International Civil Aviation Organization

THE THIRD MEETING OF IONOSPHERIC STUDIES TASK FORCE (ISTF/3)

15 – 17 October 2013, Seoul, Republic of Korea

국토교통부
Ministry of Land, Infrastructure and Transport

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 a flight experimental 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 will be installed in New Ishigaki Airport which is close to the equatorial ionization anomaly region in the first quarter of 2014. The first flight trials with the prototype of GAST-D ground subsystem and the airborne experimental system for GAST-D are planned in April 2013 including the sunset periods when the ionospheric anomalies associated with plasma bubbles often occur.

2.2 ENRI continues ionospheric data collection in Japan (Figure 1). 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.

2.3 Realtime GNSS data collection from 200 GEONET stations are continuously in progress. Analyzed GEONET data will be shared for the ISTF activities. The GEONET data were analyzed in realtime to detect ionospheric disturbances to help go/no-go decision of launches of ionospheric sounding rockets. The experiment was conducted on 20 July 2013 lead by Japan Aerospace Exploration Agency. The realtime ionospheric disturbance monitoring system worked well to provide essential information of ionospheric disturbance occurrence that is the target of the experiment. This is an good demonstration of one of the applications of space weather studies. The system is still working after the experiment, and the ionospheric disturbance maps over Japan that are updated every 5 min can be found at the following URL:
http://www.enri.go.jp/cnspub/susaito/rocket/recent_mstid.html

2.4 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. ENRI is collaborating with Korea Aerospace Research Institute (KARI) in the CNS/ATM field since August 2010, and a joint workshop on GNSS was held from 27 to 29 June 2012 in Daejeon, Republic of Korea.

3. ACTION REQUIRED BY THE MEETING

3.1 The meeting is invited to do the following:

a) note the information presented in this paper; and

b) discuss any relevant matters as appropriate.

– – – – – – – – – – – – –

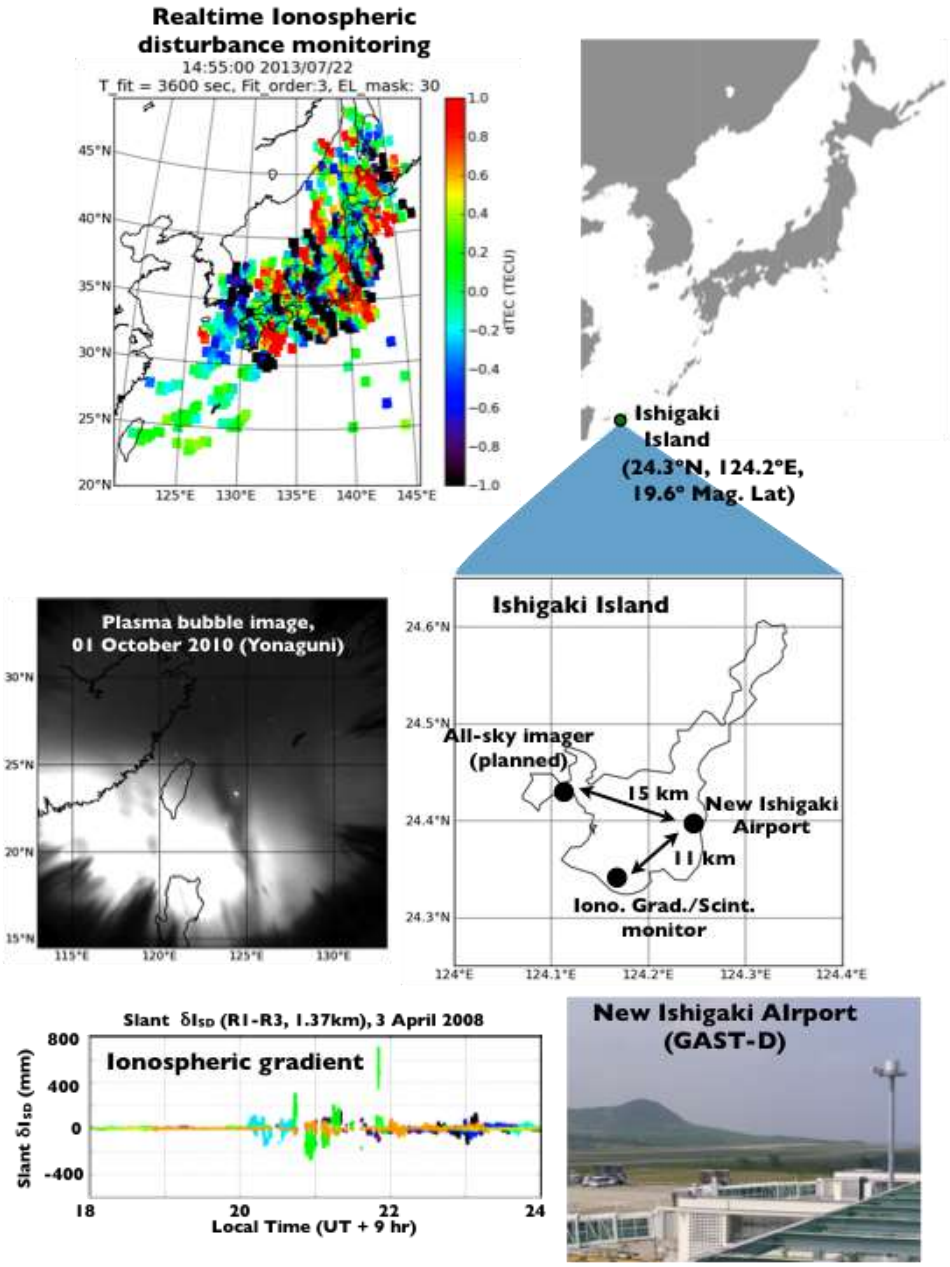

Figure 1. Ionospheric data collection and related activities by ENRI in Japan.