

ELEVENTH AIR NAVIGATION CONFERENCE

Montreal, 22 September to 3 October 2003

Agenda Item 6 Aeronautical navigation : issues

STATUS OF GROUND BASED REGIONAL AUGMENTATION SYSTEM STANDARDS AND RECOMMENDED PRACTICES

(Presented by Australia)

SUMMARY

In 1999, the Air Navigation Commission tasked the (then) Global Navigation Satellite Systems Panel (GNSSP) to develop Standards and Recommended Practices (SARPs) for an augmentation system based on very high frequency data broadcasts for wide area navigation purposes in areas where the use of the space based augmentation system (SBAS) might not be possible. The new system is known as the ground-based regional augmentation system (GRAS). Such a system utilises elements of SBAS and ground-based augmentation system (GBAS) to provide an enroute, terminal area and approach with vertical guidance navigation. At the 4th meeting of the GNSS Panel in May 2003, the text of the GRAS SARPs was agreed subject to final validation. That validation is well underway and, subject to agreement by the new Navigation Systems Panel (NSP), the GRAS SARPs will be presented to the Air Navigation Commission in late 2004 with an Applicability Date by the ICAO Council planned to be 1 November 2005.

1. INTRODUCTION

1.1 The Global Navigation Satellite Systems Panel (GNSSP) at its 3rd meeting (GNSSP/3) in 1999 agreed that a fourth augmentation system based on the global positioning system (GPS) satellite navigation constellation might be introduced. The meeting report indicated that the ground-based regional augmentation system (GRAS) might be used in areas where the space-based augmentation systems (SBAS) was not possible. The Standards and Recommended Practices (SARPs) were being written for the existing augmentation systems: satellite-based augmentation system (SBAS); ground-based augmentation system (GBAS) and aircraft-based augmentation systems (ABAS). The Air Navigation Commission subsequently

tasked the GNSS Panel to develop the GRAS SARPs (ANC Task No CNS-9401 2b) with an estimated completion date of 2002.

1.2 At the 4th meeting of the GNSS Panel in May 2003, the text of the GRAS SARPs was agreed subject to final validation. A GRAS Validation Subgroup has been established to complete the validation task. Several meetings will be held over the next nine months with the aim of presenting the completed validation to the Navigation Systems Panel Working Groups of the Whole meeting in May 2004. Assuming concurrence, the GRAS SARPs will then be progressed to the Air Navigation Commission and the ICAO Council. The aim is to have an applicability date of 1 November 2005.

2. GRAS OPERATION

2.1 Australia offered to build a GRAS test bed to facilitate the validation of the GRAS SARPs. The test bed initially demonstrated the GRAS capability. Recently the software was upgraded to be fully GRAS SARPs compliant allowing the full use of the test bed for validation purposes. The test bed has shown that GPS augmented by GRAS can provide enroute, terminal area and approach with vertical guidance navigation.

2.2 GRAS can use several techniques, including SBAS ground infrastructure, to gather GNSS integrity and differential correction information. The GRAS master control station software reformats the data to be compatible with the GBAS message format (additional message types are added) and broadcasts the data via very high frequency (VHF).

2.3 Coverage is where VHF signals can be received (approximately 200 NM line of sight). GRAS is not designed to provide global coverage, but rather regional coverage where the cost of SBAS is prohibitive to provide an augmentation system.

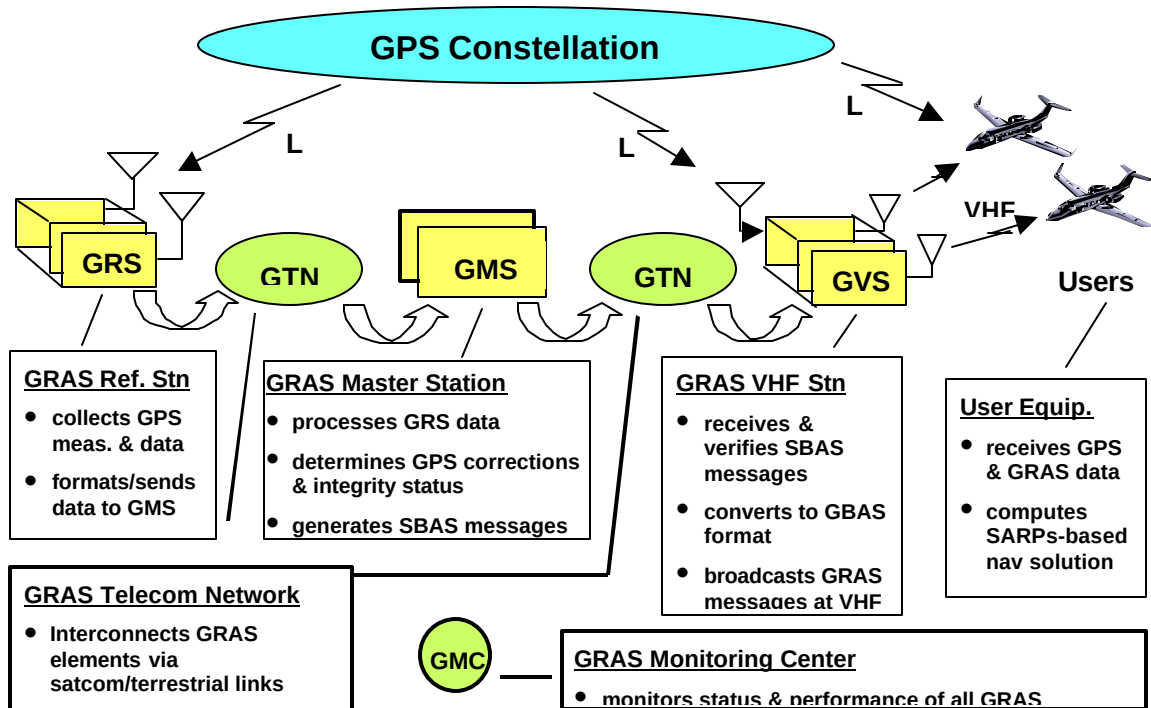
2.4 GRAS may be broadcast from multiple VHF outlets with overlapping coverage. The aircraft avionics selects the appropriate outlet by selecting either an outlet with the highest power level or the nearest outlet based upon geographic proximity.

2.5 While GRAS is designed for aircraft not fitted with flight management systems (FMS), its usage by FMS equipped aircraft is not precluded.

2.6 Some changes to the GBAS SARPs are required to accommodate GRAS. However these changes do not affect equipment being built for GBAS Category I systems.

2.7 Flight testing has shown that GRAS fully supports flexible routing, and variable geometry (curved) approaches.

2.8 GRAS has been developed to augment the GPS constellation, but can be easily adapted to accommodate GLONASS and Galileo constellations or the combined constellations. A schematic of how a GRAS system operates is in Figure 1.



3. CONCLUSIONS

3.1 GRAS is a viable and proven augmentation system for States in which SBAS is not possible or is not an economic solution. GRAS also provides sovereign control over GNSS integrity and correction data being used within a State's airspace in accordance with ICAO Document A32-19.

3.2 GRAS is well adapted to provide GNSS augmentation over regional areas where the high cost of SBAS is not warranted. The area of coverage can grow incrementally as demand increases.

3.3 The conference is invited to take into account the GNSS augmentation option soon to be available by GRAS when developing a transition strategy and regional planning, and also note the continued effort to standardize GRAS signals and services for civil aviation

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