International Civil Aviation Organization

THE THIRD MEETING OF THE ASIA/PACIFIC GBAS/SBAS IMPLEMENTATION TASK FORCE (APAC GBAS/SBAS ITF/3)

(Video conference, 27-28 September 2021)

Agenda Item 3: Updates from States/Administrations about GBAS/SBAS Implementation

CROSS BORDER APPLICATION OF SPACE BASED AUGMENTATION SYSTEM (SBAS) TO SUPPORT TERMINAL APPROACH PROCEDURES

(Presented by United States)

SUMMARY

This paper presents an overview of the U.S. SBAS, Wide Area Augmentation System (WAAS), support of LPV and RNP procedure implementation in neighboring States Canada, Mexico, and in the Caribbean.

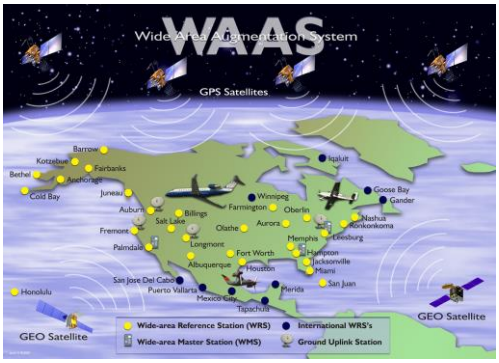
1. INTRODUCTION

1.1 Since its initial deployment in 2003, the U.S. Space Based Augmentation System (SBAS), known as the Wide Area Augmentation System (WAAS), evolved to expand precision navigation availability throughout North America and the Caribbean. Leveraging WAAS services outside U.S. airspace is a cost effective way for neighboring States to improve airport accessibility, navigation accuracy, and overall aviation safety. Asia Pacific States may consider this approach to achieve similar benefits.

2. DISCUSSION

2.1 WAAS Overview

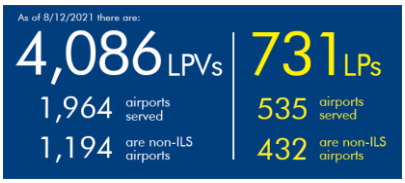
2.1.1 The WAAS system consists of a ground, space, and user segments. The ground segment consists of 38 Wide Area Reference Stations (WRS) as well as control and uplink centers; the space segment includes three Geostationary (GEO) satellites used to broadcast the information to the users; and the user segment, consisting in the users themselves.



2.1.2 WAAS collects GPS data using a network of reference stations to measure the real-time minor errors in the GPS signal and generate the SBAS correction and alerting messages which are transmitted to users via GEO satellites.

2.1.3 On July 10, 2003, the WAAS system was certified for safety-of-life aviation, covering 95% of the

contiguous U.S. and part of Alaska. In 2007, the U.S. expanded the system by adding 13 additional reference stations (4 Alaska, 5 Mexico, 4 Canada), an additional master station and additional GEO satellite redundancy to improve availability and coverage. In its current configuration, WAAS can support en-route, terminal and approach operations in the U.S., Canada, Mexico and the Caribbean.

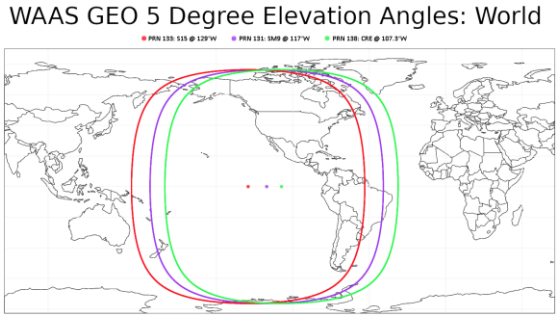


2.1.4 Using WAAS, suitably equipped aircraft have all weather access to over 4,000 runway ends in the U.S. and 600 in Canada with Localizer Performance with Vertical (LPV) guidance minimums as low as 200 feet. Today the U.S. has twice as many WAAS procedures (LPVs and LPs) as there are ILS glide slopes.

2.1.5 WAAS LPVs provide similar level of service to Category I Instrument Landing System (ILS). These potential minima are better than conventional (e.g. VOR, NDB) non-precision approaches. As the approaches are RNAV based, WAAS supported LPVs are designed to avoid terrain and other obstacles and may provide lower cost access to runways deemed unsuitable for an ILS.

2.2 Cross Border Service Expansion

2.2.1 Following the success of WAAS development, the U.S. recognized the footprint of the GEO satellites provided coverage over most of North America and the Caribbean. The FAA offered and entered service agreements with Canada and Mexico to install additional reference stations to improve and extend service performance for the U.S. and these neighboring States.



2.2.2 The U.S. provides reference station equipment while the host State provides infrastructure support and continuing maintenance support. The U.S. provides overall system maintenance and upgrade support in the form of formal system "releases". Canada and Mexico provide onsite maintenance support for their respective reference stations, as needed, for these releases.

2.2.3 The decision on how to leverage WAAS services performance are established by the host Civil Aviation Authority (CAA) and generally take consideration of their own user equipage case. Individual service providers are required to certify services within their own airspace. The U.S. provides the host CAA, users, and public access to real-time and historical system performance data to support use cases.

2.3 Performance Analysis and Monitoring

2.3.1 Performance monitoring is a critical component to assuring a reliable system and supports decision making by CAAs on the appropriate use of WAAS. The U.S. hosts a publically accessible WAAS Test Team website (https://www.nstb.tc.faa.gov/index.htm). In addition to real-time data and most recent 24 hour system performance, it also hosts 15 years of monthly GPS report cards and over 20 years of GPS and WAAS quarterly performance reports.

FAA WAAS Test Team Website Provides:

Real-Time Plots: WAAS LPV, WAAS RNP, WAAS Satellite Status, WAAS IGP Status, SPS PDOP SPS Dual Freq L2C,

Daily 24-Hour Plots; WAAS (LPV, LPV200, LP, RNP 0.3, RNP 0.1), SPS (Max PDOP, RAIM)

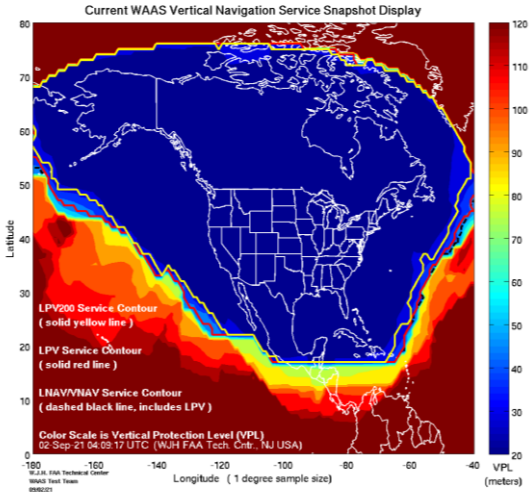
Real-Time Data: WAAS (Satellite Corrections, GEO Footprint), IGP Delays

Performance Videos: WAAS (LPV, RNP, Satellite Status), IGP Status, SPS PDOP

Quarterly Performance Reports: WAAS PAN, GPS PAN

GPS and WAAS Archives

Coverage and Status Maps: WAAS, GAGAN, EGNOS, and MSAS



2.3.2 In 2000, the U.S. has committed to providing all users unrestricted GPS capability. This decision resulted in ubiquitous use of precision navigation and timing in many areas including aviation. Consequently, U.S. recognizes that most States do not deploy satellite navigation constellations and have limited expertise in the field. In addition to providing the information above, the WAAS Test Team website includes links to other related sites to educate and inform regulators and users of the many unique issues associated with space based navigation and augmentation. Some have chosen to utilize WAAS to its full LPV-200 capability while others apply the same signal to a lower performance standard. The choice is left to the host State.

2.4 Extension of U.S. WAAS services to our neighboring States has improved the performance and reliability of the system. It has also provided a low cost option for augmented GNSS navigation guidance to the entire continent. This has improved all weather access and safety at airports unsuitable for ILS installation. The U.S. is willing to share its experience with States interested in expanding their own SBAS or establishing SBAS capability based on existing systems.

3. ACTION REQUIRED BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this papers;
b) discuss any relevant matters as appropriate; and
c) consider expansion of current SBAS to provide additional regional coverage.

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