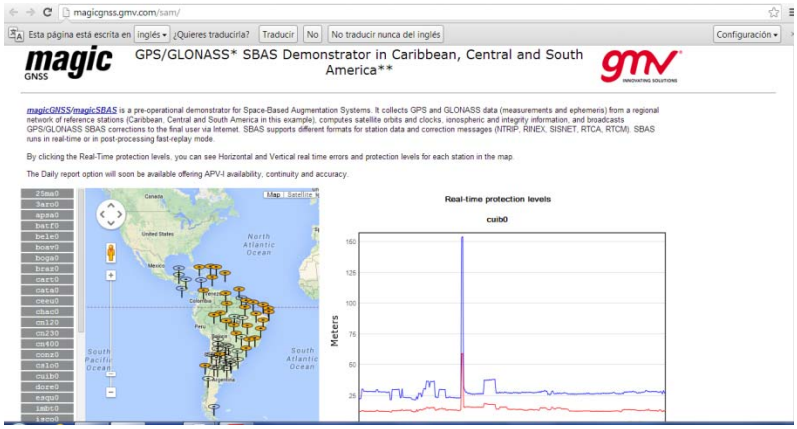


Figure 3

2.12 The Project closing event, RCC/10 consisted of a workshop to show the results, the SACCSA study and the Coordination Committee of Project RLA/03/902 (RCC) meeting, where the following items were dealt with:

i. Review of the Project status and the study final documentation
ii. Activities carried out by the technical coordination of AENA and the Project progress
iii. Review delivered work packages
iv. Financial status
v. Final evaluation Project

2.13 The Project members recognized ICAO leadership in this study and the importance and future usefulness of the study for the Project members and the CAR/SAM Regions.

2.14 Each member of the Project received a copy of the SACCSA study. Phases I to III are breakdown in different work packages. The present SACCSA website (www.rlasaccsa.com) will be available and will be kept and operative until the end of May 2015. Later on this website will be supported by Colombia or Panama.

2.15 The benefits obtained with the participation in SACCSA are presented in **Appendix** to this paper.

3. Conclusion

3.1 The SACCSA Project RLA/03/902 has completed its works with the delivery of an own SBAS system technical feasibility study for the CAR/SAM Regions, which benefits will allow States a better understanding of the benefits and feasibility of implementing a SBAS system as well as the use of them for GNSS future activities at each State level, as at the CAR/SAM Regions level.

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APPENDIX
BENEFITS OBTAINED WITH THE PARTICIPATION IN SACCSA

1.1 Two advanced GNSS courses/seminars (Mexico and Costa Rica), where GNSS high-level training in general, SBAS-SACCSA in particular and the use of GNSS in the aeronautical and multimodal sector were provided. These courses serve as a reference for States to prepare their own internal courses in their training plans, material and instruction of a very high level in GNSS technologies.

1.2 As result of the Work Packages delivered, documentation on a SBAS components, with a depth description of elements and sub-elements forming it, including the functional and operative description was prepared, being significant the subject of the control centres (Process and Control centres) because of the complexity it entails, having a level of detail equivalent to those of EGNOS or WAAS.

1.3 Ionospheric studies have been delivered to the CAR/SAM Regions with a GNSS perspective to a level never realized until now, covering maximum and minimum solar periods, and that can be used for SACCSA as for other applications that the States seems convenient.

1.4 Ionospheric algorithms have been defined in order to implement SACCSA, because those developed by WAAS and EGNOS are not applicable to the CAR/SAM Regions.

1.5 A design of the complete SBAS solution for SACCSA, applicable to the CAR/SAM Regions, has been delivered.

1.6 Financing, system operation, management, training needs, etc. models and diagrams that allow establishing the structure of the future system have been delivered.

1.7 Needs of communications in order to implement the SACCSA operational system have been defined, besides the necessary ground network reference stations.

1.8 SBAS approaches in Havana, Tegucigalpa, Bogota, Cartagena de Indias and San Andres were carried out during the EDISA tests.

1.9 A testbed in real time provided by GMV is available, where the SACCSA performance is being analyzed through the GMV magic SBAS and Magic Gemini tools (http://magicgnss.gmv.com/sam/), carrying out a continuous follow-up of what can be obtained with the system and the LPV or APV I operative areas. States could see this performance and have access to the SBAS/SACCSA messages through the network.

1.10 For the first time a real SBAS signal in the CAR/SAM Regions with SACCSA algorithms using the GMV magic SBAS testbed and the Inmarsat Geostationary satellite was broadcasted.

1.11 Indications of the use of the SACCSA system by other users have been provided. A workshop where the benefits that could be obtained with a SACCSA solution applied to other sectors not aeronautical and critical for the States was carried out.

1.12 Presentations have been made on the way to create business models through the use of services based on GNSS.

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