



**INTERNATIONAL CIVIL AVIATION ORGANIZATION**

**REPORT OF THE  
SECOND RLA/00/009 PROJECT COORDINATION MEETING  
ON GNSS AUGMENTATION TRIALS**

**(Río de Janeiro, Brazil, 28 to 30 August 2002)**

August 2002

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of ICAO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers of boundaries.

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## **HISTORY OF THE MEETING**

### **ii.1 PLACE AND DURATION OF THE MEETING**

At the invitation of the Airspace Control Department (DECEA) of Brazil, the Second RLA/00/009 Project Coordination Meeting on GNSS Augmentation Trials was held in Rio de Janeiro, Brazil. The meeting commenced on 28 August and ended on 31 August 2002. As part of the meeting activities, the participants visited the Flight Inspection Facilities (GEIV) at the Santos Dumont International Airport and the SBAS Augmentation units at the Galeao International Airport.

### **ii.2 OPENING CEREMONY**

Mr. Carlos Stehli, ICAO Deputy Regional Director of the South American, a.i., addressed the meeting on behalf of ICAO, giving a warm welcome to the participants, wishing them all success in the work to be performed by the meeting and highlighting the most important achievements reached by the RLA/00/009 project.

Brig. do Ar Paulo Roberto Cardoso Vilarinho, DECEA's Vice Diretor de Planejamento, welcomed all participants on behalf of the government of Brazil, and expressed his pleasure in hosting this event, emphasizing the work performed by Brazil in relation with the development of SBAS augmentation and the findings encountered with the ionosphere in the geomagnetic Equator. Brig. Vilarinho wished to the meeting success on its deliberations and declared inaugurated the event.

### **ii.3 ORGANIZATION, OFFICERS AND SECRETARIAT**

The meeting was chaired by Mr. Luis Rossi. Mr. Onofrio Smarrelli, SAM Regional CNS Officer, acted as Secretary of the Meeting, and was assisted by Mr. Carlos Stehli, ICAO SAM Office DEPRD, a.i.

### **ii.4 WORKING LANGUAGES**

The working languages of the meeting were Spanish and English. The documentation and the Report of the Meeting were issued in English and Spanish.

### **ii.5 AGENDA**

The Meeting approved the Agenda as indicated in the report on Agenda Item 1.

### **ii.6 ATTENDANCE**

The Meeting was attended by Argentina, Bolivia, Brazil, Chile, Colombia, Panama, United States, Venezuela and COCESNA. The list of participants is attached to this part of the report.

### **ii.7 WEB SITE**

The documentation presented to the meeting including the Summary of Discussions and Conclusions are available at <http://www.lima.icao.int/>.

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**LIST OF ACRONYMS**

CSTB	CAR/SAM Test Bed
DECEA	Departamento de Controle do Espaço Aéreo
DEPRD	Deputy Regional Director
FAA	Federal Aviation Administration
GEIV	Grupo Especial Inspección en Vuelo
GEO	Geostationary Satellite
GIVE	Grid Ionospheric Vertical Error
GNSS	Global Navigation Satellite Service
GPS	Global Position System
IGP	Ionospheric Grid Point
NPA	Non Precision Approach
NTSB	National Test Bed
RAAC	Reunión de Autoridad de Aviación Civil
RTCA	Radio Technical Commission for Aeronautical
SAM	South America
SBAS	Satellite Base Augmentation System
TRS	Test Bed Reference Station
TMS	Test Bed Master Station
UDRE	User Differential Range Order
WAAS	Wide Area Augmentation System

**Agenda Item 1:                      Agenda approval**

1.1            Under this Item, the meeting approved the Agenda, which is presented in **Appendix A**.

1.2            Nine working papers and one information paper were presented during the meeting; **Appendix B** presents the list.

1.3            The three-day work schedule approved by the meeting was from 09:00 to 14:00 hours.

**APPENDIX A**

**APPROVED AGENDA**

Agenda Item 1	Agenda approval
Agenda Item 2	Review of the First Coordination Meeting
Agenda Item 3	Report on activities carried out to date regarding execution of the project
Agenda Item 4	Review of activities foreseen in the project document and reformulation of same
Agenda Item 5	Financial situation of the project
Agenda Item 6	Other matters

## **EXPLANATORY NOTES OF THE AGENDA**

### **Agenda Item 1            Agenda approval**

Under this Agenda Item, the meeting will analyze the Agenda proposed for the meeting, for its approval.

### **Agenda Item 2            Review of the First Coordination Meeting**

Under this Agenda Item, a review will be made to the matters dealt with during the first Coordination Meeting held in Santiago, Chile, from 1 to 3 August 2001.

### **Agenda Item 3            Report on activities carried out to date regarding execution of the project**

Under this Agenda Item, the meeting will take note of the activities carried out to date in the execution of RLA/00/009 project. The installation of the reference stations (TRS), the establishment of communications circuits between the TRS and the Master Stations (TMS) in Santiago and Rio de Janeiro, the trials in Argentina, Bolivia, Chile and Peru and their results, will all be analysed during the meeting. Likewise, it is expected that Brazil present the meeting with the results of the activities carried out to date.

### **Agenda Item 4            Review of activities foreseen in the project document and reformulation of same**

Under this Agenda Item, a review will be made of the results and the activities pending in the project document and, on that basis, it is expected that the meeting reformulate the project document, as per Conclusion 7/9 of the Seventh Meeting of Civil Aviation Authorities (RAAC/7) (Salvador, Bahia, Brazil, 1 to 3 July 2002).

### **Agenda Item 5            Financial situation of the project**

Under this Agenda Item, the meeting will take note of the financial situation of the project, through the specification of expenses incurred to date, as well as the status of contribution of participating States.

### **Agenda Item 6            Other matters**

Under this matter, other aspects related with the project that might arise and not have been originally foreseen shall be analysed, as well as those that could arise due to the project's reformulation.

**APPENDIX B****LIST OF WORKING PAPERS, INFORMATION PAPERS AND PRESENTATIONS  
PRESENTED AT THE MEETING**

<b>Number</b>	<b>Agenda Item</b>	<b>Title</b>	<b>Presented by</b>
WP/1	1	Draft Agenda	Secretariat
WP/2	2	Review of the first Coordination Meeting	Secretariat
WP/3	3	GNSS augmentation Trials in the CAR/SAM Region	Secretariat
WP/4	4	Schedule of activities	Secretariat
WP/5	5	Financial Situation of the Project	Secretariat
WP/6	3	Annual Programme Report	Secretariat
WP/7	3	Report of the activities carried out to date regarding execution of the project	Brazil
WP/8	4	Review of activities foreseen in the project document and reformulation of same	Brazil
WP/9	3	Report of the activities carried out to date regarding execution of the project	Colombia
IP/1		General Information	Secretariat
Presentation 1		Resulting of the Flight Trial Argentina, Bolivia, Chile and Perú	United States
Presentation 2		SBAS activities in Brazil	Brazil



**APPENDIX A****STATUS OF CONCLUSIONS FORMULATED DURING THE RLA/00/009 PROJECT COORDINATION MEETING ON GNSS AUGMENTATION TRIALS**

<b>CONC.</b>	<b>TITLE</b>	<b>CONTENTS</b>	<b>STATUS</b>	<b>REMARKS</b>
3/1	Execution of flight trials in Argentina, Bolivia and Peru	That: a) Argentina Bolivia and Peru carry out all the activities indicated in the verification list presented as Appendix B to this part of the report, to guarantee the execution of the flight trials planned for the period between 15 November and 15 December 2001; and b) Chile carry out the scheduling of the trial at the indicated date for its remittance to the project administration and States involved.	<b>Concluded</b>	Data collection flight trials were carried out in Argentina, Bolivia and Peru.
3/2	State contributions to RLA/00/009 Project	That States involved in RLA/00/009 Project that have still not deposited their corresponding contributions, should do so as soon as possible and before 31 August 2001, so as not to affect the activities of the project.	<i>Pending</i>	Reformulated by the Second Coordination Meeting as Conclusion 2/3 (Agenda Item 5 refers).

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**Agenda Item 3: Report on activities carried out up to date regarding execution of the project**

3.1 The Meeting took note of the activities carried out for the execution of the GNSS Augmentation Regional trials during the first year of the Project. **Appendix A** contains this information.

3.2 These activities were divided into three parts: the first one corresponding to the installation of the TRS reference stations, the second one, the execution of the training programme and the third one, the execution of the initial trials.

3.3 The Meeting was informed that all TRS have been installed and that some communications circuits between the TRS and the master stations have not yet been implemented.

3.4 With respect to the execution of training courses, two of them were held, one related with the installation of a reference station and the other, on data analysis of the WAAS augmentation signals.

3.5 Regarding the execution of the trials, the Meeting was informed that they had been carried out in Argentina, Bolivia, Chile and Peru. Likewise, information was provided on recordings of the GPS satellite signals and the Inmarsat geostationary satellites, indicating that the mentioned information was recorded in the WAAS console installed on board the flight inspection aircraft of the Chilean civil aviation authority and in the ground reference stations.

3.6 Information was received from the FAA regarding the results of the analysis of the data collected during the flight tests in Argentina, Bolivia, Chile and Peru and, in this respect, the meeting noted the following:

- a) Aircraft receiver demonstrated successful data collection.
- b) For en-route and NPA procedures, the GPS accuracy demonstrated to be sufficient even without differential corrections and, also, considering the US WAAS over Panama. Availability was determined by simulating UDREs of 9 and GIVES of 45. Integrity was determined also by simulation in that HPL easily bound horizontal position error during tests.
- c) For NPA with vertical guidance, the Master Station needs to have “safety approved” algorithm which can set GIVES to 6 or less at most IGPs (Ionospheric Grid Points). Further tests are required to demonstrate accuracy, availability, and integrity while operating a Master Station implementing the (undefined) GIVE algorithm.
- d) For the ionosphere analysis, it was determined that no severe conditions occurred, including satellite carrier loss due to scintillation or large gradient bubbles, were observed during this test.

3.7 The Brazilian Delegate presented to the meeting a description of their activities in GNSS Augmentation trials and, in that respect, informed that Brazilian and FAA specialists in GNSS augmentation have verified that the behaviour of the ionosphere in this area is different to the ionosphere behaviour over the United States. Therefore, the ionosphere algorithm implemented in the Rio de Janeiro master station, which is the same as the master station implemented in United States, is not applicable for the CSTB.

3.8 Based on the results of the above mentioned trials, the representative from Brazil concluded that the following activities have to be carried out: concerning scintillation analysis, identify the operational requirements and establish a new ionosphere model.

3.9 The meeting noted that to mitigate the scintillation issue a better location and number for the GEO and the TRS should be determined, taking into consideration the number of necessary GEOs. Concerning the operational requirements, the study will be made in conjunction with ICAO, RTCA and other pertinent organizations and later trials will be conducted to validate them. In relation to the ionosphere model, this one has to be defined for the CAR/SAM Regions to support procedures that require vertical guidance.

3.10 The meeting was provided with an annual programme report outlining the progress of the project over its first year. This report also contains a questionnaire form to be answered by the participating States, which address matters for an evaluation of the project. The State's assessment on this issue is attached as **Appendix B** to this part of the report.

## APPENDIX A

### ACTIVITIES CARRIED OUT AT STATES PARTICIPATING IN THE PROJECT

#### **Argentina**

The TRS is installed and operational since December 2001 and the communication with the Master Station in Chile was completed in March 2002. From 12 to 15 May trials consisting in the obtainment and storage of GPS data and of Inmarsat geostationary satellites through the WAAS console installed on board the Chilean flight inspection aircraft, and recording of data from the TRS.

The trials were held two to three hours after sunset. En route data was registered during the Santiago de Chile/Buenos Aires and Buenos Aires/La Paz flights. In addition, flight trials on non precision approach procedures were made at Ezeiza airport. During these last trials, personnel from the Argentinean civil aviation administration had the opportunity of active participation.

The data obtained and processed by the TRS during the flight trials were recorded in the FAA Atlantic City WAAS Trial Unit data bank (NTSB). All of it could not be recorded for there were interruptions in the circuit between the Buenos Aires TRS and the Chile TMS.

#### **Bolivia**

The equipment for the reference station was sent to Bolivia in two parts and the last part was shipped in mid-April 2002. The TRS was installed by the first week of May 2002, when it also became operational. The circuit between the La Paz TRS and the Chile TMS has not been installed. The recording of the information received by the TRS was done locally. The information was copied to a CD and sent to the Lima ICAO Office for further remittance to the NTSB trial centre of the FAA in Atlantic City.

Flight trials were held from 15 to 21 May and consisted in the obtainment and storage of GPS data and of Inmarsat geostationary satellites in the WAAS console at the Chilean flight inspection aircraft during enroute operation phase over Bolivian territory air space during Buenos Aires/La Paz and La Paz/lima flights, as well as non precision approach operations at El Alto international airport in La Paz. All these trials were effected two to three hours after sunset. Bolivian civil aviation personnel had the opportunity to actively participate in the non precision approach trials.

#### **Brazil**

The five TRS stations, as well as the TMS station foreseen for Brazil are installed and operational since September 2001. Likewise, all of the communication links between the reference stations and the master station have been implemented. In-flight trials were conducted in January 2002 with the collaboration of FAA technical personnel for the purpose of collecting GPS data in order to analyse the behaviour of said data in the ionosphere. In March 2002, a seminar on the ionosphere was conducted, at which the results of the trial were presented.

To complete the regional trial platform, the implementation of the communications circuits between the Rio de Janeiro master station and the Colombia and Honduras reference stations is pending, as well as the circuit with the Chile Master Station. To establish these circuits, the installation of a VSAT station from the Colombian satellite network has been foreseen in Rio de Janeiro, Brazil, and Tegucigalpa, Honduras; the circuit Honduras/Colombia has been installed. The implementation of the communications circuit between the Chile and Rio de Janeiro master stations will be through the REDDIG.

### **Chile**

The reference stations in Chile, as well as its master station, are installed and operational since 1998. As for the topology of the regional trial platform, the communication circuit between the La Paz reference station and the master station in Chile is still lacking, as is the connection between the Santiago master station and that of Rio. The implementation date for these circuits is described in sections on Bolivia and Brazil in this working paper.

The Chilean flight inspection aircraft, carried out flight trials for the collection of GPS data and of Inmarsat geostationary satellites for en route and non precision approach in Argentina, Bolivia, Chile and Peru between 13 and 24 May.

### **Colombia**

The reference stations were installed by the end of May 2002, pending the communications circuit with the Brazil master station. To be able to analyze the data stored in the light trials and in the reference stations, Colombia is proceeding with the installation of application software for the processing and presentation of the trials results. This software is being installed with the collaboration of the FAA. The same software is installed in Rio de Janeiro. Additionally, Colombian Administration is currently equipping the Flight Inspection aircraft with the GPS&WAAS avionics.

### **COCESNA**

The installation of the reference station is ready but not in operation in the mean time COCESNA is in coordination with the FAA to solve the problems, by the end of May 2002, is still pending the implementation of the circuit with the Brazil master station

### **Panamá**

The reference station is installed and operational, and is connected to the FAA master station in Atlantic City, making it part of the United States satellite-augmentation trial platform (NTSB). The information from the Panama reference station will also be interconnected with the Rio master station once the circuit between Rio de Janeiro and Atlantic City has been implemented.

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**Perú**

The reference station of Peru is installed and operational since December 2001, as were the communication circuit between the Lima reference station and the Santiago master station. Trials regarding collecting and storage of GPS data and of the Inmarsat geostationary satellites through the WAAS console installed on board the Chilean flight inspection aircraft, and recording of data from the TRS were carried out from 21 to 24 May.

Trials were carried out two to three hours after sunset. En route data was registered during the flight over Peruvian airspace in the La Paz/Lima and Lima/Santiago of Chilean routes. Likewise, flight trials were carried out using overlay non precision approach procedures at the Jorge Chavez International airport in Lima. During these last trials, Peruvian civil aviation administration personnel had the opportunity of actively participating.

**APPENDIX B****PROGRAMME OR PROJECT ANNUAL REPORT****Basic Information on the Programme or Project**

Number and title of the project:	RLA/00/009–Regional GNSS augmentation test
Designated institution:	ICAO
Project initiation date:	
Originally planned:	July 2001
Effective:	July 2001
Project termination date:	
Originally planned:	June 2004
Effective:	
Total budget (Dollars):	
Initial amount:	US\$229,000
Last approved revision:	US\$188,936
Period covered by the report:	July 2001 – 30 July 2002

**PART I: NUMERIC EVALUATION**

Please evaluate pertinence and performance of the programme or project, using the following scale:

- |   |                      |
|---|----------------------|
| 1 – Highly satisfactory                           | 4 – Not satisfactory |
| 2 – Satisfactory                                  | X – Does not apply   |
| 3 – Not satisfactory, with some positive elements |                      |

Please indicate your answers in the column corresponding to your function in the programme or project.

SUBSTANTIVE APPROACH	ICAO	ARG	BOL	BRA	CHI	COL	ECU	EE.UU.	PAN	PER	VEN	COCESNA	AVERAGE
1. How do you evaluate the level of pertinence of the programme or project in relation to the development priorities of the country?	X			1									
2. How do you evaluate the pertinence of the programme or project in respect to sustainable human development promotion? Please indicate your mark in the concentration sphere of what programme or project should treat.													
a) Eradication of poverty and sustainable means of life	X												
b) Protection and regeneration of the environment	X												
c) Woman in development	X												
d) Promotion of a favourable scope for sustainable human development, including governability.	X												
3. In what measure the programme or project is oriented to appropriate beneficiary groups, based on the following considerations?													
a) Gender	X												
b) Socioeconomic factors	X												
c) Geographical location	X												
4. Given the programme or project objectives, support is provided to pertinent institutions?	2	_	2	1	2	2							

SUBSTANTIVE APPROACH	ICAO	ARG	BOL	BRA	CHI	COL	ECU	EE.UU.	PAN	PER	VEN	COCESNA	AVERAGE
<p>1. Using the following indicators, evaluate the product contribution to the achievement of the immediate objectives <u>a/</u>:</p> <p><b>Indicator #1</b> GREPECAS will count with the necessary information that will allow the establishment of an operational model of a system augmentation, type GNSS (SBAS/ GBAS) in the CAR/SAM regions.</p> <p><b>Indicator #2</b> Project participant States will have qualified personnel to analyze the installation of the augmentation systems in support to the navigation systems.</p>	2	2	2	2	2	3		2	3		1	2	
2. Evaluate achievement of desired products.	2	2	2	2	2	-		2	2		2	2	
3. Are management mechanisms of the programme or project adequate?	2	2	2	2	2	2		3	2		2	2	
<p>4. Are programme or project resources sufficient (financial, physical and human) in respect to:</p> <p>a) quantity?</p> <p>b) quality?</p>	2	2	2	2	2	3		2	-		2	2	
5. Are programme or project resources being used efficiently to produce aimed results?	2	2	2	1	-	2		2	2		2	2	
6. Is the programme or project effective in function of costs, in comparison with similar programme or projects?	2	2	2	1	-	2		-	2		2		

SUBSTANTIVE APPROACH	ICAO	ARG	BOL	BRA	CHI	COL	ECU	EE.UU.	PAN	PER	VEN	COCESNA	AVERAGE
7. Based in the work plan, how would you evaluate the opportunity of the programme or project regarding:  a) achievement of initial products and results?  b) delivery of supplies?													
<b>GLOBAL EVALUTION OF THE PROGRAMME OR PROJECT</b>	2	2	2	2	2	2		2	2		2	2	

Since the beginning of the implementation of the UNDP/ICAO Project, July 2001, so far, all the Reference Stations have been installed. Additionally, some communication links between TRS and TMS have been implemented. Two of the three foreseen training courses have been imparted. Likewise, the first flight tests were carried out in Argentina, Bolivia, Peru, Chile and Brazil. The tests were mainly oriented to the recollection of data for their analysis. Once the initial tests were carried in Brazil, Argentina, Bolivia, Chile and Peru, important conclusions were obtained.

**PART II: DESCRIPTIVE EVALUATION**

1. Which are the principal achievements of the programme or project in relation to the expected results during the period being evaluated? If possible, please include an evaluation of possible effects, sustainability, and contribution to capacity development:
  - **Installation of the Reference Stations**
  - **Installation of some communication links between the TRS and the TMS.**
  - **Realization of two training courses.**
  - **Initial flight tests for collection of data and analysis in Argentina, Bolivia, Brazil, Chile and Peru.**
  - **Important conclusions as results of the first tests.**
  
2. Which are the questions and principal problems that influence the achievement of the programme or project results?
  - **More coordination on flight test development including specific goals objectives and the technical support necessary.**
  - **The timely contribution of the States regarding all their concerned activities (cost-sharing contributions, establishment of the communication circuits between the TRS and the TMS, etc.).**
  
3. How do these questions or problems should be solved? Please provide a detailed explanation of the recommended action or actions. Specify who should be responsible for these actions. Indicate also a provisional timetable and necessary resources.

**In view that the foreseen tests represent a novelty to the participant States, in which they do not have experience, it would be necessary that the FAA personnel participate as necessary in the rest of the foreseen tests, so that the project obtains the expected success.**

**For the establishment of circuits between the TRS and TMS, it is expected that these are implemented through the REDDIG by the end of 2002.**

4. What new happenings could probably affect the achievement of the programme or project results? What do you recommend to be prepared for these happenings?

**As a result of the first tests, it has been observed that in order to make operational procedures tests, which might require a certain vertical precision, it becomes necessary the realization of a ionospheric model. The cost of this study is not foreseen in the project budget. The GNSS TF needs to determine the regional requirements for SBAS APV (before the second civil frequency is available) and implement a second phase to determine the feasibility of approved ionospheric algorithm.**

5. Which is the opinion of the beneficiary groups regarding the programme or project? Please indicate any significant difference based in gender aspects regarding these opinions.

**According to Conclusion 7/9 formulated in the RAAC/7 (Meeting of Civil Aviation Authorities), it becomes necessary to reformulate the project in accordance to the results obtained in the first tests.**

6. Up to date, what lessons (positive or negative) can be pointed out from the programme or project experience?

**See No. 2. Realization of necessary operational coordination to implement SBAS.**

7. If the programme or project has been subject of evaluation, which is the degree of application of the recommendations formulated by the evaluators?

**The project has not been evaluated.**

8. Do you propose any substantive revision of the document in support of the programme of project document? In case the answer is positive, which are these revisions? Please provide explanation.

**See No. 4.**

9. Provide any other information that could support or give clarity to your programme or project evaluation. You may include the annexes that you consider necessary.

**PART III: Summary chart of the programme or project**

Programme or project title and number:	GNSS Regional Augmentation Trials	Management dispositions:	
Designed institution:	ICAO	Covered period:	July 2001/June 2004
GLOBAL EVALUATION			
<p><b>In general, it can be considered that the project in its first year of operation has been satisfactory. The installation of most of the Reference Stations was made effectively. Two of the three foreseen training courses were imparted and the first flight tests were carried out in Argentina, Bolivia, Brazil, Chile and Peru. Important conclusions were obtained as result of the tests carried out.</b></p>			

FINANCIAL SUMMARY			
Funds Source	Total budget (Thousand Dollars)	Total estimated expenditure (Thousand Dollars)	Implementation Rate (%)
Participation in funding of expenditures: Governments of:	188,936	107,981	57%
Argentina			
Bolivia			
Brasil			
Chile			
Colombia			
Ecuador			
United States			
Panama			
Peru			
Venezuela			
COCESNA			

SUMMARY OF RESULTS		
Programme support objectives or immediate objectives	Indicators	Achievements
<p><b>Obj. 1</b> Develop a test and evaluation plan on the technical and operational benefits of the U.S. FAA WAAS in the Caribbean and South American regions (CAR/SAM), so as to assist in the establishment of the satellite based augmentation systems operational model being developed by the GREPECAS CNS/ATM implementation coordination subgroup.</p>	<p><b>Indicator #1</b> GREPECAS will count with the necessary information that will allow the establishment of an operational model of a system augmentation, type GNSS (SBAS/ GBAS) in the CAR/SAM regions.</p> <p><b>Indicator #2</b> Project participant States will have qualified personnel to analyze the installation of the augmentation systems in support to the navigation systems.</p>	<p>According to what has been carried out to-date, there is a lack of information necessary for the establishment of an operational model for an augmentation system, GNSS type in the CAR/SAM Regions.</p> <p>Participant States have been trained through the realization of two of the three foreseen courses.</p> <p>They have acquired the knowledge for the TRS installation.</p> <p>They have achieved familiarization with the initial tests of data recollection in ground and air.</p>

Annual goals	Products achievement	Proposed products goals for next year
<b>Objective 1</b>		
Develop a test and evaluation plan on the technical and operational benefits of the U.S. FAA WAAS in the Caribbean and South American regions (CAR/SAM), so as to assist in the establishment of the satellite based augmentation systems operational model being developed by the GREPECAS CNS/ATM implementation coordination subgroup.		
1.1 CAR/SAM test bed operational test and evaluation plan developed and approved.	The tests plans elaborated so far and approved by the participant States consisted on the collection of data in ground and air to analyze the influence of these with the ionosphere for en route and NPA operative procedures.	To finish the elaboration of the remaining plans.
1.2 GPS approach procedures for test flight to exercise the WAAS component in each participating State at one airport.	Not yet carried out.	Their realization is expected after the third training course is conducted after regional requirements plans have been analyzed.
1.3 Development and refinement of operational standards and procedures for use and approval of satellite-based navigation systems.	ICAO effective regulations will be used.	ICAO effective regulations will be used.
1.4 Preparation for test and evaluation data collection and analysis in each participating State (Equipment Installation Site Survey and Installation Plan.	All the TRS specified in the project were installed. Some communications links were established between the TRS and the TMS.	It is expected that by the end of July 2003 the augmentation platform will be concluded, so that to enable to carry out the SBAS type tests.
1.5 Regional Flight Test Plan ( <b>Phase 1</b> ) developed for testing and evaluation of cooperative concepts and architecture for an integrated satellite navigation system.	The first phase of the tests were developed in Argentina, Bolivia, Brazil, Chile and Peru, using a Chilean flight inspection aircraft.	Flight tests for the verification of the SBAS augmentation. For this purpose a Brazilian flight inspection aircraft will be used.
1.6 Completed Regional Flight Test Plan ( <b>Phase 2</b> ).		It is expected that the flight tests will conclude by end of January 2004.

Annual goals	Products achievement	Proposed products goals for next year
1.7 Regional Flight Test Report ( <b>Phase 3</b> ) to include each sub-region test bed airborne segment analysis and reports for the regional tests.		It is expected that the report will be finished for the beginning of the second trimester of 2004.
1.8 State Flight Test Plan developed ( <b>Phase 4</b> ) for testing and verification of satellite navigation concepts in each participating State.	The first phase of the tests was developed in Argentina, Bolivia, Brazil, Chile and Peru, using a Chilean flight inspection aircraft.	Flight tests for the verification of the SBAS augmentation. For this purpose a Brazilian flight inspection aircraft will be used.
1.9 Preparation for testing and evaluation of the performance of the test bed for all phases of flight down to and including CAT I precision approaches. State Flight Test Plan.	In accordance with the first results of the tests carried out to-date, the type of tests that the project will be able to embrace will be for en route and NPA operations. No CAT 1 tests will be carried out.	
1.10 Completed State Flight Test Plan ( <b>Phase 5</b> ).		It is expected that they will be completed by February 2004.
1.11 State Flight Test Report ( <b>Phase 6</b> ) completed to include each sub-region test bed airborne segment analysis and reports at the State level.		Its completion is expected by March 2004.
1.12 State Operational Implementation Strategy/Plan ( <b>Phase 7</b> ). Reduction of the risks and removal of the barriers involved with a future implementation of satellite navigation in the CAR/SAM regions.		This plan will be included in the Project final report.

<b>Annual goals</b>	<b>Products achievement</b>	<b>Proposed products goals for next year</b>
1.13 State/Regional Training Plan Technical and operational experience and training provided to facilitate the implementation of a satellite navigation system.	So far, two training courses have been carried out: <ul style="list-style-type: none"> <li>• Installation of a Reference Station (Buenos Aires, Argentina, December 2001).</li> <li>• WAAS Operation, Data Reduction and Analysis (Atlantic City, USA, February 2002).</li> </ul>	The last course is foreseen for June 2004.
1.14 State/Regional Cost Benefits Analysis. Provision of data and information for the development of a verifiable cost/benefit analysis.		This analysis will begin in the second trimester of 2004, with a duration of 15 days.
1.15 State/Regional Satellite Navigation Architecture. (Hardware, Software/ Communications). Provision of convincing technical proof of concept to initiate funding to start the implementation of satellite navigation in the CAR/SAM regions.		This will depend entirely on the results of the tests.
1.16 Operational training programmes available for all participants in the test program. (Training support as requested).		

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**Agenda Item 4:                    Review of activities foreseen in the project document and reformulation of same**

4.1            The meeting took note that using the current infrastructure, with test bed equipment replaced by equipment approved for operational use, will enable en route and NPA air operation. However, since simulation can affect availability and continuity in most of the region, further trials would be necessary to quantify this effect.

4.2            For SBAS NPA augmentation operations, the meeting considered that air and ground data collection should continue to be analysed for the scintillation study effects affecting the GPS signals and those from the geostationary satellites.

4.3            A draft schedule to carry out the project activities during 2003 and mid-2004 for the development of regional and State trials oriented towards en route and NPA air operations was presented, which is included as **Appendix A** to this part of the report. The meeting noted that this programme could be modified due to the early availability of the Colombian aircraft flight test, the plans of Brazil as indicated below and the new date of the third training course, which should be conducted at the end of the project's activities.

4.4            The meeting considered that the collection of data from the TRS is of utmost importance for the analysis of the project's trials results, therefore, it was agreed to keep in operation the currently implemented circuits and to apply alternate actions in the event of their failure, such as local recording of the GPS data from the reference stations. This will be especially important during the next ionosphere peak time from October 2002 to March 2003 to ensure that a complete set of CSTB reference station data is available for ionosphere and scintillation analysis. In addition, it was recognized that this justifies the presence of the reference stations since it should not only be used when flight tests are performed.

4.4.1          Based on the above, the meeting formulated the following conclusion:

**CONCLUSION 2/1 -            RECORDING AND ANALYSIS OF DATA OBTAINED BY THE REFERENCE STATIONS**

That, with the aim of guaranteeing the collection and analysis of the data obtained by the reference stations, consideration be given to the following:

- a) a group of States conformed by Brazil, Colombia and United States will analyse the data obtained by the TRS of the CSTB, and will produce and deliver quarterly reports, starting on October 2002, to the States participating in the project, to obtain information on the result of the trials; and
- b) the Secretariat will present and deliver to the States participants in the project, a detailed procedure of execution of TRS data acquisition by 1 October 1 2002.

4.5 The meeting considered the importance to perform trials of NPA with vertical guidance (NPV) in the CAR/SAM Regions. In this respect, the meeting agreed on the need to carry out a study to develop an ionosphere model in order to perform the corresponding differential corrections based on the ionosphere behaviour in the geomagnetic equator. The meeting took note that the development of the ionosphere model should be carried out by experts on this matter

4.5.1 In relation with the above, Brazil presented a proposal to the meeting based on the conclusions formulated by the RAAC/7 Meeting. In discussing the Brazilian proposal, it was noted that the same should be further documented in relation with the scope of activities, resources and other matters in relation to activities being shared with the other project participants. Concerning this matter, the meeting requested to Brazil to present to ICAO a detailed proposal for consideration of the organization and the others not later than 6 September 2002. In this regard, the meeting formulated the following conclusion:

**CONCLUSION 2/2 - EXTENSION OF TRIALS UNDER RLA/00/009 PROJECT**

That:

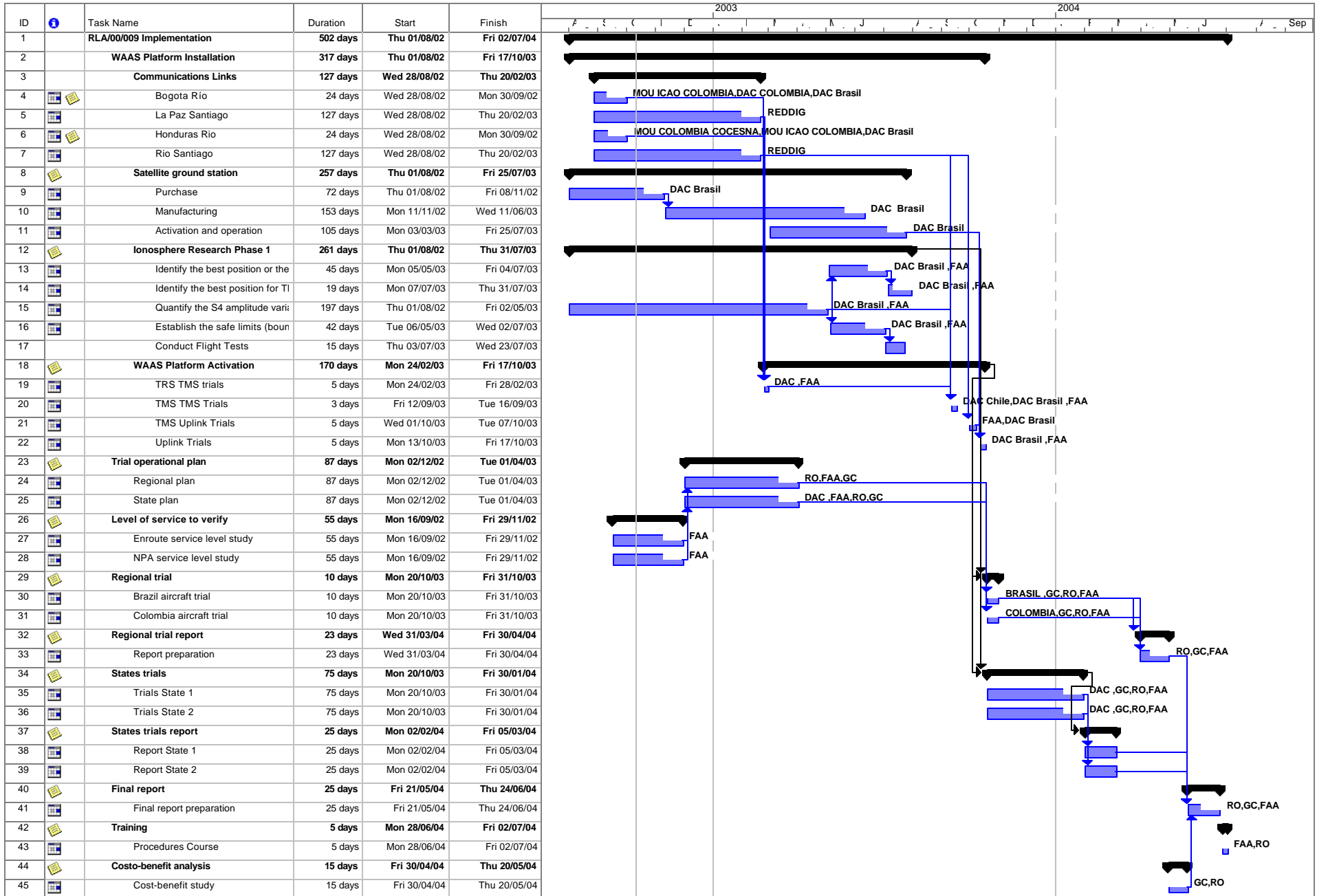
- a) the project, recognizing the need to carry out studies to perform a ionosphere study to develop the corresponding suitable modelling of the same for the CAR/SAM regions aimed at implementing trials for air operations requiring vertical guidance, request to Brazil to document and present to ICAO not later than 6 September 2002, a detailed proposal on this matter indicating scope of the activities, resources and other pertinent matters related with the activities sharing among the project parties; and
- b) ICAO in considering the Brazilian proposal in coordination with the other project parties, determine the most adequate course of action to study the feasibility to implement this new activity as part of the RLA/00/009 project schedule.

4.6 For the next project activities, the meeting was informed that:

- a) with the REDDIG Implementation at the end of the first quarter of 2003, the communication networks of the trial platform for SBAS augmentation would be completed;
- b) once the up link satellite system is implemented, the flight trials for satellite augmentation to determine the effectiveness of the GPS and GEO it would be initiated. These trials will be scheduled for the beginning of September 2002 and the flight test aircraft of Brazil and Colombia will be used;
- c) the execution of the third course of the RLA project related with operational procedures, has been scheduled for June 2004; and
- d) in view that if the trials were finished, the final regional and State reports will be elaborated. Initially, all the trials were oriented for En Route and NPA, and the possibilities to implement tests for NPA with Vertical guidance will depend on the result of the ionosphere study in the CAR/SAM Region.

APPENDIX A to Report on Agenda Item 4 / Apéndice A al Informe sobre el Asunto 4

RLA/00/009 - ACTIVITIES TO BE CARRIED OUT FOR EXECUTION OF SBAS AUGMENTATION TRIALS / ACTIVIDADES A LLEVARSE A CABO PARA EJECUCION DE ENSAYOS AUMENTACION SBAS



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**Agenda Item 5: Financial situation of the project**

5.1 The meeting examined the information related with the financial situation of the same. In this regard, it was noted that as per Revision C, the Project budget had been adjusted to US\$ 188,936.00. Concerning the expenses executed, it was noted that an amount of US\$ 71,160.00 had been used.

5.2 In reviewing the project contributions, it was noted that 69% of the contributions had been collected and that for the prosecution of the project it was required that the participants make effective the rest of the corresponding deposits in accordance with the yearly payment plans. The status of the project contributions are indicated in **Appendix A** to this part of the report.

5.2.1 Based on the above, the meeting formulated the following Conclusion:

**CONCLUSION 2/3 - STATES CONTRIBUTIONS TO THE RLA/00/09 PROJECT**

In order to proceed with the activities of the Project, the States with pending contributions should make all the necessary efforts to make effective the corresponding deposits before the end of 2002.

5.3 During the meeting Colombia and COCESNA informed their plans to make the corresponding deposits during 2002. Argentina presented to the meeting a document indicating the corresponding early 2002 payment. Bolivia informed that its project contribution would be made in September 2002.

5.4 The meeting considered the necessity to supply to all States participating in the Project a detailed budget specifying all the items, including the amounts spent to date.

## APPENDIX A

## COST-SHARING CONTRIBUTIONS REGISTRY

STATE	2001		2002		2003		TOTAL		
	Contrib.	Deposit	Contrib.	Deposit	Contrib.	Deposit	Contrib.	Deposit	Balance
<b>ARG</b>	13,673	<b>13,673</b>	6,362	<b>6,362</b>	3,582		23,617	<b>20,035</b>	9,944
<b>BOL</b>	13,673	DGAC 30% <b>4,102</b> AASANA 70% <b>9,571</b>	6,362	AASANA 70% <b>4,460</b>	3,582		23,617	<b>18,133</b>	5,484
<b>COL</b>	13,673	<b>13,673</b>	6,362		3,582		23,617	<b>13,673</b>	9,944
<b>ECU</b>	13,673	<b>13,673</b>	6,362	<b>6,362</b>	3,582		23,617	<b>20,035</b>	3,492
<b>PAN</b>	13,673	<b>13,673</b>	6,362		3,582		23,617	<b>13,673</b>	9,854
<b>PER</b>	13,673	<b>13,673</b>	6,362		3,582		23,617	<b>13,673</b>	9,944
<b>VEN</b>	13,673	<b>13,673</b>	6,362	<b>6,362</b>	3,582	<b>3,582</b>	23,617	<b>23,617</b>	0
<b>COCESNA</b>	13,673	<b>13,673</b>	6,362		3,582		23,617	<b>13,673</b>	9,944
<b>TOTAL</b>	109,384	<b>109,384</b>	50,896	<b>23,546</b>	28,656	<b>3,582</b>	188,936	<b>136,512</b>	52,424

**Agenda Item 6:                      Other matters**

6.1            Under this Agenda Item, the date for the future project coordination meeting was discussed. In this regard, it was agreed that this meeting should be held during the second semester of 2003.

6.2            The meeting agreed that if a State were interested in hosting the next coordination meeting, this should be informed to the ICAO SAM Regional Office before 30 March 2003.