



International Civil Aviation Organization

**THE FOURTH MEETING OF IONOSPHERIC
STUDIES TASK FORCE (ISTF/4)**

New Delhi, India, 05 – 07 February, 2014



Agenda Item 3: Review of status of States' activities

CURRENT STATUS OF ACTIVITIES ON IONOSPHERIC STUDIES FOR GNSS IN JAPAN

(Presented by Japan)

SUMMARY

This information paper reports on the current status of ionospheric studies for GNSS for aviation in Japan.

1. INTRODUCTION

1.1 Japan Civil Aviation Bureau (JCAB) has developed the long-term strategy of Future ATM and CNS structure in Japan, which is named CARATS. As a candidate for the future GNSS landing system, JCAB has engaged in feasibility study of GBAS from both operational and technical sides.

1.2 Electronic Navigation Research Institute (ENRI) has started the current mid-term plan since 2011. The plan includes two priority subjects related to GNSS based operation, which are developments of a novel procedure for curved approaches using GNSS and a high category approach using GNSS. ENRI also focuses on research and development activity with international collaboration.

1.3 Among the GNSS related studies, mitigation of impacts by the low latitude ionospheric anomalies has been focused on partly because of the differences of ionospheric conditions from those in the mid-latitude region. The studies includes active participation in defining and validating the development baseline SARPs of GBAS Service Type-D (GAST-D) which enables Category-III approach by using GPS L1 signals as well as continuous data collection and analysis for characterizing low latitude ionospheric anomalies for GNSS implementation.

2. DISCUSSION

2.1 To identify and solve major technical subjects and to feed our experience back to the GAST-D development SARPs, ENRI has launched a project consisting of the following three major topics, (1) development of a prototype of GAST-D ground subsystem, (2) development of an airborne experiment system including major airborne integrity monitors for GAST-D, and (3) validation of the GAST-D ionospheric threat model for low latitude. The prototype GAST-D ground subsystem has been delivered in September 2013. It has been installed in New Ishigaki Airport (124.2°E, 24.3°N, magnetic latitude 19.4°) which is close to the equatorial ionization anomaly region by January 2014 (Figure 1). The airborne experiment system has been developed by November 2013. The first flight trials with the prototype of GAST-D ground subsystem and the airborne experimental system for

GAST-D are planned in late March 2013 including the sunset periods when the ionospheric anomalies associated with plasma bubbles often occur.

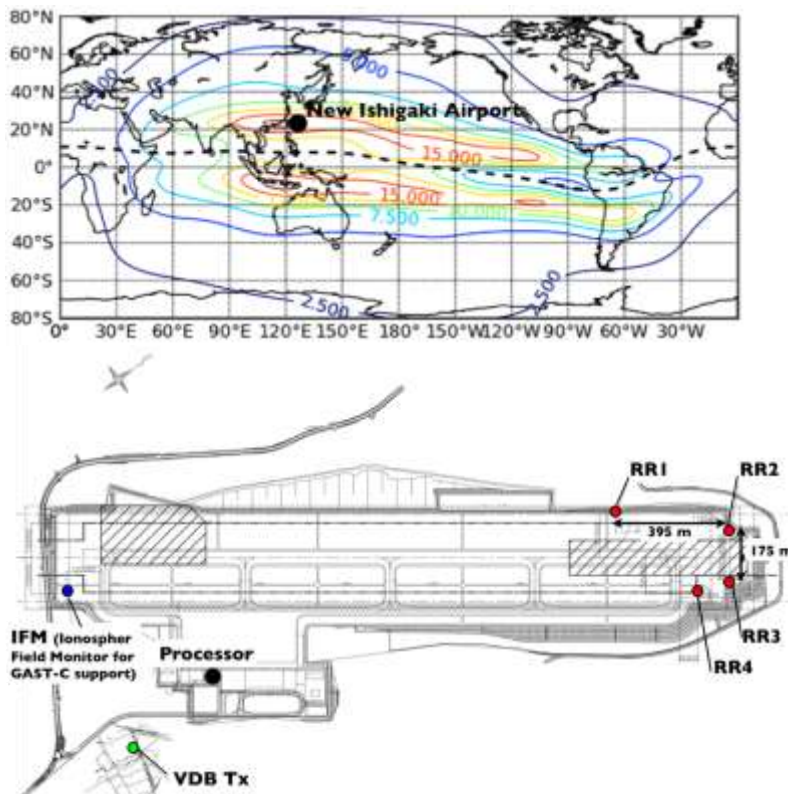


Figure 1. Location of New Ishigaki Airport (top) and the layout of equipments of the ground subsystem at the airport (bottom).

2.2 ENRI continues ionospheric data collection in Japan. Various instruments to observe the low latitude ionosphere are concentrated in Ishigaki Island (Figure 2). A short-baseline ionospheric gradient/scintillation measurement system in Ishigaki, Japan has been operated continuously. The scintillation receivers in Ishigaki will be replaced with new receivers capable of tracking L1/L2/L5 signals of GPS, GLONASS, Galileo, QZSS, and SBAS satellites in 2013. An all-sky airglow imager that can detect two-dimensional shapes of plasma bubbles will be installed in Ishigaki by February 2014. These instruments will also help evaluating the data obtained by the GAST-D prototype at New Ishigaki Airport with additional information on the local ionospheric environment. They would help go/no-go decision of flight experiments targeting on the plasma bubble conditions.

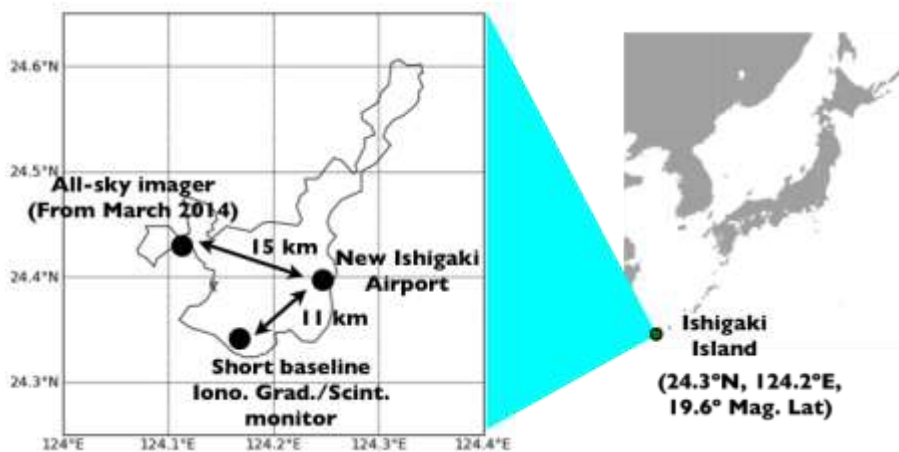


Figure 2. Observations of low latitude ionosphere in Ishigaki, Japan.

2.3 ENRI is actively working on GNSS studies collaborating with a number of institutes and companies worldwide. Since April 2011, ENRI has started research collaboration with King Mongkut's Institute of Ladkrabang (KMITL), Thailand for low latitude ionosphere studies. Since October 2012, another short baseline ionospheric delay gradient observation has been started at Kototabang (100.3°E, 0.2°S, magnetic latitude -10.4°), Indonesia in collaboration with Nagoya University and Kyoto University Japan. The observation is also supported by the National Institute of Aeronautics and Space (LAPAN), Indonesia. ENRI is collaborating with Korea Aerospace Research Institute (KARI) in the CNS/ATM field since August 2011. ENRI and KARI have joint workshops on GNSS regularly. The second workshop was held from xx to xx November 2013 in Jeju, Republic of Korea.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) note the information presented in this paper; and
- b) discuss any relevant matters as appropriate.
