International Civil Aviation Organization

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

(Tokyo, Japan, 21- 23 June 2023)

Agenda Item 3: Updates from States/Administrations about GBAS/SBAS Implementation

Australia's GBAS Implementation Experience

(Presented by Australia)

SUMMARY

This paper provides an update of Australia's experience with implementing GBAS and the number of GLS capable aircraft operating into Australian airports that are GBAS equipped.

1. INTRODUCTION

1.1 Australia has been one of the early adopters of Ground Based Augmentation System (GBAS) technology in the region.

1.2 A Honeywell SLS-4000 GBAS system was installed and commissioned in Sydney in May 2014 supporting CAT I operations.

1.3 This was followed by installation in Melbourne in May 2017 which included the provision of the 09 and 34 GLS approach which were the first ever precision approaches to these runways.

2. DISCUSSION

2.1 Based on industry feedback since November 2018, GBAS Landing System (GLS) is the expected approach method for capable aircraft flying into Sydney or Melbourne. Previously GLS clearance was provided on request by the pilot. Generally the GLS approach is seen as a more stable approach to fly from a pilot perspective.

2.2 Based on industry feedback, the GBAS Maximum Use Distance (Dmax) was extended from 23 NM to 50 NM. This was enabled through a change to the definition of Dmax in ICAO Annex 10, Volume 1, Amendment 91. Between 23 NM to 50 NM from the GBAS site, the GBAS guidance information is advisory only. This enhances pilot situational awareness by providing lateral deviation information without integrity and continuity assurances, provides an indication of GBAS station health and improves GBAS course capture at the limits of the Approach Service Volume.

2.3 Operational experience with the ground system over many years has yielded a few insights. The largest impact to system availability has 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 is offered by the manufacturer and is currently being investigated as a possible solution.

2.4 Subsequent to the commissioning of the 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 (the Conterminous United States (CONUS) ionosphere threat model is used in Australia). Observations of anomalous ionospheric gradients in the Australian mid-latitude region have been well within the parameters of the ionospheric threat model integrated into the CONUS.

2.5 Australia actively monitors changes to the GPS satellite constellation configuration and will 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 is exploring the option of implementing a region-specific Ionosphere Threat Model.

2.6 Australia has on occasions observed a reduction in GLS Service Availability due to satellite cross-correlation events. The cross-correlation events are primarily attributed to the geometry of the satellites relative to the location of the GBAS. The satellite cross-correlation events nominally result in the unexpected loss of a single satellite which in combination with the use of the CONUS ionosphere threat model can result in periods where the VPL exceeds the VAL impacting the availability of the GLS service.

2.7 A severe space weather event was observed across Australia on the 24 April 2023. During the event, the Australian Disturbance Storm-Time (Dst) Index reduced below -250 nano Tesla (nT). This was the first instance of the Dst reducing below -250 nT in the preceding decade. Based on feedback from Australia's space weather service provider, a reduction of the Dst index below -250 nT may lead to the formation of ionosphere gradients. There were no observed impacts on GBAS performance or pilot reports of anomalous GBAS behaviour during the event.

2.8 Melbourne Airport have been undertaking a series of runway resurfacing and airfield ground lighting works. During certain periods of the works, the runway 16 threshold is displaced. To facilitate a precision approach capability to the displaced threshold, Australia developed, implemented and validated a temporary GLS approach to the displaced threshold demonstrating the capability of the technology.

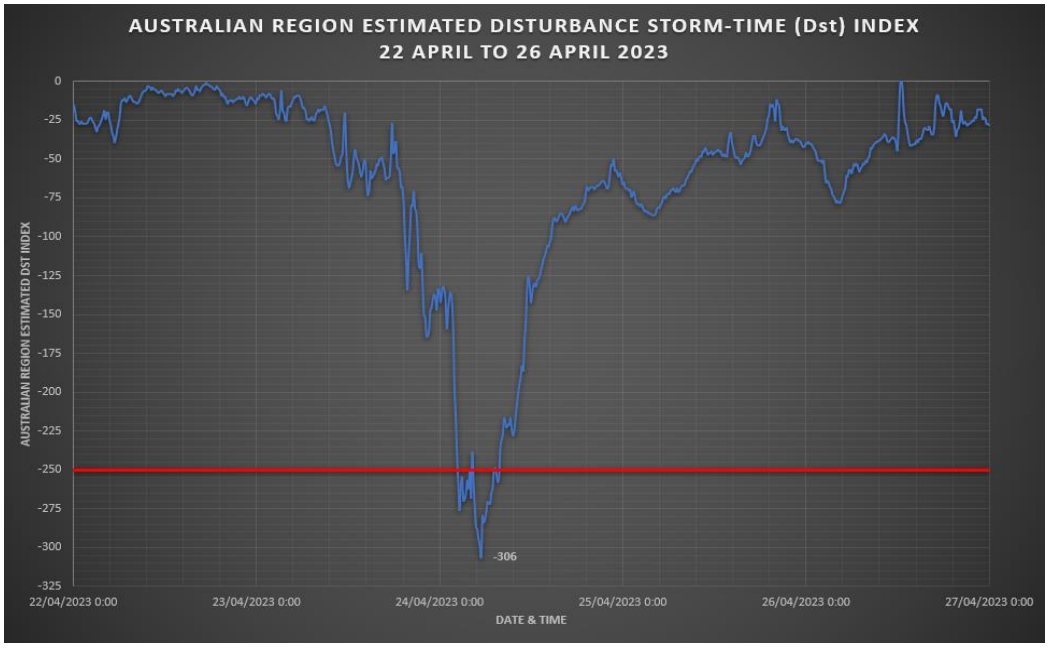

Figure 1 : Variation in the AusDst Index for the period 22 April 2023 to 26 April 2023 (AusDst data provided by the Australian Bureau of Meteorology)

FLEET EQUIPAGE ANALYSIS

2.9 An analysis of Field 10A (Communications and Navigation Equipment) of Flight Plan data for Sydney and Melbourne was performed to identify the number of GLS capable aircraft flying into these locations. An operator will annotate Field 10A with "A" to indicate GLS capability.

2.10 At the top level it is observed that 36% of Sydney arrivals and 45% of Melbourne arrivals are indicating GLS capability in their flight plan. These rates have risen year on year since tracking this data began.

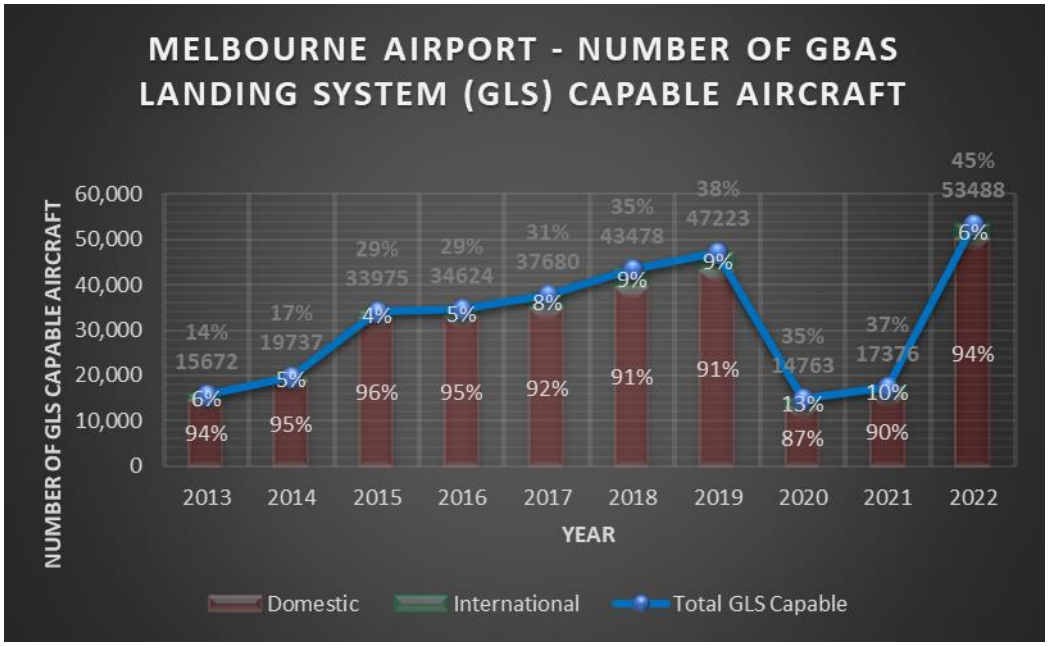

Figure 2 : Number of GLS Capable Aircraft landing into Melbourne Airport (YMML)

2.11 There is a rising trend in the Australian domestic fleet with more GLS capable aircraft being flown into Sydney and Melbourne. The increase is primarily attributed to domestic operators increasing the number of existing Boeing 737 aircraft with GLS capability operating into these aerodromes.

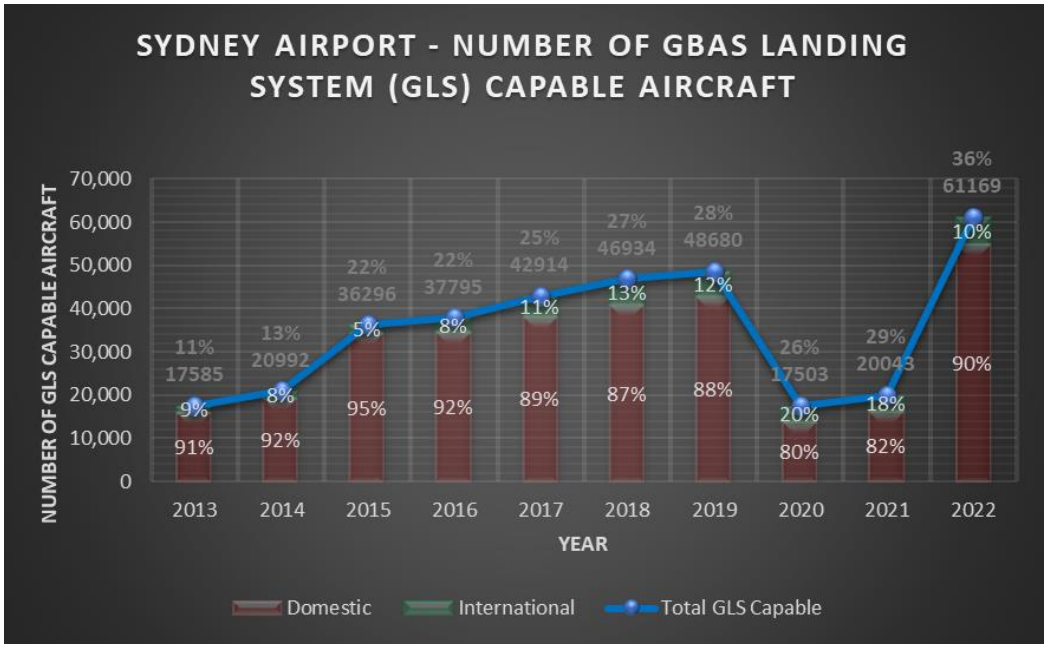

Figure 3 : Number of GLS Capable Aircraft landing into Sydney Airport (YSSY)

2.12 In the international sector, the rising trend is associated with key aircraft types such as the A350 and B787 which have been more popular with carriers for long haul sectors, and the A320neo on medium haul international routes.

2.13 Engagement with Australian carriers have indicated that they will continue to acquire aircraft with GLS capabilities.

2.14 There is demand from industry to utilise the GBAS beyond existing capabilities offered by the GAST-C system to support operations below Category I. Additionally, implementation of displaced thresholds and adaptive Glide Path angles to support operational efficiencies (reduced taxi times) are sought by carriers.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper; and

b) discuss any relevant matters as appropriate.