International Civil Aviation Organization

NINTH MEETING OF THE COMMUNICATIONS/NAVIGATION/SURVEILLANCE AND METEOROLOGY SUB-GROUP OF APANPIRG (CNS/MET SG/9)

Bangkok, Thailand, 11–15 July 2005

Agenda Item 5: Navigation

STATUS OF THE US WIDE AREA AUGMENTATION SYSTEM (WAAS)

(Presented by USA)

SUMMARY

This information paper provides the most recent status of the United States Federal Aviation Administration's (FAA) Wide Area Augmentation System, or WAAS, and 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 700 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' 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' decision height, ¾ mile visibility without proper lighting (½ mile visibility with proper lighting), 40m HAL, and 50m VAL.

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 are expected to be operational in the first quarter of 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 scheduled to occur in two phases. The first site was installed in June 2005 with the second to be installed later this fall. The remaining two will be installed in the summer of 2006. Once these sites have 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 will occur at roughly the same schedule as the Canadian sites. New sites are scheduled to be installed in LaPaz, Puerto Vallerta, Mexico City, Merida, and Tapachula. The first three sites will be installed in the summer of 2005 with the remaining two occurring approximately a year later. 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 is 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 is also looking 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 The completion of WAAS Full LPV Capability (FOC) 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. When available for use, WAAS will incorporate L5 into its operation to upgrade the LPV capability available at full operational capability (FOC) to a GPS Landing System (GLS) capability. GLS is the Category I precision approach equivalent for GPS systems with aviation minimums of 200' decision height and ½ mile visibility (with proper lighting). GLS Capability is expected in the 2013 timeframe.

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.

– – – – – – – – – – –