Agenda Item -4
Technical updates related to GBAS-SBAS
WP-05
Presented by Secretariat

Proposed Amendment to Annex 10- Vol-I to include DFMC GNSS & SBASs, Galileo & BDS Standards

V.K. Mishra,
Regional Officer, PBN,
ICAO APAC RSO

Proposed Amendments

Proposed Amendment(Envisaged to be implemented from 2 Nov 2023) to Annex 10, Volume I to:

a) Support the introduction of dual-frequency, multi-constellation (DFMC) global navigation satellite system (GNSS) by adding-

- Provisions for additional frequencies of operation for
  - the global positioning system (GPS),
  - the global navigation satellite system (GLONASS) and
  - the satellite-based augmentation system (SBAS),
- By introducing provisions for the new Beidou navigation satellite system (BDS) and Galileo system;

b) Support ionospheric gradient mitigation for the ground-based augmentation system (GBAS)

Proposed Amendments

Multiple GNSS constellations offering dual-frequency signals are being introduced into service by

- The United states (GPS modernization),
- The Russian federation (GLONASS modernization),
- European Union (Galileo constellation) and
- China (BeiDou Navigation Satellite System (BDS) constellation).

A number of States and regions also plan to deploy DFMC satellite based augmentation systems (SBASs)

Benefits of DFMC GNSS

DFMC GNSS offers to enhance

- GNSS robustness,
- Navigation performance
- Operational benefits.
- Mitigate vulnerabilities in respect of
  - ionospheric disturbance
  - radio frequency interference.
  - the risk of having insufficient satellites within a single constellation.

These technical improvements will enable operational benefits in terms of safety and efficiency, such as

- Improved operational reliability for communications, navigation and surveillance (CNS) applications,
- Increased deployment of 3D instrument approach operations worldwide in line with PBN global goals,
- Introduction of innovative operational concepts and applications and
- Continued rationalization of conventional navigation aids

Proposed Amendments

- SARPs for GPS to be amended to include L5 frequency of operation in addition to L1 frequency.
- SARPs for GLONASS to be amended to include CDMA signals in the L1 band and in the L3 band in addition to FDMA signal in the L1 frequency band.
- To introduce the Galileo Open Service (Galileo OS) in Annex 10. The Galileo OS uses signals in two frequency bands .
- To introduce the BDS Open Service (BDS OS) in Annex 10. The BDS OS uses signals in two frequency bands.

DFMC SBAS

- Currently, SBAS services are provided by several systems worldwide , using signals transmitted on the L1 frequency.
- The proposed amendment to Annex 10 is intended to introduce an additional signal transmitted on the L5 frequency and to enhance the ability of SBAS to augment multiple constellations.
- This will enable DFMC SBAS to provide improved availability, continuity and accuracy compared to the existing L1 SBAS.

DFMC SBAS

- The DFMC SBAS service is independent of the L1 SBAS service, as all the information required for the DFMC SBAS service is transmitted on the L5 frequency.
- Hence, provision of DFMC SBAS services does not require provision of an L1 SBAS service.
- However, it is expected that DFMC SBAS providers will provide L1 SBAS service as well, and that all DFMC SBAS avionics will include the capability to operate in L1 SBAS mode.
- Existing L1 SBAS avionics will continue to function with the existing L1 SBAS service, which is not modified by the proposed amendment.

IONOSPHERIC GRADIENT MITIGATION FOR THE GROUND-BASED AUGMENTATION SYSTEM (GBAS)

- GBAS supports approach and landing operations down to Category III minima.
- Technical standards in Annex 10, Volume I as GBAS Approach Service Types (GAST) A, B, C and D.
- GAST D specifically to support Category II/III operations but supports Category I operations as well.
- GAST D SARPs include provisions for mitigation of ionospheric errors affecting GNSS positioning.
- As part of the ionospheric error mitigation provisions, the GBAS SARPs define a parameter called EIG, with a maximum allowable value of 2.75 m.
- The value of EIG is proportional to the distance between the GBAS ground station and the runway threshold(s) served by that station.

IONOSPHERIC GRADIENT MITIGATION FOR THE GROUND-BASED AUGMENTATION SYSTEM (GBAS)

- Setting a limit on EIG implicitly sets a limit on the maximum distance allowed between the ground station and the threshold(s).
- This can potentially impose significant restrictions on the use of a single GBAS station to support multiple runways.
- The amendment maintains the original limit as a general provision, but allows deviations for airports in which availability remains acceptable if the limit is increased.
- This amendment will permit some flexibility in location of GBAS system on an Airport so as to provide GLS procedures on all the runways.


MONTRÉAL
(HEADQUARTERS)
ICAO
PARIS
(EUROPEAN AND
NORTH ATLANTIC)
ICAO
BEIJING
(ASIA-PACIFIC
SUB-OFFICE)
ICAO
ICAO
CAIRO
(MIDDLE EAST)
MEXICO CITY
(NORTH AMERICA AND CARIBBEAN)
ICAO
ICAO
DAKAR
(WESTERN AFRICA)
ICAO
BANGKOK
(ASIA-PACIFIC)
NAIROBI
(EASTERN AFRICA)
ICAO
LIMA
(SOUTH AMERICA)

THANK YOU!