



GBAS – Frequently Asked Questions

What is GBAS?

A Ground Based Augmentation System (GBAS) augments the Global Positioning System (GPS) used in U.S. airspace by providing corrections to aircraft in the vicinity of an airport in order to improve the accuracy of, and provide integrity for, these aircrafts' GPS navigational positions. The goal of GBAS implementation is to provide a satellite-based alternative to the Instrument Landing System (ILS) supporting the full range of approach and landing operations.

What is LAAS?

GBAS is an International Civil Aviation Organization (ICAO) standardized system for local area differential systems. The U.S. version of GBAS was initially referred to as the Local Area Augmentation System (LAAS). Several historical FAA and RTCA documents still retain the LAAS terminology. While the terms are synonymous, the FAA has migrated to the ICAO term GBAS.

What is GLS?

According to FAA Order 8260.19, Flight Procedures and Airspace, GBAS Landing System (GLS) is the FAA's official term for a GBAS instrument approach procedure. The term GLS appears on every GBAS approach chart.

What is the difference between GBAS and GLS?

GBAS is the name of the navigation system which provides precision GBAS corrections from a ground-based transmitter. GBAS corrections can provide position, navigation, and precision approach services. GLS is the name assigned to the instrument approach procedure/capability provided by GBAS.

What are the benefits of GBAS?

GBAS has several advantages in comparison to traditional ILS. One GBAS station can support multiple runway ends and reduce the total number of systems at an airport. This reduces the Very High Frequency (VHF) requirements and simplifies airport infrastructure. Unlike ILS — which requires one frequency per system — a GBAS only requires one VHF assignment for up to 48 individual approach procedures. The GBAS has more flexible siting criteria, allowing the GBAS to serve runways which ILS is unable to support. A GBAS is sited to minimize critical areas which place fewer restrictions on aircraft movement during ground taxi and air operations. The GBAS approach guidance is steadier than ILS approach guidance. Also, GBAS requires less frequent flight inspections compared to those required of ILS systems.

What equipment does a GBAS have?

A GBAS ground facility typically has three or more GPS antennas, a central processing system (i.e., a computer), and a VHF Data Broadcast (VDB) transmitter all locally situated on or near an airport. GBAS airborne equipment consists of GPS antenna(s), a VHF antenna, and associated processing equipment. Multi-Mode Receiver (MMR) technology allows simultaneous implementation of GPS, GBAS and ILS using common antennas and hardware. The GBAS uses the VHF radio link to provide aircraft with GPS corrections, integrity, and approach path information. More information about how GBAS works is available on the FAA Navigation Services – GBAS – How It Works web page link:

http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/navservices/gnss/laas/howitworks/

What are “GAST-C” and “GAST-D”?

The GBAS Approach Service Type (GAST) is a nomenclature which describes the level of service provided by a specific GBAS facility. GAST-C and GAST-D define requirements based on single-frequency augmentation. GAST-C is intended to support precision approach operations in CAT-I minima and GAST-D is planned to support operations up to Category III (CAT-III) minima. Note: A combination of factors determines the flight minimums authorized for a specific approach and aircraft.

Are any GBAS systems approved for Precision Approach operations?

Yes, the SLS-4000 supports Category I (CAT-I) Precision Approach operations. The Honeywell International SLS-4000 SmartPath® Landing System received System Design Approval (SDA) from the FAA in September 2009. Honeywell developed an upgrade (Block I) which improves operation when exposed to radio frequency interference; this received FAA SDA in September 2012. Honeywell developed a second upgrade (Block II). Block II improves availability, adds an optional ionosphere monitoring capability using SBAS, and adds flexibility to set regional integrity parameters subject to local regulatory approval. The Block II upgrade received FAA SDA in October 2015.

What is the FAA's implementation plan for GBAS?

The FAA has no plans to procure GAST-C GBAS. The Honeywell Int'l SLS-4000 GAST-C/CAT-I system is currently being implemented in the NAS a non-Federal navigation aid. Non-federal navigation aids may be purchased and maintained by airports, cities, and/or private entities for either private or public use. In order to ensure public safety, the FAA retains the power to approve or not approve these non-Fed systems and perform annual inspections.

Are there special requirements and associated certifications needed related to the installation of a GBAS at an airport?

Yes. GBAS has some siting, licensing, and certification requirements. GBAS has more flexible siting requirements than ILS in that it is not aligned to a specific runway. Manufacturer guidance and FAA Order 6884.1, Siting Criteria for GBAS, identify specific siting requirements. GBAS requires a Federal Communications Commission license and frequency assignment for the VDB transmitter, as well as a Site Acceptance Test, a Flight Check, and non-Fed approval. These requirements are similar to ILS.

Where are public operational GBAS systems located?

Currently, two U.S. locations have obtained operational approval for public GBAS use and support revenue airline traffic. These stations are located at Newark Liberty International Airport (EWR) and Houston George Bush Intercontinental Airport (IAH). Internationally, airports that have GBAS installations supporting revenue operations include Bremen and Frankfurt in Germany, Sydney Australia, Malaga Spain, Zurich Switzerland and 15 Russian locations.

Are there any private GBAS systems in operation?

Yes, some private companies have installed systems for use in the development and certification of aircraft and avionics (e.g., the Honeywell test facility at Olathe, Kansas). In some cases, the private companies have obtained FAA operational approval for Instrument Flight Rules operations to CAT-I decision heights. The Boeing Company's Honeywell SLS-4000 installation at Moses Lake, Washington (MWH) is an example of such an installation.

What aircraft have GBAS equipage?

GBAS is available on many new transport aircraft models. GBAS equipage is standard on Boeing 747-8 and Boeing 787 aircraft. GBAS is an option on Boeing 737-Next Generation (737-600/-700/-800/-900), Airbus A320, A330/340, A350, and A380 aircraft.

Are airlines using GBAS?

Yes. Many airlines have operational approval to fly GLS in the United States. These include United Airlines, Delta Airlines, British Airways, Emirates Airlines, Lufthansa, and Cathay Pacific. Additional airlines fly GLS internationally, including Qantas, TUIfly, Swiss Air, Air Berlin and various Russian airlines.

What GBAS avionics are available?

At least two manufactures have FAA approved GBAS avionics. These are Rockwell Collins (the Multi-Mode Receivers (MMR) GNLU 925 and GNLU 930) and Honeywell International (Integrated Navigation Receiver (INR)). The FAA's Technical Standard Order (TSO) C161a, Ground Based Augmentation System Positioning and Navigation Equipment, provides approval criteria for the GBAS avionics navigation function, while TSO-C162a, Ground Based Augmentation System Very High Frequency Data Broadcast Equipment provides the approval criteria for the data link equipment.

What GBAS developmental work is ongoing in the FAA?

The FAA and other States are in the process of validating proposed ICAO GAST-D standards to support CAT-III precision approach operations. The FAA has supported this effort thru commercial prototyping contracts and participation in the ICAO Navigation Systems Panel (NSP) GBAS Working Group (GWG). The FAA expects ICAO GAST-D Standards and Recommended Practices (SARPS) will be approved in 2016 for publication in 2018.

When is a GAST-D (CAT-II/III) GBAS system expected to be available?

The FAA is currently supporting a non-Federal applicant's request for System Design Approval (SDA) for a GAST-D GBAS. The FAA currently projects that this SDA will be finalized in 2019. As a non-Federal system, the final schedule is conditional on the vendor's development schedule and desire to continue the project based on customer demand.

Is the FAA collaborating with airlines and industry on the GBAS development effort?

Yes. The FAA has agreements with United Airlines, the Port Authority of New York and New Jersey (PANYNJ), Houston Airport System (HAS), and the Boeing Company to gain operational experience with existing CAT-I GBAS systems. The knowledge gained from these operational systems is helping the FAA better define the GAST-D GBAS system and provide realistic operational costs and benefits which will be used to make future decisions regarding GAST-D GBAS acquisition.

How is GBAS different than WAAS?

GBAS and Wide Area Augmentation System (WAAS) are both GPS augmentation systems. However, GBAS and WAAS differ in approach and infrastructure, resulting in different capabilities. WAAS uses a network of spatially separated reference stations to make multiple simultaneous measurements of GPS satellites. The multiple simultaneous measurements support the calculation of individual correction of ephemeris (orbit), clock, and ionosphere delay. The corrections are broadcast by a geostationary satellite using the L1 frequency, enabling the use of the same GPS antenna to receive the corrections. GBAS makes GPS measurements at the local airport it serves and averages measurements from multiple antennas to minimize the potential error. GBAS broadcasts the GPS corrections using a VHF data link to the region around the airport, resulting in timely receipt of sufficiently accurate corrections potentially good enough to support operations to CAT-III minima.

Can the same avionics be used for GBAS and WAAS?

The GBAS and WAAS standards are different and initial avionics and integrations only supported one of the two capabilities. Emerging aircraft integrations can support both services (e.g. A350).

Where can I find a concise and high-level handout that provides information about GBAS?

Please see our GBAS fact sheet on the faa.gov web page link:

http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/navservices/gnss/library/factsheets/

The Ground Based Augmentation System (GBAS) program is managed by the FAA's Engineering Development Services Division, Navigation Branch and ANG-C32 at the FAA William J. Hughes Technical Center. More information can be found at <http://laas.tc.faa.gov/>.