

GBAS on the Move

2014 saw an increase in both the operational use and interest in the Ground Based Augmentation System (GBAS). United Airlines, Delta Airlines, Emirates Airlines, Lufthansa, Cathay Pacific, and British Airways have all benefited from GBAS over the last year.

United Airlines

In November 2014, United Airlines hit a milestone of 1,000 GBAS Landing System (GLS) approaches at George Bush Intercontinental Airport (IAH) in Houston, Texas and at Newark Liberty International Airport (EWR) in Newark, New Jersey. This is the number of approaches at both airports combined since United gained initial GBAS operational approval. United Airlines is using GLS on a regular basis with Boeing 737s (currently operates 95 737 GLS-capable aircraft) and Boeing 787s (currently operates 14 787 GLS-capable aircraft). Additionally, all new 737s purchased by United will be GLS-capable. GLS capability comes standard on 787 aircraft. United flies an average of 65 to 70 GLS approaches each month.

Delta Airlines

In December 2014, the Houston Airport System (HAS) announced "GBAS Groundbreaking Technology Continues to Take Flight at Bush Airport" as Delta Air Lines pilots, Captain Mike Spicuzza and First Officer Jim West, completed the airline's first GBAS landing in one of Delta's Boeing 737 aircraft. (More and more airlines operating from IAH are using GBAS).

Delta Airlines has made a conscious decision to implement GLS capability into their fleet. In 2014, Delta Airlines operated 42 GBAS-equipped 737 new generation (NG) aircraft. Delta is also investigating GBAS equipage for their Airbus fleet. Delta could have 177 GLS-capable aircraft (combination of Boeing and Airbus) by 2019.

Emirates Airlines

Emirates conducted their first GLS landing in Houston on December 3, 2014 with the Airbus A380. All of the Emirates Airlines' A380 aircraft (57 as of December 2014) are GLS-capable and fly the GLS approach where available. Currently, this includes approaches into Sydney, Australia; Frankfurt, Germany; Zurich, Switzerland; and now into Houston.

Lufthansa

Lufthansa's first GLS landing in Houston was December 8, 2014 with the Airbus A380 aircraft. All of Lufthansa's A380 aircraft (12 as of December 2014) are GLS-capable and perform GLS approaches into Sydney, Frankfurt, and Houston.

Cathay Pacific

Cathay Pacific's first GLS landing in Houston was on January 30, 2015 with a Boeing 747-800 aircraft.

British Airways

British Airways is flying GBAS-equipped B787s into Newark.

More and more airlines are equipping with GBAS-capable aircraft and will take advantage of flying GLS approaches into Newark and Houston. To fly GLS in the U.S. National Airspace System (NAS), non-U.S. airlines will need an operational specification (Ops Spec) approval by the FAA. So far, British Airways, Cathay Pacific, Emirates, and Lufthansa have achieved this approval. Virgin Atlantic is also planning to go through the approval process for their 787 aircraft in order to fly GLS approaches into Newark.

Worldwide Operational Implementation

More GBAS locations around the world are reaching operational status and airline operations using GBAS are increasing as additional GLS-equipped aircraft are entering service for the various airlines. Boeing has confirmed that many of the customers who have ordered multiple 787s, 747-8s, or 737s have publically stated their intentions of using the GLS capability on these aircraft. Today, there are over 1,000 Boeing GLS-equipped aircraft in use and this number is growing by an estimated 25 airplanes per month. This estimate is based upon current production rates – one third of 737s are being equipped with the GLS option. GLS is standard on 787 and 747-8 aircraft.

The list below provides a summary of the airlines using GBAS and the airports where GLS approaches are flown on a regular basis.

U.S. Carriers

- Delta Airlines – Houston, Newark
- United Airlines – Houston, Newark

Non-U.S. Carriers

- Air Berlin –Bremen, Malaga
- British Airways –Newark
- Cathay Pacific – Houston, Sydney (plans for Newark in the future)
- Emirates Airlines – Frankfurt, Houston, Sydney, Zurich
- Lufthansa – Frankfurt, Houston
- Qantas – Sydney
- Swiss Air – Zurich
- TUIfly – Malaga

Various Russian airlines (S7, Transaero, Utair, Sakhalin Energy, Gaspromavia Russia) - 15 GBAS locations in Russia have been approved with each airline using different airports (Domodedovo, Pulkovo, Tyumen, Ostafyevo, Nogliki and others)

The commitment to GBAS development and implementation continues to grow. This is visible by new airline interest and plans to implement GBAS in additional locations:

- Dubai, United Arab Emirates
- Chennai, India
- Gimpo, South Korea
- London Heathrow, United Kingdom
- Melbourne, Australia
- Oslo, Norway
- Rio de Janeiro, Brazil
- St. Helena, United Kingdom

Next Steps

The GBAS program is now focused on validating standards for a GBAS Approach Service Type-D (GAST-D) which will align with Category (CAT) III minima service. The program currently projects that a GAST-D GBAS system can be available in 2018.

FAA flight testing at the FAA Technical Center in Atlantic City, New Jersey and Single European Sky ATM Research (SESAR) flight testing at Toulouse, France, and Frankfurt, Germany has proved that a reliable alternative to an Instrument Landing System (ILS) signal can be produced

with a Global Navigation Satellite System (GNSS) constellation and a single-frequency input signal.

SESAR is also exploring the potential for a future extension of the project for multi-constellation, multi-frequency GBAS. This would lead to an even more robust system suitable for use virtually anywhere in the world as a replacement for existing ILS. It is also expected to extend activities to validate enhanced functions which support curved approaches and displaced runway threshold capabilities.

Additionally, the Boeing eco-Demonstrator program is designed to speed up the development of new features to a higher technology-readiness level at which they could be considered mature enough for product introduction. The ecoDemonstrator 787 Flight Test Airplane successfully completed GLS CAT III autoland testing at Moses Lake, Washington using Honeywell's prototype GBAS and a prototype Honeywell Integrated Navigation Radio (INR). The testing included 12 GLS approaches. Flight test data will be used to validate industry standards for new GBAS protocols and monitors designed to support CAT III operations.

New procedures were also tested on the ecoDemonstrator that combined new and existing technologies. For example, a Required Navigation Performance (RNP) procedure to a GLS short final was demonstrated to show the reduction of track miles and community noise. Also, various glideslopes on final approach and displaced final touch down points were demonstrated to show the operational flexibility of GNSS landing systems to improve airport operations. Boeing is in the process of analyzing the flight test data to produce fuel, emission, and noise benefits of such procedures.

To date, flight testing and operational experience with the GLS has been excellent. Many GLS-guided approaches and landings have been conducted successfully at a variety of airports and under various runway conditions. Research and development efforts as well as operational experience have shown that navigation systems relying on GBAS can be considered as a promising solution for approach and landing in all weather and visibility conditions up to CAT III.

- Dieter Guenter, FAA AJM-32/NAVTAC