

ELEVENTH AIR NAVIGATION CONFERENCE

Montreal, 22 September to 3 October 2003

Agenda Item 6 Aeronautical navigation : issues

GNSS IMPLEMENTATION, PLANS AND PROJECTS IN COLOMBIA

(Presented by Colombia)

SUMMARY

This working paper describes the status of GNSS implementation in Colombia, the work that it has progressed and its strengths and challenges with respect to the transition to GNSS.

Action by the conference is in paragraph 8.

1. INTRODUCTION

1.1 Colombia has been working in an active and committed manner on activities for the implementation of and the transition to GNSS systems. Colombia's special conditions, that is a large forest area, two oceans and fairly mountainous terrain, in addition to its strategic geographical location in the centre of the American continent and in an equatorial area, compel it to work in a committed manner on the transition to GNSS navigation technologies as a way of developing its aviation and all the other fields of its national economy.

1.2 Colombia's policy with respect to GNSS in the first phase of research and development has been that of opening up to international cooperation in order to technically evaluate all the possibilities of GNSS systems.

¹ Spanish version provided by Colombia.

2. **SATELLITE-BASED AUGMENTATION SYSTEMS (SBAS)**

2.1 Through the Project RLA/00/009 called the CAR/SAM Test Bed (CSTB), trials have been progressed at the regional and national levels to evaluate the levels of service anticipated and to collect data for the definition of the SBAS architecture in the CAR and SAM Regions. With respect to this project, Colombia has, in collaboration with the FAA of the United States of America, provided itself with an infrastructure for the project; it presently has a prototype reference station (TRS) (provided by the FAA), a dedicated server and software for the processing and analysis of data collected through the CSTB, airborne equipment installed on its own aircraft for the collection of GNSS data in flight, personnel duly trained in GNSS and the establishment of a data link for the reference station (TRS) of COCESNA and Colombia with the master station (TMS) of Rio de Janeiro.

2.2 As a result of the recent operational commissioning of the wide area augmentation system (WAAS), the plans of Aeronáutica Civil de Colombia include the task of making evaluations of the level of service in the Caribbean area and assessing the possibilities of using the WAAS system as a navigation means that would allow a more optimum service than that obtained with only the aircraft-based augmentation system (ABAS). The solution ABAS + WAAS and message 27 (ranging, satellite status and basic differential corrections) will be evaluated with respect to the SARPs requirements for the different phases of flight and volumes of traffic supported.

2.3 Together with COCESNA, Cuba and the European Community, Colombia is participating in the Project RLA/03/902, EGNOS Demonstration in South America (EDISA). Through this project, it has been possible for the first time in history to transmit an SBAS signal with specific data for the CAR and SAM Regions through the geostationary satellite (AOR-E), which were derived from the processing of the GNSS signals collected through the local reference stations (Bogotá, Havana and Tegucigalpa ranging and integrity monitoring stations (RIMS)). Static and in-flight data were taken during the transmission of the SBAS message, obtaining very satisfactory results during this transmission for the approach levels APV 1 (see Figure 1). We shall continue until the middle of 2004 with a second phase of the project involving: data analysis, GNSS training, work with simulation tools and other tasks still being defined. Through this project, Colombia now has the Eurocontrol Pegasus Plus software for data analysis.

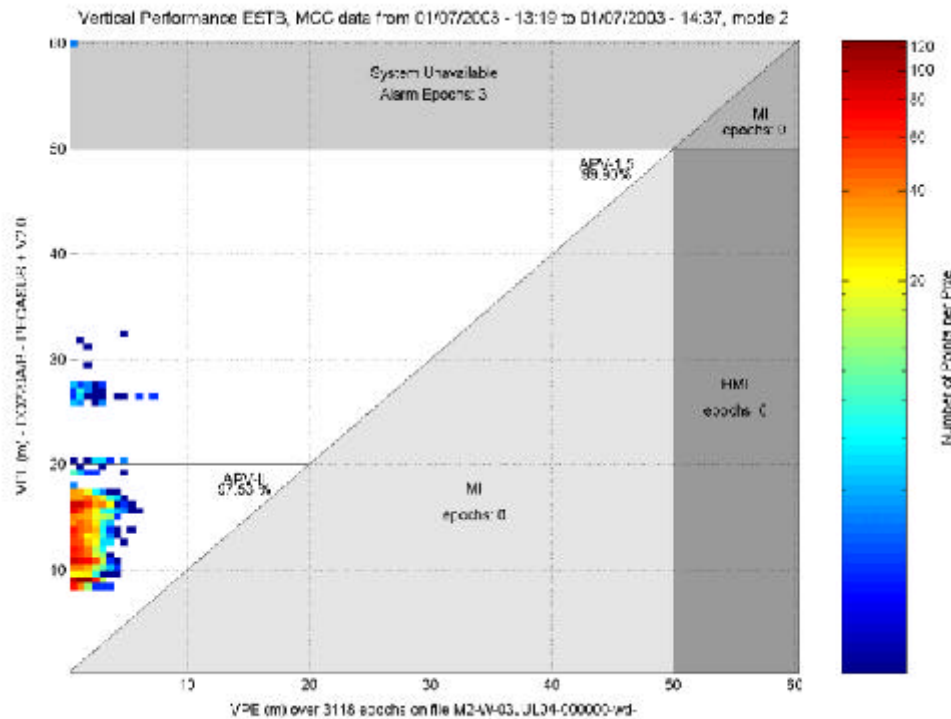


Figure 1. Stanford diagram, EDISA performance for APV 1 and 2

2.4 It is planned to have more complete databases for SBAS research and development work and analysis, through cooperation agreements with other institutions at the national level in order to take advantage of already existing resources and establish simple GNSS fixed data collection stations. The universities are being involved actively in this process in conducting research related to the ionosphere and GNSS enhancement.

3. GROUND-BASED AUGMENTATION (GBAS)

3.1 Preliminary studies are being progressed in collaboration with Colombian universities for the implementation of a GBAS system in the city of Bogotá to be used as CAT I approach guidance for the three airports in that area. This possibility could provide great advantages to our aviation since this is the sector with the most aircraft movements in the country and it could become a very economical solution for GNSS CAT I approaches to the eight thresholds of the airports involved.

3.2 The first contacts are being made with Analysis Unlimited and Air Services Australia to address the subject of the ground-based regional augmentation system (GRAS). We have requirements at the national level to improve satellite navigation, not only in the air transport sector, but also in the other fields of transport and the economy. We therefore see in this new system a development possibility to improve satellite navigation with national coverage that would reach all the development sectors.

4. ABAS SYSTEMS

4.1 Colombia has been progressing a navigation plan using ABAS augmentation systems, in compliance with the SARPs recommended by ICAO. It was for this reason that a GNSS + ABAS implementation plan was designed that defines flight regions and airports with a small number of flights as the first objective and that would continue to evolve as more information and data are available with regard to GPS performance with respect to the SARPs for our airspace. For the definition of the plan, account is also being taken of the ICAO guidelines for the introduction and operational use of the global navigation satellite system (GNSS).

4.2 As part of this process, contacts are being made with universities and research institutes in Colombia to develop software tools to predict the availability of receiver autonomous integrity monitoring (RAIM) and fault detection and exclusion (FDE) in order to provide aeronautical information through NOTAMs and pre-flight information bulletins (PIB).

5. CNS/ATM TRAINING

5.1 We are aware that the basis for a satisfactory transition to CNS/ATM is the existence of personnel at all levels who are duly trained in this subject and Aeronáutica Civil de Colombia has through its Aeronautical Training Centre (CEA) been progressing a fairly ambitious strategy in the training of the human resources in our institution. As a result of this, Colombia presently has 10 professionals trained at the master's level in CNS/ATM through an agreement with the Aeronautics and Space Institute (IAS) in France and the National Civil Aviation School (ENAC) in France. Arrangements were made for these staff members to receive in-service training while they worked in France in the different fields of CNS/ATM and to have practical work in: CNS/ATM Strategy, GNSS, Surveillance, AIS Automation, ATM, Communications, ATC Simulation and Airworthiness.

5.2 This strategy has resulted in a great knowledge of CNS/ATM that places us in a privileged position to offer training at the national and regional levels. The following sequential schedule of courses for the training of human resources in CNS/ATM has been created:

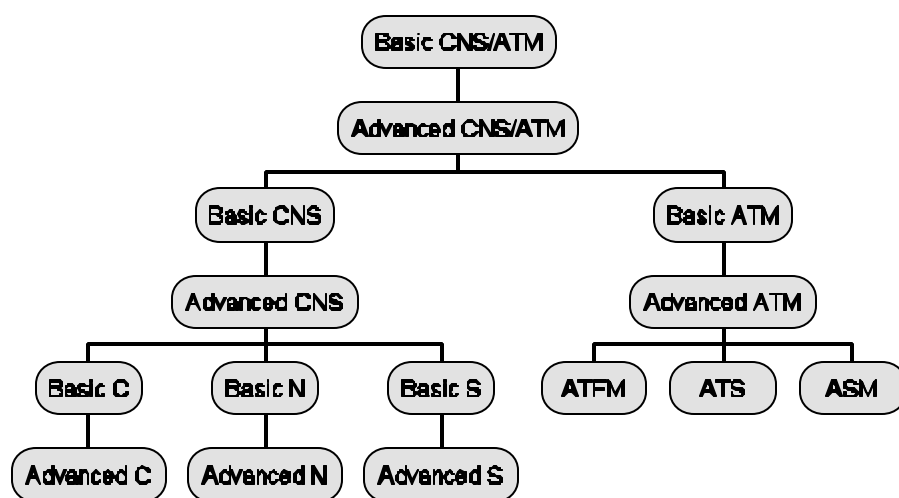


Figure 2. Structure of CNS/ATM training at Aerocivil

6. CONTACTS WITH OTHER FIELDS OF THE ECONOMY AT THE LEVEL OF STATES AND INTERREGIONAL COOPERATION

6.1 In order to have greater institutional, financial, economic and technical support in the implementation of and transition to GNSS systems, Aeronáutica Civil de Colombia has been involving the other development sectors of the country such as: transport ministries, communications ministries, cartography institutes and the defence ministry. It has also been participating in the work of the Office for Outer Space Affairs (OOSA) with its GNSS Action Team, the purpose of which is to make the use of GNSS technologies widespread in developing countries in order to support economic development.

6.2 As part of this transition process, Aeronáutica Civil de Colombia has through a study sponsored by the United States Trade and Development Agency (USTDA) also been undertaking complete feasibility studies for the transition to CNS/ATM technologies, in close collaboration with a consultancy firm.

7. CONCLUSIONS

7.1 It is appropriate for States which are neither owners nor developers of a given GNSS technology to evaluate each of the possible technological solutions with respect to satellite navigation in order to have more information with which to form a judgement at the time of defining the most suitable technological solution according to cost/benefit criteria.

7.2 Work and progress in GNSS do not necessarily require large investments on the part of States; tasks such as linking up with universities and research centres and appropriate training of human resources are very significant elements in the transition to and contribution of States in GNSS.

7.3 Colombia presently has the experience, the infrastructure and sufficient trained human resources to offer CNS/ATM training and instruction to States that require it. Because of the low level of the cost of living in Colombia, our country stands out as a high-level place with the capability for many States to receive appropriate CNS/ATM training economically.

7.4 The linking-up and management of satellite navigation at the State national policy level and the integration of institutions and other projects related to satellite navigation have made it possible to have greater effectiveness and drive in the transition to and implementation of GNSS. This must be seen as a good strategy to benefit the GNSS implementation plans in civil aviation.

8. ACTION BY THE CONFERENCE

8.1 The conference is invited to agree on the following recommendations:

- a) note the information provided and contact Aeronáutica Civil de Colombia for more information;
- b) take into account the CNS/ATM capabilities developed by Colombia and urge States that require training in this field to consider our country's Aeronautical Training Centre (CEA) as an option for this purpose;
- c) develop plans for the creation of regional training centres which would evaluate not only the technical capability, but also the costs that would be involved in such training;
- d) urge States in technical cooperation to integrate plans, programmes and research teams;
- e) seek from States and organizations which are owners and developers of SBAS systems support for the implementation of systems that would ensure that States outside the main service area have the possibility of using the signal for air navigation purposes and progress joint work to achieve a seamless satellite navigation environment through scenarios of interoperability.

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