CNS/COMM/5-IP/04
International Civil Aviation Organization 27/10/06
CAR/SAM REGIONAL PLANNING IMPLEMENTATION GROUP (GREPECAS)
Fifth Meeting of the CNS Committee of the GREPECAS ATM/CNS Subgroup (CNS/COMM/5)
Lima, Peru, 13 to 17 November 2006

Agenda Item 2: Navigation systems developments

STATUS OF THE U.S. WIDE AREA AUGMENTATION SYSTEM (WAAS)

(Presented by the United States)

SUMMARY

This information paper provides the most recent status of the United States Federal Aviation Administration's (FAA) Wide Area Augmentation System, or WAAS, including its current and future operational capability.

1. The Future of Navigation

1.1 Satellite navigation technology is already in use in the United States and around the globe as a navigation aid for en route, oceanic and remote airspace, and non-precision approach operations. The U.S. Global Positioning System (GPS) provides this service as an integral part of the International Civil Aviation Organization's (ICAO) envisioned seamless Global Navigation Satellite System (GNSS).

1.2 Satellite navigation, represented by GPS and its various augmentation systems under development today, provides significant flight safety and system capacity and efficiency benefits by making precision approaches possible at thousands of airports worldwide where no such capability exists today. The introduction of new, straight-in GPS approach procedures has reduced the need for procedure turns and circling approaches, thus providing a very reliable and accurate navigation system that dramatically improves safety over a Non-directional Beacon (NDB) approach or a VHF Omni-directional Range (VOR) approach when the VOR is not collocated with the runway.

1.3 The United States continues to aggressively work towards the operational implementation of GPS and its Wide Area Augmentation System (WAAS) and Local Area Augmentation System (LAAS) to complete the transition to satellite-based navigation.

2. Wide Area Augmentation System (WAAS) Background

2.1 The WAAS uses a network of ground reference stations (WRS), master stations (WMS), geostationary communication satellites (GEO), and GEO uplink stations (GUS) to augment the basic GPS service and provide increased accuracy, availability, integrity, and continuity of service to all properly equipped users in the U.S. National Airspace System (NAS).

2.2 WAAS was commissioned on July 10, 2003 for use in all phases of air navigation in the U.S. NAS. WAAS performance consistently demonstrates 1 meter horizontal and 1.5 meters vertical accuracy. WAAS provides users with the capability to fly approaches with vertical guidance throughout the U.S. NAS. WAAS capability also provides improved guidance to users in the en route and departure domains. Presently, over 900 LNAV/VNAV published procedures are available which WAAS capable aircraft can fly. LNAV/VNAV is an approach procedure with vertical guidance with nominal minimums of a 350 foot decision height, 1½-mile visibility, 556m horizontal alert limit (HAL), and 50m vertical alert limit (VAL). The WAAS service area is the continental United States and portions of Alaska.

2.3 In the fall of 2003, FAA improved the precision approach capability provided by WAAS through terminal approach procedures (TERPS) optimization. This improvement took full advantage of the capabilities of the WAAS Signal-in-Space and provided a new approach procedure with vertical guidance called LPV. LPV provides more lateral precision over LNAV/VNAV resulting in lower approach minima for most runways. LPV procedures have nominal minimums of a 250 foot decision height, ¾ mile visibility without proper lighting (½ mile visibility with proper lighting), 40m HAL, and 50m VAL. Currently, there are over 400 LPV procedures published which can be flown by WAAS equipped aircraft.

2.4 LPV and LNAV/VNAV approaches do not require any equipment beyond standard WAAS Technical Standard Order (TSO) avionics, and will make vertical guidance safety benefits accessible to the general aviation community, thus directly affecting flight safety for general aviation aircraft and other WAAS users.

3. WAAS Improvements

3.1 The FAA is working to increase the performance of the WAAS service/system.

3.2 The ground development piece of WAAS is based around the work needed to install new reference stations in Alaska, Canada, and Mexico and integrate them into the operational system. Four new Alaskan sites were installed in Fairbanks, Bethel, Kotzebue, and Barrow. These stations became operational on July 12, 2006, providing much better WAAS coverage in Alaskan airspace.

3.3 The U.S has been actively cooperating with Canada and Mexico on Space Based Augmentation System (SBAS) since the mid 1990's. This cooperation led to an agreement at the 9th meeting of the North American Aviation Trilateral. The United States, Canada, and Mexico agreed to "establish essential interoperable ATC functionality" and to "jointly develop regional satellite navigation systems". Negotiations between the FAA and the Mexican CAA and NavCanada commenced and resulted in international agreements on the scope of work in May 2004.

3.4 New Canadian sites in Gander, Goose Bay, Iqaluit, and Winnipeg are being installed and integrated into the operational WAAS. Actual installation of these new reference stations is occurring in two phases. The first two sites were installed in 2005 and the third site was installed in May 2006. The remaining site will be installed in August 2006. The first two sites are expected to become operational in 2007 followed by the remaining two in 2008. Once these sites become operational, it will have the effect of expanding the WAAS coverage in the Northeastern United States and a majority of the Canadian airspace.

3.5 Mexican expansions have been occurring concurrently with the Canadian sites. New sites were installed in Mexico City, Puerto Vallarta and Merida in 2005. Two more sites in Tapachula and San Jose del Cabo will be installed in August – September timeframe this year. The first three sites are expected to become operational in 2007 followed by the remaining two in 2008. These installations will provide WAAS coverage to the entire southern United States as well as much of Mexico.

3.6 Due to the long lead-time necessary to plan for, and secure, GEO satellite services, the FAA has been working for the past couple of years to ensure that WAAS is supported with redundant GEO services. The initial and critical goal was to provide a third GEO satellite on orbit as soon as possible to mitigate the single thread failure of the existing INMARSAT-III AOR-W and POR satellite solution. The FAA also sought to improve WAAS system availability (during GUS switchovers) and improve overall system coverage through more optimized GEO orbital locations.

3.7 In support of the GEO initiatives, the FAA awarded a contract to Lockheed Martin Air Traffic Management on March 5, 2003 to provide additional satellite services for the WAAS. This contract provides for a 24-month development of ground earth stations with the flexibility for the FAA to procure up to three payloads on satellite-leased communication services. Designed to support both the initial and final operating capabilities of WAAS, this contract also provides the FAA with flexibility in acquiring additional GEO assets to ensure uninterrupted GEO service and system reliability for all WAAS users.

3.8 Two new satellite communications payloads have been acquired to replace the aging INMARSAT satellites. PanAmSat, located at 133°W, was launched October 2005 and is scheduled to become operational October 2006. Telesat, located at 107°W, was launched in September 2005 with an anticipated operational date of April 2007. Both new satellites are optimally located and will provide dual coverage over the entire U.S. service volume.

3.9 The FAA continually monitors the WAAS system. In over two years of service, WAAS has provided coverage to roughly 99% of the Continental United States and been available 99.87% of the time. During this time frame, WAAS has never provided faulty data and continually exceeds performance expectations. Due to this record of performance, it has been determined that use of WAAS can be extended to fly vertically guided instrument approaches down to 200 feet above an airport and ½ mile visibility at existing precision instrument runways in the U.S. This will enable WAAS LPV procedures to achieve an operational capability similar to ILS where suitable airport infrastructure exists.

3.10 This increased benefit will be available to all users equipped with LPV-capable WAAS avionics. The expansion of this capability to as low as 200 foot minima at ILS airports is a major step towards reducing the ground-based infrastructure and reducing FAA's operating costs. The first procedures that allow operations down to 200 feet at ILS and non-ILS airports where existing infrastructure and airspace permit are to be published in 2007.

3.11 The completion of WAAS Full LPV is expected in the late 2008 time frame. At this time, the U.S. Government plans to incorporate a second civil frequency (L5 at 1176.45 MHz) will be more solidified.

4. Conclusion

4.1 The meeting is requested to note the material presented in this information paper, and consider its contribution to the implementation of a global satellite-based navigation system.

4.2 Attendees are invited to visit the FAA's GPS Product Team's website at http://gps.faa.gov for up-to-date WAAS program information.

- END -