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ELEVENTH AIR NAVIGATION CONFERENCE

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Agenda Item 6 : Aeronautical navigation issues

STATUS OF THE UNITED STATES WIDE AREA AUGMENTATION SYSTEM (WAAS)

(Presented by the United States)

SUMMARY

This information paper provides the status of the United States Federal Aviation Administration's (FAA) wide area augmentation system (WAAS), and its current and future operational capability.

1. OBJECTIVE

1.1 The wide area augmentation system (WAAS) uses a network of ground reference stations (WRS), master stations (WMS), geostationary communication satellites (GEO), and GEO uplink stations (GUS) to improve the Global Positioning System (GPS) standard positioning service and provide increased accuracy, availability, integrity, and continuity of service to all properly equipped users in the United States National Airspace System (NAS). Using measurements of GPS error at reference stations throughout the United States, WAAS computes corrections as a function of latitude and longitude that are broadcast through the appropriate geostationary satellite. WAAS corrections are suitable for improved navigation capability including provision of instrument approach with vertical guidance service throughout most of North America.

2. COMMISSIONING OF THE WIDE AREA AUGMENTATION SYSTEM (WAAS)

2.1 WAAS was commissioned for use in all phases of air navigation in the United States NAS including one class of instrument approach with both lateral and vertical guidance (lateral navigation (LNAV)/ vertical navigation (VNAV)) on 10 July, 2003. WAAS performance consistently demonstrates 1 m horizontal and 1.5 m vertical accuracy. WAAS initial operating capability (IOC) provides users with the capability to

fly approaches with vertical guidance throughout the United States NAS. This initial WAAS capability also provides improved guidance to users in the en route and departure domains. LNAV/VNAV is an approach procedure with vertical guidance with nominal minimums of a 350 ft decision height and 1¼ mile visibility. Over 700 LNAV/VNAV procedures have been published for WAAS operations. The WAAS service area is the continental United States and portions of Alaska.

3. WAAS POST-IOC IMPROVEMENTS

3.1 This September, the Federal Aviation Administration (FAA) improved the approach capability of WAAS through terminal instrument procedure optimization. This improvement is a new approach procedure with vertical guidance called LPV. LPV provides lateral approach guidance performance equivalent to instrument landing system (ILS) localizer performance. This is a significant improvement over LNAV/VNAV resulting in lower approach minima for most runways. LPV procedures have nominal minimums of a 250 ft decision height and ½ mile visibility with proper lighting.

3.2 LPV approaches, from a pilot's standpoint, will behave like an instrument landing system (ILS) approach and do not require any equipment beyond standard WAAS technical standard order (TSO) avionics. LPV will make the vertical guidance safety benefit accessible to the general aviation community, thus directly affecting the flying safety for general aviation aircraft and other WAAS users.

3.3 The FAA also plans to complete several other WAAS service/system enhancements in the post-IOC time frame. These system improvements are being made to increase the coverage area and to improve the availability of the signal in areas served by WAAS. These system enhancements include:

a) development and implementation of more efficient software monitor algorithms;

b) installation of additional WRSs to improve availability and coverage. Approximately 10 to 12 WRSs should be required. Discussions are underway with Mexico and Canada to determine the feasibility of installing some of the reference stations in those countries. The remaining WRS's are expected to be installed in Alaska.

c) procurement of additional GEO satellite communications links; and

d) equipment upgrades.

3.4 Due to the long lead-time necessary to plan for and secure GEO satellite services, the FAA has been working for several years to acquire redundant GEO signals in all areas served by WAAS. The initial goal is to provide a third GEO satellite on orbit as soon as possible after WAAS IOC to mitigate the single thread failure of the existing INMARSAT-III Atlantic Ocean Region — West (AOR-W) and Pacific Ocean Region (POR) satellite solution. The FAA also wants to improve WAAS system availability (during GUS switchovers) and improve overall system coverage through more optimized GEO orbital locations.

3.5 WAAS final operating capability (FOC), with LPV capability throughout its service area, is expected by December 2007. WAAS GLS (GNSS landing system) capability, will await the availability of the second GPS aviation frequency, L5 (1176.45 MHz). GLS is the Category I precision approach equivalent

for GPS systems with aviation minimums of 200 ft decision height and ½ mile visibility (with proper lighting). The current plan is, by 2013, enough GPS satellites with L5 capability will be on orbit so as to be operationally usable by aviation. The FAA plans to upgrade WAAS to use L5 prior to this time.

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