



**INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE**

REPORT OF GNSS WORKSHOP

Bangkok, Thailand

(26 March 2012)

PART I: HISTORY OF THE WORKSHOP**1.1 Introduction**

1.1.1 The GNSS Implementation Workshop was held at ICAO APAC Regional Office, Bangkok, Thailand, on 26 March 2012.

1.2 Attendance

1.2.1 40 participants from 12 Administrations and IATA attended the Workshop. A list of participants is provided at **Attachment 1** to this Report.

1.3 Opening of the Workshop

1.3.1 Mr. Li Peng, Regional Officer, CNS of the ICAO Asia and Pacific Office welcomed participants and highlighted the background and objectives of the Workshop. He emphasized importance of implementation of GNSS for regional PBN and ADS-B projects and briefly introduced the programme of the Workshop.

1.4 Officers and Secretariat

1.4.1 Mr. Ian Mallett, Chairman of APANPIRG PBN Task Force acted as facilitator of the Workshop and Messrs. Li Peng and Sujana Saraswati, Regional Officers CNS of ICAO Asia and Pacific Office, acted as the Secretaries of the Workshop.

1.5 Working Arrangements, Language and Documentation

1.5.1 The GNSS Workshop met as a single body. The working language for the Workshop was English inclusive of all presentations and papers. Lists of Presentations/Papers presented at the workshop are provided at **Attachment 2** to this Report.

PART II: Summary of Presentations and Discussions

2.1 The GNSS Workshop was organized in conjunction with the Ninth Meeting of Performance Based Navigation Task Force (PBN TF/9). The objective of the Workshop was to provide information to the participants on various aspects of GNSS implementation and their applications with the focus on the result of GNSS survey conducted in 2010. The Workshop had 12 presentations covering a comprehensive list of topics on the GNSS as follows (presentations and papers are posted on the ICAO APAC website):

http://www.bangkok.icao.int/cns/meeting.do?method=MeetingDetail&meeting_id=154

- Overview of GNSS related regional activities
- Review Result of GNSS Survey
- GNSS development and status including SBAS
- APECT GIT and Regional RAIM
- Validations of Flight procedures and measurement of interference on GNSS
- GNSS Applications – PBN and ADS-B
- GNSS/PBN related activities
- Introduction on ASBU and navigation roadmap

Outcome of GNSS Survey and Recommendations

2.2 Based on the discussions on the outcome of the GNSS survey conducted in 2010, the Workshop developed following recommendations:

2.2.1 Many States in the region were using GNSS Manual ICAO Doc 9849. The next Navigation System Panel meeting scheduled in May 2012 will review a draft of new edition of Doc 9849 and then to be presented to ANC for consideration. It was recommended that an integrated GNSS and PBN Plan should be developed by States with GNSS elements as a part of the plan. It was also recognized that GNSS was supporting not only PBN implementation but also other applications such as ADS-B. In the regional PBN plan, there was a requirement to review CNS infrastructure as part of the Basic Plan elements. States were invited to consider including GNSS as part of infrastructure under this item. In view of foregoing the workshop developed following recommendations:

Recommendation 1

That, the States, which have not yet developed a GNSS plan, be requested to integrate their GNSS implementation plan within their PBN plan.

2.2.2 The Workshop was also reminded of the GNSS implementation checklist which was developed in 2001. It was proposed to have the checklist updated and it may be recommended for inclusion in the updated GNSS manual.

2.2.3 Some States in the Region had already permitted the use of GNSS-capable FMS to perform distance/altitude checks as a part of ILS let down procedures, where DME was not available. This option may be included and maintained during the period of time while ILS is still being used as one of the elements of the instrument landing systems. It was recalled that APANPIRG/22 meeting agreed that GNSS should be considered for inclusion as an ILS component and invited ICAO to conduct a workshop to address issues identified through survey. Accordingly, the following recommendation was made.

Recommendation 2

That, ICAO be invited to consider including GNSS as an element of ILS for the purpose of distance/altitude verification.

2.2.4 The meeting also recommended developing guidance on how to support GNSS implementation efforts in the region including conducting Seminar/Workshops on GNSS/PBN implementation. States capable of doing so were encouraged to provide assistance to other States in implementing GNSS/PBN.

2.2.5 The outcome of the first meeting of the Ionospheric Studies Task Force and related activities were noted.

Discussions on GPS Receivers

2.3 Nepal informed that FAA cancelled TSO C129a in October 2011. Manufacturers were requested to cancel new receivers with TSO C129a, some ICAO documents and regional guidance materials with reference of the standard may be affected and need to be updated. It was clarified that those receivers which are being used on board the aircraft are going to continue. The TSO Cancellation will not affect production under an existing TSO authorization (TSOA). Articles produced under an existing TSOA can still be installed according to existing airworthiness approvals and applications for new airworthiness approvals will still be processed. But no approvals will be accorded for new TSO-129a design or production. This implies that receivers produced to comply with TSO – C129a will continue to be used in the region. The reason behind cancellation of TSO – C129a was that TSO-C145c, TSO-C146c and TSO-C196 incorporate more stringent standards and testing requirements that made the GPS equipment more accurate and robust than sensors built to the minimum requirements in TSO-129a.

Core GNSS Development and Chinese Beidou

2.4 The Workshop noted the status and development progress of existing and new GNSS constellations. There will be more than 80 GNSS satellites covering Asia/Pacific Region by the end of 2012 and more than 100 GNSS satellites by the end of this decade. It was noted that Asia would be able to use multi-GNSS signals earlier than other regions in the world. The development history and current status of Beidou (COMPASS) was introduced. The testing ICD for terminal equipment was also provided. Boeing had conducted a study for use of multimodal receivers and confirmed that aviation receivers for more than four constellations become very complex. To achieve early benefits, it was suggested to have an Interface Document for Beidou receivers published by China as soon as possible.

2.4.1 The issue for use of signals from multi satellite constellations is challenging. Multimodal receiving equipment or devices for available m-GNSS resources need to be developed in the years to come.

2.4.2 The Workshop also noted that UN ICG has called to promote cooperation, compatibility and interoperability of GNSS, while increasing their use to support sustainable development particularly in developing countries.

APEC GIT Programme Update

2.5 The Workshop noted outcome of APEC GIT/16 Programme presented by the co-chair of APEC GIT. It was noted that the programme of GIT covers GNSS implementation and research for all modes of transportation, but mostly related to aviation. The work programme was adopted by the APEC Transport Ministers Group. It had been also working with ICAO on GNSS application for civil aviation. Activities of the GIT included:

- Feasibility Study on Regional Satellite Navigation Implementation
- Recommendation for rapid implementation of WGS-84 (2004);
- Test Bed with 6 economies implemented in the timeframe from 2006 to 2009;
- Initial SBAS performance evaluation;
- PBN regulatory review visit.

2.6 The GIT also agreed to share the data collected with ICAO Ionospheric Task Force. Regarding the LightSquared issue, the workshop noted that FCC (frequency regulatory agency in USA) has restricted the use of LightSquared facility unless a much better technology is used.

Regional RAIM Prediction System

2.7 It was recognized that predicting outage of GNSS and monitoring integrity of GNSS system is necessary for its operational use. Introduction and the status of development of RAIM system by Aerothai was presented to the workshop. It was informed that the required equipment would be purchased and an Internet-based service with security procedure would be provided shortly in phases for other APAC States. States in the region were encouraged to participate.

GAGAN

2.8 India presented the status of GAGAN implementation. The Final System Acceptance Test (FSAT) of the GAGAN system is planned to be conducted in 2012 with GSAT-8 and GSAT-10. It was noted that the Integrity Team has been formed to assess the integrity data. India offered to provide the IGM-MLDF algorithm model developed by India and use it as the base model. India will use the same safety assurance model that was used for WAAS. It was informed that in one of the GIT meetings, there was a proposal for developing a regional SBAS, which was not progressed further.

Flight Validation for RNP APCH Procedures

2.9 Aerothai made a presentation on flight validation for RNP APCH procedures. The correctness of navigation database, reliability of navigation system – identification of signal interference, conformity with ground based system are validated and inspected accordingly. ICAO has divided the activity into flight inspection and flight validation. The relevant manuals are Doc 8071 for flight inspection and Doc 9906 Vol.5 and Vol. 6 for Flight Validation (part of the Quality Assurance Manual). Aerothai had developed an Operational Manual, which was approved by Department of the Civil Aviation Thailand (DCA). Most of the manual is in Thai and some forms are in English. It was informed that DCA inspector was also on board when the flight validation procedure was conducted.

Updates on ADS-B and PBN Implementation in Hong Kong, China

2.10 As one of the GNSS applications, the planning for ADS-B implementation and current implementation status in Hong Kong, China was presented to the Workshop. It was considered to implement ADS-B to further enhance the resilience in full radar coverage for Hong Kong FIR and to consider providing low level surveillance coverage for helicopters operate at mountainous area. Hong Kong China also included GBAS, as another GNSS application, a part of the integrated PBN implementation plan.

2.11 In compliance with ICAO recommendations, Hong Kong, China has divided their PBN implementation plan into phases i.e. short term, medium term and long term.

- **Approach:** In the short term, Hong Kong, China implemented RNP AR APCH Procedure for North Runway in 2010 and will implement the procedure for the Southern Runway in 2012. A Trial of GBAS would be conducted in the Medium Term. A new RNP AR APACH Procedure was being considered to reduce amount of flight over densely populated area. Ground validation of the procedures was carried out with the help of operators.
- **Terminal:** Hong Kong, China issues the mandate for Basic RNP 1 SIDs/STARs/ capability by 2013. There is a plan to implement basic RNP1 in the Medium Term.
- **En-route airspace:** In the short term, there is a plan to implement RNP4 capability by 2014. In the Long Term, Hong Kong, China considers mandating better navigation specifications in accordance with ICAO requirement. A new RNP AR APCH procedure practically will be overlay the ILS procedure, except for the missed approach procedure to avoid crossing.

2.11.1 An issue on the procedure identifier was mentioned. To identify the procedure uniquely for runways at the same airport, seven characters have been recommended, but most of the FMS accept only six characters. Only B777 and B748 are capable of accommodating this requirement of seven characters. It was recalled that this issue was discussed earlier at the PBNTF and CNS/MET SG as well and comments were forwarded for consideration by ICAO Headquarters. PBN Task Force may take it up for further discussion.

GBAS and PBN Related Updates by Chair of PBN Task Force

2.12 The presentation highlighted the GNSS environment in the region. Need for backup was projected. The presentation also discussed some of the regional PBN issues such as many States do not have PBN Plan etc. It also covered the issue of RAIM prediction which is available for basic receiver predictions for integrity (fault detection) and Exclusion.

2.12.1 It was recommended to remove circling approaches since it is 25 times less safe than straight in. Relative benefits of ICAO recommended procedures were also referred. Issues with the vertical advisories/overlay approaches were discussed. ICAO PBN Tiger Team was set up to review PBN material and produce ICAO PBN Advisory circular. Presentation highlighted status of activities of the team. The workshop was also advised about the recommended PBN implementation mechanism. Training Resources available in the shape of documents and their status were discussed. The implementation status of ADS-B in Australia was also presented.

Introduction on ASBU and Navigation Roadmap

2.13 Concept of ASBU and navigation/surveillance roadmap was presented by the Secretariat. The latest draft of ASBU document was also provided to the Workshop.

Feedback from participants of the Workshop

2.14 Based on the evaluation of the feedback, it was observed that the GNSS workshop was well received by the participants. There was also a proposal for further improvement.

2.15 The outcome of the workshop will be presented to CNS/MET Sub-group of APANPIRG for review.
