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Agenda Item 3 CNS Developments
3.4 Follow up to GNSS Implementation and Action Plan

GNSS: CONSIDERATIONS AND FOLLOW-UP ON IMPLEMENTATION AND ACTION PLAN

(Presented by the Secretariat)

SUMMARY

This working paper presents a summary of considerations for matters related to GNSS implementation. These considerations cover references, follow-up activities on action plans, updated regulations in the navigation field and other issues related to the planning and implementation of this concept.

References:

- Report of the CAR/WG/1 Meeting, Trinidad and Tobago, 2007
- Annex 10, Volume I
- Report of the AN-Conf/11
- Reports of GREPECAS/12, 13 and 14 Meetings
- Global Air Navigation Plan, Doc 9750/AN/968
- Regional Air Navigation Plan, Doc 8733
- Global Navigation Satellite System (GNSS) Manual. Doc 9849/AN/457. First edition – 2005
- Manual on Testing of Radio Navigation Aids (Doc 8071), Volume II — Testing of Satellite-based Radio Navigation Systems, Fifth edition 2007

Strategic Objectives	*This working paper relates to Strategic Objectives A and D.*

1. Regional Plan and Regional Directives for the Implementation of Air Navigation Systems

1.1 Table CNS 3 of Doc 8733, Volume II (FASID) – is the regional plan for navigation systems that includes GNSS, GBAS and SBAS augmentation requirements. Based on CAR/WG/1 Conclusion 1/9, ICAO requested States to designate a point-of-contact to update Table CNS3A and provide comments and amendments.

1.2 The proposal for amendment to the CAR/SAM FASID Table CNS3 regarding changes to columns 10 and 11, indicated in Agenda Item 3, paragraph 3.4.10 of the Report of the CAR/WG/01, will be considered during the next meeting of the GREPECAS CNS Committee in view that the format of the FASID plans have Global as well as Regional CAR/SAM application, along with future Air Navigation Plan updating to an electronic format, eANP.

1.3 CAR/SAM directives and regional strategy were updated by GREPECAS Conclusion 12/45 – *Amendment to the Regional Guidelines for the Transition to the Global Navigation Satellite Systems (GNSS) and the Regional Strategy for the Introduction and Application of Non Visual Aids to Approach, Landing and Departure*. (**Appendixes A** and **B** to this working paper)

1.4 GREPECAS Conclusion 12/46 – *CAR/SAM Regional Activities for the SBAS and GBAS Implementation*, part b), recommended a regional strategy and rules for SBAS and GBAS definition and implementation. This information is presented in **Appendix C** to this working paper.

2. Considerations and References of the Action Plan for GNSS Implementation

2.1 The Eleventh Air Navigation Conference (AN-Conf/11), *Recommendation 6/1 - Transition to satellite-based air navigation* urged ICAO to continue developing, as necessary, provisions that would support seamless GNSS guidance for all phases of flight and that air navigation service providers, in agreement with airspace users, quickly adopt measures to achieve, , worldwide navigation capability to at least APV performance; and that States and airspace users take note of the available and upcoming SBAS navigation services providing for APV operations and take necessary steps towards installation and certification of SBAS capable avionics.

2.2 GREPECAS Conclusion 13/84 – *Studies for a CAR/SAM Regional SBAS Solution*, urged States/Territories/International Organizations to continue introducing GNSS in an evolutionary and coordinated manner according to the ICAO global plan; conduct studies for a regional SBAS solution consistent with the requirements and characteristics of the CAR/SAM Regions and apply other augmentation, taking into account that added benefits should help justify the cost of reaching the ultimate goal of migrating to GNSS and dismantling ground-based aids.

2.3 GREPECAS Conclusion 13/85 – *Foster the Use of GNSS in Diverse Sectors of the States* urged States/Territories/International Organizations to foster the use of GNSS in various sectors of their respective States and disseminate the results of the studies for solution of SBAS augmentation.

2.4 GREPECAS Decision 14/55 mentioned that SBAS solutions proposed for the CAR/SAM Regions should be capable of achieving at least APV I capability.

2.5 GREPECAS Conclusion 14/56 – *Progressive Deactivation of NDB Stations* urged States, Territories, International Organizations and airspace users to analzse the service provided by each NDB station, its function, and procedural relevance to other aids such as VOR/DME, GNSS-RNAV, as well as aircraft capability/development operating in serviced airspace aimed at developing a plan for the progressive deactivation of NDB stations without affecting safety. CAR/WG/01 Conclusion 1/8 shows this same action.

2.6 Through state letter electronic distribution, Ref. EC 2/84-EB/07/14 dated 11 May 2007, ICAO published provisional policy guidelines on cost assignments for GNSS.

2.7 The ICAO Global Air Navigation Plan (Doc 9750) initiative (GPI-21) – *Navigation Systems* establish strategy to enable the introduction and evolution of performance-based navigation supported by a robust navigation infrastructure providing accurate, reliable and seamless global positioning capability.

2.8 At present, some guidance material for planning and gradual implementation of GNSS is available, a summary of this documentation is presented in **Appendix D** to this working paper.

2.9 CAR/WG Conclusion 1/10 – *Follow-up on GNSS Activities – Cycle 2007-2008*, urged States/Territories/International Organizations to review and begin action to continue implementation of GNSS basic services.

Follow-up on amendments to the new SARPS and ICAO guidelines on GNSS

2.10 Amendment 83 to Annex 10, Vol. I and Vol. III, Part I and III in its air navigation portion) introduce an update to some GNSS implementation aspects and shows evolution of current GNSS systems and equipments. Likewise, the amendment aligns the terminology of the required navigation performance (RNP) and air navigation (RNAV) with the performance-based navigation concept (PBN). This amendment will be applicable in November 2008.

2.11 Likewise, a proposal for amendment to Annexes 4, 11 and 15, PANS-ABC, PANS-ATM and PANS-OPS on instrument flight procedures, published through State Letter, Ref. SP 65/4-08/05, dated 29 February 2008, is under review by States. This proposal considers issues related to GNSS:

a) The amendment proposal to Annex 4 gives guidance for adding publication of bearings and tracks as true values on RNAV charts and expands on the existing definition of minimum en-route altitude in order to provide benefits for users of GNSS sensors.

b) The amendment proposal to Annex 15 and the PANS-ABC expand on the existing definition of minimum en-route altitude in order to provide benefits for users of GNSS sensors.

c) The amendment proposal to PANS-OPS, Volumes I and II, addresses the following:

- aligns the procedure design criteria for RNAV applications in PANS-OPS, Volume II with the PBN concept as detailed in the *Performance-based Navigation Manual* (Doc 9613);

- expands the guidance on coding requirements for SBAS and GBAS final approach segment (FAS) data block and extends the existing precision approach criteria for simultaneous approaches to parallel or near parallel runways and for procedures with glide paths above 3.5° for approach procedures with vertical guidance (APV) SBAS;

The proposed amendments to the PANS-ABC and PANS-OPS are envisaged for applicability on 20 November 2008. The proposed amendments to Annexes 4, 11, 15 and the PANS-ATM are envisaged for applicability on 19 November 2009.

2.12 The results of the ITU-2007 World Radiocommunication Conference (WRC-2007) were satisfactory; regarding the ICAO position, it was agreed to move forward with radio-electric spectrum assurance for use in ILS and VOR frequencies and the GNSS elements operation band.

2.13 Within the GREPECAS ATM/CNS Subgroup work, during the CNS/GNSS Task Force Meeting in June 2008, GNSS short, medium and long term requirements to support PBN implementation in the CAR/SAM Regions will be analyzed.

2.14 The ICAO Navigation System Panel (NSP) endeavours to review and update SARPs and other guidance material for air navigation system(s) implementation and future navigation systems through its different Working Groups. At present, the Panel is processing the following issues:

a) developments of present systems (GPS, GLONASS, GBAS and SBAS). Most of the updates are contained in Amendment 83; however, some minor changes are been evaluated;
b) introduction of new signs for the GPS System (GPS L5) and the GLONASS System (GLONASS L3);
c) introduction of the Galileo System;
d) extension of SBAS use to 200 feet DH (Provisions for “LPV200”). Foreseen for Amendment No. 85; and
e) introduction of GBAS Cat II/III landing capability.

Follow-up on studies, trials and results of regional GNSS projects, RLA/00/009 and RLA/03/902

2.15 Project RLA/00/009 – GNSS Augmentation Trials concluded in 2006 with the publication of its final results and respective seminar, where analysis of data collected during its three year period, an analysis of the navigation requirements in the CAR/SAM Regions and options for GNSS system implementation were made known.

2.16 Project RLA/03/902 – Transition to GNSS in the CAR/SAM Regions – SACCSA has completed the execution of the second phase whose main objective was "*study, develop and planning of technical, financial, operational and institutional aspects of possible alternatives for implementing a pre-operational SBAS system for the CAR/SAM Regions,"* and provide an approach and perspective on decision-making criteria for GREPECAS and States, Territories and International Organizations of the CAR/SAM Regions regarding GNSS implementation, and more precisely SBAS augmentation in the CAR/SAM Regions.

2.17 Project RLA/93/902 is in the process of executing the Third Phase, whose objectives are analysis of GNSS transition, preparation of GNSS implementation in the short term, and the study and recommendation of the definition for a pre-operational SBAS system for the CAR/SAM Regions . **Appendix E** to this working paper presents a summary of the Third Phase of the Project . The web page for project RLA/03/902 is: www.rlasaccsa.com.

2.18 Under GREPECAS Conclusion 13/84, States, Territories and Internacional Organizations are invited to participate in Project RLA/03/902.

3. Discussion

3.1 Taking into account ICAO Council guidelines in accordance with the organization's strategic objectives, the strategy defined for these systems in the Global Air Navigation Plan , as well as relevant GREPECAS conclusions aimed at achieving related benefits on safety and efficiency by greater application of existing standards and recommended practices on GNSS, and given follow-up on the implementation work of other sub-regional groups, this working paper suggests the review and follow-up of the following aspects:

Regional Plan for the Implementation of Air Navigation Systems

3.2 Based on the regional plan referred to in section 1 of this working paper, the Meeting is invited to review and report its comments or changes to Table CNS 3.

National Action Plan for GNSS Implementation

3.3 Based on CAR/WG Conclusion 1/11, and the background and analysis mentioned in the preceding paragraphs, the Meeting is asked to present their national action plans for GNSS implementation in accordance with the form recommended by the CAR/WG/01 Meeting.

4. Suggested Action

4.1 The Meeting is invited to:

a) take note of the information presented in this working paper;

b) follow-up on SARPs and their amendments, as well as ICAO GNSS guidelines;

c) review and recommend actions to continue basic GNSS services implementation and follow-up on regional studies for SBAS and other augmentation systems implementation;

d) proceed with actions mentioned in paragraphs 3.2 to 3.3 of this working paper; and

e) consider and recommend other appropriate action.

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APPENDIX A

GUIDELINES FOR TRANSITION TO SATELLITE NAVIGATION SYSTEMS IN THE CAR/SAM REGIONS

1. GNSS should be introduced in an evolutionary manner, with improvements in GNSS capability generating increased benefits, and culminating in GNSS supporting all phases of flight. As GNSS evolves, the planning for the removal of ground-based navigation aids should take account of the issues described below:

2. The ground infrastructure for current navigation systems must remain available during the transition period.

3. States/regions can consider segregating traffic according to navigation capability and granting preferred routes to aircraft with better navigation performance where this can be done without reducing airspace capacity.

4. Before any existing ground infrastructure is considered for removal, users shall be given reasonable transition time to allow them to equip with GNSS to attain equivalent navigation service.

5. As GNSS is introduced for enroute operation, States/regions should coordinate to ensure that harmonized separation standards and procedures are developed and introduced concurrently in all flight information regions along major traffic flows to allow for a seamless transition to GNSS-based navigation

6. In planning the transition to GNSS, the following issues must be considered:

a) maintaining or improving the current level of safety;

b) schedule for provision and/or adoption of a GNSS service, including aircraft and operator approval processes;

c) extent of existing ground-based radio navigation services;

d) strategy for transition schedule to GNSS capability (i.e. benefits-driven or mandatory);

e) appropriate level of user equipage with GNSS capability;

f) provision of other air traffic services (i.e. surveillance and communications);

g) density of traffic/frequency of operations;

h) mitigation of risks associated with radio frequency interference failures and ionospheric issues;

i) design and implementation of procedures; and

j) over-all economics and lead times to introduce aircraft avionics requirements.

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APPENDIX B

STRATEGIES FOR THE INTRODUCTION AND APPLICATION OF NON VISUAL AIDS IN APPROACH, LANDING AND DEPARTURE IN THE CAR/SAM REGION

a) Maintain the ILS as the ICAO standard precision approach and landing system as long as necessary and as long as it remains operationally acceptable and economically beneficial, doing everything possible to not deny access to airports to aircraft equipped only with ILS;

b) implement GNSS with augmentation as required for APV and Category I operations where operationally required, technically feasible and economically beneficial, taking into account GNSS evolution;

c) promote the development and use of a multi-modal airborne landing capability;

d) promote the use of APV operations, particularly those using GNSS vertical guidance, to enhance safety and accessibility; and

e) identify and resolve operational and technical feasibility issues for GNSS with ground-based augmentation system (GBAS) to support Category II and III operations; implement GNSS for Category II and III operations where operationally required and economically beneficial.

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APPENDIX C

CAR/SAM REGIONAL STRATEGIES AND RULES TO DEFINE THE SATELLITE BASED AUGMENTATION SYSTEM (SBAS) ARCHITECTURE AND THE INTRODUCTION OF GROUND BASED AUGMENTATION SYSTEM (GBAS) LEADING TO IMPLEMENTATION

1. To perform the above-mentioned studies, bear in mind that GNSS evolutionary development stems from the new multiple signals and multiple constellations, as well as the SARPs, for gradual and progressive implementation in two consecutive implementation stages, consisting of required actions, aim at satisfying Table CNS 3 – *Radio navigations aids*, contained in the FASID, Part IV, according to the following Table:

PHASES OF THE SBAS AND GBAS-GNSS IMPLEMENTATION		
PHASE	**Date**	**Minimal performance to be satisfied**
Phase I: (Initial GNSS-SBAS introduction)	Current – 2010	• En-route navigation and en-route terminal; • Capacity of non-precision approach (NPA); and • Approach capacity, non-precision, with vertical guidance - APV-I (in equatorial areas this capacity may not be obtained).
Phase II: (Final GNSS-GBAS Introduction)	2010 - 2015	• APV II and precision approach (PA) Category I. • PA Cat II and Cat III.

Note: These phases would be conditional constellations and new GNSS signals coming into service in accordance with the AN-Conf/11 plan.

2. SBAS and GBAS introduction would be in accordance with CAR/SAM Region guidelines for the transition of navigation systems and the regional strategy for implementation in support of approach, landing and departure operations.

3. During Phase I, SBAS-GNSS initial implementation should be aimed at resolving airspace problems and increasing capacity, as well as facilitating improved access, terminal area flexibility and RNAV coverage, particularly in mountainous areas with several obstacles or other limitations (e.g. noise reduction requirements), to achieve GNSS operational and safety benefits, including advanced capabilities. This service should be achieved through small investments and coordinated participation of States/International organizations. During this phase, the system should also satisfy APV-I performance requirements, with the exception of the equatorial areas.

4. Additionally, during Phase I conventional ground radio aids will remain as backup for GNSS or be integrated. GNSS signal interruption resulting from the rapid and large ionosphere changes taking place at the equatorial zone, including the ionospheric scintillation should be mitigated by better use of ground navigation radio aids, as well as radar surveillance support and other techniques in accordance with AN-Conf/11, Recommendation 6/2 - *Guidelines on mitigation of GNSS vulnerabilities.*

5. During Phase II it is expected that effects caused by rapid and large ionospheric changes will be minimized due to the availability of multiple new signals and constellations. The results of the Brazilian studies, and ICAO guidance should be noted. The ultimate GNSS will essentially consist of the level of services to achieve APV-II and precision approach (PA) Category I performance. Moreover, GBAS introduction should be carried out in order to obtain Category I, II and III.

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APPENDIX D

GUIDELINES AND SUPPORT DOCUMENTS FOR THE PROGRESSIVE IMPLEMENTATION OF THE GNSS SYSTEM

1. For the introduction of new GNSS navigation services, a State should evaluate navigation systems against four essential criteria: accuracy, integrity (including time-to-alert), continuity of service and availability of service. Chapter 4 of the Global Navigation Satellite System (GNSS) Manual, Doc 9849, clearly explains the provision of services with GNSS, including the performance characteristics and operational potential of GNSS augmentation systems. Chapter 5 of the mentioned Manual provides guidance on aspects related to GNSS implementation.

2. PANS-OPS, Doc 8168, Volumes I and II criteria for GNSS terminal, non-precision approach and departure operations have been developed in line with avionics performance obtained with a basic GNSS receiver.

3. In accordance with paragraph 3.7.2 of Annex 10, Volume I, GNSS shall use various combinations of the following elements installed on the ground, satellites and/or on board aircraft:

a) Global Positioning System (GPS) that provides Standard Positioning Service (SPS);
b) Global Navigation Satellite System (GLONASS) that provides the Channel of Standard Accuracy (CSA) navigation signal;
c) aircraft-based augmentation system (ABAS);
d) satellite-based augmentation system (SBAS);
e) ground-based augmentation system (GBAS);
f) ground-based regional augmentation system (GRAS); and
g) aircraft GNSS receiver.

4. Additionally, among other provisions, the Table 3.7.2.4-1 of Annex 10, Volume I, establishes the signal-in space performance requirements for the following typical operations:

a) En-route (oceanic/continental low density)
b) En-route (continental)
c) En-route, Terminal
d) Initial approach, Intermediate approach, Non-precision approach (NPA), Departure
e) Approach operations with vertical guidance (APV-I)
f) Approach operations with vertical guidance (APV-II)
g) Category I precision approach

5. The *Global Navigation Satellite System (GNSS) Manual* also provides information on the implementation aspects of GNSS in order to assist States with the introduction of GNSS operations. The Manual is therefore aimed at air navigation service providers responsible for fielding and operating GNSS elements, and at regulatory agencies responsible for approving the use of GNSS for flight operations. Additionally, it provides GNSS information to aircraft operators and manufacturers. The Manual is to be used in conjunction with the relevant provisions in Annex 10, Volume I.

6. The *Manual on Testing of Radio Navigation Aids* Doc 8071, Volume II — *Testing of Satellite-based Radio Navigation Systems* contains guidance on testing of satellite-based radio navigation systems including in-flight inspections of the augmentation systems.

7. Annexes 11 and 15 now contain provisions related to the GNSS.

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APPENDIX E

Due to budgetary limitations, this Appendix is available in Spanish only.

TERCERA FASE DEL PROYECTO RLA/03/902

De acuerdo a los resultados obtenidos en la Fase II del SACCSA, se precisa ejecutar una tercera fase (Fase III) que de continuidad a los trabajos iniciados y los complete, al objeto de establecer la viabilidad definitiva del Proyecto, tanto a nivel técnico como financiero. Esta nueva Fase deberá cubrir todos aquellos estudios y análisis que no han podido ser cubiertos en la Fase II, bien por motivos presupuestarios, bien como consecuencia de los análisis realizados y que abren las puertas a nuevos estudios que contribuyan a llegar a resultados consolidados y garantizados.

También, la FASE III de SACCSA tiene el propósito de establecer una demostración de SACCSA que permita corroborar que los supuestos y modelos definidos / desarrollados en la FASE II son válidos, permitiendo tomar a los Estados/Organizaciones de las regiones CAR/SAM la decisión final sobre la idoneidad o no de implementar el sistema, así como la forma de hacerlo. En esta decisión, intervendrían todos los Estados/Organizaciones, siendo necesario llegar a disponer de un mínimo de quórum, dado el alcance regional del estudio y la necesidad de que se llegue a concertar acuerdos entre Estados adyacentes.

Esta Fase, estudiará la viabilidad de que las regiones CAR/SAM dispongan de un sistema SBAS, que permita cubrir sus necesidades y las de sus usuarios. Dicho sistema se definirá de acuerdo a las especiales características de ambas regiones, adaptando su configuración a la distribución del espacio aéreo. Asimismo, se establecerán las bases para la gestión y operación del mismo, definiendo los órganos internacionales a ser creados para llevar a acabo dichas acciones. Por otra parte, y dado el coste que implica implantar un SBAS, se realizará un análisis exhaustivo de los recursos financieros necesarios y el modo de obtenerlos, a través de las diferentes fuentes y modalidades de crédito disponibles.

Este proyecto constatará la viabilidad de que las Regiones CAR/SAM dispongan de un sistema SBAS que permita cubrir sus necesidades y las de sus usuarios teniendo en cuenta la evolución del GNSS. Dicho sistema se definirá de acuerdo a las características propias de ambas regiones, basado en la estrategia y pautas regionales adoptados por la reunión GREPECAS/12 (Apéndice W al Informe sobre la cuestión 3 del orden del día), adaptando su configuración a la distribución del espacio aéreo y densidad del tránsito aéreo. Asimismo, se establecerán las bases para la gestión y operación del mismo, proponiendo los órganos internacionales que podrían ser creados para llevar a acabo dichas acciones. Por otra parte, y dado el coste que implica proponer la implantación de un sistema preoperacional SBAS, se realizará un análisis exhaustivo de los recursos financieros necesarios y el modo de obtenerlo, a través de las diferentes fuentes y modalidades de crédito disponibles.

Los trabajos necesarios se realizarán sobre la base de las cuestiones siguientes:

1. Transición al GNSS
2. Implantación del uso del GNSS a corto plazo
3. Red de monitorización para analizar el comportamiento ionosférico y funcionamiento de los modelos elaborados para las Regiones CAR/SAM
4. Finalización de los estudios de la fase actual, concretando las cuestiones sobre las comunicaciones, ionosfera, topología de red terrena y otras
5. Definición de actividades de soporte a la validación / certificación
6. Estudio de coste/beneficio
7. Ejecución de cursos y seminarios

8. Estudio de los emplazamientos de las instalaciones críticas: Centros de control (3), infraestructura de apoyo (1), estaciones de acceso a los GEOS (4 - 6)
9. Primeros entrenamientos sobre el sistema. Formación a alto nivel
10. Asistencia a los Estados / Organizaciones/ Instituciones para poder abordar el sistema y contactar con las entidades crediticias correspondientes
11. Analizar otras opciones complementarias en zonas de prestaciones pobres o limitadas
12. Actividades de apoyo a la futura implantación del GNSS en las Regiones CAR/SAM

Objetivos de la Fase III del Proyecto RLA/03/902

Estudiar y recomendar la definición de un sistema preoperacional SBAS para las Regiones CAR/SAM que permita a estas disponer de una señal operacional basada en el mismo. En dicha definición, se realizarán estudios de índole técnico, financiero, de gestión y de recursos humanos.

Al final de este estudio, el GREPECAS y los Estados, Territorios y las organizaciones internacionales dispondrán de los conocimientos, las herramientas, y las orientaciones necesarias sobre la implantación de un sistema preoperacional SBAS coordinado en las Regiones CAR/SAM.

Los objetivos se presentan en la tabla siguiente:

Objetivos de la Fase III del Proyecto RLA/03/902	
Resultados	**Actividades**
Volumen 1: Transición al GNSS	**A.1** Contribuir al establecimiento de la transición al GNSS y ampliar la utilización de los elementos y las capacidades actuales del GNSS mediante las tareas siguientes: ✈ Contribuciones sobre la utilización de las capacidades actuales del GNSS en RNAV / RNP/ NPA, mediante el empleo de GPS y ABAS ✈ Análisis de implantación y uso del SBAS ✈ Análisis de implantación y uso del GBAS ✈ Análisis de implantación de la navegación basada en performance (PBN)
Volumen 2: Implantación del uso del GNSS a corto plazo	**A.2** Implementación de los elementos del GNSS disponibles: ✈ Utilización del GPS/ABAS ✈ Diseño de procedimientos RNAV/RNP/NPA basados en el GNSS ✈ Formación en el diseño de procedimientos basados en la utilización del GNSS

Objetivos de la Fase III del Proyecto RLA/03/902	
Resultados	**Actividades**
Volumen 3: Red de monitorización para analizar el comportamiento ionosférico y funcionamiento de los modelos elaborados para las Regiones CAR/SAM	**A.3** Monitoreo y análisis del comportamiento ionosferico: ✈ Validación de los modelos para garantizar que si sería factible la implantación del SBAS aumentación ✈ despliegue de una red de receptores GPS bifrecuencia (L1 – L2) y que realicen medidas a 1 sg. ✈ reutilizar las estaciones de referencia del Proyecto RLA/03/009 ✈ adquisición de los receptores tipo OM4 ✈ publicación de los datos recibidos por los receptores en Internet (FTP o envío en tiempo real) ✈ procesamiento de los datos mediante un modelo UCP y publicación del mensaje en la red ✈ las correcciones resultantes podrán ser usadas por los Estados/Organizaciones, universidades, empresas y otras entidades que así lo deseen para realizar análisis de las prestaciones, desarrollar aplicaciones con vistas a cuando se disponga el SBAS, e incluso para realizar demostraciones en aplicaciones no críticas (seguridad, transporte por carreteras, control de flotas, etc).
Volumen 4: Finalización de los estudios y, concretando las cuestiones sobre las comunicaciones, ionosfera, topología de red terrena y otras	**A.4** Se ejecutarán las tareas siguientes: ✈ Análisis técnico de la solución SBAS ✈ Análisis detallado de las redes de comunicaciones disponibles en las regiones CAR/SAM en base a los datos que se proporcionen desde el punto 11. ✈ Optimización de la topología de las ERS. ✈ Completar los estudios ionosféricos. ✈ Mantenimiento del mapa interactivo. ✈ Licencias de uso de herramientas tipo “Service Volume”.
Volumen 5: Definición de las actividades de soporte a la validación / certificación	**B.5** Ejecución actividades necesarias para el proceso de validación / certificación siguientes: ✈ Supervisión técnica con respecto a estándares y normativa, incluyendo documentación ✈ Verificación de los sistemas técnicos con respecto a los estándares y normativa, incluyendo documentación ✈ Definición de un modelo de desarrollo y seguimiento del Proyecto
Volumen 6: Estudio de coste/beneficio	**B.6** Realización de las actividades siguientes para el estudio de coste/beneficio: análisis coste/beneficio ✈ presentación a los Estados/Organizaciones, entidades financieras y otras ✈ identificación de las entidades financieras que puedan proporcionar los créditos para apoyar las necesidades financieras para el desarrollo del sistema ✈ determinación de las condiciones crediticias
Volumen 7: Ejecución de cursos y seminarios	**B.7** Con el propósito de capacitar al personal relacionado con la ejecución de las actividades del proyecto RLA/02/902, se prevé la realización de los cursos y seminarios siguientes: ✈ Curso de capacitación de los equipos de toma de datos ✈ Seminario sobre información detallada y el establecimiento de posibles correcciones en el desarrollo de las diferentes actividades; el cual deberá realizar a mediados del término de la ejecución de la Fase III ✈ Seminario final de la Fase III donde se presentarán los resultados de esta fase

Objetivos de la Fase III del Proyecto RLA/03/902	
Resultados	**Actividades**
Volumen 8: Estudio de los emplazamientos de las instalaciones críticas: Centros de control (3), infraestructura de apoyo (1), estaciones de acceso a los GEOS (4 - 6)	**C.8** Para seleccionar la ubicación de los emplazamientos se estudiarán los diversos aspectos, entre otros: ✈ Capacidad y relaciones internacionales del Estado que lo acoja ✈ Soporte tecnológico local y preparación del personal que lo opere ✈ Infraestructura soporte (calidad de nodos de comunicaciones, conexiones internacionales por vía aérea, facilidad de aduanas para el envío de repuestos, etc.) ✈ Aporte del edificio que lo aloje, teniendo en cuenta los estrictos criterios de seguridad y accesos restringidos que se tendrán que imponer ✈ Otros
Volumen 9: Primeros entrenamientos sobre el sistema. Formación a alto nivel	**C.9** Se realizará las actividades siguientes de formación de personal: ✈ entrenamiento sobre apoyo en el proceso de despliegue, instalación y mantenimiento de los diferentes elementos ✈ formación progresiva sobre los CPCS y SAS (este entrenamiento recaerá sobre los Estados que alojarán dichos elementos)
Volumen 10: Asistencia a los Estados / Organizaciones/ Instituciones para poder abordar el sistema y contactar con las entidades crediticias correspondientes	**C.10** Se realizarán estudios para organizar una adecuada estructura institucional a nivel regional que permita garantizar eficazmente la ejecución, implantación y operación del sistema. Se tendrán en cuenta, entre otros, los aspectos siguientes: a) Definición de la estructura de gestión del Proyecto b) Definición del operador, gestor/propietario del Sistema
Volumen 11: Analizar otras opciones complementarias en zonas de prestaciones pobres o limitadas	**C.11** Dado que se han encontrado algunas áreas con prestaciones limitadas, debido por un lado a los problemas ionosféricos producidos por la carencia de estaciones que delimiten un IGP (algún área de la amazonía), o por problemas geográficos, al no disponer de tierra donde colocar una estación de referencia (zona de Tierra del Fuego), se estudiarán alternativas operacionales a dichas zonas al objeto de poder cubrir sus necesidades operativas actuales y futuras. Para ello, habrá que recurrir al estudio de otras posibilidades GNSS (tales como el GBAS), o el mantenimiento de radioayudas convencionales.
Volumen 12: Actividades de apoyo a la futura implantación del GNSS en las Regiones CAR/SAM	**C.12** Se desarrollarán las actividades de apoyo siguientes: ✈ Análisis de emplazamientos ✈ Análisis de las prestaciones y características de las redes de comunicaciones ✈ Informe y estudios sobre la idoneidad del SBAS ✈ Intermodalidad. Requisitos de otros usuarios ✈ “Safety Case” ✈ Análisis del impacto de las responsabilidades jurídicas inherentes a la utilización del sistema ✈ Promoción y difusión ✈ Validación operacional y certificación ✈ Estándares y normativa aplicable ✈ Análisis de GEOS disponibles en las Regiones CAR/SAM. Identificar y contactar a las entidades responsables de dichos satélites