INTERNATIONAL CIVIL AVIATION ORGANIZATION

REPORT OF THE FIFTH MEETING OF THE ICAO ASIA/PACIFIC GBAS/SBAS IMPLEMENTATION TASK FORCE (GBAS/SBAS ITF/5)

TOKYO, JAPAN 21-23 JUNE 2023

The views expressed in this Report should be taken as those of the Meeting and not the Organization.

Approved by the Meeting and published by the ICAO Asia and Pacific Office, Bangkok

1. INTRODUCTION

Meeting

1.1 The fifth Meeting of the ICAO Asia/Pacific GBAS/SBAS Implementation Task Force (GBAS/SBAS ITF/5) was held in Tokyo, Japan on 21-23 June 2023 and was hosted by Japan Civil Aviation Bureau (JCAB).

Attendance

2.1 A total of 85 participants from Australia, China, Hong Kong China, India, Japan, Malaysia, New Zealand, Pakistan, Philippines, Republic of Korea, Singapore, Thailand, USA, Vietnam, IATA, IFALPA and ICAO were registered for the GBAS/SBAS ITF/5. A list of participants is provided at Appendix B to this report.

Officers and Secretariat

3.1 Mr. V. K. Mishra, Regional Officer, PBN, ICAO APAC was the Secretary of the meeting. He was supported by Ms. Yang Siqi, Program Assistant, ICAO APAC RSO.

Opening of Meeting

4.1 A JCAB official cordially welcomed all the participants of the meeting. On behalf of Mr. Tao Ma, Regional Director of ICAO Asia and Pacific Office, Mr. Raphael Guillet, Chief of ICAO APAC RSO invited all the States to actively participate in the meeting discussion and exchange knowledge to help GBAS-SBAS implementation in the APAC region. The meeting was conducted by the incumbent Co-Chairs of the ITF Mr. Susumu Saito, ENRI Japan, and Mr. George Wong, CAD, Hong Kong China.

Documentation and Working Language

5.1 The working language of the meeting and all documentation was in English.

5.2 A total of nine (9) Information Papers (IPs) and five (5) Working Papers (WPs) were presented in the meeting. The list of papers and presentations is provided in Appendix A to this report. The papers are available on the webpage of the meeting; https://www.icao.int/APAC/Meetings/Pages/2023-GBAS-SBAS-ITF-5.aspx

6. List of Decisions/Conclusions and Draft Conclusions/ Draft Decisions

6.1 The Sub-groups of APANPIRG record their actions in the form of Draft Conclusions, Draft Decisions, Conclusions and Decisions with the following significance:

1) Draft Conclusions deal with matters which, by the Sub-Group's Terms of Reference, require the attention of States or actions by ICAO following established procedures.

2) Draft Decisions relate solely to matters dealing with the internal working arrangements of APANPIRG and its contributory bodies.

3) Conclusions: Those Conclusions adopted by the Sub-group on behalf of APANPIRG on technical matters; and

4) Decisions relate solely to matters dealing with the internal working arrangement of the Sub-group only

6.2 List of Draft Conclusions

Draft Conclusion GBAS/SBAS ITF 5/01 - Draft GBAS safety assessment guidance document related to anomalous ionospheric conditions.

Draft Conclusion GBAS-SBAS ITF 5/02 - Draft SBAS safety assessment guidance document related to anomalous ionospheric conditions.

Draft Conclusion GBAS-SBAS ITF 5/03 - GBAS and SBAS Elements in Revised Navigation Strategy for APAC.

Draft Conclusion GBAS-SBAS ITF 5/04 - Extension of the Asia/Pacific GBAS/SBAS Implementation Task Force to complete tasks as per TORs of GBAS/SBAS ITF.

6.3 List of Draft Decisions

Nil

6.4 List of Decisions

Nil

6.5 List of Conclusions

Nil

REPORT ON AGENDA ITEMS

Agenda Item 1: Adoption of Agenda

1.1 The following proposed agenda was adopted by the meeting.

Agenda Item 1: Adoption of Agenda

Agenda Item 2: Progress on the work of Expert Groups constituted to:

- Review and revise the GBAS and SBAS safety assessment guidance document related to anomalous ionospheric conditions, and to
- Draft a Guidance Document on Implementation Process for GBAS/SBAS.

Agenda Item 3: Updates on GBAS/SBAS and States' Implementation status

Agenda Item 4: Visit to GBAS-SBAS Facilities

Agenda Item 5: Review of Action Item List

Agenda Item 6: Any Other Business

Agenda Item 7: Date and Venue of Next Meeting

Agenda Item 2: Progress on the work of Expert Groups

2. Progress on the work of Expert Groups

2.1 WP01 – Expert group 3-1 – GBAS safety assessment guidance document related to anomalous ionospheric conditions - Co-chair.

Mr. Susumu Saito, Co-Chair of the task force, presented the draft of the revised GBAS safety assessment guidance document related to anomalous ionospheric conditions (Appendix A to WP01). Major updates to the GBAS iono guidance document are inclusion of latest GAST D SARPs along with existing materials on GAST D, materials about the protection levels and a summary of how to develop the GBAS ionospheric threat model based on the experience and input by Thailand. The meeting agreed that the revised draft GBAS safety assessment guidance document related to anomalous ionospheric conditions was ready to be put up to CNS-SG/27 for recommendation to APANPIRG to adopt the document.

Draft Conclusion GBAS-SBAS ITF 5/01 – Draft GBAS safety assessment guidance document related to anomalous ionospheric conditions	
What: That, the GBAS safety assessment guidance document related to anomalous ionospheric conditions (Edition 2.0) provided in Appendix A to WP01 be adopted.	Expected impact: ☐ Political / Global ☐ Inter-regional ☐ Economic ☐ Environmental ☒ Ops/Technical
Why: Major updates to reflect the development of GAST D SARPs and progress of GBAS development and implementation in the region.	Follow-up: ☐Required from States
When: 23-Jun-23	Status: Draft to be adopted by PIRG
Who: ☒CNS Sub group ☐APAC States ☒ICAO APAC RO ☐ICAO HQ ☐Other:	

2.2 WP02 – Expert group 3-1 – SBAS safety assessment guidance document related to anomalous ionospheric conditions - Co-chair.

Mr. Susumu Saito, Co-Chair of the task force, presented the draft of the revised SBAS safety assessment guidance document related to anomalous ionospheric conditions (Appendix A to WP02). Main updates to the SBAS iono guidance document are inclusion of information on new SBAS services under development/deployment, such as SDCM, BDSBAS, KASS, South-PAN, and A-SBAS, distinction between the disturbed and quiet ionospheric conditions for SBAS, GAGAN ionospheric threat model based on MLDF (Multi-Layer Data Fusion), interface control documents (ICD) of BDSBAS, differences of DFMC from L1 SBAS from ionospheric effects perspective and new guidance material on post-adoption activities of SBAS for ionospheric monitoring.

Japan enquired about compatibility of MDLF model used in GAGAN Ionospheric threat model with ICAO SARPS & MOPS. India informed the meeting that MDLF was in line with ICAO SARPS (Annex 10) and MOPS. Co-chair, Mr. Saito, added that two layers used in MDLF better represent the ionosphere.

ICAO asked whether CAT I LPV could be achieved in APAC Region. India informed the meeting that studies so far indicated very difficult to achieve CAT I due to Ionospheric disturbances. Co-chair, Mr. Saito, added that it was difficult to achieve, and however it depended on the SBAS system design.

Japan suggested to include a map of the region with service volume, ionospheric threat model and service providers of various SBAS in the region. Co-chair, Mr. Saito, explained that this was beyond the scope of iono document and could be possible in implementation guidance document. Co-chair, Mr. George Wong, supplemented and explained that it would be difficult to put the suggested map and service information in the implementation guidance document and, in an alternative way, the suggested map and information could be uploaded to the GBAS-SBAS Information Sharing Platform on the ICAO APAC website for sharing with States. This alternative way would be more flexible for adapting to any changes in those materials in the future. Nevertheless, if all those map and materials could be provided by the States, the appropriate way for sharing them could be explored.

Australia provided minor updates to the document for better understandings of the contents which were accepted by the meeting. The meeting agreed that the revised draft SBAS safety assessment guidance

document related to anomalous ionospheric conditions was ready to be put up to CNS-SG/27 for recommendation to APANPIRG to adopt the document.

<table>
<tr><td colspan="3">Draft Conclusion GBAS-SBAS ITF 5/02 – Draft SBAS safety assessment guidance document related to anomalous ionospheric conditions</td></tr>
<tr><td colspan="2">What: That, the SBAS safety assessment guidance document related to anomalous ionospheric conditions (Edition 2.0) provided in Appendix A to WP02 be adopted.</td><td>Expected impact:
☐ Political / Global
☐ Inter-regional
☐ Economic
☐ Environmental
☒ Ops/Technical</td></tr>
<tr><td>Why: Major updates to enrich the contents and reflect the progress of SBAS development and implementation in the region and DFMC SBAS SARPs development.</td><td colspan="2">Follow-up: ☐Required from States</td></tr>
<tr><td>When: 23-Jun-23</td><td colspan="2">Status: Draft to be adopted by PIRG</td></tr>
<tr><td colspan="3">Who: ☒CNS Sub group ☐APAC States ☒ICAO APAC RO ☐ICAO HQ ☐Other:</td></tr>
</table>

2.3 WP03 – Expert group 3-2 – Guidance Document on Implementation Process for GBAS/SBAS - Co-chair

Mr. George Wong, Co-Chair of the task force, presented progress of Expert Group 3-2 in developing the guidance document for the implementation of GBAS/SBAS. Taking into consideration the current readiness and completeness of draft materials for prepared guidance on GBAS and SBAS implementation, it was considered more justified in splitting the GBAS/SBAS implementation guidance document into two separate volumes (i.e. one book for GBAS implementation and the other one for SBAS implementation, with the structure and content list given in Appendices B and C respectively).

The draft guidance documents for GBAS and SBAS Implementation were placed as **Attachment A and B** of WP03 respectively. The majority of the draft GBAS implementation guidance document was considered completed in principle and ready for States' review. However, further fine tuning on some details was required and it was anticipated to be wholly completed and ready for promulgation in 2024 after consolidating another round of comments from States on this revision of draft guidance document for GBAS. To enhance the draft guidance document for SBAS Implementation, further review and consolidation of States' inputs was considered necessary. As per the assessment of Leads/Co-Leads of Expert Group, it was anticipated the draft guidance document to be ready for final review in 2024/2025, subject to the progress in further enriching the draft guidance document for SBAS Implementation with another round of consolidation. The high-level timeline in completing remaining works for preparing the GBAS and SBAS implementation guidance documents anticipated in the coming three years was proposed in Appendix E of WP03 for members' discussion and consideration.

Since the Asia/Pacific GBAS/SBAS Implementation Task Force was initially planned for a period of 3 years with the last meeting in 2023. In view of the status of the draft guidance documents for GBAS and SBAS Implementation and the need for spending more time to finish these two guidance documents, the

Expert Group considered the need and necessity to extend the period of Asia/Pacific GBAS/SBAS Implementation Task Force for another three (3) years for inputs/comments to be collected from States.

Members' Suggestions for Draft GBAS Implementation Guidance Document

ICAO APAC RSO suggested to include wording of "implementation" in the "Objective" section of the guidance document as the guidance was for the implementation of GBAS-SBAS. To complete the task in an efficient manner, it was recommended for States to provide all further inputs by July 2023 so that Co-chair could provide a clean version for ICAO RSO to upload the revision on SharePoint, which would be accessible to all the members for comments, and members to provide inputs or comments by September 2023. Those comments would be compiled and available for final review by members until November 2023. An online meeting was planned for January 2024 with States' participation to finalize the guidance documents.

India suggested to revise and supplement the service scope of GBAS in the guidance document that it could support terminal as well as en-route operation, and the suggestion was supported by Australia. Co-chair proposed and India agreed to provide wording for the supplement.

Singapore queried why operation and maintenance cost could be performance indicators. Co-chair explained that it was one of the determinants considered by some stakeholders.

India suggested to put concept of operations in a separate section after "Operational Need Analysis". Australia explained that concept of operations and operational needs were interrelated. ICAO RSO supplemented that concept of operation was related to needs analysis.

China suggested to replace wording "RNAV" by "RNP" to align with APAC ANS seamless plan and to replace GPS by GNSS as there were other constellations. These suggestions were agreed in the meeting.

India suggested some amendments in CONOPS. On Co-chair's request, India agreed to provide wording for those amendments for improving paragraphs about CONOPS.

Philippines suggested to include fuel savings as one of benefits. ICAO RSO supplemented that fuel savings in GBAS was subject to procedure design and aircraft capability to fly RF. However, fuel saving was considered a possible benefit from GBAS.

In Technical feasibility, satellite performance assessment at GBAS site for satellite signal reception, multipath and interference should also be considered India suggested to include structures in the vicinity of aerodromes in technical feasibility and agreed to provide wording on corresponding amendments in the GBAS implementation guidance document.

China suggested to include tropospheric effects in VDB coverage assessment and agreed to provide wording for corresponding amendments and relevant reference accordingly. In addition, China also suggested to add assessment for feasibility of airborne receivers and agreed to propose wording on amendments for it.

For experience sharing in Appendix 3 of GBAS implementation guidance document, ICAO RSO suggested not to attach PowerPoint presentation and proposed to incorporate a link in the guidance document pointing to the GBAS-SBAS Information Sharing Platform on the ICAO APAC website with the respective materials uploaded for sharing there.

Members' Suggestions for Draft SBAS Implementation Guidance Document

For SBAS implementation guidance document, ICAO RSO commented that it had a good structure, however, a lot of items needed to be updated. ICAO RSO further suggested that all inputs by the States should be provided by August 2023 and a clean version with those inputs would be uploaded on SharePoint, which would be accessible to all the members for comments, for members to provide further inputs or comments by September 2023. A revision would be further compiled and available for final review by members until November 2023. An online meeting was planned for January 2024 to finalize the SBAS implementation guidance document accordingly.

New Zealand and India raised in the meeting that their inputs had not been fully incorporated in this revision of SBAS implementation guidance document. On the Co-Chair's suggestion, they agreed to submit their inputs again.

ICAO RSO urged States undertaking SBAS projects to share their experiences for drafting the guidance document.

Pakistan suggested that interoperability and compatibility aspects should be included in the guidance document. States having experience were invited to contribute, and New Zealand agreed to provide inputs on the cost benefits analysis' experience leading to the plans for SBAS implementation.

ICAO RSO raised the following comments regarding the SBAS implementation guidance document:

- SBAS was not related to DME coverage or surveillance coverage at all and therefore the corresponding sections should be re-written to make it coherent.
- In the procedure design section, it would only need to elaborate differences with other procedures and the name of software vendor should be avoided.
- In regulatory aspect, it would need to deliberate difference among SBAS system certification, flight procedure approval and operational approval.

India suggested to include training for regulator and agreed to provide corresponding amendments.

Japan informed the meeting that post implementation activity was equally important and should be adequately addressed. Japan volunteered to share its experience and provide supplementary materials afterwards.

The meeting agreed that the GBAS implementation guidance document only needed some refinement whereas SBAS document should be critically reviewed and re-written and it would require at least one year, subject to the progress afterwards. After deliberation in the meeting, members agreed on the draft decision proposed in WP03 that the period of this task force should be extended to allow more time to finish up the GBAS and SBAS implementation guidance documents.

As proposed in the meeting, ICAO has put up the draft SBAS guidance on SharePoint and notified all the members to access, review and input their comments. The target date for comments on GBAS document is the end of July 2023 and for SBAS document is the end of August 2023 and as agreed an online discussion would be held on 12 September 2023.

Agenda Item 3: **Updates on GBAS/SBAS and States' Implementation status**

3.1 WP04 - Revised Navigation Strategy for Asia Pacific Region (Secretariat)

The Secretariat presented the Navigation Strategy for Asia/Pacific Region, which was revised in 2016 by CNS SG/20 and adopted via Conclusion APANPIRG/27/37. In view of the latest developments in GNSS navigation, there was a need to review the navigation strategy for the region.

Accordingly, ICAO APAC Regional Office sent a state letter no. T8/5-AP021/23(CNS) on 27 January 2023 to suitably review the Strategy for currency and applicability to the latest Navigation requirements in the Region. The copy of the State letter is placed as Attachment-1 of WP04. The draft Navigation strategy including the feedback from the States was deliberated in PBNICG/10 meeting. Based on the suggestion by PBNICG/10, comments of ICAO NSP secretary were obtained on the draft. A final draft navigation strategy as agreed by PBNICG/10 meeting and reviewed by the NSP secretary was placed as Attachment of WP04 for review by the ITF on GBAS and SBAS elements.

After members' deliberation on the final draft navigation, the meeting agreed to GBAS and SBAS elements of the draft revised navigation strategy given in WP04 and presented in the meeting.

<table>
<tr><td colspan="3">Draft Conclusion GBAS-SBAS ITF 5/03 - GBAS and SBAS Elements in Draft Revised Navigation Strategy for APAC Region</td></tr>
<tr><td colspan="2">What: The GBAS and SBAS elements in draft revised Navigation strategy for APAC Region was reviewed by the meeting and was agreed without any change.</td><td>Expected impact:
☐ Political / Global
☐ Inter-regional
☐ Economic
☐ Environmental
☒ Ops/Technical</td></tr>
<tr><td>Why: To revisit the draft navigation strategy revised in 2016 by CNS SG/20 and adopted via Conclusion APANPIRG/27/37, in view of the latest developments in GNSS navigation.</td><td colspan="2">Follow-up: ☒Required from States</td></tr>
<tr><td>When: June 2023</td><td colspan="2">Status: Draft to be adopted by CNS SG</td></tr>
<tr><td colspan="3">Who: ☒ CNS Sub group ☒APAC States ☒ICAO APAC RO ☐ICAO HQ ☐Other:</td></tr>
</table>

3.2 WP05 - Australia's GBAS Implementation Experience (Australia)

Australia provided an update of Australia's experience with implementing GBAS and the number of GLS capable aircraft operating into Australian airports that were GBAS equipped. The biggest impact to system availability had been a result of lightning damage in highly susceptible sites such as Sydney airport**.** The use of fibre optic cables to connect to the reference antennas was currently being investigated as a possible solution.

Since the implementation of GBAS at Sydney, a limited number of pilots reported experiencing a loss of vertical deviation indications whilst performing a GLS approach. Investigations attributed these events to the Vertical Protection Level (VPL) exceeding the Vertical Alert Limit (VAL) due to the prevailing GPS

satellite geometry in combination with the implementation of a conservative ionosphere threat model. Australia actively monitored changes to the GPS satellite constellation configuration and would remove the GBAS from service (through a NOTAM) during periods where the Vertical Dilution of Precision (VDOP) is inflated. To enhance availability during high VDOP periods, Australia was exploring the option of implementing a region-specific Ionosphere Threat Model.

Australia had on occasions observed a reduction in GLS Service Availability due to satellite cross-correlation events. The cross-correlation events were primarily attributed to the geometry of the satellites relative to the location of the GBAS. A severe space weather event was observed across Australia on the 24 April 2023. There were no observed impacts on GBAS performance or pilot reports of anomalous GBAS behaviour during the event.

To facilitate a precision approach capability to the displaced threshold, Australia developed, implemented and validated a temporary GLS approach to the displaced threshold in Melbourne Airport demonstrating the capability of the technology.

In 2022, 36% of Sydney arrivals and 45% of Melbourne arrivals had GLS capability. There was demand from industry to utilize the GBAS beyond existing capabilities offered by the GAST-C system to support operations below Category I.

3.3 IP01- Update on DFMC (Secretariat)

The Secretariat provided an update on DFMC (Dual Frequency Multi Constellation) that ICAO Council adopted ICAO SARPs for DFMC GNSS in March 2023 and the DFMC GNSS SARPs would introduce the next generation of GNSS for aviation as follows:

- two entirely new GNSS constellations, Galileo (Europe) and BeiDou (China), were being standardized by ICAO for the first time.
- the existing SARPs for the GPS (USA) and GLONASS (Russia) constellations were being enhanced to introduce a second frequency and modernized technology.
- the existing satellite-based augmentation system (SBAS) SARPs were being enhanced to introduce a second frequency and the ability to augment the new constellations.

DFMC would give aviation access to over 50 additional new GNSS satellites and modernized satellites for existing constellations, which would:

- mitigate vulnerabilities in respect of ionospheric disturbance and radio frequency interference due to availability of a new frequency.
- contribute to mitigate ionospheric scintillation and mitigate the risk of having insufficient satellites within a single constellation due to the availability of multiple constellations.
- enhance GNSS robustness due to the increased system redundancy both in terms of frequencies of operations and of satellites in use.

3.4 IP02- SouthPAN in Australia and New Zealand (Australia)

Australia presented a brief summary of the SouthPAN program, which would provide a SBAS aeronautical radio navigation service to Australia and New Zealand by 2028. SouthPAN commenced service delivery on 26 September 2022 and had provided a number of Early Open Services:

a) L1 SBAS Open Service (on the L1 navigation signal), augmenting the L1 C/A GPS signal.

b) DFMC SBAS Open Service (on the L5 navigation signal), augmenting the L1 C/A and L5 GPS signals, and the E1 and E5a Galileo signals; and

c) Precise Point Positioning (PPP) Via SouthPAN (PVS) (on the L5 navigation signal), augmenting the L1 C/A and L5 GPS signals, and the E1 and E5a Galileo signals.

Further information about SouthPAN's services can be found in the Service Definition Document available on Geoscience Australia's website: https://www.ga.gov.au/southpan-sdd-os.

3.5 IP03- Update from Philippines (Philippines)

Philippines presented activities in relation to GBAS/SBAS implementation in their State. In cooperation with JRANSA (Japan Radio Air Navigation Systems Association) and the Country of Japan, the Civil Aviation Authority of the Philippines hosted GIPTA (GNSS Implementation Plan Training for ASEAN) at Civil Aviation Training Center (CATC) in November 2022. GNSS Concept of operations, installation, ionosphere effects and maintenance were discussed. The training also covered cost effectiveness, certification, and other necessary technologies to encourage the development of GNSS in the region.

ICAO asked whether Philippines had some concrete plan of implementing GBAS or SBAS and, for SBAS, whether they were considering MSAS or developing their own. Philippines informed the meeting that they were keen on GBAS-SBAS implementation, and this needed to be decided by the authority.

3.6 IP04- Update on GBAS Proof-of-Concept Project (Thailand)

Thailand presented updates on the GBAS Proof-of-Concept (PoC) Project between Japan and Thailand. It focused on the development of the ionospheric threat model, flight demonstration results, and future actions to be carried out for the GBAS implementation at Suvarnabhumi International Airport in Bangkok, Thailand.

Aeronautical Radio of Thailand (AEROTHAI) developed the ionospheric threat model with technical support from the Electronic Navigation Research Institute (ENRI) and King Mongkut's Institute of Technology Ladkrabang (KMITL). The collected GPS data was analyzed to estimate the background residual ionospheric uncertainty during both ionospheric quiet and disturbed conditions. The results after validating the ambiguity resolution were summarized in the paper.

AEROTHAI conducted several GBAS flight demonstrations using their Beechcraft Super King Air 350 aircraft equipped with the GBAS Flight Inspection System (FIS). The aircraft performed various flight patterns, including arc flights, level runs, and normal approaches. Several parameters were evaluated during these demonstrations, including the coverage of the VHF Data Broadcast (VDB), deviation errors between GLS and ILS approaches, and radio signal interferences.

The overall results of the demonstration indicated that the GBAS system successfully met all performance requirements. The VDB coverage was found sufficient, and the deviation error between GBAS and ILS approaches remained within acceptable limits. Additionally, the GBAS system demonstrated its ability to improve runway throughput and capacity by eliminating the need for critical or sensitive areas of the ILS during runway operations.

3.7 IP05- GBAS Status Update in Japan (Japan)

Japan presented the status of GBAS implementation in Japan. Japan Civil Aviation Bureau (JCAB) installed the first GBAS at Tokyo international airport (HND) and had been conducting CAT-I trial operation since 2020. Pilot feedback indicated GLS provided a more stable approach compared to ILS. More experiences on GLS approaches were needed for all the operators to be familiarized with GLS operations and to verify that the GBAS system was fully compatible with various aircraft models.

Electronic Navigation Research Institute (ENRI) had carried out research and development activities related to GBAS which included DFMC GBAS concept development, GAST-D performance enhancement for the low latitude region and advanced operations by GBAS.

3.8 IP06- MSAS Program Update (Japan)

Japan informed the meeting that the MSAS was declared operational in 2007 up to NPA due to ionospheric effect. Commercial flight-based trial operations of RNP approach procedures with LPV250 minima was ongoing within limited time at fourteen airports in Japan. The feedback from the operators was to identify the need for improvement of system performance.

The Research and development activities on Dual Frequency Multi constellation MSAS (DFMC MSAS) including message authentication using L5 QPSK signals were undergoing at the Electronic Navigation Research Institute (ENRI).

ICAO RSO asked Japan whether LPV procedures had been published. Japan informed the meeting that LPV procedures for 13 domestic and one international airport had been published and for post implementation, feedbacks from pilots were requested.

3.9 IP07- GNSS RFI monitoring service by JCAB in Japan (Japan)

Japan Civil Aviation Bureau (JCAB) established the Network Performance Assessment Center (NPAC) in 2020 for the mission of centrally monitoring, analyzing, and assessing service levels of CNS as the core of CNS performance management. This paper introduced the performance monitoring of GNSS conducted by NPAC. NPAC collected GNSS signals by GPM system and provided the following three services to users.

a) GNSS Performance Prediction Service providing availability forecasts for ABAS and SBAS

b) GNSS Performance Monitoring Service providing information on the impact on operations utilizing GNSS.

c) GNSS Performance Analysis and Evaluation Service conducting analysis and evaluation of GNSS performance for safe and continuous utilization of GNSS.

3.10 IP08 – SBAS Development Status (Pakistan)

Pakistan informed the meeting that the Pak-SBAS program was initiated in 2019. It was owned by the Government of Pakistan and was being implemented and would be operated by SUPARCO (www.suparco.gov.pk) – the National Space Agency of Pakistan. PCAA was cooperating with SUPARCO in the implementation of Pak-SBAS and planned to utilize its services for Performance Based Navigation (PBN) in the aviation sector in Pakistan.

The Pak-SBAS Public service would augment GPS L1 signal and would utilize GPS & BDS for L5 Dual Frequency Multi Constellation (DFMC) signal. The Pak-SBAS Authorized service would also provide Precise Point Positioning (PPP) service using BDS B2b signal.

3.11 IP-09 - Korean SBAS (KASS) development and implementation status (Republic of Korea)

The Republic of Korea (ROK) presented the implementation status of its SBAS, called KASS (Korea Augmentation Satellite System) and updated that KASS Sol Service will be started in Dec 2023. On a query from ICAO, ROK informed the meeting that they are planning to publish APV-1 procedures first in Incheon.

Agenda Item 4: Visit to GBAS-SBAS Facilities

4.1 GBAS Facility

The participants visited Tokyo International Airport (Haneda) where the GBAS under operational trial was installed. JCAB and NEC Corp. explained about functions and implementation of the GBAS system. The participants also visited the GBAS reference stations in the airfield. The officer in charge of the facility invited the secretary and co-chairs of the ITF for a brief meeting.

4.2 MSAS Facility

The participants visited the Technical Management Center (TMC) of JCAB. It was collocated with the Tokyo Area Control Center. JCAB introduced the backup system of MSAS and the GNSS performance monitoring system. The officer in charge of the facility invited the secretary and co-chairs of the ITF for a brief meeting.

Agenda Item 5: Review of the Action list

5.1 The Action List of the task force is a collection of technical matters identified during the first meeting of the task force. It provides description, relevance, ownership and priority to be assessed in each meeting. A review of the current status of tasks in the Action List was conducted in the meeting and the follow-up actions, as well as revised target dates, of outstanding tasks were discussed and deliberated in the meeting. Some of the action items had been closed as those actions had been completed and new target dates have been assigned for the remaining ones per the discussion among members in the meeting. The updated Action list as concluded in the meeting is attached as **Appendix C**.

5.2 With reference to the latest status in the updated Action List, the following tasks in high priority are still outstanding:

(a) Organize a workshop with airspace users of APAC Region

(b) Organize a specific meeting with APAC regulators interested in GBAS/SBAS

(c) GBAS and SBAS Safety Assessment

(d) GBAS/SBAS Performance Demonstration

(e) Develop High Level Guide on Implementation Process for GBAS and SBAS (i.e. GBAS and SBAS Implementation Guidance Documents)

As per members' deliberation in the meeting, these remaining tasks were considered essential for fulfilling the objectives stated in the Terms of Reference (TORs) of the Asia/Pacific GBAS/SBAS Implementation Task Force (APAC GBAS/SBAS ITF). Taking into consideration the remaining tasks listed above, especially for the need in getting more time to finish up the GBAS and SBAS implementation guidance

documents, the meeting concluded and agreed that the task force should be extended by another three-year term to complete these outstanding tasks.

<table>
<tr><td colspan="3">Draft Conclusion GBAS-SBAS ITF 5/04 - Extension of the Asia/Pacific GBAS/SBAS Implementation Task Force to complete tasks as per TORs of GBAS/SBAS ITF</td></tr>
<tr><td colspan="2">What: To extend the period of Asia/Pacific GBAS/SBAS Implementation Task Force for another 3 years (i.e. up to 2026) for completing the following remaining tasks with high priority in the Action List and considered essential for fulfilling the objectives stated in the Terms of Reference (TORs) of the APAC GBAS/SBAS ITF:
- GBAS and SBAS implementation guidance documents.
- Workshop/meeting for APAC airspace users and regulators; and
- Discussion and deliberation on technical issues in relation to GBAS/SBAS Safety Assessment and Performance Demonstration.</td><td>Expected impact:
☐ Political / Global
☐ Inter-regional
☐ Economic
☐ Environmental
☒ Ops/Technical</td></tr>
<tr><td>Why: To complete tasks, such as guidance reference for GBAS/SBAS Implementation, under the TORs of Asia/Pacific GBAS/SBAS Implementation Task Force</td><td colspan="2">Follow-up: ☒Required from States</td></tr>
<tr><td>When: June 2023</td><td colspan="2">Status: Draft to be adopted by CNS SG</td></tr>
<tr><td colspan="3">Who: ☒CNS Sub groups ☒APAC States ☒ICAO APAC RO ☐ICAO HQ ☐Other:</td></tr>
</table>

Agenda Item 6: Any Other Business

6.1 FPP Presentation

APAC FPP introduced Procedure Design (GBAS-SBAS) seminar to be conducted in Nov 2023. More information of the Seminar is available at following link: https://www.icao.int/APAC/APAC-FPP/Procedure%20Design%20Seminar%20GLSSBAS/Forms/AllItems.aspx

Agenda Item 7: Date and Venue of Next Meeting

The Co-chairs proposed to conduct the 6th Task Force meeting in early 2024 and an intermediate online meeting would be conducted to review the progress of draft guidance documents. ICAO proposed that the States willing to host next meeting should write to the Secretariat APAC-RSO@icao.int and/or vkmishra@icao.int.

Closing of Meeting

Co-Chairs and Mr. Raphael GUILLET thanked Japan (JCAB & ENRI) for hosting this meeting in Tokyo especially arranging visit to GBAS & SBAS facilities and all participants for their fruitful contributions and closed the meeting.

Appendix A

List of Papers

Information Papers

IP-01- DFMC Update -Secretariat

IP-02- SouthPAN program update - Australia

IP-03- Update from Philippines

IP-04- Update on GBAS PoC Project - Japan & Thailand

IP-05- GBAS Update in Japan - Japan

IP-06- MSAS Program Update - Japan

IP-07- GNSS RFI monitoring service by JCAB in Japan - Japan

IP-08- SBAS Development Status – Pakistan

IP-09 - Korean SBAS (KASS) development and implementation status

Working Papers

WP-0 - Provisional Agenda - Secretariat

WP-01- GBAS Iono Guidance – Co-chair Expert Group 3-1

WP-02- SBAS Iono Guidance – Co-chair Expert Group 3-1

WP-03- GBAS-SBAS Implementation Guidance Materials– Co-chair Expert Group 3-2

WP-04- Revised Navigation Strategy for APAC - Secretariat

WP-05- GBAS Status Update and Operational Experience - Australia

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(Hybrid, 21 – 23 June 2023) (APAC GBAS/SBAS ITF/5)

List of Participants

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ACTION PLAN

GBAS SBAS Implementation TF Last Updated: 23/6/2023

N	ACTION ITEM	PRIORITY	OWNER	DUE	STATUS	NOTES (ICAO Document ref)	Decision by the meeting
1	Develop awareness and information sharing						
1.1	Organize a workshop with airspace users of the APAC region (expected benefits, comparison with ILS and Baro VNAV, operational concept, coverage of SBAS and GBAS, programmes in the region, fleet readiness, cockpit interface, business case, retrofit, mandates, inviting air operators already using SBAS or GBAS procedures)	HIGH	ICAO/IATA	Early 2023		ICAO and IATA as main organizers, with the host State. First choice would be to have a face-to-face workshop, in India for example, as Gagan has been put in place. Second choice is to organize a small webinar. To be decided in Dec 2020.	Should be hosted by the States, which have published GBAS/SBAS procedures. A concept note on the workshop would be shared by ICAO alongwith GBAS-SBAS ITF/5 report.
1.2	Organize a specific meeting with APAC regulators interested in GBAS SBAS (update of regulation, certification of provider, certify pilot training and standard operating procedures., approval of procedures,…)	HIGH	ICAO and some States to conduct a survey first			Australia is supporting	No consensus so far
1.3	Create a brochure to summarize main aspects of GBAS and SBAS systems	HIGH	1) ICAO to collect information already available and put on the website 2)See whether we do need a	S1 2021	Closed	With input from other actions, may be combined with 1.4 Brochure in a second stage	Already available on Information Sharing Platform, TF members are encouraged to see and suggest for any changes
1.4	Make reference to existing information about benefits of GBAS and SBAS vs ILS and APV Baro	MEDIUM	ICAO	12/31/2020	Closed	What is already available from ICAO or from other regions ? From FAA : https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/navservices/gnss/ https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/navservices/gnss/library/factsheets/media/RNAV_QFacts_final_06122012.pdf From ICAO EUR/NAT https://www.icao.int/EURNAT/EUR%20and%20NAT%20Documents/EUR%20Documents/EUR%20Documents/025%20-%20EUR%20RNP%20APCH%20Guidance%20Material/EUD%20Doc%20025%20RNP%20APCH.pdf	Already available on Information Sharing Platform, TF members are encouraged to see and suggest for any amendments.
1.5	Develop a list of GBAS and/or SBAS focal points in each APAC State	HIGH	ICAO / Action of the GBAS SBAS ITF/2 for ICAO RO to send a State Letter	9/30/2020- for dispatch of SL	Closed	Information to be put on the website	Already available on Information Sharing Platform, TF members are encouraged to see and suggest for any changes
1.6	Develop a synthetic list of the on going development of GBAS SBAS systems in the APAC region (coverage, date of entry into service)	HIGH	ICAO / Information to put on the website / Action Focal point to provide GBAS SBAS programme information to ICAO	12/31/2020	Closed	Reuse the format of the information presented at the workshop in Republic of Korea in 2019	Already available on Information Sharing Platform, TF members are encouraged to see and suggest for any changes
1.7	Develop a synthetic list of GBAS and SBAS fleet readiness	MEDIUM	ICAO/IATA/Eurocontrol	End of Q1 2021	Closed	Public information from IGWG and aircraft manufacturers. (https://ext.eurocontrol.int/analytics/saw.dll?Dashboard) The IGWG information is available at the EUROCONTROL's One Sky Team website (registration required).	Can be acessed through One Sky Team website and Airbus and Boeings presentation in ICAO APAC GBAS-SBAS workshop contents.

N	ACTION ITEM	PRIORITY	OWNER	DUE	STATUS	NOTES (ICAO Document ref)	Decision by the meeting
1.8	Develop a list/map of published GBAS and SBAS procedures in the APAC region	MEDIUM	ICAO with input from focal points	Next meeting	Closed	The flygls.net website (Airbus/Eurocontrol) lists the GBAS stations worldwide SBAS : FAA LPV approaches: https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/navservices/gnss/approaches/media/LPVs.xlsx EGNOS LPV https://egnos-user-support.essp-sas.eu/new_egnos_ops/resources-tools/lpv-procedures-map Europe through Eurocontrol access https://www.eurocontrol.int/platform/performance-based-navigation-map-tool	Already available on Information Sharing Platform, TF members are encouraged to see and suggest for any changes
1.9	Develop a list of APAC States' mandates (existing and planned) related to GBAS and SBAS	MEDIUM	ICAO with input from focal points	On going			Focal points to respond.
2 Experience sharing							
2.1	Organize a discussion and a visit if possible of States/Airports who have already implemented Gbas or Sbas systems (all subjects including siting,performance demonstration, safety assessment..)	HIGH	ICAO / When possible	To be discussed in the next meetings	Closed	Could be done in : - Australia as Melbourne and Sydney have published procedures on GBAS stations. - Japan : a GBAS operational trial procedure has been published at Tokyo Haneda and is applicable from 16 July 2020.	Site vist to GBAS & SBAS facilities organized by Japan during GBAS-SBAS ITF/5.
3 Technical issues							
3.1	Review of the previous ionosphere studies published in 2016 (also look at how to use SBAS coverage for GBAS)	HIGH	Expert Subgroup 3-1	2022/12/1	Closed	Coordination/harmonization with the ad hoc group of ICAO NSP GWG (GBAS Working Group) working on iono guidance for GBAS in low latitude regions.	At least GBAS guidance needs update to include GAST-D. ICAO NSP GWG is working on developling a manual on GBAS including iono mitigation. SBAS guidance should be reviewed, maybe to add some on DFMC SBAS.
3.2	Management of SBAS Channel	MEDIUM	States to contact ICAO to get the SBAS channel numbers as per SL 2019/87		Closed	Handled by ICAO HQ SL 2019/87 from ICAO to States to nominate contact point and then can access the ICAO tool	Already available on Information Sharing Platform
3.3	VDB frequency assignment and coordination in APAC	HIGH	Hong Kong China to coordinate with other States and ICAO	Next meeting	Closed	ICAO Doc 9718 is under revision to include VDB frequency compatibility criteria. To coordinate with Spectrum Review WG and Navigation System Panel (NSP). Mr Susumu Saito offered to help in coordination with NSP.	WP07 from HK in ITF/3 and WP09 from Cochair in ITF/4
3.4	ATC interface and NOTAM matters (both for GBAS and SBAS) (Ref essential navigation means in Annex 10 ??)	MEDIUM	ICAO/ WP and discussion for a future meeting	Next meetings in Dec2022		Based from ICAO provision and experience of other regions	To kepp it open
3.5	SBAS coverage extension to neighboring States (simulation, adding ground station and associated costs, certification,Service Level Agreement)	HIGH	States operating SBAS should present WP	Next meetings	Closed	India / USA are willing to contribute to this WP	India and USA prsented in ITF/3. Competed
3.6	GBAS and SBAS safety assessment	HIGH	States to share their experience	Next meetings		Presented by Australia on GBAS in ITF/3	GBAS Completed, SBAS Safety Assessment prsented by India in ITF/4(IP06). Some more input from States is required
3.7	GBAS SBAS performance demonstration (acc,int,avail,cont,time to alarm, data collection, simulation,…)	HIGH	States to share their experience	Next meetings		Also addressed in IGWG	States to respond
3.8	GNSS signal monitoring (legal recording,…)	MEDIUM	States to share their experience	Next meetings	Closed	Ref ICAO GNSS Manual	Already available on Information Sharing Platform
3.9	GBAS siting criteria	MEDIUM			Closed	EUROCAE ED114B and FAA Order 6884.1 (http://www.faa.gov/documentLibrary/media/Order/6884_1.pdf)	Already available on Information Sharing Platform

N	ACTION ITEM	PRIORITY	OWNER	DUE	STATUS	NOTES (ICAO Document ref)	Decision by the meeting
3.10-	Information to be provided in the flight plan and information into AIP	MEDIUM			Closed	ICAO DOC 4444	Already available on Information Sharing Platform
3.1	Final Approach Segment Data Block : 1) Tool to elaborate the FAS DB ; 2) How to validate FAS DB during the ground and flight inspection	MEDIUM	States to share their experience	Next meetings	Closed	Same for SBAS and GBAS? Ref Eurocontrol tool to create FAS DB : EUROCAE ED114B for GBAS	Competed
3.1	Phraseology	LOW			Closed	ICAO DOC 4444	Already available on Information Sharing Platform
3.1	Lack of PRN numbers for SBAS Geo Satellites	MEDIUM	Mainly for new SBAS providers		Closed	Annex 10 / NSP and receiver standards RTCA DO229F	Already available on Information Sharing Platform
3.1	Interference management (but this is not only specific to GBAS SBAS)	MEDIUM	States to share their experience		Closed		Refer to GNSS manual (Doc9849) on website
4 Quick guides and references							
4.1	ICAO and others document review (Top Down)	HIGH	ICAO / Website		Closed	Source : ICAO presentation given at the first workshop in ROK in 2019	Already available on Information Sharing Platform
4.2	Develop High Level guide on Implementation Process for GBAS and SBAS	HIGH	Expert Sub group 3-2	1st draft to be presented at the next meeting in March 2023	GBAS doc needs refinement, SBAS doc needs to be written.	What is already available from ICAO or from other regions ? Ref- GBAS Guide- ICAO SAM Region	Expert Sub Group 3-2 working on this
4.3	Technical support for system certification and operation certification	TBD		Next meeting in Dec2022		To be decided after meeting with regulators Linked with 1.2 and 3.6 above.	SBAS to be covered, States having experience to share
4.4	Complement the "PBN in a page"	LOW	ICAO to assess what could be done		Closed	https://www.icao.int/APAC/Documents/edocs/PBN-in-a-page%20V2.pdf GBAS is not part of PBN but rather comparable with ILS	Already available on APAC website
5 Training							
5.1	Develop syllabus for ATCOs	MEDIUM	To be confirmed	Next meeting			
5.2	Develop one day/two day training workshop for ATCOs (Use of GBAS/SBAS for approach and landing : mixity of traffic, ATC interface, Notam,...)	MEDIUM	To be confirmed		Closed		WP08-ATC perspective from Australia in ITF/4, IP05-ATSEP training for SBAS by JAPAN in ITF/4;WP04-USA on GBAS in ITF/4
5.3	Deliver a training module on GBAS and SBAS instrument flight procedure design	MEDIUM	ICAO TCB Flight Procedure Programme (FPP)			Training conducted by FPP on 13-17 July 2020	FPP is considering