GBAS/SBAS Implementation Workshop

ICAO Document Review related to GBAS/SBAS

ICAO APAC Regional Sub-office
Related documents on GBAS/SBAS implementation

- **Global Strategy**
  - Global Air Navigation Plan (Doc 9750)

- **Regional Strategy**
  - Asia/Pacific Seamless ATM Plan (V2.3 Draft)

- **System requirements and testing**
  - Annex 10 Vol I - Radio Navigation Aids

- **Procedure design and validation**
  - Doc 8168 Vol II - Construction of Visual and Instrument FPs
  - Doc 9906 Vol V - IFP validation

- **Operations**
  - Doc 8168 Vol I - Flight Procedures
  - Doc 9613 PBN Manual
  - Doc 9849 GNSS Manual
  - Doc 4444 Air Traffic Management
Documents related to GBAS/SBAS Implementation

- **Global Air Navigation Plan**
  - A strategic plan to guide the implementation of CNS/ATM systems
    - Comprising technical, operational, economic, environmental, financial, legal and institutional elements; and
    - Offering practical guidance and advice to regional planning groups and States on implementation and funding strategies.
  - Contains near- and medium-term guidance on air navigation system improvements necessary to support a uniform transition to the ATM system envisioned in the operational concept.
  - Introduced the Aviation System Block Upgrade (ASBU) methodology considering existing technologies and anticipated future development based on State/industry agreed operational objectives.
Documents related to GBAS/SBAS Implementation

Global Air Navigation Plan

- GBAS/SBAS implementation in the GANP
  - B0 – APTA: application of GNSS, Baro-VNAV, LPV, GLS to enhance the reliability and predictability of approaches to runways, thus increasing safety, accessibility and efficiency
  - B1 – APTA: progress further with PBN and GLS (CAT II/III)
  - Navigation: explanation of GNSS infrastructure, SBAS (LPV, LP, CAT I), GBAS (CAT I, CAT II/III), policies for conventional navigation aids, mitigation measures to a GNSS outage, etc.
Documents related to GBAS/SBAS Implementation

- Global Air Navigation Plan
  - GBAS/SBAS implementation in the GANP

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## Documents related to GBAS/SBAS Implementation

- **Global Air Navigation Plan**

-Changes of ASBU elements in the update of GANP (Oct. 2019)

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See [https://www4.icao.int/ganppportal](https://www4.icao.int/ganpportal)
Asia/Pacific Seamless ATM Plan

- The plan provides a framework for a transition to a Seamless ATM environment to meet future performance requirements.
  - In accordance with GANP update in 2019, the plan will be amended accordingly.
- GBAS CAT I and SBAS LPV/CAT I implementation has the priority 1 in the plan.
- GBAS and SBAS systems should be established as appropriate to the level and type of aircraft operations and operating environment subject to an assessment of benefits and costs.
Annex 10 Vol I Radio Navigation Aids

- Requirements for the GNSS (para. 3.7)
  - GNSS shall provide position and time data to the aircraft
  - GNSS elements include GPS, GLONASS, ABAS, SBAS, GBAS, GRAS and aircraft receivers (paras 3.7.3.1~3.7.3.6)
  - Position and time shall be expressed by WGS-84 and UTC
  - The signal-in-space requirements and GNSS elements specifications are also provided.

- Appendix B. Technical specifications for the GNSS
- Attachment D – Information and material for guidance in the application of the GNSS SARPs
Documents related to GBAS/SBAS Implementation

  - Requirements for ground/flight testing of radio navigation aids are in para. 2.2 of Annex 10 Vol I.
  - Vol II of Doc 8071 contains guidance on
    - Testing of NPA procedures using ABAS (Ch. 2);
    - Testing of SBAS and GBAS (Ch. 3 & 4); and
    - Flight validation of IFPs (Ch. 4).
  - Vol II provides general guidance on the extent of testing and inspection of GNSS-based procedures
    - The guidance is representative of practices existing in a number of States
Documents related to GBAS/SBAS Implementation

- **Doc 8168 Vol I Flight Procedures**
  - Contains the use of SBAS/GBAS approach procedures (Part II, Section 5)
  - Includes helicopter procedures using SBAS

- **Doc 8168 Vol II Construction of Visual and Instrument Flight Procedures**
  - Part III contains PBN procedure design criteria
    - SBAS design criteria (NPA, APV I and CAT I) (Sec. 3, Ch. 5)
    - GLS CAT I (Sec. 3, Ch. 6)
    - Application of FAS data block for SBAS and GBAS (Sec. 2, Ch. 6)
  - Part IV contains design criteria for helicopters using SBAS receivers
Documents related to GBAS/SBAS Implementation

- **Doc 9906 Vol 5 Validation of Instrument Flight Procedures**
  - Provides guidance for conducting validation of IFPs, incl. safety, fliability and design accuracy.
  - Flight validation for GBAS/SBAS procedures require:
    - analysis of additional parameters contained in the FAS data block and data link (GBAS)
      - i.e. GPA, TCH (LTP or FTP), LTP coordinates or FTP, and FPAP coordinates
    - Record and save VPL, HPL and maximum observed VDOP (SBAS)
  - Flight inspection for GBAS may be required for GBAS data broadcast and/or FAS data which supports the procedure
Documents related to GBAS/SBAS Implementation

- Doc 9613 Vol II Part C, Ch. 5. Implementing RNP APCH – Section B RNP APCH Operations down to LP and LPV Minima
  - PBN Manual provides practical guidance on RNAV and RNP application and their performance requirements to States, ANSPs and airspace users.
  - Section B
    - provides guidance to States implementing RNP APCH operations down to LP and LPV minima
    - includes CNS considerations, ATC training, navigation service and ATC system monitoring, operational approval, aircraft requirement, operating procedures, pilot knowledge and training, navigation database, oversight of operators, etc.

Note – GBAS (GLS) is not a PBN navigation specification but a PBN initial segment may be used to link up with GLS.
Documents related to GBAS/SBAS Implementation

- **Doc 9849 GNSS Manual**
  - GANP and ASBUs recognize the GNSS as a technical enabler supporting improved services that meet their objectives.
  - GNSS supports positioning, navigation and timing (PNT) applications, which is the base of PBN.
  - The Manual provides information about GNSS technology and operational applications to assist State regulators and ANSPs to introduce GNSS-based services.
    - Contents include performance requirements, core satellite constellations, augmentation systems, GNSS vulnerability, GNSS evolution, considerations on the implementation of GNSS-based services, etc.
Documents related to GBAS/SBAS Implementation

Doc 4444 Air Traffic Management

- Phraseologies related to GBAS/SBAS application (Chapter 12)
  - Approach clearance will be the same as other conventional approaches
    E.g. Cleared ILS/ GLS/RNP Approach Runway 23
- GLS/LPV capability should be included in the Item 10 of flight plan (Appendix 2)
  - A – GBAS landing system / B – LPV (APV with SBAS)
  - G – GNSS, then in Item 18, NAV/GBAS, SBAS, if required by ATS
  - R – PBN, then in Item 18, PBN/2 letter PBN navspecs, max. 16
Documents related to GBAS/SBAS Implementation

Other considerations

- Provision of information on operational status of radio navigation services (para 2.3 of Annex 10)
  - Aerodrome and approach control units shall be provided with information on the operational status of radio navigation services essential for approach, landing and take-off on a timely basis.
  - Do we need to designate GBAS/SBAS as the essential radio navigation service as they can provide precision approach performance like ILS?

- Provision of GNSS availability
  - Do States provide RAIM prediction service for GLS by either NOTAM or other means, e.g. dedicated website, commercial sources, etc.?

- Operational approval of GLS
  - Operational approval requirements for PBN operations are in Annex 6, Doc 8168 Vol I, Doc 9613 and Doc 9997.
  - Do we need a specific approval for GLS?
THANK YOU