Australian Government
Geoscience Australia

Aviation Green Paper - Geoscience Australia feedback

Geoscience Australia welcomes the opportunity to provide feedback on the *Aviation Green Paper: Towards 2050* to highlight the opportunities that the Australian Government investment in the satellite-based augmentation system (SBAS) known as SouthPAN[1] can have on the Australian aviation sector.

SBAS is an aviation technology standardised by International Civil Aviation Organization (ICAO) that has been present in Europe and the US for more than a decade. A SBAS comprises reference stations, telecommunications infrastructure, computing centres, signal generators, and satellites that provide improved positioning and navigation services. The wide area broadcast capability gives SBAS a key advantage over other precision approach navigation aids like the Instrument Landing System (ILS) and Ground Based Augmentation System (GBAS), which only serve a single runway or airport, respectively. This presents an opportunity to provide a level of navigation performance at rural and regional aerodromes previously available only at major airports.

The Southern Positioning Augmentation Network (SouthPAN) is a joint initiative of the Australian and New Zealand Governments that provides SBAS services for Australia and New Zealand. Geoscience Australia as the Australian Government lead agency is working in collaboration with Toitū Te Whenua Land Information New Zealand on the development, deployment, and operation of SouthPAN for both countries; the first SBAS in the Southern Hemisphere. While SBAS is originally aviation technology, there are many other industry sectors that benefit from improved positioning and navigation services.

SouthPAN delivers three early Open Services across all of Australia, New Zealand and their maritime zones: L1 SBAS, Dual Frequency Multi-Constellation (DFMC) SBAS, and Precise Point Positioning Via SouthPAN (PVS). The L1 SBAS will be certified for safety-of-life use by aviation in Australia south of 20 degrees south latitude, expected from 2028.

SouthPAN is also a “next-generation SBAS”, which means that in addition to delivering an Open Service augmenting the GPS L1-C/A navigation signal, it will also transmit DFMC Open Service augmenting the GPS L1-C/A and L5 navigation signals, and Galileo E1 and E5a navigation signals.

A DFMC SBAS safety-of-life service would provide greater operational capability and regularity for regular passenger transport aircraft through relying on multiple constellations and frequencies rather than only the L1 signal. The aviation sector globally are working towards standardising DFMC services as the primary future SBAS with the ICAO adopting DFMC standards in March 2023.[2]

[1] https://www.ga.gov.au/scientific-topics/positioning-navigation/positioning-australia/about-the-program/southpan

[2] https://www.icao.int/Newsroom/Pages/GNSS-milestone-achieved-as-ICAO-Council-adopts-new-dualfrequency-multiconstellation-standards.aspx

The Australian Government has invested $1.4 billion over the next 20 years in SouthPAN, with economic benefits estimated at over $6 billion over thirty years[3]. Since early Open Services became available in September 2022, these benefits are starting to be realised. SouthPAN has been designed that should other countries seek to fund expansion of SouthPAN in the Asia-Pacific region, it would result in reduced ongoing costs of SouthPAN to Australia.

SouthPAN's economic, safety and efficiency benefits in the aviation industry are estimated at $282 million over 30 years[4]. The investment in SouthPAN provides flexibility and capability to how regional and rural aerodromes can be utilised and serviced in the future. In turn, the introduction of SouthPAN into regional airports will support the economic sustainability and growth of regional economies at the same time as increasing the safety of regional travellers and providing efficiency contributions to net zero. Additionally, Emergency Medical Services aircraft require a reliable navigation capability into rural and regional aerodromes.

The benefits of SouthPAN are derived from the ability of a SBAS-enabled avionics to provide continuous vertical guidance to the pilot during the approach and landing phase of flight. This new capability lowers pilot workload during a critical time - increasing safety - and allows the aircraft to safely get closer to the runway threshold before making visual contact - reducing the incidence of missed approaches and diversions.

These benefits are also recognised in the international aviation community, where ICAO has identified that runway aligned approaches are 25 times safer than circling approaches and the addition of continuous vertical guidance increases the safety by a further factor of eight.[5] ICAO member States ultimately adopted Resolution a37-11[6] to improve safety in the final phase of flight, including the statement "States…achieve implementation of approach procedures with vertical guidance (APV) (Baro-VNAV and/or augmented GNSS)…for all instrument runway ends…"

Instrument flight procedures that include continuous vertical guidance is available at a number of aerodromes in Australia using ILS, GBAS, and Barometric Vertical Navigation (Baro-VNAV), however the nature of these technologies means the air navigation services are typically provided only at major airports, and/or useable only by larger aircraft. There are a large number of aerodromes and runways across Australia where it will never be economically viable to install these technologies. For the Australian aviation community, SouthPAN is a cost-effective technology to meet the needs of aviation in rural and regional locations; and satisfies ICAO Resolution 37-11.

[3] See https://frontiersi.com.au/wp-content/uploads/2018/08/SBAS-Economic-Benefits-Report.pdf for estimates, methodology and limitations.
[4] See https://frontiersi.com.au/wp-content/uploads/2018/08/SBAS-Economic-Benefits-Report.pdf for estimates, methodology and limitations.
[5] https://www.icao.int/Meetings/AMC/Assembly37/Working%20Papers%20by%20Number/wp148_en.pdf
[6] See https://www.icao.int/safety/pbn/pbn%20references/assembly%20resolution%2037-11_%20pbn%20global%20goals.pdf

A large number of Instrument Flight Rules aircraft have been equipped with SBAS-enabled avionics since the GNSS fitment mandate[7] in 2016. While the mandate did not explicitly require SBAS-enabled avionics, many single-/twin-propeller, single-/twin-turbine, business jets, and rotary wing aircraft ultimately installed capable avionics due to the availability of such equipment on the market. While legacy Boeing and Airbus aircraft that make up the backbone of regular passenger transport are not fitted with SBAS-enabled avionics, the prevalence and government support for SBAS in Europe and the US means that next generation narrow- and wide-body jets are. This includes the Airbus A350, Boeing 737MAX, and Boeing 777X.

To completely realise these benefits the aviation industry needs early awareness and visibility of SouthPAN as well as certainty from Government of the investments in SouthPAN and landing procedures in aerodromes. These certainties will allow industry to take account of the availability of future SBAS technology when purchasing new aircrafts or avionics. As the Aviation Paper outlines, the Australian aviation fleet is ageing, therefore now is the ideal time for industry to upgrade to aircrafts with instruments supporting landing procedures utilising SouthPAN. In addition, regional and remote aerodromes will need support with how they can deliver the SouthPAN landing procedures to realise these benefits. A modest additional investment in SouthPAN would allow the expansion of vertical landing guidance procedures enabled by L1 SBAS across Australian aerodromes to provide future safety and efficiency improvements for aviation. This would be a matter for Government to consider any further investment.

The inclusion of DFMC SBAS as one of the SouthPAN Safety-of-Life services could put Australia at the forefront of emerging technology, and maximise the level of service available to all aircraft types—from two-seat single piston propeller to the most modern jet airliners. A certified DFMC will provide improved positioning for landing in locations where an active ionosphere means the availability of L1 SBAS would be low[8]. This will enable SouthPAN to improve the safety and efficiency of aviation in northern Australia above 20 degrees south latitude as in the Pacific region.

While SouthPAN was not funded for DFMC certification, only a modest additional investment could certify SouthPAN DFMC in Australia in the future. The key infrastructure components, including reference stations and satellites, will be in place. This would be a matter for Government to consider any further investment.

Finally, SouthPAN is also capable of supporting the safety and efficiency of future aviation technology such as Advanced Air Mobility (AAM) and drones. For example, Swoop Aero who were cited in the Aviation Green Paper are already utilising SouthPAN to support improved navigation of their drones. The economic benefits of AAMs and drones have not been included the estimated $282 million benefits of SouthPAN to the aviation industry.

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[7] Civil Aviation Safety Regulations Part 91 section 26.08 (previously in Civil Aviation Order 20.18) available at https://www.legislation.gov.au/Details/F2023C00346

[8] https://www.icao.int/airnavigation/Documents/NSP5_Report%20on%20Agenda%20Item%202.APPENDIX%20A3%20-%20DFMC%20SBAS%20Key%20Concepts.pdf