



International Civil Aviation Organization

**THE THIRD MEETING OF PERFORMANCE BASED NAVIGATION
IMPLEMENTATION COORDINATION GROUP (PBNICG/3)**

Bangkok, Thailand, 08 – 10 March 2016

Agenda Item 4: Reports on relevant meetings outcomes

ISTF/6 OUTCOMES

(Presented by the Secretariat)

SUMMARY

This paper presents significant outcomes of the Sixth Meeting of Ionospheric Studies Task Force (ISTF/6) was held at the ICAO Asia and Pacific Office, Bangkok from 19 to 21 January 2016

1. INTRODUCTION

1.1 The Sixth Meeting of Ionospheric Studies Task Force (ISTF/6) was held at the ICAO Asia and Pacific Office, Bangkok from 19 to 21 January 2016.

1.2 The meeting was attended by 28 participants from 10 States/Administrations (Australia, Cambodia, China, India, Indonesia, Japan, Philippines, Singapore, Thailand, and USA), 3 International Organizations from NEC, KAIST, and MITRE.

2. DISCUSSION

SBAS safety case related to anomalous ionospheric conditions

2.1 The ISTF plans to deliver the SBAS Guidance Material end of June 2016.

2.2 The draft table of contents is placed at **Appendix A**.

2.3 Considering that the work plan was sound and realistic, the meeting agreed on the following draft Conclusion for consideration by CNS SG:

Draft Conclusion xx/xx - Guidance for SBAS safety case related to anomalous ionospheric conditions

That, the guidance for SBAS safety case related to anomalous ionospheric conditions be adopted and published on the ICAO APAC website.

Guidance on GBAS ionospheric Threat Model

- 2.4 The ISTF plans to deliver the SBAS Guidance Material end of June 2016.
- 2.5 The draft table of contents is placed at **Appendix B**.
- 2.6 The ISTF/6 meeting agreed on the following draft Conclusion for consideration by CNS SG:

Draft Conclusion xx/xx - Guidance on GBAS ionospheric Threat Model

That, the guidance on GBAS Threat Model for the ionosphere be adopted and published on the ICAO APAC website

- 2.7 Following discussions during ISTF webconferences, the meeting agreed that the best way forward to publish the iono model would be through international technical journal. Therefore the meeting agreed to the following draft Conclusion for consideration by CNS SG:

Draft Conclusion xx/xx - Adoption of GBAS Ionospheric Threat Model and publication in Technical journal(s)

That, the APAC GBAS Ionospheric Threat Model be adopted, remain the intellectual property of ICAO and be published in the public domain in selected Technical journals with the list of author/contributors as per Appendix C.

- 2.8 The ISTF Terms of Reference were reviewed by the Task Force and completion assessed as follows:

- 1) Take the responsibility for identification of the available GNSS data source;
Completed
- 2) Make recommendation on sharing scenario for Ionospheric data collected;
Completed
- 3) Make recommendations on selecting ionospheric data sources and sharing scenario for the collected data;
Completed
- 4) Steer process for evaluation of the data analysis;
Completed by June 2016
- 5) Study the need for development of Regional Ionospheric Threat Models for GBAS and SBAS;
Completed
- 6) Development of Regional Ionospheric Threat Models for GBAS and SBAS if the need is identified;
Completed by June 2016

SBAS threat model was considered not feasible and replaced by guidance on safety case

- 7) Establish rules for use of shared data and the result of study for non-commercial purpose;
Completed
- 8) Investigate the effects of space weather on CNS systems in the APAC Region.
Completed by End March 2016 and referred up to METP/WG-MISD

2.9 As a result the ISTF meeting agreed to the following draft decision, for consideration by CNS SG:

Draft Decision xx/xx – Dissolution of Ionospheric Study Task Force

Considering that all tasks mentioned in the terms of reference are completed, and that in the case where the peer-review process of the technical publications is not successfully completed, CNS SG would handle the follow-up work,

That, the Ionospheric Studies Task Force be dissolved.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) note the information contained in this paper;
- b) provide PBN-related comments to the draft tables of comments of SBAS safety case related to anomalous ionospheric conditions and Guidance on GBAS ionospheric Threat Model placed respectively at Appendices A and B; and
- c) discuss any relevant matters as appropriate.

**DRAFT TABLE OF CONTENTS OF GUIDANCE FOR SBAS SAFETY CASE RELATED
TO ANOMALOUS IONOSPHERIC CONDITIONS**

1. Introduction

2.

- a) GNSS overview
- b) Scope: Guidance for SBAS safety case related to anomalous ionospheric conditions

3. Threat mitigation strategy against anomalous ionospheric conditions

- a) High level principles
 - i. Improvement of availability and continuity of the system
 - ii. The smaller the threat space, the better the performance
 - iii. Meeting the integrity requirements is an essential characteristic of threat models
 - iv. Schemes for Iono Monitoring and for protecting airspace users
- b) Ionospheric correction by SBAS
 - i. Broadcast information
 - ii. Protocol of ionospheric correction and protection levels computation
 - iii. Generation of ionospheric correction information inside SBAS
- c) Necessity of the threat model
 - i. Overbounding uncertainty; Spatial and temporal threats
- d) Creation of the threat model
 - i. Function of observability of ionosphere and ionosphere model used
 - ii. Necessity to archive data for a certain period: for how long?
- e) Post-implementation activities

DRAFT TABLE OF CONTENTS FOR GUIDANCE ON GBAS THREAT MODEL

1. Introduction

- a) GBAS and its fundamental principles
- b) Scope: GBAS threat model to mitigate anomalous ionospheric conditions
- c) Ionospheric effects on GBAS

2. Ionosphere conditions to consider for GBAS safety analysis

- a) Overview of relationship between GBAS safety assessment and ionospheric conditions
- b) Nominal conditions bounded by PL (protection level)
- c) Anomalous conditions and ionospheric disturbances to consider
 - i. Storm enhanced density
 - ii. Plasma bubble
 - iii. Other
- d) Ionospheric threat model for GBAS safety analysis
- e) Role: evaluations of requirement and performance including integrity monitoring
- f) Ionospheric front model (Wedge model) and its important parameters
 - i. Ranging errors induced by ionospheric anomaly
 - ii. Positioning errors in the final implementation
- g) Other important descriptions
 - i. Localities, dominant season/time, occurrence rate and number of impacted satellites

3. Development of the threat model

- a) Observational approach
 - i. Tools like LTIAM
 - ii. Time Step method
 - iii. Other
- b) Simulation approach
 - i. 3D
- c) Validation

4. Post-implementation activities

- a) Monitoring of ionospheric activity
- b) Maintenance of threat model

5. Annexes

- a) CONUS model
- b) Safety analysis for GBAS prototyping in Osaka
- c) other
