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Quick Facts: Worldwide SBAS

A Satellite Based Augmentation System (SBAS) is a navigation system that supplements Global Navigation Satellite Systems (GNSS) providing a more accurate and reliable navigation service than GNSS alone.

SBAS Benefits

SBAS provides a more accurate navigation service than GNSS and also provides the high level of integrity required for most aviation navigation operations. SBAS began with the implementation of the Wide Area Augmentation System (WAAS) in the United States (US). Interoperable SBAS' are also being implemented in other regions of the world due to the benefits they provide.

Approach Capability

SBAS enables Localizer Performance with Vertical guidance (LPV) approaches. LPVs are operationally equivalent to a Category I Instrument Landing System (ILS), but are more economical. LPVs do not require the installation or maintenance of navigation aids at the airport since the navigation service is provided to the aircraft entirely by satellites.

- **United States:** As of January 10, 2013 there are 3,052 published LPVs serving over 1,531 airports. There are 1,981 LPV procedures serving non-ILS Runways. In fact, within the U.S., SBAS-enabled LPVs outnumber Category I ILS approaches. The FAA is adding 500 new LPVs per year.
- **Canada:** As of October 4, 2012 Canada has published 109 LPVs at 41 airports with plans for more to follow.
- **Mexico:** WAAS ground network is operational with LPVs planned to follow.
- **Europe:** Across Europe there are over 40 EGNOS LPV procedures published with more planned for in 2013 and beyond. More information at http://www.essp-sas.eu/

Localizer performance (LP) is another type of SBAS-enabled approach procedure that made its debut in January 2011. LPs provide approach capability to runways unsuitable for vertically-guided approaches. They provide the lateral accuracy, integrity, and reliability of a LPV without the vertical guidance, similar to a localizer only approach. As of January 10, 2013, there are 412 LPs published with more planned.

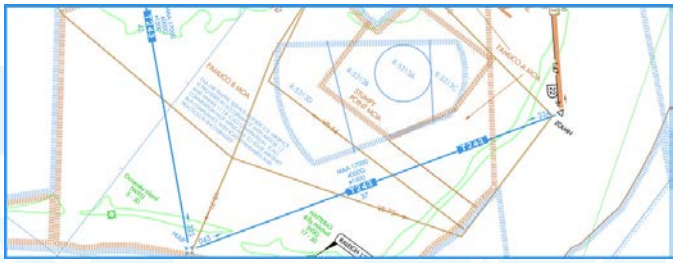
SBAS technology provides the opportunity to cover very large areas of airspace and areas formerly un-served by navigation aids. It also adds increased capability, flexibility, and in many cases, more cost-effective navigation options than legacy ground-based navigation aids. SBAS use will become increasingly more vital as older legacy equipment (such as NDB, VOR, or ILS) is decommissioned and taken out of service.

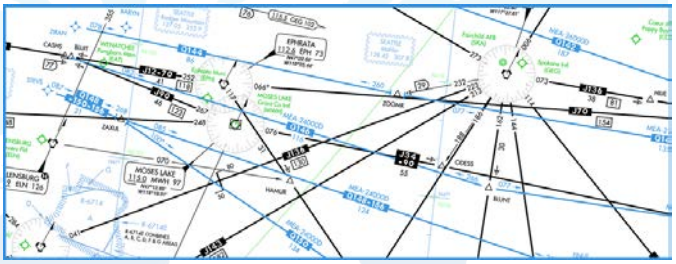
En Route Capability

For en route navigation guidance, SBAS includes integrity as a part of its service and eliminates the need for GPS Receiver Autonomous Integrity Monitoring (RAIM) checks.

Direct routes improve airspace capacity and relieve congestion while reducing fuel use and pollution. By eliminating the need for airways to be tied to ground-based navigation aids, SBAS-equipped aircraft gain the flexibility and benefit of point-to-point operations. SBAS satisfies equipment requirements for the new, more direct en route flight options of 'T' and 'Q' routes.

- T-Route: an Area Navigation (RNAV) route used in low-altitude airspace operating below 18,000 feet.
- Q-Route: an Area Navigation (RNAV) route used in high-altitude airspace (18,000 feet – 45,000 feet).





Learn more about T-routes, Q-routes, and LPVs, at: http://www.faa.gov/nextgen/flashmap/

SBAS around the World

SBAS is available in many parts of the world. Current SBAS service coverage is provided by a collection of interoperable systems. Worldwide SBAS coverage is continuing to grow.

Wide Area Augmentation System (WAAS)

- Commissioned in July 2003 (http:gps.faa.gov)
- Serves North America, with benefits that extend into Central and South America and over the Atlantic and Pacific oceans.

European Geostationary Navigation Overlay Service (EGNOS)

- Available in Europe since October 2009
- Commissioned for Safety-of-Life Service in March 2011
- Serves Europe and northern portion of Africa

Multi-functional Transport Satellite (MTSAT) Satellite Augmentation System (MSAS)

- Commissioned in 2007
- Serves Japan and surrounding area
- Provide LNAV service

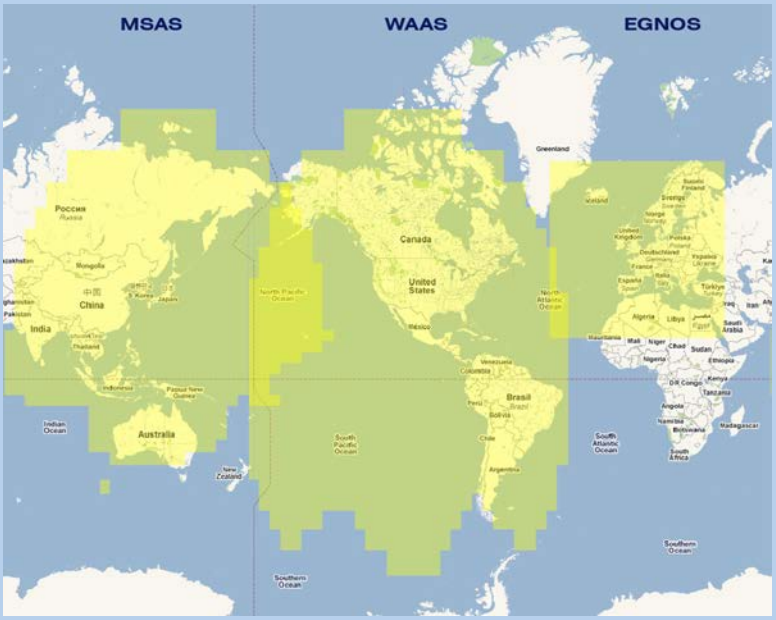
GPS Aided Geostationary Earth Orbit (GEO) Augmented Navigation (GAGAN)

- Currently under development
- Will serve India and the surrounding area

System of Differential Correction and Monitoring (SDCM)

- Currently under development
- Augmentation of GPS and GLONASS
- Will provide Horizontal and Vertical Guidance
- Will serve Russia and the surrounding area

Worldwide SBAS RNP 3.0



Interoperability

To ensure seamless operation, each SBAS system has been developed to the same standard as defined by the International Civil Aviation Organization (ICAO) SARPs Annex 10. The Interoperability Working Group (IWG) comprised of SBAS service providers meet on a regular basis to ensure seamless operations as systems expand, are enhanced, or as new SBAS systems are implemented. SBAS Avionics are intended as interoperable as they are properly developed in accordance with ICAO SARPs thus enabling aircraft to easily transition from one SBAS system to the next.

SBAS in the Future

- Satellite navigation systems will reduce the dependence on aging, ground-based, legacy infrastructure, allowing for more rapid decommissioning of legacy systems.
- The use of performance-based SBAS navigation will increase operational efficiencies with resulting cost savings and emission reductions.
- With the future introduction of dual-frequency SBAS, satellite navigation service availability increases during ionospheric storms.
- As more satellite navigation constellations become operational, such as Europe's Galileo, China's BeiDou (COMPASS), and Russia's GLONASS which is transitioning to an interoperable GNSS format, satellite navigation will become the standard for global aviation navigation.
- More details on this projected expansion of SBAS can be found in the GPS World article, "The Future Augmented." http://www.gpsworld.com/gnss-system/augmentation-assistance/future-augmented-9606

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