



International Civil Aviation Organization

**EIGHTEENTH MEETING OF THE COMMUNICATIONS/NAVIGATION
AND SURVEILLANCE SUG-GROUP (CNS SG/18) OF APANPIRG**

Asia and Pacific Regional Sub-Office, Beijing, China
(21 – 25 July 2014)

Agenda Item 6: Navigation

6.3) Review outcome of Third/Fourth Meetings of Ionospheric Studies
Task Force

**CURRENT STATUS AND WORKING PLAN OF
IONOSPHERIC STUDIES TASK FORCE**

(Presented by Chairman, ISTF)

SUMMARY

This paper presents the current status of the ionospheric studies task force (ISTF) activities and the working plan.

1. INTRODUCTION

1.1 The Ionospheric Studies Task Force (ISTF) has been working on the coordinated ionospheric data collection, analysis and sharing to facilitate ionospheric data collection and sharing in the Asia-Pacific (APAC) region since 2011. The goals of the ISTF activities are to study the need for development of regional ionospheric threat models for GBAS and SBAS, to develop them if the need is identified, and to investigate the effects of space weather on CNS systems in the APAC Region.

1.2 To achieve the goals, six tasks have been identified as:

- 1) Identification of data source, GNSS data collection, sharing, distribution and archiving. Identification of data sharing format. (Sequence 1, Lead by Susumu Saito (Japan))
- 2) Identification of analysis methodology and GNSS ionospheric data analysis (Sequence 1, Lead by Mr. Jong-Kyun Chung (ROK))
- 3) GNSS total electron content (TEC) gradient data generation (Sequence 2, Lead by Dr. Michael Terkildsen (Australia))
- 4) GNSS ionospheric scintillation data generation (Sequence 2, Lead by Dr. Michael Terkildsen (Australia))

- 5) Assessment of need to Regional GBAS and SBAS ionospheric models and development of these models if it is needed (Sequence 3, Lead by Dr. Takayuki Yoshihara (Japan) for GBAS and by Dr. Takeyasu Sakai (Japan) for SBAS).
- 6) Analyze, based on data shared within ISTF and public information, the effects of space weather and the concept of operations for the provision of space weather information in support of international air navigation (Sequence N/A, Lead by Dr. Takuya Tsugawa (Japan))

1.3 At the seventeenth meeting of CNS subgroup of APANPIRG, target date to deliver some outcome was set to the end of 2014. This paper presents the current status of the ISTF activities and proposes its working plan.

2. DISCUSSION

2.1 Currently, Tasks 1 and 2 have been partly finished to allow Tasks 3 and 4 to be launched. Task 5 has not been launched, and will be initiated after some amount of outputs from Tasks 3 and 4 are obtained. Task 6 has been launched and is in progress in parallel with Tasks 1 to 5.

2.2 Status of Task 1 (Data Collection): 580 and 37 stations are nominated as data sources of ionospheric delay and ionospheric scintillation measurements, respectively. Common data formats, GTEX (developed by NICT, Japan) and SCINTEX (developed by European Space Agency) are decided to be used for sharing the ionospheric delay and scintillation data, respectively. A data server to host the collected and analyzed data has been installed at the Electronic Navigation Research Institute, Japan. Data collected by Thailand, Hong Kong China, and APEC GNSS Implementation Team (GIT) test bed has been transferred to the data server for analysis. Data from Philippines in selected periods will be transferred to the data server in GTEX format by July 2014. Ionospheric delay and scintillation data from GAGAN stations in India in selected periods will be transferred to the data server in by July 2014. National Institute of Information and Communications Technology (NICT), Japan will transfer their collected Ionospheric delay data in GTEX format by July 2014. Other nominated stations are being in contact for data transfer.

2.3 Status of Task 2 (Iono Analysis): Periods of interests for data analysis have been identified for efficient data analysis. The periods include Geomagnetic disturbed periods and post sunset periods in equinox seasons. This selection enables ISTF to study both the mid-latitude and low-latitude type ionospheric anomalies. 336 days from 2004 to 2013 have already identified as being relevant to the analysis for the data from India based on the behavior of the Total Electron Content (TEC). To identify the particular dates of interests for data from other area, Along Arc TEC Rate (AATR) and Rate Of TEC Index (ROTI) are selected as indices. As analysis tools, the Long-term ionosphere anomaly monitor (LTIAM) tool developed by FAA, which is under coordination, and the precise ionospheric delay gradient estimation method developed by ENRI have been chosen. The cross-validation of those two tools is planned in the near future. For scintillation data analysis, modeling of local ionospheric scintillation occurrences as a function of the azimuth and elevation angles of satellites was introduced. This kind of modeling is important in evaluating the performance of GNSS-based systems with more realistic probability of scintillation impact, and adopted as one of the ways of scintillation data analysis.

2.4 Status of Tasks 3 and 4 (TEC/Scintillation Generation): Following the progress of Tasks 1 and 2, the data generation software tools are being prepared.

2.5 Status of Task 6 (Space Weather): Space weather effects on CNS systems in APAC region has been started after the decision of the seventeenth meeting of CNS subgroup. Based on the discussion at the fourth meeting of ISTF, comments on the draft concept of operations of space weather (Space Weather ConOps) from the APAC regional point of view were sent to IAVWOPSG.

2.6 Due to delay in data collection and in identifying the analysis methodology, the progress of ISTF activities is behind the schedule. The ISTF has been working to accelerate the analysis to have some results by the end of 2014. However, due to technical difficulty in planning the fifth ISTF meeting (ISTF/5) in 2014, the results will be delivered at the fifth ISTF meeting by early 2015. To fill the long gap between the last and next face-to-face meetings, three webconferences will be held. One has already been done on 24 June 2014 attended by Australia, India, Japan, and ICAO Secretariat. The webconference was very fruitful and the way forward to the next two more webconferences which are planned in September and December 2014 was made clear. (Webconference minutes as Attachment?) With these meetings as milestones, ISTF will work to obtain some results of Task 5 to be delivered at ISTF/5. Table 1 summarizes the working plan.

2.7 Potential risk in the working plan could be a lack of information on the ionospheric threat model definition used in different SBAS systems, which is usually confidential. It would make it difficult to assess the need of regional model for SBAS. To mitigate this risk, information on the ionospheric threat definitions for different SBAS systems should be collected from publically available publications.

Target Date	Achievements	Remarks
24 June 2014 (done)	Identify the details of data analysis methodology	1st webconference
16 September 2014	Implement analysis tools	2nd webconference
	Start TEC/Scintillation data generation	
	Collect available information on ionospheric threat definition on SBAS and GBAS systems	
December 2014	Start discussion on the methodology of Task 5	3rd webconference
	Review the generated data	
	Review and define the methodology of Task 5	
February-March 2015	Start assessments of need of the regional threat models for SBAS and GBAS	ISTF/5
	Review the preliminary evaluation of need of the regional threat models for SBAS and GBAS	
	Continue data generation	
June 2015	Continue assessment of need of regional threat models	4th webconference
	Decide whether the regional threat model is needed or not. (If needed, threat model generation will take some more months.)	
	Prepare report to the CNS-SG	
July 2015	Report to CNS-SG	CNS-19

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) accept the working plan of ISTF presented in this paper;
- b) note the information contained in this paper; and
- c) discuss any relevant matters as appropriate.
