

## **GAGAN PROJECT**

### **Minutes of the Working Group on Satellite-based Augmentation System (SBAS) certification**

1. A special session on Satellite based Augmentation System (SBAS) certification related issues was held on 6 September 2007.
2. A presentation was made by Navin Mathur (ISRO) on SBAS certification, highlighting three major approvals related to the system, facility and the service. It was emphasized that the certification activity primarily had dealt with the proof for integrity and a number of documents, required by the certification authority.
3. The current WAAS architecture in Northern America had: (i) 38 WAAS Reference Stations (WRS), (ii) 3 Master Stations, (iii) 2 GEOs, and (iv) 4 Ground Uplink Stations (GUS).
4. The approach procedures were developed as follows: (i) 4225 GNSS, (ii) 1121 Lateral NAVigation /Vertical NAVigation (LNAV/VNAV), (iii) 925 LPVs
5. The Federal Aviation Administration (FAA) team had mentioned that the WAAS Request for Proposal (RFP) for the full Operational Capability (FOC) could be shared with the ISRO Airports Authority of India (ISRO/AAI), to further strengthen the GAGAN Final Operational Phase (FOP) RFP. A letter of intent was required to be sent to FAA, to obtain the WAAS RFP.
6. The FAA team assumed that the cost-benefit analysis for the GAGAN system had already been completed, before initiating the system certification related activities. The activities related to the ground elements and SBAS receivers for aircraft need to go in parallel. The SBAS receiver should adhere to RTCA-DO-229D standards.
7. It was highlighted that the major activities in the system approval consisted of requirements planning, system acquisition, system baseline, system safety assurance, testing and evaluation, contract acceptance inspection.
8. The FAA advised that LPV-200 (HAL=40 m, VAL=35 m and H-Acc=16 m, V-Acc=4 m) could be defined as the performance criteria for GAGAN-FOP, which had already been achieved in the United States. This requirement consisted of other Non-Precision Approaches (NPA) requirements including Required Navigation Performance (RNP) and area navigation (RNAV).
9. It was mentioned that the WAAS Minimum Operational Performance Standards (MOPS) had been equivalent of RTCA-DO-229D standards for SBAS receiver. But, the international standard for entire SBAS navigation system (SBAS user airborne equipment and SBAS signal-in-space) was governed by ICAO SBAS Standards and Recommended Practices (SARPs) (included in ICAO Annex 10, Vol. 1, Amendments 76 and 77). These documents could be taken as standard for GAGAN-FOP.
10. The system acquisition process for each service provider was unique. But, if required, the system acquisition process details for FAA acquisition management process can be accessed at <http://fast.faa.gov>.
11. The certification agency (like Directorate General of Civil Aviation (DGCA)) had to be involved from the very beginning of the project, since a number of reviews/audits needed to be conducted to baseline the system requirements, system design, design implementation and hardware and software

configuration. These reviews needed to be reflected in the RFP. However, the lower level requirements needed to be defined in consultation with the vendor. A reference to RTCA-DO-252 document was also made.

12. It was stressed that all the activities required for system safety assurance had needed to be independently checked and re-done afresh for GAGAN by the vendor. Even though the same activity had already been done for WAAS earlier, it could not be taken as valid for GAGAN. During the discussion on system safety assurance process, FAA mentioned that the following documents should be purchased, i.e. Safety standards (ARP 4761/4654). The AAI might have to initiate this procurement.

13. To address the concerns related to WAAS safety design, a group like the WAAS Integrity Performance Panel (WIPP) should be formed in India. It was informed that the WIPP was currently active in the United States. Its participants had have role in algorithm development and Hazardously Misleading Information (HMI) analysis and were: FAA GPS Product Team, FAA aircraft certification service, FAA technical centre, FAA airway facilities, Raytheon company, Stanford University, Zeta Associates, the Jet Propulsion Laboratory (JPL), Ohio University, Advanced Technology Management, Inc. (AMTI), MITRE Corporation.

14. The FAA noted that the baseline threats for SBAS had been defined by ICAO. However, the FAA had categorized the threats into various sources including signal errors, atmosphere, environment, hardware faults, transmission errors, software errors, human errors and input data errors.

15. The FAA emphasized the importance of WAAS system safety assurance and system safety products in the Acquisition Management System (AMS) life cycle. This needed to be understood in detail and to be implemented during the course of GAGAN FOP.

16. The test and evaluation of the system was also discussed. All acceptance tests confirmed to the sub-system level testing for WAAS. One of the major activities was the Contractor Acceptance Inspection (CAI), prior to Joint Acceptance Inspection (JAI).

17. The next activity was the facility approval, which involved: (i) installation and citing, (ii) operational test and evaluation, (iii) training, air traffic and union coordination, (iv) joint acceptance inspection.

18. It was mentioned that the FAA could provide the document on site surveys, based on AAI request. It was recommended that the interference detection instruments (hand-held, LAN and WAN) be operating at all the sites continuously, during the FOP.

19. The last item in certification was mentioned as the service approval, wherein a host of activities needed to be completed by the service provider including surveys and procedure developments, NOTAMS, flight inspection and commissioning.

20. The FAA is ready to share the manufacturer details for the instrumentation related to the RF interference detection and mitigation, based on a request from AAI.

21. The flight inspection activity for aircraft requirements needed to follow the ICAO Doc 8071 and the advisory circular (AC) AC20-138A provided guidance material for the airworthiness approval of GNSS equipment.