

INTERNATIONAL CIVIL AVIATION ORGANIZATION
THIRD RLA/00/009 PROJECT COORDINATION MEETING

(Rio de Janeiro, Brazil, 15 to 17 October 2003)

Agenda Item 2: Report on activities carried out to date

GNSS AUGMENTATION TRIALS IN THE CAR/SAM REGION (CSTB)

(Presented by the Secretariat)

Summary

This working paper informs the meeting on the activities carried out for the execution of regional GNSS augmentation trials.

References:

- RLA/00/009 Project Document; and
- Report of the second RLA/00/009 project coordination meeting.

1. Background

1.1 During the second RLA/00/009 project coordination meeting, held in Rio de Janeiro, Brazil, from 28 to 30 August 2002, a schedule to execute project activities was established. This schedule was included as Appendix A to Report on Agenda Item 4 of the second RLA/00/009 project coordination meeting.

1.2 In addition, in the second coordination meeting, it was considered appropriate that for non precision approaches using satellite based augmentation, it was necessary to continue collecting ground data, as well as air data, from the GPS signal, with the aim of analyzing it from the point of view of the scintillation phenomenon effects produced in the GPS signal, as well as in the geostationary satellite augmentation signal.

1.3 Therefore, data collection from the reference station would be, for the result of the trials analyses taken into consideration by the project, of great importance. To this effect, the meeting formulated Conclusion 2/1, which urged States involved to ensure a continuous data recording starting November 2002, and that the data collected be analyzed by Brazil, Colombia and United States.

1.4 Likewise, during the meeting, Brazil presented a schedule of activities specifying the studies it would make with regard to the ionosphere, specifically in the analysis of the scintillation phenomenon, as well as the ionospheric models in the equatorial areas. The scintillation phenomenon study, as per the project's schedule of activities, would have to end by the beginnings of 2003's second semester. It is expected that the results of these studies be presented during the coordination meeting.

1.5 In view of the above, it was considered convenient that the trials to carry out be oriented towards routes and non precision approaches, and that vertical guidance approaches would depend on the results of the ionospheric study in the CAR/SAM Region.

2. **Activities carried out**

Augmentation trial platform

2.1 As regards the implementation of the communications network supporting the augmentation platform, the current situation is as follows:

- a) At the South American digital network (REDDIG), as forecast, interfaces were installed at each of the nodes where reference stations are also located, with the aim of being able to receive and transport the signals.
- b) At some sites, the REDDIG node and the reference station are not in the same locality and, therefore, it was necessary to establish physical links between both sites, such is the case of Brazil, which implemented a communications link between Rio de Janeiro and Curitiba, where the REDDIG node is found. In addition, Chile is in the process of installing a link between Santiago international airport, where the TRS station is found, and the REDDIG node, at Cerro Colorado. Colombia is working on a link between the facilities of the Aeronautical Training Centre (CEA), where the TRS station is located, and the ACC building, where the REDDIG node is. In Honduras, the Colombian aeronautical administration installed a Colombian satellite network VSAT station, and the information is available in Bogota. At the remaining stations, the TRS are near the REDDIG nodes and will be connected by cable.
- c) REDDIG started operations at the end of September 2003. Currently, the transfer of services to the network is being made based on the order of priorities. As first priority, voice and AFTN network services were decided upon. The GNSS augmentation service is expected to be totally implemented by the end of November 2003.
- d) Operation of the ground satellite station, as per the schedule of activities, was planned for the end of July 2003. In accordance with information provided by the Brazilian aeronautical authorities, this station will not be purchased for the moment, due to its high cost. It is expected to receive more information on the matter during the meeting.

GPS data collection from reference stations

2.2 As indicated in Conclusion 2/1, in October 2002 the Regional Office elaborated a procedure for the collection of GPS data, and sent it to States for knowledge and application. **Appendix B** to this working paper includes the corresponding procedure.

2.3 The data collection process started in November 2002. Some States that had not implemented the communications means to the corresponding master station recorded the GPS signals in CDs. This procedure has been only carried out by Bolivia and COCESNA.

2.4 The ICAO Regional office, as established in the procedure, received the CDs and sent them to the FAA William Hughes Technical Centre in Atlantic City for analysis. In addition, the mentioned FAA centre received, through the Santiago-Atlantic City communications circuit, information of the data recorded in Chile, Argentina and Peru. The information of the GPS data recorded by the Colombian reference station is stored and updated weekly in the Colombian aeronautical administration web page.

2.5 At the end of June, since the Colombian administration had implemented a station to process the GPS data from the reference stations, the Regional Office proceeded to send the data recorded for analysis.

2.6 The results of the GPS data analyses will be presented during the coordination meeting through working papers related with this subject.

Regional and State trials

2.7 There have been no regional or State flight trials during the year, due to lack of implementation of the augmentation trial, as described in the above paragraphs. Augmentation trials for en route and non precision approach operations, with the aim of verifying the integrity, precision, continuity, availability and coverage for en route and NPA operations, would be carried out once all reference stations are installed and in operation, all required communications circuits are established, the ground satellite station is implemented and the augmentation is disseminated through the geostationary satellite.

2.8 All activities mainly consisted in the collection of data and their analyses by some States.

3. Actions suggested

3.1 The meeting is invited to take note of the information contained in this working paper and analyze the results obtained to date.

APPENDIX A

ACTIVITIES CARRIED OUT BY PROJECT PARTICIPATING STATES

Argentina

The TRS station is installed and operational since December 2001. Communications with the Chilean Master Station was completed in March 2002. Since the most important activity carried out was data collection from the TRS, this activity has been carried out in a continuous manner and all information recorded is in the FAA's data base.

Bolivia

Since November 2002, upon not having available a communications line with the Chilean master station, all data obtained in the TRS station were recorded in CD, sent on a monthly basis to the ICAO Regional Office in Lima and then sent to the FAA for processing. In addition, some of these CDs were sent to Colombia (June 2003) since a processing unit was available and in operation. From the analyses of the data processed by the FAA, it was determined that the Millenium GPS receiver was having problems and the FAA sent a new GPS receiver.

Brazil

Brazil continues recording and analyzing the data obtained from its reference stations. Implementation of the ground satellite stations is still pending due to its high cost. Important ionosphere studies have been carried out in the equatorial area with regard to its impact on GPS signals. The analyses results of the GPS data processed, as well as of those obtained to date on the ionosphere study will be presented at the third RLA/00/009 coordination meeting.

Chile

The information obtained by the Chilean reference stations is continuously transmitted for storage and processing, since 1998, to the FAA NSTB facilities at the Atlantic City Technical Centre, through a 64 Kbits/Sec direct digital circuit established between Santiago and Atlantic City.

Colombia

Colombia, since June 2003, has started operation of a processing unit of GPS data obtained by the reference stations and, for this purpose, uses GPS Solution Software to be in the capacity of obtaining archives such as PDF Site Name Ext (Position Domain Navigation Error), SV Tatus Range and SV Domain, as well as geostationary satellite event data archives.

In addition, has developed a programme in C language, which statistically analyzes the data in the PDF output of the PDF Site Name ext archive. The programme's objective is to provide availability, integrity, continuity and coverage values for NPA operations and APV/1 and APV/2 approaches. A technical and operational guidance manual for the RLA/00/009 CAR/SAM Test Bed has also been elaborated. A Colombian network VSAT station has been installed in Tegucigalpa, Honduras, to be able to take the information from the Honduras TRS to Bogota, and from Bogota to Rio de Janeiro, via REDDIG. The link with the Brazilian master station is pending. It is expected to be implemented and operational through REDDIG at the end of November 2003. The GPS data recorded from the reference station are uploaded in the Colombian aeronautical administration's web page, with a weekly updating.

Panama

This reference station is part of the United States satellite augmentation trial platform (NTSB). The information of the data is recorded directly at the Atlantic City Technical Centre's NSTB.

Peru

The TRS station is installed and operational since December 2001; communications with the Chilean master station was completed in the beginning of 2002. Since the most important activity carried out was data collection from the TRS, this has been continuously carried out and all information recorded is in the FAA's data base.

Likewise, the Peruvian administration has purchased a work station and installed the GPS Solution data processor, provided by the FAA. The unit is still unable to process the information in its totality and currently, technical personnel is making coordinations with FAA for its operation.

COCESNA

COCECNA records since 2002 and in CDs the information obtained in its reference station, and sends the information to the FAA Atlantic City Technical Centre.

APPENDIX B

GPS DATA COLLECTION AND RECORDING PROCEDURES AT TRS

To comply with Conclusion 2/1 of the Second Coordination Meeting of RLA/00/009 Project (GNSS regional augmentation trials), please find below data collection procedure.

Stations that can analyze GPS data obtained by the TRS

- William J. Hughes Technical Center, Atlantic City International Airport, FAA, United States
- Master Station in Rio de Janeiro, Brazil
- TRS in Bogota, Colombia
- TRS in Lima, Peru

These stations have the hardware and software necessary to analyze GPS data obtained by the TRS.

BOLIVIA, COLOMBIA AND COCESNA TRS

Since these stations do not have communications links with the respective master stations, the GPS information collected by the TRS must be locally recorded in a CD. The recording has to be round the clock, beginning this month of October until end of March 2003, when it is expected that the communications circuits between the TRS and respective master stations are installed.

It will be appreciated that each of these States send the data recorded to the ICAO South American Office in Lima at the end of each month. The information would have to arrive within the first five days of the next month of the recording.

Please compress the information so as to reduce the quantity of CDs necessary. The recording of one day of information from the TRS amounts to approximately 30Mbits.

Argentina, Chile and Peru TRS

These TRS are physically connected to their respective mater station (Santiago, Chile). This station has a communications link with the FAA Technical Center in Atlantic City.

This centre records the information permanently. The information recorded can be accessed and downloaded from the web page: www.nstb.tc.faa.gov

To guarantee continuous data recording, it is recommended to also register the information in a CD (same procedure as indicated in above paragraph) in addition to the information that would be recording Atlantic City. Likewise, it would be recommendable to daily monitor the status of the communications circuits between the TRS and the master station, and from the master station to the Atlantic City Technical Center.

The aforementioned web page can be checked upon to verify whether the data is being registered.

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