International Civil Aviation Organization

THE SEVENTH MEETING OF THE ASIA/PACIFIC GBAS/SBAS IMPLEMENTATION TASK FORCE (GBAS/SBAS ITF/7)

(Bangkok, Thailand, 14-16 May 2025)

Agenda Item 4: Updates from States/Administrations about GBAS/SBAS Implementation

GBAS STATUS UPDATE AND OPERATIONAL EXPERIENCES IN AUSTRALIA

(Presented by Australia)

SUMMARY

This paper provides an update on Australia's GBAS implementation, operational experiences, information on in-service observations in the preceding 12-month period, results from a review of the Ionosphere Threat Model and an update on the number of GLS capable aircraft operating into GBAS equipped airports in Australia.

1. INTRODUCTION

1.1 Australia continues to operate two Honeywell SLS-4000 GBAS systems, at Sydney and Melbourne airports, supporting Category I GBAS Landing System (GLS) approaches to all runway ends (six (6) at Sydney and four (4) at Melbourne).

1.2 The GBAS Maximum Use Distance (Dmax) is set to 50 NM at both airports. Between 23 NM and 50 NM from the GBAS site, the GBAS information is advisory only.

1.3 GBAS Landing System (GLS) continues to be the expected approach method for capable aircraft flying into Sydney or Melbourne. Generally, a GLS approach is seen as a more stable approach to fly from a pilot perspective.

2. OPERATIONAL EXPERIENCES

2.1 Prior to GLS becoming the expected approach method, a change was required to the Australian Air Traffic Management System. This was necessary to enable Air Traffic Control (ATC) to identify which aircraft are GLS equipped. The ATM system in Australia will automatically scan the Flight Plan for arriving aircraft and search for GLS capability. In the event GLS capability is detected, the arrival runway for that aircraft is highlighted in a different colour to the Approach Controllers. Figure 1 depicts the display to ATC when an aircraft is GLS capable (left) and is not GLS capable (right).The Controller retains the capability to either manually disable the highlight (should an operator not wish to fly a GLS approach) or enable the highlight (should an operator wish to fly a GLS approach, however did not indicate GLS capability in their Flight Plan).

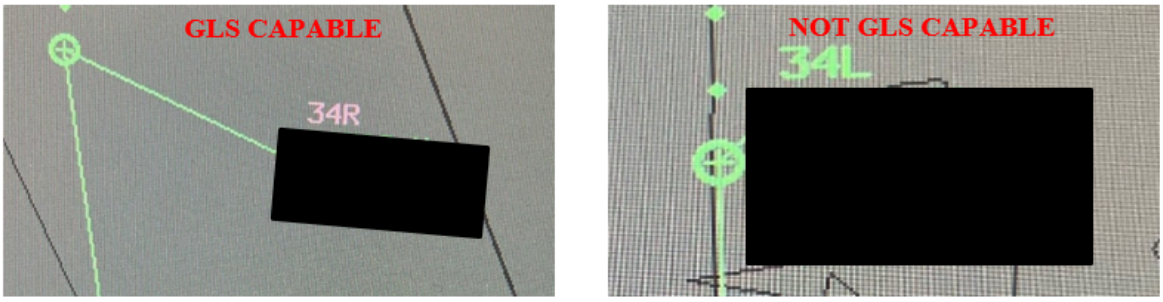

Figure 1 - Display to Air Traffic Control when an aircraft is GLS capable (left – arrival runway highlighted in magenta) and not GLS capable (right)

2.2 GLS Service Availability at one site was affected due to the unplanned loss of satellite PRN08 in combination with the decommissioning of satellite PRN21. Satellite PRN08 was being excluded due to a cross-correlation event with satellite PRN32. The cross-correlation event was occurring when satellite PRN08 was at a relatively low elevation angle of approximately 5 degrees. The unanticipated exclusion of PRN08 resulted in a short period each day where the Vertical Protection Level (VPL) was exceeding the Vertical Alert Limit (VAL) as depicted in Figure 2. This required a daily NOTAM to be published removing the GBAS from service during this short period the VPL exceeded the VAL.

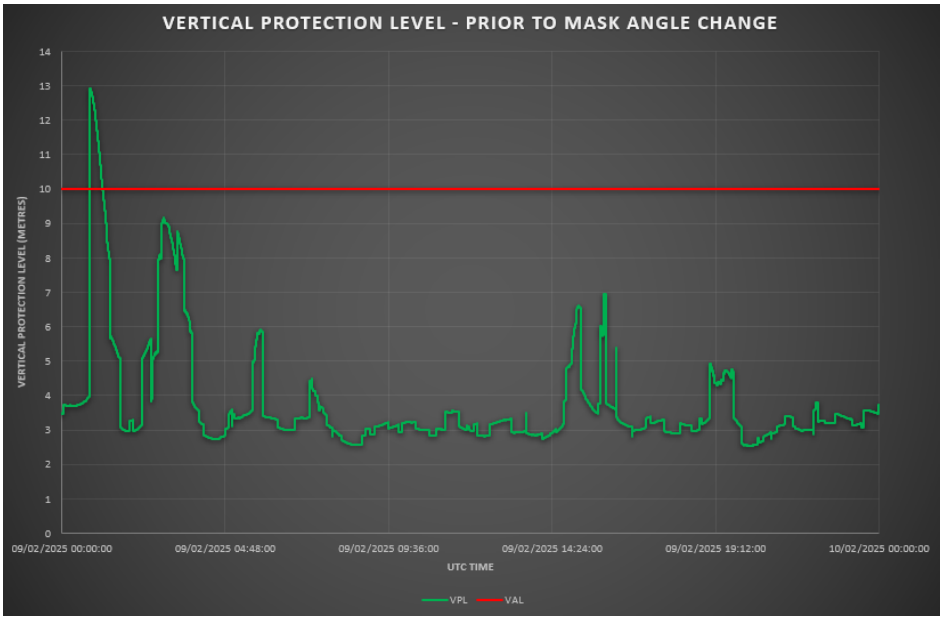

Figure 2 - VPL with satellite PRN08 excluded and 5-degree mask angle

2.3 To enable the GBAS to once again use satellite PRN08, the satellite acquisition mask angle was increased from 3° to 5° and the broadcast mask angle increased from 5° to 7°. By increasing the mask angles, the GBAS would essentially discard any data at which the cross-correlation event was occurring, thereby enabling satellite PRN08 to once again be available for use. Figure 3 depicts the reduction in the VPL with the re-introduction of satellite PRN08 and amended mask angles. Satellite PRN08 has not been excluded due to cross-correlation since the changes to the mask angles.

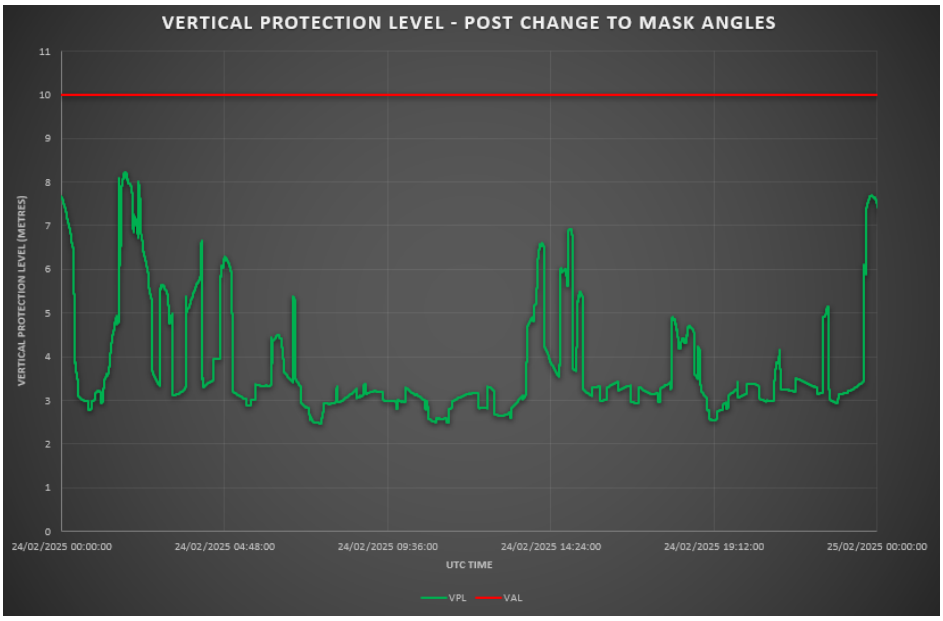

Figure 3 - VPL with satellite PRN08 available and 7-degree mask angle

2.4 In the preceding 12-month period, Australia's Space Weather service provider issued four Severe Space Weather 'Event In Progress' notifications for the Australian region (10/11 May 2024, 12 August 2024, 11 October 2024 and 2 January 2025). A Severe Space Weather 'Event In Progress' notification is issued when the Australian region Disturbance Storm Time (AusDst) Index reduces below a value of -250 nano Tesla (nT). Figure 4 depicts the variability in the AusDst over the period 10 to 17 May 2024 during which a significant Geomagnetic Storm was observed over the Australian region.

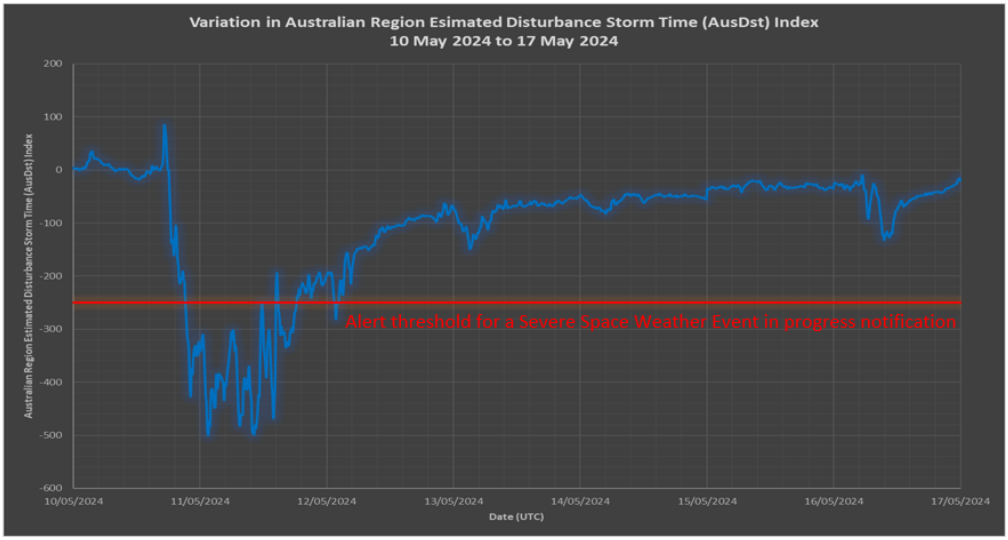

Figure 4 - Variation in the Australian region Dst Index during May 2024 Severe Space Weather Event

2.5 During all these severe space weather events, the GBAS ground station continued to operate normally. There was an observable increase in the number of code-carrier divergence events on the GBAS ground station resulting in the short-term exclusion of a satellite. However, in the majority of instances the VPL did not exceed the VAL even with the short-term exclusion of a satellite. There was only one instance of the VPL exceeded the VAL during these events. This occurred during the severe space weather event on the 11 October 2024 and was attributed to the short-term exclusion of satellite PRN23 due to a carrier rate event. During this period, multiple aircraft reported a loss of vertical

deviation indications on the approach. Satellite PRN23 was subsequently re-admitted for use shortly after the event with no ongoing effect on Availability.

3. IONOSPHERE THREAT MODEL REVIEW

3.1 With the increasing number of severe space weather events, Australia undertook a study to validate that the existing Conterminous United States (CONUS) Ionosphere Threat Model (which is currently used in Australia) continues to bound the worst cast anomalous ionosphere gradients observed at Sydney and Melbourne. A previous study, undertaken in 2010, concluded that the range of anomalous ionosphere gradients fell well within the bounds of the CONUS Ionosphere Threat Model.

3.2 For this analysis, the Long-Term Ionospheric Anomaly Monitoring Tool (LTIAM) was used to initially screen for potentially high ionospheric gradients. This was followed by a manual validation stage to validate the high gradients are attributable to the ionosphere.

3.3 The study concluded that the magnitude of anomalous ionosphere gradients since the last study was completed in 2010, fell well within the bounds of the CONUS Ionosphere Threat Model. Most anomalous ionosphere gradients were observed during the severe space weather events in May and October 2024 with the largest recorded gradient being 157.4 mm/km at Melbourne and 68.4 mm/km at Sydney.

3.4 Figure 5 and Figure 6 depict the magnitude of anomalous ionosphere gradients observed in the Melbourne and Sydney regions along with the CONUS Ionosphere Threat Model.

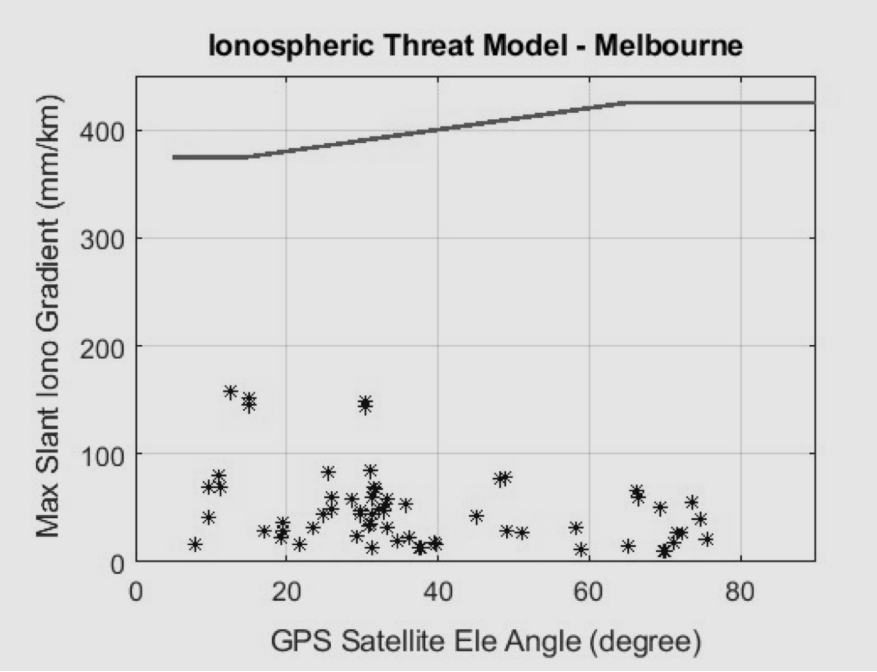

Figure 5 - Maximum Ionosphere Gradients recorded in the Melbourne region

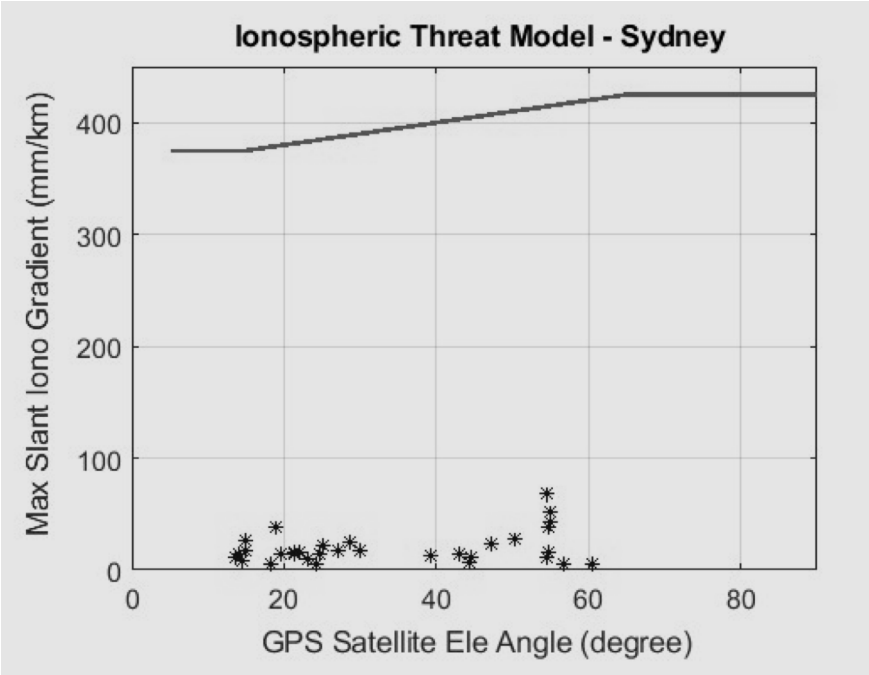

Figure 6 - Maximum Ionosphere Gradients recorded in the Sydney region

4. UPDATED FLEET EQUIPAGE ANALYSIS

4.1 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.

4.2 For the calendar year 2024, 47% of Melbourne arrivals (67,472) and 41% of Sydney arrivals (80,602) indicated GLS capability in their Flight Plan. This corresponds to an approximate 9% increase in the number of GLS capable aircraft arriving at these airports since 2023. Figure 7 and Figure 8 depicts the increase in GLS capable aircraft arriving at these aerodromes.

4.3 The increase in GLS capable aircraft is primarily attributed to an increase in the number of domestically registered A321neo aircraft and internationally registered A350 and 787 aircraft arriving at these locations.

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

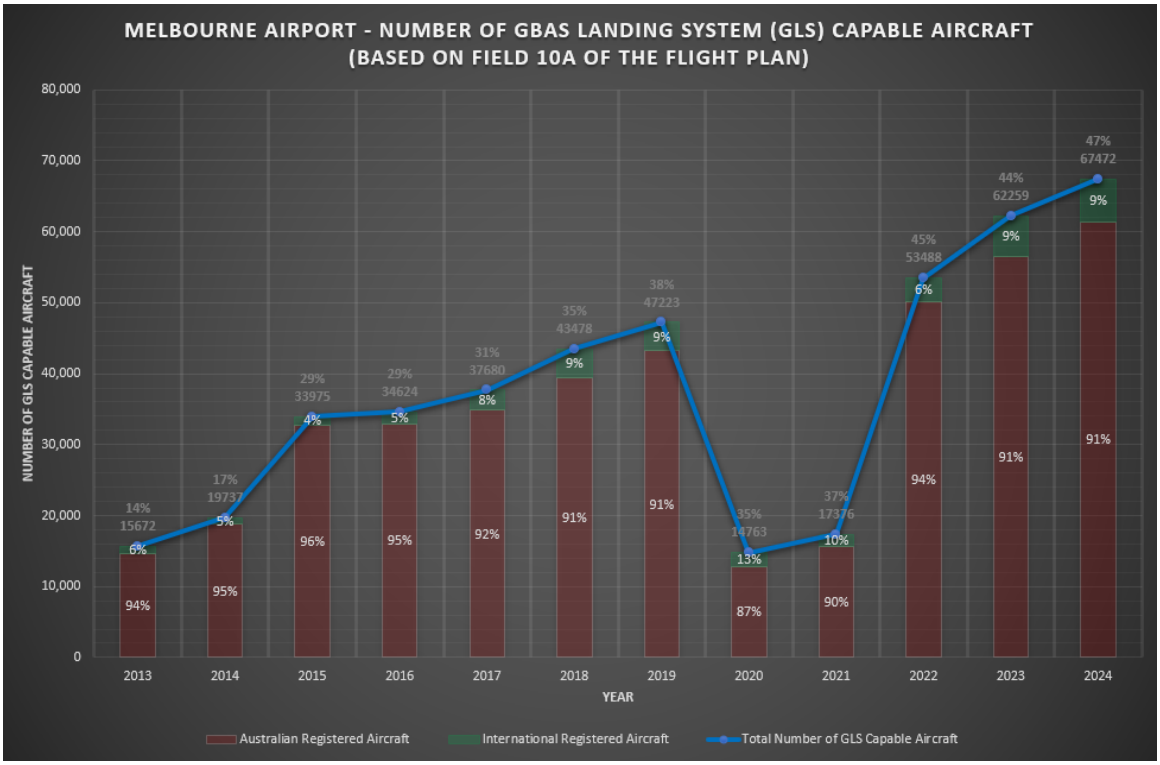

Figure 7 - Melbourne Airport - Number of GLS capable aircraft

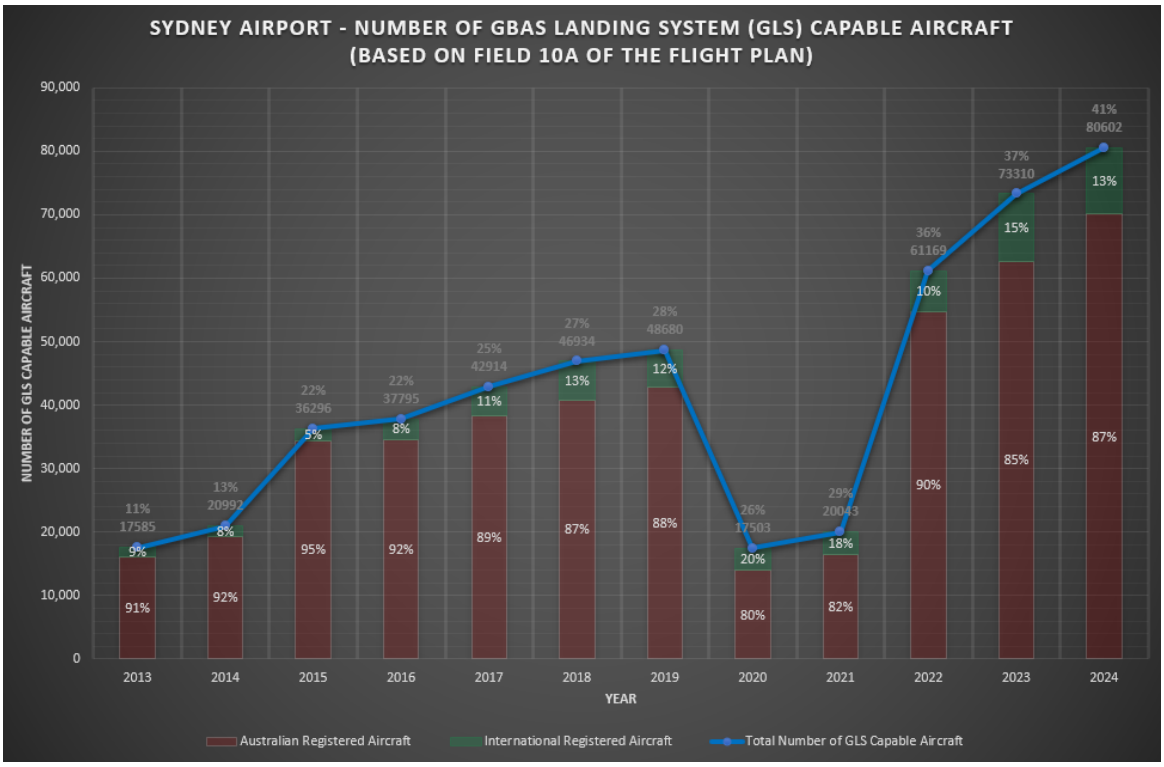

Figure 8 - Sydney Airport - Number of GLS capable aircraft

5. DISCUSSION

5.1 The meeting is invited to:

a) note the information contained in this paper; and

b) discuss any relevant matters as appropriate.

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