

APEC GIT9 - PRESENTATIONS/REPORTS FROM ECONOMIES

Australia

Ms. Marilyn Bassett, Department of Transport and Regional Services, provided information regarding GNSS initiatives in the land transport, maritime, and aviation modes as below:

- Land transport - the Intelligent Access Program (IAP) regulates vehicles' access to routes and times. Detailed information is available at www.austroads.com.au;
- Maritime - national plan has been developed to combat pollution of sea by oil and other noxious/hazardous substances; and
- Aviation - 42nd Director General Civil Aviation Conference, held in Gold Coast in September 2005, addressed GNSS-related matters; Australia's voluntary ADS-B program is moving forward - any decision regarding mandatory use of ADS-B will be made on a national interest policy basis by the Minister; ASTRA, the Australian Strategic Air Traffic Management Group, has established two focus groups for AVP (Approach procedures with vertical guidance) and CAT II/III operations; and an update on WGS-84 implementation.

Brunei Darussalam

Mr. Haji Damit, Department of Civil Aviation, updated the meeting with the following changes being made to the information provided at GIT/7:

- Review of the CNS/ATM implementation plan for Brunei Darussalam;
- Upgrade and replacement of radar and ATM system;
- Implementation of ADS-B subject to regional development;
- Development of GNSS Non-precision approach (NPA) and RNAV/RNP SIDs;
- ASEAN+ Japan New Air Navigation project; and
- On-going coordination with oil industry and other transport sectors, such as land and maritime, for GNSS use.

Hong Kong China

Mr. C. K. Yuen, Civil Aviation Department, provided the meeting with information concerning the latest GNSS developments in Hong Kong.

- Continuation of GPS data sample collection to analyze signal availability;
- Latest sample check by government flights results in GPS availability of rate higher than 99.97%, satisfying the ICAO requirements;
- Establishment of RNAV SIDs for two runways at the Hong Kong Airport with the navigation accuracy of 1NM (95%) since July 2005; and
- Study/design of RNAV non-precision approach (NPA) procedures utilizing GPS, which will replace current VOR/DME approach procedures, is to commence in early 2006.

Mr. Yuen reiterated their interest in participating in the GNSS Test-Bed Project to collect more GPS data.

Indonesia

Mr. Novie Rahardjo, DGCA updated the meeting with current conditions of navigation and strategy relating to GNSS implementation in Indonesia.

- GNSS instrument procedures overlaying VOR/DME have been designed for 38 airports;
- Use of GNSS, as primary means for enroute and as secondary means for terminal, has been promulgated in AIP Supplement in 2005;
- Conventional navigation aids, such as NDB, VOR, ILS, DME, will be decommissioned in a phased manner, taking into account the progress of GNSS tests and trials; and
- A plan of GNSS development has been established with programs for short (-2009), medium (-2015), and long (-2025) terms.

Japan

Mr. Jun Imamura, Civil Aviation Bureau Japan, briefed the latest status of MSAS as below:

- Successful launch of MTSAT-1R on 26 February 2005;
- Completion of orbit test;
- Commencement of meteorological mission in June 2005;
- Total system integration initiated in July 2005;
- Transmission of MSAS test signal on going (More details may be found at http://www.kasc.go.jp/msas/index_e.html);
- Launch of MTSAT-2 scheduled in early 2006;
- Amendment of the regulations to allow use of MSAS as primary means of navigation;
- RAIM prediction service available RAIM NOTAM issued in Japan;
- RNAV (GPS) approaches published for 3 domestic airports; and
- MSAS initial operational capability with dual MTSAT expected in early 2007.

In addition, Mr. Imamura explained the limitation of un-augmented GPS for aviation use and benefits of SBAS with analysis of signal availability, lateral accuracy and ionospheric delay correction with MSAS.

Mr. Yoshiki Imawaka presented an intensive work of RNAV implementation in Japan.

- “RNAV Roadmap for Japan” was developed and released in April 2005;
- RNAV Implementation Team, involving airlines has been established within JCAB and commenced its work in October 2005;
- Due considerations is being given to airspace user requirements, airspace design requirements, route/track spacing requirements, navigation infrastructure, and safety assessment as specified in ICAO Annex 11; and
- Implementation schedule for RNAV in Japan was divided into 3 phases, i.e. short (2005-2007), medium (2008-2012), and long (2013-2018 and beyond) terms.

Republic of Korea

Mr. Hyeong Taek Park, Civil Aviation Safety Authority updated on the implementation of CNS/ATM systems in Korea.

- Formulation of Master Plan, which consists of 3 phases, i.e. initial (1996-2007), installation (-2011), and operation (-2015);
- Implementation of VHF data communications (D-PDC and D-ATIS) at major airports;
- Development of pseudo-GPS satellite system (2002-2005) and GNSS-related technology (2004-2007);
- Modernization of ATC system with Mode-S, and planning of introduction of ADS-B.

R&D projects in Korea have been in progress in various areas, including GBAS flight test at Gimpo Airport, pseudo-satellite system, GNSS key technology, and datalink. In addition, it was advised that the Korean Aviation Act was amended in 2004 to include GNSS for navigation and entrust development and management of GNSS with KCASA.

Mr. Hyun-Dong Kong, Ministry of Maritime and Fisheries presented activities in Nationwide DGPS (NDGPS) which has been designed for maritime and land users in Korea as follows:

- 11 M-DGPS Reference Stations/8 M-DGPS Monitoring Stations for maritime use and 6 Reference Stations/3 Monitoring Stations for land use provide a nationwide coverage in Korea;
- NDGPS are to be used for navigation, GIS and fishery management in the marine field, and for freight logistics and vehicle management, forest GIS, construction, road limit checking, and power transmission tower location checking in the land field;
- Research activities include development of dual frequency GPS receiver, wide-area DGPS, high-accuracy DGPS, pseudolite-based port precision positioning technology.
- For more details, see <http://www.ndgps.go.kr>.

Mr. Ki-Dok An, National Geographic Information Institute (NGII) provided overall activities of NGII in geodetic survey using GNSS. It was noted that as of 1 January 2007, WGS-84 will be mandatory for use in Korea.

Malaysia

Mr. Lim Yong Heng, Department of Civil Aviation Malaysia reported the following activities to the meeting:

- The CNS/ATM systems concept in Malaysia is now in its implementation phase, and its implementation will be carried out in three broad phases. *Phase 1*: Systems and Situation Analysis (present). Studies on the CNS/ATM systems technology and gap analysis on present systems be carried out. Formulation of the National Plan of Implementation. *Phase 2*: Trials and Evaluation (2001 – 2008). Trials and evaluation of technologically mature systems (ADS/CPDLC be conducted as a matter of priority). *Phase 3*: CNS/ATM Implementation & Transition (2004 – 2015). Procurement of operational CNS/ATM systems
- WGS-84 has been fully implemented in Malaysia, and this was announced at the recent ICAO APANPIRG meeting;
- GNSS Non-Precision Approach Procedures was promulgated in the AIP;
- Malaysia has carried out feasibility and technical studies and has identified 5 international airports potentially for the installation of GBAS CAT I system in the near future;
- By the support of FAA through USTDA, and with the cooperation of Thailand, the Philippines, Indonesia, Viet Nam, Malaysia has participated in the program of GNSS Test-Bed; and
- Malaysia will definitely comply with the dateline stipulated by ICAO for the implementation of the CNS/ATM systems.

New Zealand

Mr. Dennis Hoskin, Airways New Zealand provided the following information in relation to GNSS developments in New Zealand:

- NZ Datum 2000 based on International Terrestrial Reference System (ITRF96) was implemented in 2000, which has a maximum difference value of 10cm of WGS-84;
- 62 GPS non-precision approach procedures and 5 RNAV/Baro-VNAV procedures have been established in 2005 and been published in AIP;
- The Implementation of ILS CAT III has commenced at Auckland airport with operations due to commence in two years;
- Ground-based navigation aids decommissioning program has been developed;
- Domestic RNP project has been developed to create a national route structure that permits optimum routing and fuel efficient profiles;
- Compliance with Annex 10 requirements "GNSS data";
- NZ active control network with approximately 30 tracking stations is to be used to determine GPS satellite integrity, confirming that satellites are transmitting reliable data; and
- A final decision on GBAS/SBAS implementation schedule is yet to be made though currently GBAS in 2009 and SBAS/GRAS in 2010-2012 under consideration.

The Philippines

Mr. Andrew Basallote, Air Transportation Office, updated on GNSS Implementation in the Philippines as follows:

- WGS-84 survey completed for all 7 international/alternate airports, 9 out of 11 Trunkline airports, 4 out of 36 Secondary airports, and 2 out of 29 Feeder airports, as of October 2005;
- RNAV/RNP0.3 (GPS) approach/departure procedures have been developed for Subic Bay, Ninoy Aquino, Mactan-Cebu, and Diosdado Macapagal International Airports; and

- Planning to use MTSAT-1R and MTSAT-2 for SBAS with 2 GMS in Manila and Davao, and services will be available by 2011.

Singapore

Capt. Sengkuttuvank reported that there had been no significant changes being made on CAAS activities, but provided the following information from airline perspective:

- RNAV/RNP approach procedures are in need to enhance efficiency and increase traffic in small terminal airspace;
- APEC Workshop on RNAP/RNP was organized at Singapore Academy on 20-24 September 2005; and
- Study on RNAV/RNP departures undergoing and will be updated at the next meeting.

Chinese Taipei

Mr. Chia-chu Hsu, Ministry of Transport and Communication presented the latest CNS/ATM implementation status, with focus on the following:

- Master Plan for 2002-2011 (revision as of April 2005), including SBAS and GBAS from 2007 in the navigation field;
- Commencement of construction of 2 new ATM centers in northern and southern regions in October 2005;
- Airspace re-sectorization for enroute and terminal; and
- Commissioning of Voice/datalink VOLMET and ATIS in November 2005.

It was advised that GRAST activities, which were reported at the GIT/7 meeting, continues and that Chinese Taipei wished to continue participating in GNSS Test-Bed project.

Thailand

Mr. Noppadol Pringvanich, AEROTHAI reported the status of GNSS-related activities in Thailand. Their implementation strategy indicated implementation timeline as follows:

- RNAV (GNSS) Enroute from 2005 to 2006;
- RNAV (GNSS) SID/STAR from 2005 to 2008 (all airports);
- RNAV (GNSS) Non-Precision Approaches from 2005 to 2008;
- Baro-VNAV Approaches from 2005 to 2008, subject to aircraft readiness and operators willingness; and
- GNSS Precision Approaches from 2008 to 2011 (major airports).

Other AEROTHAI's activities in GNSS field includes:

- Establishment of an in-house WGS-84 survey team of properly trained persons;
- RAIM services under development with cooperation of DFS of Germany since August 2005;
- GNSS monitoring and archival system, meeting the Annex 10 requirements, to be ready for initial operations in 6 months;
- Training for GNSS navigational aids engineers in progress;
- Approval for 2 RNAV (GNSS) NPAs at Hat Yai and Ubon Ratchathani airports by the Department of Civil Aviation, Thailand;
- Training for procedures designers; and
- Flight inspection aircraft being upgraded for RNAV and APEC GNSS Test-Bed.

Mr. Pringvanich also updated the meeting with progress on the GNSS Test-Bed project since the GIT/7 meeting as follows:

- Contract between AEROTHAI and ITT was signed in May 2005;
- The first meeting of GNSS Test Bed was held in Bangkok in June 2005;
- Progress was reported to the APEC TPT 26 and 42nd DGCA Conference in September 2005;
- Contract was approved by USTDA in October 2005;
- Factory acceptance test and training is to be organized in late February – early March 2006;
- System installation and on-site training in March 2006;

- Flight test and data collection from March to September 2006;
- Initial study results will be available in June 2006; and
- Final report will be available in November 2006.

Furthermore, Mr. Pringvanich informed about GNSS multimodal applications, i.e. “vessel navigation and tracking” in maritime and “vehicle tracking and terminal & traffic management” in land transport in Thailand.

The United States

Mr. Dan Hanlon, Federal Aviation Administration briefed on development of GNSS in the United States.

- GPS satellite modernization plans 1st launch of Block IIR-M in 2005, Block IIF in 2007, and Block III in 2013;
- WAAS plans full capability in 2008 with installation of 13 additional reference stations, consequently availability would be improved to 99.9% for CONUS and above 99 – 99.9% for Alaskan region;
- GLS will commence in 2008;
- [the US reported that LAAS was put back into R&D – it would be useful to have this recorded]
- Prototype avionics for LAAS by Honeywell is expected by the end of 2006;
- FAA has established working relations with various organizations as international GBAS development activities; and
- FAA has developed “Roadmap for Performance-Based Navigation”, with focus on operational capabilities in enroute, terminal and approach domains up to 2020.

PRESENTATIONS /REPORTS FROM INDUSTRIES AND OTHERS

ICAO

Mr. K.P. Rimal, ICAO Asia/Pacific Office, briefed on the outcome of the 16th meeting of the ICAO Asia/Pacific Regional Planning and Implementation Group (APANPIRG), which is of the interest of GIT. It was reported that APANPIRG revised the strategy for the implementation of GNSS navigation capability in the Asia/Pacific region, developed “ADS-B Implementation and Operational Guidance Document” to be used in the region, and pursued regional preparatory activities for WRC-2007. The meeting recognized the importance of frequency protection for aviation, and encouraged all Economies to provide ICAO with information concerning contact point for the aviation frequency issues as soon as possible if not yet done so.

Airservices Australia

Mr. Keith McPherson, Airservices Australia reported that:

- First GBAS CAT I flight in the world by a commercial airline (Qantas B737-800) was successfully conducted at Sydney International Airport on 29 October 2005;
- Nine B737NG to be delivered to Qantas in 2005 are fitted with GBAS CAT I, and the existing B737 will be retrofitted;
- Twelve A380 to be delivered to Qantas will also be fitted with GBAS CAT I;
- DFS Germany and AENA Spain are also purchased a beta GBAS CAT 1 system;
- Australian Part 171 approval for GBAS ground system is planned for issue by December 2007; and
- FAA/EUROCONTROL GBAS interoperability meeting will be held in Sydney on 7-9 February 2006 and encouraged the GIT members to attend.

Mr. McPherson also informed of activities relating to GRAS in Australia as below:

- Contract was signed with Honeywell in June 2005;
- System design (Phase 1) expected to be completed in February 2006;
- Phase 2 (operational Development) to commence in February 2006; and

- Rollout expected in January 2008.

Electric Navigation Research Institute (ENRI) of Japan

Dr. Takeyasu Sasaki, Electric Navigation Research Institute, explained SBAS-related R&D activities at ENRI, with focus on issues of dual frequency SBAS, ionospheric correction, and scintillation effects, especially plasma bubbles. It was reported that Adaptive Fit would improve the availability from 70-80% to over 90% and accuracy by 12% in RMS during severe ionospheric storm condition.

Korea Aerospace Research Institute (KARI)

Dr. Gi-Wook Nam outlined R&D activities regarding GNSS in KARI.

- The Government of Korea decided to join the European Galileo system in March 2005;
- Plan for GBAS including CAT I prototype development;
- A-SMGCS utilizing GBAS and VDL Mode4;
- Korea joined the Galileo project; and
- Launch of COMS-I and II scheduled for 2008 and 2014 respectively.

It was advised that the purpose of the KARI's research is for study of feasibility, and future development is subject to government decision based on analysis of cost/benefit as well as availability/interoperability of other GNSS.

Korea Astronomy and Space Science Institute (KASI)

Dr. Jong-Uk Park presented their GNSS research activities in geodesy and meteorology. KASI is the national astronomy and space science research institute, and has been participating in the international GNSS services (IGS) since 1994. More detailed information is available at <http://www.kasi.re.kr> and <http://www.gps.re.kr>.

Electronics & Telecommunications Research Institute (ETRI)

Mr. Sanguk Lee presented ETRI's activities in satellite communications and ground systems development, including future projects relating to Galileo external regional integrity system and search & rescue system. More details may be found at <http://www.etri.re.kr>.

Mr. Wan-Sik Choi outlined Telematics system which is under development by ETRI. Utilizing GNSS, this system will provide vehicle drivers/passengers with multimedia services containing various information, such as traffic, emergency & rescue, and remote vehicle diagnosis, and internet services.

Seoul National University

Dr. Taik-Jin Lee presented a concept of GPS Pseudolite navigation system, which supplements the availability of GPS only. This system can be applied for car navigation in urban area, rescue operations in mountains, vertical accuracy improvement for aircraft in taking-off/landing, UAV operations, and indoor navigation.

Hankuk Aviation University

Dr. Hyung-Keun Lee introduced software modules "GNSS Algorithm for Accuracy and Safety" (GAFAS), which can be implemented on any GNSS receivers and will enhance reliability in aerospace, surveying and civil applications.

Chungnam National University

Dr. Sang-Jeong Lee informed the establishment of Korea GNSS Technology Council in 1994 and its advisory and academic activities. He advised that an international symposium on GPS/GNSS will be held in Hong Kong from 8 to 10 December 2005, and encouraged GIT experts to attend it. For more details, see <http://www.lsgi.polyu.edu.hk/GNSS2005/>.

MITRE

Dr. Vince Massimini presented the latest information on the development of RNAV and RNP procedures and simulation models. Examples from Atlanta and Palm Spring airports indicated various benefits derived from RNAV departure and arrival procedures. He also introduced an instrument approach simulation model (MIAME), and results of evaluation of HAT benefits using MIAME. Furthermore, he explained results of computer simulation on how availability could be improved by MSAS in high value of RNP type operations, such as RNP0.1 approaches. [suggest the references to ARNFS be included]

Ms. Mimi Dobbs outlined activities of the company and introduced courses of MITRE Aviation Institute (MAI).

Dr. Taehwan Kim identified a time-offset problem between GPS and Galileo and expressed his views on safety capability of future GNSS. He also raised his concerns on GNSS spectrum matters.

Federal Express Airlines

Mr. Dan Torres explained general aspects of RNAV operations at Subic Bay airport and experiences using GPS over the last 3 and half years. He emphasized more active involvement of stakeholders in the development and implementation of GNSS. Mr. Torres also emphasized ABAS capability for conducting RNAV (GPS) approaches.

Innovative Solutions International (ISI)

Mr. Robert Loh presented ISI's experiences in certification process for GNSS programs, such as the FAA WAAS and LAAS, Japanese MSAS, European EGNOS and DoD GPS III. Safety Risk Management process was introduced to the meeting, and the need for a systematic approach was emphasized.

Mr. Loh emphasized the ICAO requirements as below.

- Continuous real time status monitoring of GNSS for airport landing applications (ICAO Annex 10, Chapter 2.8)
- Continuous real time data storage of GNSS performance for liability and accident investigations (ICAO Annex 10, Chapter 2.4.3)
- Provide Notice to Airmen (NOTAM) to users when GNSS cannot be used for specific safety applications (ICAO Annex 10, Chapter 3.7.6)
- Verification that the local interference environment is not harmful to GNSS users (ICAO Annex 10, Chapter 3.7.4)

In addition, Mr. Loh provided information concerning Brazil's GNSS Performance Monitoring System (GPMS). The GPMS project is divided into 2 phases, and operational demonstration is planned for 2006 as part of phase 1 (initial operational proof of concept).

SARACOM

Mr. Justin Bae presented features of their Automatic Identification System Aids to Navigation to be used for maritime safety and harbor control.

Telematics Co.

Mr. Sung-Hoon Lee briefed recent efforts to develop ground-based navigation aids, and a successful deployment of DVOR in 2004 and future plans of DME and ILS deployment in Korea.

Jeppessen/Boeing

Mr. Bob Withers advised how satellite imagery technology can be used to enhance obstacle evaluation/analysis capability in aviation. He stressed the need to meet the requirements in ICAO Annex 10, Chapter 10 "Electronic terrain and obstacle data" which will become applicable in November 2008. He identified benefits of application of space-based technology in 4 areas, *i.e.* verification and measurement of data, detection of obstacle misplacement, omission of error, and reconnaissance for Areas 3/4 detection.

Mr. Withers also presented recent implementation activities of RNP in the U.S.A, and the development of avionics and integrated cockpit displays by Boeing. He emphasized the benefits derived from the operations, such as fuel saving, stabilized approach, etc.

NEC

Mr. Kaoru Asaba outlined software to support MSAS operations. MSV (MSAS Service Volume Monitor System) provides MSAS/RAIM service level prediction/monitor/playback functions, MAS (MSAS Analysis System) provides MSAS performance and additional data analysis functions, and GRAIP (GPS RAIM Predictor) provides RAIM outage prediction function.

Honeywell

Mr. Michael Hoodspith briefly outlined Honeywell's LAAS/GBAS roadmap and relevant airborne and ground systems for GBAS. He introduced their "STAR Tracks 2007 project" being conducted at Memphis airport which commenced in August 2005. This project is aimed to evaluate and implement LAAS at the airport to improve efficiency of flight operations while conforming ATC procedures traffic flow procedures. Anticipated benefits from the project are 3D approach capability, complex procedures such as curved/offset approaches, flexibility in RNP routes, and better approach availability. In order to prove these benefits, 4 phased approach to testing is taken until 2007.

Lockheed Martin

Mr. F. M Bay suggested a collaborative approach to GNSS augmentation, which is expected to bring benefits to APEC Economies, such as minimization of individual commitment, equal participation with some capability, national border-crossing cooperation, and better services to airspace users.

Raytheon

Mr. Tim Katanik introduced their products and services in the field of GNSS, such as Service Monitoring and Prediction System (SMS). The meeting noted the ICAO Annex 10 requirements, detailed in Chapter 3 paragraph 3.7.6.1, that changes in the current and projected status of GNSS space and ground elements that may have an impact on user performance or operational approvals shall be reported to relevant air traffic services units.