

HOW DOES EGNOS WORK?

The EGNOS architecture is highly redundant, generating wide-area differential corrections and alerting users within six seconds if something is wrong. Thirty-four reference stations are deployed to monitor the satellites used for navigation. Each satellite has to be monitored by multiple stations before correction and integrity messages are generated. Four Mission Control Centres process data received from these stations to generate the corrections and the integrity messages for each satellite. Satellite up-link stations upload the corrections and integrity messages to the EGNOS satellites for onward broadcasting to the users.



The EGNOS space segment is composed of three geostationary satellites: two Inmarsat-3 satellites (AOR-E and IOR-W) and ESA's Artemis satellite. EGNOS users should be able to track at least two of them. This approach is very effective in most environments, but sometimes the visibility of the satellites may be limited, for instance in urban areas. For these challenging environments, the EGNOS signals may also be accessed by other means such as via the Internet (e.g. through ESA SISNeT technology, GPRS/GSM mobile phones) or radio links.

Future SBAS system upgrades really depend on GPS and geostationary satellite modernisation and on the introduction of Galileo services. These will enhance the system's accuracy and availability and will be backwards-compatible; in other words, an SBAS receiver purchased today will still work after the systems have been upgraded. We will also see SBASs expanded in the future to cover other regions of the World.

WHAT DOES THIS MEAN FOR USERS?

SBAS/EGNOS is a powerful tool, improving both accuracy and safety. Today, tests are underway by aviators for landing aircraft and helicopters, by farmers for limiting the use of fertilisers and improving the environment, and by blind people for improving their quality of life. These users are experiencing how EGNOS can work for them. Other users are equally curious, and we are sure that they too will discover real improvements by using SBAS/EGNOS for marine and inland waterway navigation, rail transport, offshore exploration, fishing and much more.

WHEN YOU WANT TO KNOW MORE

To learn more about SBAS and EGNOS, please visit the following web sites:

- www.esa.int/egnos
- www.esa.int/navigation
- <http://gps.faa.gov/programs>
- www.mlit.go.jp/koku/ats/e/mtsats/role

EGNOS is a collaborative project of the European Space Agency (ESA), the European Commission and Eurocontrol, with the participation of the French Space Agency (CNES), the Norwegian Mapping Authority (NMA) and the Air Navigation Service providers of France (DGAC), Germany (DFS), Italy (ENAV), Portugal (NAV-EP), Spain (AENA), Switzerland (Skyguide) and the United Kingdom (NATS).

Important Note

Until EGNOS is officially approved for operational (safety or non-safety) use, the signals are provided in the framework of a technical development programme, without warranty as to their availability, continuity, accuracy or reliability. The use of EGNOS receivers and/or messages/signals in any safety-critical application must be certified by the appropriate State authority in accordance with the intended application/operation.



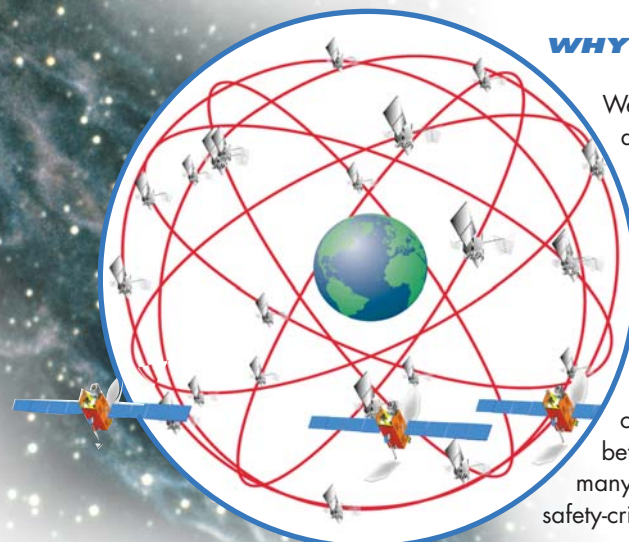
The European Geostationary Navigation Overlay Service



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EGNOS

EGNOS



WHY SBAS?

We all know that GPS has revolutionised navigation and positioning over the last two decades. Today, there are nearly 30 satellites that give us accurate positioning and timing information worldwide and we can use them to give us positioning accuracies of better than 10 metres and timing accuracies of better than 30 nanoseconds.

So, why SBAS? Listening to users, it is clear that there are shortfalls with GPS: some users need firm commitments about civil control; others need much better accuracy than GPS alone can provide; and many need improved system 'health warnings' to support safety-critical applications.

SBAS DOES ALL THIS AND MORE

There are four SBASs being developed: EGNOS in Europe, GAGAN in India, MSAS in Japan and WAAS in the USA. When operational, SBAS signals will be available globally. Other states and regions are also considering developing new systems or linking into these existing developments. These are all civil-controlled regional systems and there is a form of coordination to ensure that they are interoperable to provide a seamless worldwide navigation system so that you can use one SBAS/GPS receiver for all of them.



Each SBAS provides GPS look-alike signals and GPS corrections to improve positioning accuracy to around 1 metre horizontally and 3 metres vertically. Timing accuracy is enhanced to better than 10 nanoseconds.

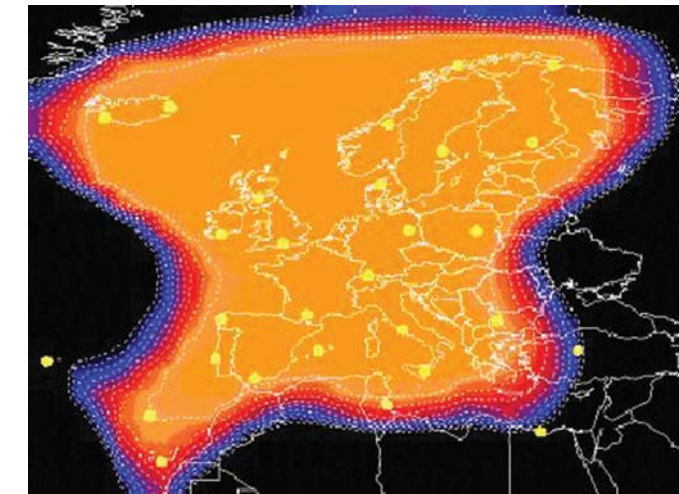
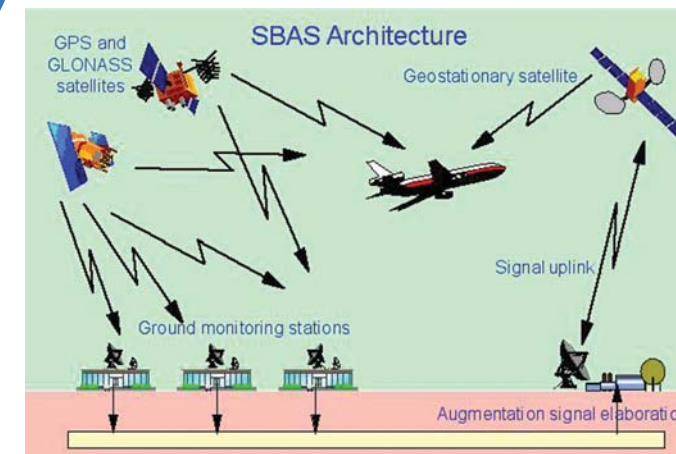
Today, when a GPS satellite malfunctions, it can take up to three hours for the satellite to be declared 'unhealthy' and in that time your positional accuracy can be much worse than 100 metres. Each SBAS provides an integrity-related message every six seconds to tell you when GPS malfunctions and to help maintain performance. This is vitally important not only for safety-critical users perhaps landing aircraft, but also for anyone who needs accuracies of better than 10 metres with a high level of confidence.

WHAT IS EGNOS?

EGNOS, the European Geostationary Navigation Overlay Service, is the European SBAS and is being deployed to provide regional satellite-based augmentation services to aviation, maritime and land-based users in Europe. EGNOS is the first step in the European Satellite Navigation strategy that leads to 'Galileo', the future European satellite navigation system that will complement GPS.

We have designed EGNOS to meet the extremely challenging performance requirements for landing aircraft, meaning that it meets most other users' requirements also:

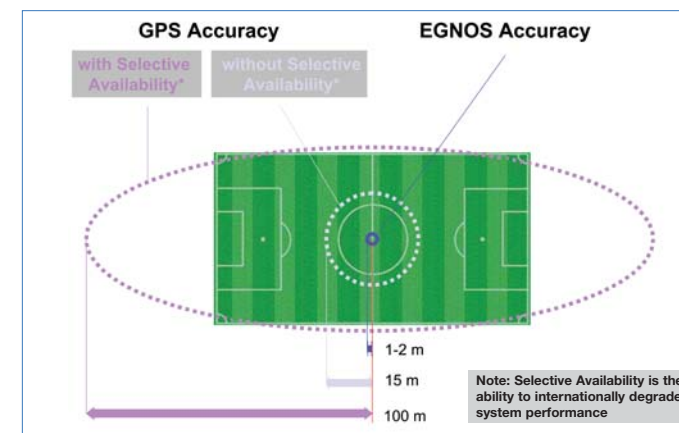
- *availability is improved* by broadcasting GPS look-alike signals from up to three geostationary satellites;
- *accuracy is improved* to between 1 and 2 metres horizontally and between 2 and 4 metres vertically; and
- *integrity and safety are improved* by alerting users within 6 seconds if a malfunction occurs in EGNOS or GPS.



Expected EGNOS coverage for a high-accuracy service (1-3 m horizontal)

EGNOS provides a European-wide, standardised and quality-assured positioning system suitable for a wide range of applications. It also provides precise time with respect to UTC (Coordinated Universal Time) for time and frequency users. EGNOS is highly compatible with GPS, so that a single receiver can process both the GPS and EGNOS signals, eliminating the need for separate equipment to receive differential corrections.

EGNOS services are expected to be available in Western Europe and the Mediterranean area from October 2004 onwards for non-safety-critical applications. EGNOS may also be extended to cover other areas, including Africa, South America and Asia.



SBAS AND EGNOS EXPLAINED

This leaflet has been produced by the European Space Agency to explain Satellite-Based Augmentation Systems (SBAS) in general, and the European version EGNOS in particular. You may, for instance, be wondering why you need SBAS when there is already GPS (Global Positioning System) available. It is because SBAS augments GPS and improves your positioning solution and enhances safety. This means that everything you have done before with GPS has just got better and is now much more easily achievable.

This leaflet explains the many reasons for developing, choosing and using EGNOS, and tells you how the service works. It also indicates how others are using EGNOS to improve on GPS.