

Annex B**IONOSPHERE Working Group****Notes from Tuesday, March 5, 2002**

The BTB Ionospheric Working Group (IWG) convened its first formal meeting in Rio de Janeiro, Brazil. The purpose of the meeting was to provide a continuing forum in which the technical and operational issues associated with characterizing the impact of near equatorial ionosphere on an SBAS and how it can be identified and dealt with. The IWG is co-chaired by Maj Corbelli (DECEA) and Mr. Tom Dehel (FAATC). Attendees included personnel from Brazilian and American universities, INPE, CTA, DECEA, FAA, and industry. The following people made presentations;

Maj Carlos Cirilo presented an Operational work plan for Brazil. The plan laid out the operational goals the IWG will be required to satisfy and a phased approach to reaching the goals. Phase I will characterize the effects of scintillation on GNSS receiver performance. The main goal of phase one is to increase the availability of the signal in space down to non-precision approach (NPA). It is intended that vertical guidance provided in phase I be provided through baro-aiding. Phase I will be complete by the end of the BTB project in mid 04. Phase II will focus on development of a GIVE algorithm that supports flight operations with vertical guidance being provided by the SBAS. Phase I and II will be conducted concurrently.

Tom Dehel Presented the FAA GIVE Algorithm and the criteria used to develop the GIVE and the WAAS correction grid. The WAAS GIVE will not support primary means flight operations in near equatorial regions but the process used to develop the GIVE can be used to assist the IWG.

Brazilian universities shared their observations on the issues of IONO and the effects of the bubbles in this area and the Amazon. There has been a significant amount of research conducted on the near equatorial region. In order to take advantage of the research there will be an effort to organize this data into a cohesive database for use by the IWG.

The group did agree that there is a strong necessity to have a lexicon, with CNS/ATM expressions and terms.

Fernando Walter presented his position regarding the need to start looking to Klobuchar coefficients and a way to try to improve it to deal with the IONO effects.

Maj Corbelli presented the Brazil IONO priority chart. The chart lays out the operational goals and the corresponding ionospheric issues.

Robert Loh suggested to skip the study on the GPS NPA (RAIM) and leave this to the manufacture's.

Major Corbelli suggested and the group decided to arrange the operational goals along a timeline and divide the IWG into 3 primary Teams to deal with specific aspects of the

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ionosphere. Team 1 is responsible for characterizing the effects of scintillation. Team 2 is responsible for defining operational goals and interfacing with organizations that define system standards, e.g. RTCA. Team 3 is responsible for developing the near equatorial GIVE algorithm.

Pat Doherty presented slides depicting the IONO collection sites on the Western side of South America and the data collected and analyzed. She was assigned the task of acting as the liaison between the ionospheric research community and the operational community in coordination with Major Corbelli.

Brazil IONO PRIORITY CHART

Application	GPS NPA (RAIM)	SBAS L/VNAV	SBAS XNAV	SBAS NPA	SBAS 2nd Civil PA/GLS	GBAS
Iono Feature						
Appleton Anomaly		X	X			
Voids/Bubbles		X	X			X
Scint (GPS)	X	X	X	X	X	X
Scint (GEO)		X	X	X	X	?

Group Tasks**Group 1- Scintillation Study – NPA (UP to August 2003)**

- Identify the best position for the GEO(s)
- Identify the best position for the TRS
- Quantify the S4 amplitude variations in order to verify the impact to the GPS receivers
- Establish the safe limits (boundaries) for the amplitude anomalies

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Group 2 - Operational Requirements and Evaluation

- Interface with RTCA to change MOPS
- Interface with ICAO PANEL to change SARPS
- Conduct flight tests to validate MOPS/SARPS

Grupo 3 – Ionosphere Modeling for the CAR-SAM Region (LNAV - VNAV) or/
(XNAV) - TBD

- Environmental Modeling
- CAR-SAM Region - GIVE
- Study the capability to attain Regional LNAV-VNAV service
- Study a new Ionosphere Model

Group 1

Corbelli- DECEA – Coordinator

Schaefer – DECEA

Waldir – DECEA

Ulisses – DECEA

Eurico de Paula – INPE

Ivan Kantor – INPE

Fabiano S. Rodrigues – INPE

M. A. Abdu – INPE

Inez Batista – INPE

Emanoel Costa – PUC - RJ

Luiz P. Carvalho – UFF

Carlos Alberto Malcher – UFF

Robert Loh – ISI

Tom Dehel – FAATC (*)

Alexandre Pinhel – FURNAS

Mauro Assis – IME

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Group2

Carlos Cirilo – DECEA – Coordinator

Corbelli – DECEA

Richard Cole – ISI (*)

David Nelthropp – Titan – FAATC (*)

Fernando Walter – ITA – CTA

Crivelli – DECEA

Waldir – DECEA

Group3

Angelo Canavitsas – DECEA – Coordinator

Corbelli – DECEA

Pat Doherty – Boston College (*)

Jack Klobuchar – ISI (*)

Julio Dal Bello – UFF

Ivan Kantor – INPE

M. A. Abdu – INPE

Inez Batista – INPE

Luiz Felipe – INPE

Prasad – INPE

Paulo de Oliveira Camargo – UNESP

Fernando Walter – ITA – CTA

(*) Level of involvement to be coordinate with FAA.

On May 7th - 9th, 2002 will be held in Alexandria – Virginia – USA an Ionosphere Seminar. Some representatives from INPE and DECEA are expected to attend. Pat Doherty will attempt to have these people invited to take part in the SBAS Ionosphere Working group on May 10th, 2002.

The Next Meeting for the Ionosphere Working Groups 1, 2 and 3 is projected to be in Rio de Janeiro on May 20th - 21th, 2002.