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ASSEMBLY — 39TH SESSION

TECHNICAL COMMISSION

Agenda Item 37: Other issues to be considered by the Technical Commission

GBAS SYSTEM DEVELOPMENT

(Presented by Argentina)

EXECUTIVE SUMMARY

The Civil Aviation Administration (ANAC) in Argentina, in cooperation with the technology company INVAP S.E., is developing a precision approach and landing system known as the Ground-based Augmentation System (GBAS). This is a local augmentation system which receives the signal of visible satellites of the GPS constellation, performs a distance pseudo-correction, monitors the signal integrity, and generates and transmits messages type 1, 2 and 4, in order to provide support to the positioning of aircraft in flight, especially in precision approaches CAT I. The Assembly is invited to note the information included in this paper.

Strategic Objectives:	This working paper relates to the Safety, Air Navigation Capacity and Efficiency and Environmental Protection Strategic Objectives.
Financial implications:	None.
References:	Annex 10, – *Aeronautical Telecommunications*, Volume I — *Radio Navigation Aids* Annex 14 – *Aerodromes*, Volume I — *Aerodrome Design and Operations* ED-114A, MOPS for GBAS to Support Category I Order 6884.1, FAA, Siting Criteria for GBAS

[1] English and Spanish versions provided by Argentina.

1. INTRODUCTION

1.1 INVAP S.E. is a high-technology Argentine company devoted to designing, manufacturing and integrating equipment and devices in areas of high complexity such as nuclear energy, space technology, industrial technology as well as scientific and medical equipment.

1.2 This forty-year-old company has achieved international recognition as designer and provider of both nuclear reactor systems and nuclear reactors for research and experimentation purposes. Since the late 1990s, the company has ventured into the aerospace sector, namely through the design, manufacture and operation of satellites as well as radars.

1.3 The company´s first foray into the radar area was in 2004, when the National Aerospace Surveillance and Control System (SINVICA) was created in Argentina with the objective of supplying a radar system to comply with the tasks related to the aerospace defense, as well as provide efficient air traffic service. On that basis, in response to the Argentine Government´s request, INVAP S.E. started a project on the design, manufacture and installation of secondary radars. The project continued in 2007 with the development and manufacture of primary radars, followed by the development of weather radars. At present, there are twenty-two secondary radars monitoring the Argentine continental space.

1.4 INVAP S.E. is certified under ISO 9001:2008 (Quality Management) and ISO 14001:2004 (Environmental Management), and its sole owner and shareholder is Rio Negro Province (in the south of Argentina). It employs over 1 000 people, of whom 85 per cent are professionals and specialized technicians. It is the only company in Latin America recognized by NASA as suitable for the development of complete satellite systems, from the design and manufacturing stages to the operation stage.

1.5 Taking into account this background and the favourable response received at the time from INVAP S.E. regarding the challenge of designing, manufacturing and installing the first radars developed in our country, ANAC decided to hire its services to develop a satellite signal augmentation system GNSS, ground-based (GBAS).

1.6 It should be noted that, for this development, consideration has also been given to the wide experience, in the scientific research field, of the Facultad de Ciencias Astronómicas y Geofísicas de la Universidad Nacional de La Plata, as regards GNSS systems and tropospheric/ionospheric phenomena. It has contributed with the academic algorithm correction as well as the setting of the necessary local parameters to mitigate the typical deviations and phenomena in the South American region, thus defining a multi-sector and multidisciplinary working group of international recognition.

1.7 ANAC took the decision to develop a ground-based augmentation system having taken into account that most Latin American civil aviation authorities had declined the European proposal to base this service on a satellite platform (SACCSA –Augmentation System for the Caribbean, Central and South America). This decision was made based not only on the high initial and operational costs, but also on the technological dependency that the aforementioned implied.

1.8 In this respect and compared to other precision approach systems, GBAS offers a great number of benefits that place it in the lead of other existing options:

a) reduction of critical and sensitive zones;
b) bend approach;
c) positioning service;

d) service supply at different runways of the same airport;
e) supply of different approaching glide angles and threshold displacement;
f) guided missed approach; and
g) use in adjacent airports.

1.9 To sum up, and in full agreement with ICAO´s strategy expressed in the Global Air Navigation Plan, ANAC has opted for the implementation of PBN as the air navigation system, and GBAS as the best technological alternative for precision approaches CAT I, which in the future shall replace ILS systems.

2. GBAS ARGENTINE PROJECT CRONOLOGY

24/01/2014	First Stage	Design, manufacture, installation, implementation and validation of a GBAS system at San Carlos de Bariloche International Airport.
2014/2015	Laboratory technological assessment model	a) Generation and transmission of a simulated positioning signal with only precision correction. b) Algorithm of integrity, continuity and operational availability in a laboratory environment. c) Data collection for analysis and reliability statistics.
2016	Site technological assessment model	a) Fence and perimeter path displacement within the siting area, at Bariloche Airport. b) Installation and implementation of four reference stations. c) Installation of the power supply line and optical fiber (OF) control line. d) Data collection and place parameters setting. e) Implementation of the signal processing centre and on test VDB transmission.
2016	Certification and validation process	A manual that states the certification process has been elaborated in order to demonstrate that the GBAS system complies with the relevant regulations. This process shall facilitate the validation of the product.
2016-Onwards	1st Testing period (Static tests)	Data received by the local monitoring station will be analysed and safeguarded.
	2nd Testing period (Advanced tests with aircraft)	Data received by the MMR will be analysed and safeguarded.
	Second Stage	Manufacture, installation and implementation of six systems in airports to define.

3. ARGENTINE GBAS SYSTEM FEATURES

3.1 The system is composed of four antennas and GPS receivers which make up the receiving system; a shelter incorporates the main electronics, which consists of two processing channels and a redundant transmission system, plus a VDB antenna. In addition, in order to check the pseudo-correction values that the system obtains, an antenna and a receiver have been installed in the airport vicinity. The system aims to provide CAT I approach and positioning service.

3.2 The system setting up was carried out according to FAA Order 6884.1 recommendations and ICAO Annex 14 – *Aerodromes*.

3.3 Besides the airport setting up, a testing bench was installed at INVAP laboratories, in Bariloche city, which consists of:

a) ROHDE & SCHWARZ – Vector signal generator (Constellation simulator);

b) GPS receivers;

c) a processing unit with the algorithm that performs the pseudo-correction, the signal integrity control and messages type 1, 2 and 4 generation;

d) a VDB transmitter;

e) a VDB receiver; and

f) ROHDE & SCHWARZ ILS/VOR/GBAS Analyzer.

4. FURTHER ACTIONS

4.1 Testing bench: the implementation of the algorithm of correction has been carried out in the testing bench. In the first stage, work was done on the pseudo-correction calculations, Beta values, etc. In the second stage, SQM, PW, CCD, EFEMÉRIDES and ACELERACIÓN integrity monitors were incorporated to information processing. Algorithm parameters are being adjusted according to the data and GAD collected on site, and there will also be RFI tests performed with noise generators.

4.2 SAZS site: Site features have been set and the system is now in the operational testing stage, which is estimated to end in about a year. Finally, after the algorithm adjustment, processing will be operationally implemented and the performance testing stage will be started.

5. CONCLUSION

5.1 The Assembly is invited to note the information included in this paper.

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