

30TH CIVIL GPS SERVICE INTERFACE COMMITTEE

Nashville, Tennessee

13-15 September 1998

International Session - Australasia/Pacific activities.

NAVIGATION SERVICES DEFINITION - TRANSITION TO THE GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS) IN AUSTRALIA

(Presented by Mr Graeme Crosby, Airservices Australia)

SUMMARY

This paper provides an update on the implementation of GNSS in Australia. It also provides advice on a new Airservices Australia (Airservices) project which will complete by June 1999 the evaluations necessary to define the future civil aviation navigation services to be provided in Australia over the next 15-20 years as well as assess their business potential.

1. Introduction

1.1 Satellite-based navigation is expected to provide significant operational benefits, such as enhanced safety in enroute and terminal areas, by reducing hazards related to uncertain position and by the provision of non-precision and precision approaches at non-equipped airports. In some cases, this technology will also reduce delays, provide for better airport and runway utilisation, and increase flexibility and efficiency of flight operations by reducing flight time and fuel required.

1.2 This form of navigation also has the potential to reduce the cost of providing services through the phased decommissioning of most, and possibly all, of the existing conventional ground-based navigation aid infrastructure.

2. Objectives

2.1 Airservices' GNSS objectives are:

- To achieve implementation of GNSS for civil aviation in the Australian Flight Information Region in a manner that brings early benefits to operators while in no way compromising safety. These developments are expected to lead to a progressive reduction on dependency of ground-based navigation aids.
- Oversee planning and implementation of the GNSS in Australia to provide continuous, reliable and accurate positioning information for all phases of flight.

3. Industry/Customer Consultation

3.1 The GNSS Implementation Team, or GIT, is the primary industry/customer consultative forum on GNSS issues. Meetings are hosted by Airservices normally in Canberra twice a year. Representatives from Airservices, the Civil Aviation Safety Authority(CASA), Department of Defence, Department of Transport and Regional Development, Bureau of Air Safety Investigation, Australian Maritime Safety Authority, Australian Surveying and Land Information Group, Universities and all levels of the aviation industry, including airport owners, participate. Representatives from other countries, such as Papua New Guinea, Fiji, New Zealand and the United States, are also regular and welcome participants. Sub-groups are used extensively to examine assigned GNSS/GPS planning and implementation issues and to provide Airservices and CASA with industry advice and recommendations on such issues.

4. Current GPS-based Operational Approvals

4.1 The current Instrument Flight Rules (IFR) Global Positioning System (GPS) operational approvals in Australia, which essentially still require the preservation of the existing ground-based navaid infrastructure as a "safety net", are as follows. These approvals are supported by comprehensive training material jointly developed by Airservices and CASA:

- (i) "supplemental means" enroute (implemented August 1994, by Aeronautical Information Publication Supplement (AIP SUP) H18/94);
- (ii) "primary means" enroute and GPS arrivals (implemented December 1995, by AIP SUP H50/95);

- (iii) “primary means” oceanic and remote areas (implemented 1 January 1998, by AIP SUP H2/98); and
- (iv) runway aligned, standalone, “supplemental means” non-precision approaches (NPAs) (implemented 29 January 1998, by AIP SUP H1/98). To date, twenty four GPS NPAs have been approved and implemented for IFR use, at locations such as Adelaide, Avalon, Brisbane, Cunderdin, Darwin, Devonport, Flinders Island, Gladstone, Goulburn, Horn Island, King Island, Moorabbin, Moruya, Smithton, St Helens, Strahan, Temora, Wollongong, Wynyard and Young. A further fifty are expected to be published in the AIP/Departures and Arrival Procedures (DAP) by December 1998.

5. RAIM Prediction Service

5.1 Aeronautical Information Circular (AIC) H20/98, dated 16 July 1998, provides details of the Australian GPS Receiver Autonomous Integrity Monitoring (RAIM) Prediction Service. This service, which was implemented during July 1998, is an enhancement to the pre-flight briefing services provided for those aerodromes with a GPS non-precision approach.

6. Navigation Services Definition - Transition to the GNSS Project

6.1 This project was approved by the Airservices Board on 22 May 1998 and will complete by June 1999 the evaluations necessary to define the future civil aviation navigation services to be provided in Australia over the next 15-20 years as well as assess their business potential.

6.2 The scope of this project will include the development of a business strategy for the provision, by Airservices, of future civil aviation navigation services, including infrastructure and engineering/operational services, to the Australian aviation industry. This will encompass aircraft operators, airport owners and other interested parties.

6.3 A *Global Navigation Satellite System (GNSS) Augmentation Systems Technical Audit and Cost Benefit Analysis* completed in March 1997, recommended GNSS augmentation in Australia to support “sole means” enroute, non-precision approach and Category 1 precision approach navigation capability. A summary report on the outcome of this major study is available.

6.4 Although this study, which identified an actual cost benefit analysis ratio of 2.73:1 (a raw ratio of financial benefits to costs), recommended a preferred sole means GNSS scenario, Airservices Australia management decided to continue to maintain a watching brief on several scenarios not regarded as being front runners against the civil aviation navigation operational requirements specified during this study. This was in light of the significance of the potential investment for Airservices Australia and our industry customers, emerging GNSS technological developments and ongoing research and

development activity, improvements in the continuity and availability of space segments, and expected trends in regulatory approvals.

6.5 The Airservices Australia *Augmentation System Test Bed Project*, which was completed on 30 June 1998, successfully evaluated a Special Category 1 “private domain” Local Area Augmentation System at Melbourne Airport (completed January 1998); initiated an evaluation of a similar system, with a different architecture, at Canberra Airport (equipment on six month loan); and successfully completed an initial evaluation of wide area augmentation, using reference stations at Alice Springs, Brisbane, Ceduna, Darwin, Hobart, a master control station at Canberra, and a very high frequency (VHF) datalink to uplink wide area correction messages (in the SBAS message format). The concept of utilising a terrestrial VHF network for the datalink is the basis for Airservices Australia’s proposal of a Ground-based Regional Augmentation System (GRAS), which the ICAO GNSS Panel has agreed to consider for future standardisation.

6.6 Under the *Navigation Services Definition - Transition to the GNSS Project* the feasibility of combining local and wide area augmentation, using a VHF datalink, and uplinking a wide area correction message, in the GBAS message format, are being evaluated. The ability of aircraft based augmentation systems (ABAS), e.g. multi-sensor systems, to satisfy the essential requirement of regional interoperability together with local civil aviation navigation operational requirements are also being assessed.

7. Issues

7.1 Current expectations are that ICAO will finalise and approve mid-term GNSS standards and recommended practices, covering enroute, non-precision approach and precision approach (to at least Category 1) during 1999. These standards should then be published for global application by late 2000.

7.2 Within the Australian Flight Information Region, the navigation infrastructure service currently provided by Airservices costs approximately A\$24 million annually to operate and maintain. It is primarily focused on the provision, maintenance and monitoring of ground-based navigation systems that support the level of air traffic management provided within particular airspace descriptions and classifications.

7.3 The Technical Audit and Cost Benefit Analysis provided a good basis from which to commence the development of a GNSS transition plan. The Augmentation System Test Bed Project has resulted in valuable analysis of local and wide area ground based augmentation systems and concepts. However, insufficient information was provided to support the development of sustainable safety case and business cases. Based on recent developments in aircraft-based and ground-based augmentation systems, it is Airservice’s expectation that a more practical and less costly solution to the satellite based augmentation GNSS scenario recommended in the 1997 study is now feasible.

7.4 The impact of major international strategic decisions expected to be made during 1998 and 1999, on items such as GNSS spectrum protection, GPS modernisation and the provision of additional civil frequencies, the possible need for GNSS requiring a “back-up” system, will also need to be assessed to ensure that the essential requirement for international compatibility and interoperability is achieved.

8. Scope

8.1 The proposed project will involve a final evaluation of the operational and technical feasibility of GNSS augmentation options to support up to “sole means” enroute, non-precision and precision approach navigation. It will provide the required analysis to complete a *Navigation Services Definition - Transition to the GNSS Plan* and supporting safety and business cases. This work will concentrate on evaluating appropriate aircraft, ground and satellite-based GNSS augmentation systems, including avionics, against their performance requirements and relevant transition planning issues such as regional interoperability.

8.2 This Plan will be developed by Airservices, in conjunction with the Australian Civil Aviation Safety Authority (CASA), Department of Defence, and industry, i.e. the aviation industry and airport owners. Consultation will also continue with other potential “multi-modal GNSS stakeholders”, such as the Australian Maritime Safety Authority (AMSA) and the Australian Surveying and Land Information Group (AUSLIG). The Plan will aim to deliver safe, responsive and efficient future navigation infrastructure service that is wholly or partly based on GNSS, and which to the maximum extent possible meets customer requirements. Associated markets and revenues for the services will be identified to permit a rigorous assessment of the business potential for future navigation services.

8.3 The project will also initiate the development of a framework for service and location specific charging for navigation services, both GNSS and terrestrial.

8.4 The main activities will involve the procurement of capital items, flight testing, data collection and analysis, and availability and performance evaluations.

9. Key deliverables

9.1 On completion of the project in June 1999, Airservices will have developed a future navigation services definition to customer and regulatory requirements. The resulting *Navigation Services Definition - Transition to the GNSS Plan* will incorporate both a safety case and an assessment of the business potential of the services.

10. Recommendation

10.1 The meeting is invited to note the information presented and to seek any clarification that may be required.