→ EGNOS: EUROPEAN GEOSTATIONARY NAVIGATION OVERLAY SERVICE

Europe's first contribution to satellite navigation

→ WHAT IS EGNOS?

EGNOS is the first pan-European satellite navigation system. Its signals complement those of GPS in order to provide users with more precise positioning. In addition, it gives users information on the reliability of the GPS signals ('integrity data').

→ WHY USE EGNOS?

Any application requiring better positioning accuracy than provided by GPS can benefit from EGNOS. For example, many applications have already been developed for agriculture.

The integrity data provided by EGNOS is particularly suited for applications driven by stringent safety constraints during critical navigation phases such as landing aircraft, manoeuvring ships in narrow channels, and tracking the precise locations of trains.

→ WHAT SERVICES ARE AVAILABLE?

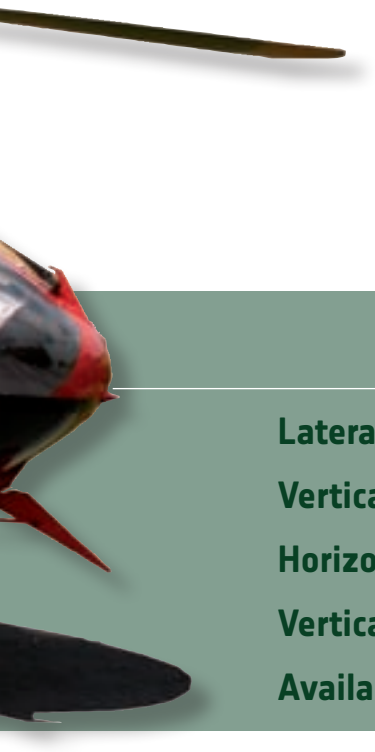
EGNOS is designed to deliver three services:

Open Service EGNOS positioning data have been freely provided since 1 October 2009 through satellite signals to all Europeans via enabled GPS receivers. Its performance accuracy is in the range of 1–3 m horizontal and 2–4 m vertical, substantially improving the GPS position accuracy.

Commercial Data Distribution Service All EGNOS raw data and process products can be made available to professional users through controlled access. On the EGNOS Data Access Service (EDAS) server, users can obtain information such as:

- Raw GPS data from the EGNOS ground segment (e.g. real-time high-precision GPS L1 and L2 pseudo-range corrections and code phase information at 1 Hz).
- All EGNOS message corrections and integrity in real time, including GPS clock, orbit and ionosphere corrections and associated integrity.

Safety of Life service Designed to meet the specific requirements of the aviation community, the SoL service is based on the integrity data, provided through satellite signals. Two service levels are provided, matching the International Civil Aviation Organisation (ICAO) requirements for Non-Precision Approach (NPA) and Approach with Vertical guidance (APV). The latter is the more stringent.



	En route NPA	APV	
Lateral accuracy	220 m	16 m	
Vertical accuracy	N.A.	20 m	
Horizontal alert limit	556 m	40 m	
Vertical alert limit	N.A	50 m	
Availability	0.99	0.99	

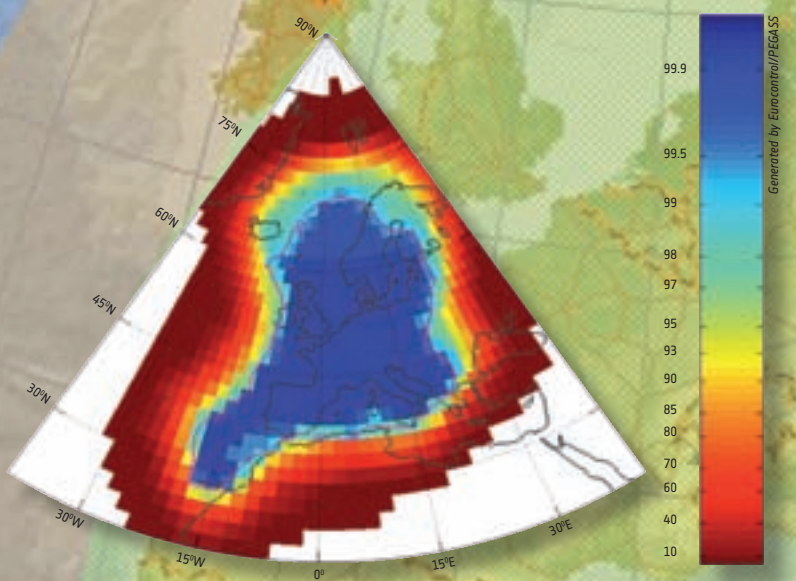
→ WHERE CAN I USE EGNOS SIGNALS TODAY?

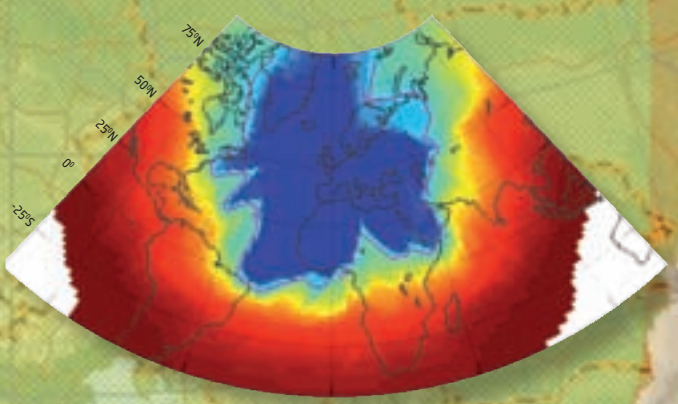
EGNOS satellite signals currently cover most of Europe, with different coverage areas depending on the service.

1–2m (›82%)
2–3m (›95%)

The daily availability of accuracy of the EGNOS Open Service

1–2m (›95%)
2–3m (›99%)





APPROACH WITH VERTICAL GUIDANCE AVAILABILITY

NON-PRECISION APPROACH AVAILABILITY

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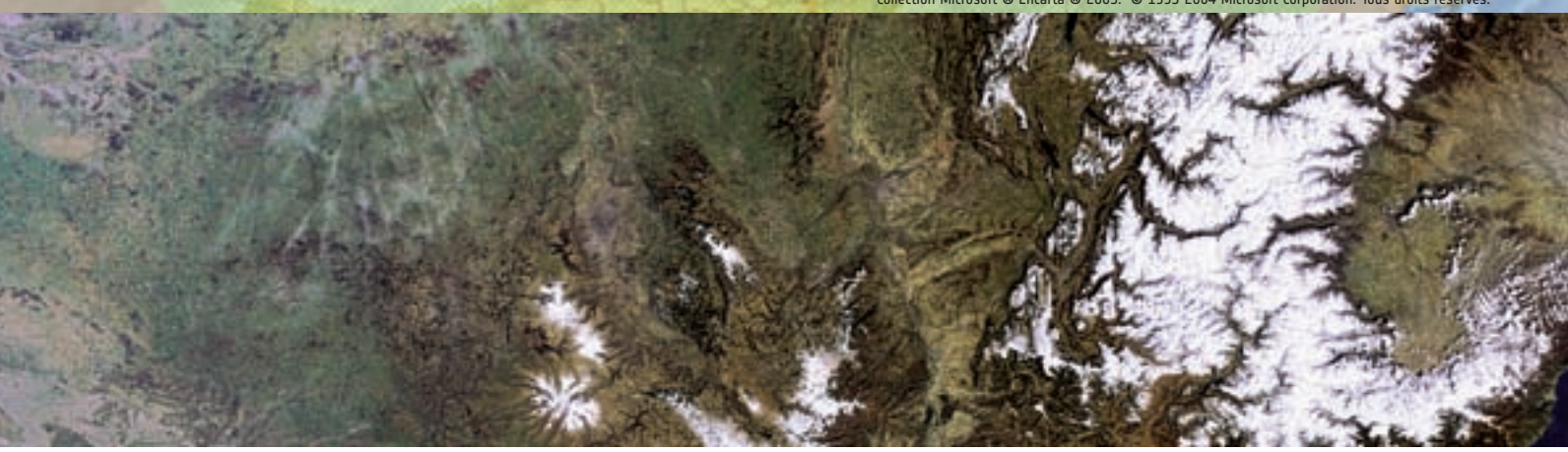
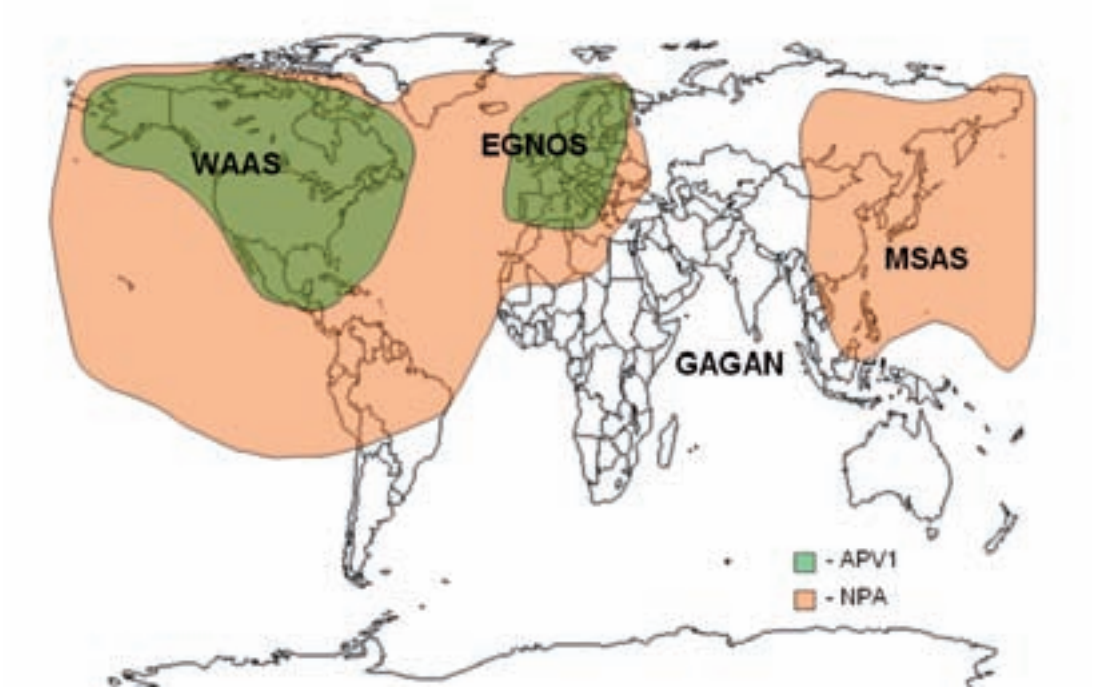


→ EGNOS IN THE WORLD

EGNOS was designed according to the ICAO Satellite-Based Augmentation System (SBAS) international standards. Its development was coordinated to ensure interoperability with the world's other SBASs:

- Multi-Functional Satellite Augmentation System (MSAS) in Japan,
- Wide Area Augmentation System (WAAS) in the USA,
- Geosynchronous Augmented Navigation System (GAGAN) in India; not yet operational.



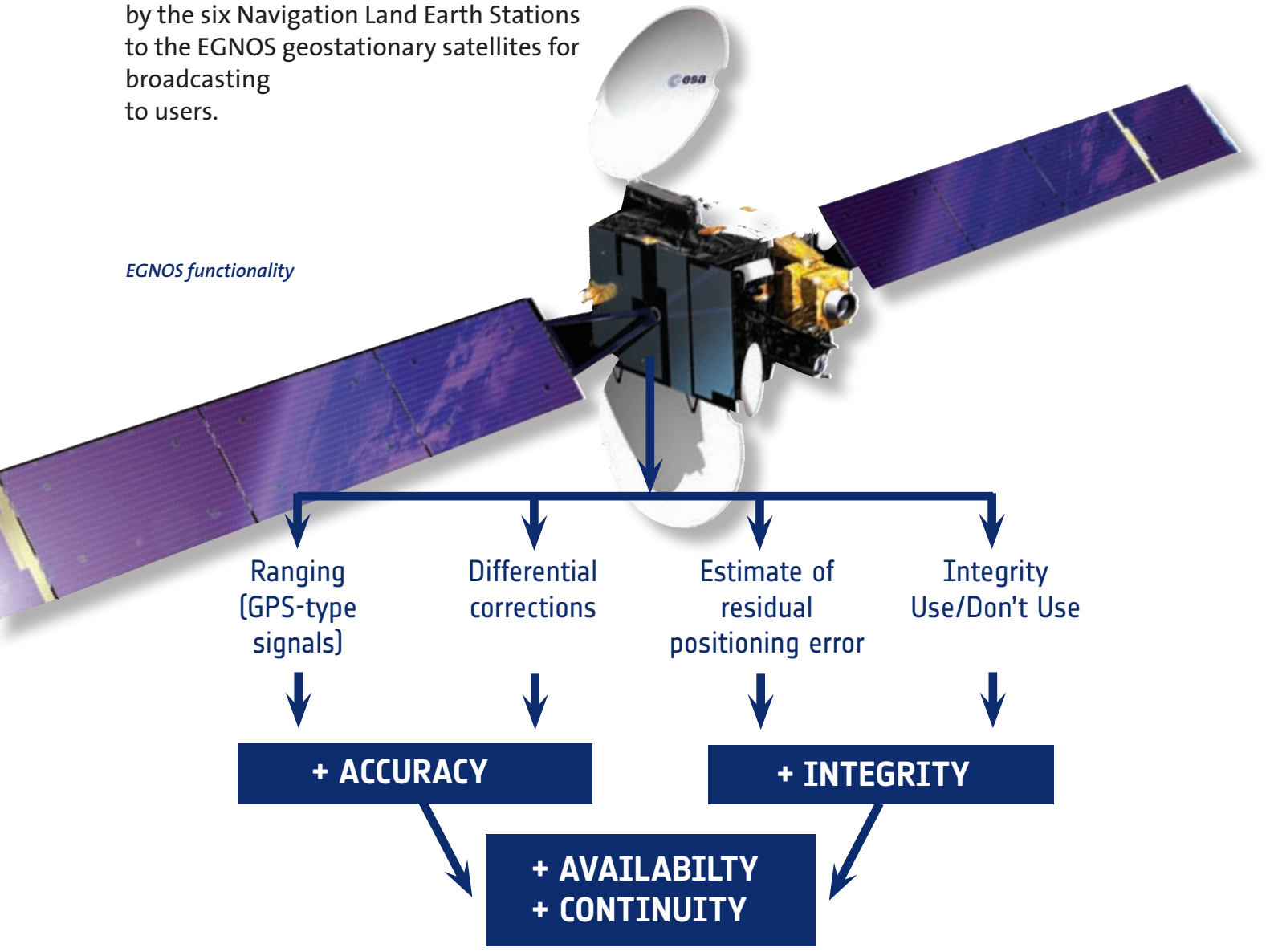
2009 coverage areas of SBAS

→ HOW DOES IT WORK?

EGNOS collects data from GPS satellites through a Europe-wide network of Ranging & Integrity Monitoring Stations (RIMs). Each GPS satellite is monitored by multiple RIMs. Four Mission Control Centres process the data received from these RIMs to generate the corrections and the integrity messages for each satellite. The augmentation signals are then transmitted by the six Navigation Land Earth Stations to the EGNOS geostationary satellites for broadcasting to users.

In space, EGNOS relies on payloads aboard three telecommunication satellites in geostationary orbit at an altitude of 36 000 km. As of 2009, the signals are being broadcast by two Inmarsat-3 satellites and ESA's Artemis satellite, all visible simultaneously from Europe, Africa and the Middle East.

EGNOS functionality



→ WHO WILL BENEFIT FROM EGNOS?

Since the first signals became available to users, demonstrations have shown the usefulness of EGNOS services in every type of application, with emphasis on promoting its use outside of the civil aviation domain.

There are already applications based on EGNOS, and the Open Service is now used in the agricultural world. Several users have installed EGNOS receivers because it has proved valuable for reducing the use of fertilisers, thus helping to protect the environment.

The accuracy of the Open Service has also proved useful during tests made in Spain to guide blind people in the city via mobile phones – like car drivers using GPS.

An 'Airport Ground Movement Surveillance' application is operational at Bordeaux Airport to secure and improve ground traffic flow.

Pending certification of the Safety of Life service, tests have been performed in the aviation, maritime and rail sectors.

As part of 'GIANT' (GNSS Introduction in the AviatioN sector), tests have proved the benefits of EGNOS when landing at airports with fewer aids or when helicopters make emergency landings.

Mapping of fixed assets, controlling mining machinery and other professional uses are potential applications that could benefit from the EGNOS Commercial Data Distribution Service, which can be accessed through conventional communication networks such as Internet and GSM.

Demonstrations showing the potential of EGNOS have been performed in many other sectors. There are certainly many more applications just waiting to be thought of, such as for rail, road and maritime users.

In addition, educational tools have been developed for students to access EGNOS data and tutorials.

→ ROLE OF THE MAIN STAKEHOLDERS

The development of EGNOS was a challenge requiring the close cooperation of many European entities.

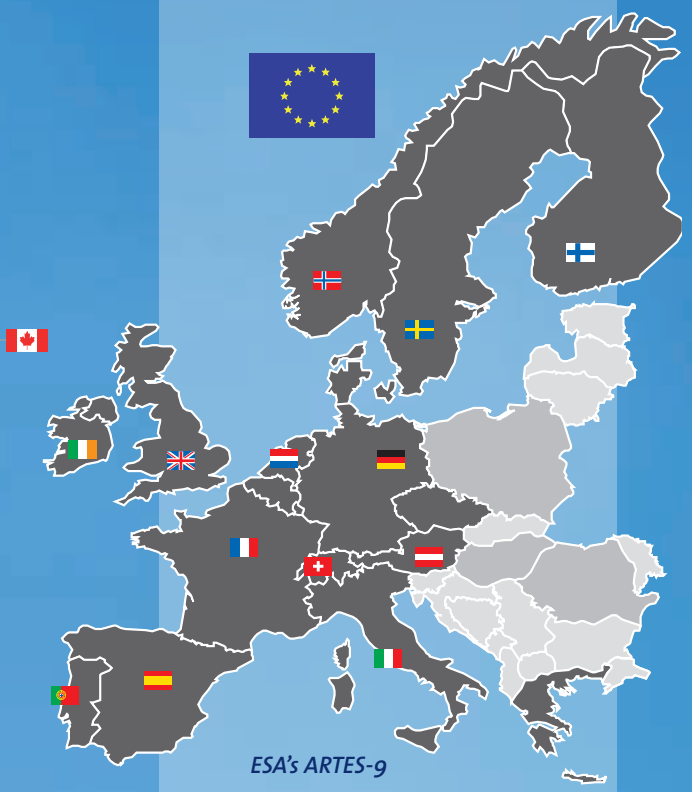
ESA was responsible for the development, validation and initial exploitation, funded under its ARTES-9 programme.

Eurocontrol defined the driving mission requirements for civil aviation users. During this phase, Eurocontrol defined workplans to support the operational acceptability of EGNOS for civil aviation.

The European Commission (EC) contributed substantially to the financing of EGNOS development, including the leasing of the payloads for the geostationary satellites. Through its Research & Development Framework Programmes activities, the European Union supported user application developments, setting up consortia in charge of specific pilot projects.

Air traffic management agencies signed bilateral agreements with ESA: AENA (Spain), DFS (Germany), DSNA (France), ENAV (Italy), NATS (UK), Skyguide (Switzerland) and NAV-EP (Portugal). They contributed to the ARTES-9 funding and created the European Satellite Service Provider (ESSP), the EGNOS Service Provider.

Following the completion of its development, EGNOS was handed over to the EC for exploitation.



ESA's ARTES-9 participating states

→ THE FUTURE

Since 1 April 2009, the EC has been in charge of managing the exploitation of EGNOS. The Open Service was launched on 1 October 2009. After a trial period, the Commercial Data Distribution Service will be accessible for customers who require enhanced performance for commercial and professional use.

For the Safety of Life service, major efforts are being directed towards certifying EGNOS for aviation use. For other SoL communities, the consolidation of user requirements and the validation of services will progress, upon definition of applied EGNOS-based standards.

In addition to its activities under the 'Global Navigation Satellite System (GNSS) Evolution Programme' for GNSS infrastructures, ESA is acting as the 'Design and Procurement Agent' on behalf of the EC for implementing future EGNOS design changes. This could include extending the service coverage area, maintaining interoperability with other SBAS, and any additional functionality for user communities.

Eurocontrol is implementing workplans to support operational acceptability of EGNOS for civil aviation and to encourage usage take-up, expected to accelerate substantially upon service provider certification under the Single European Sky regulation.

In order to continue providing the most stringent level of performances to its users, EGNOS will adapt to the coming multi-constellation GNSS (GPS and Galileo).

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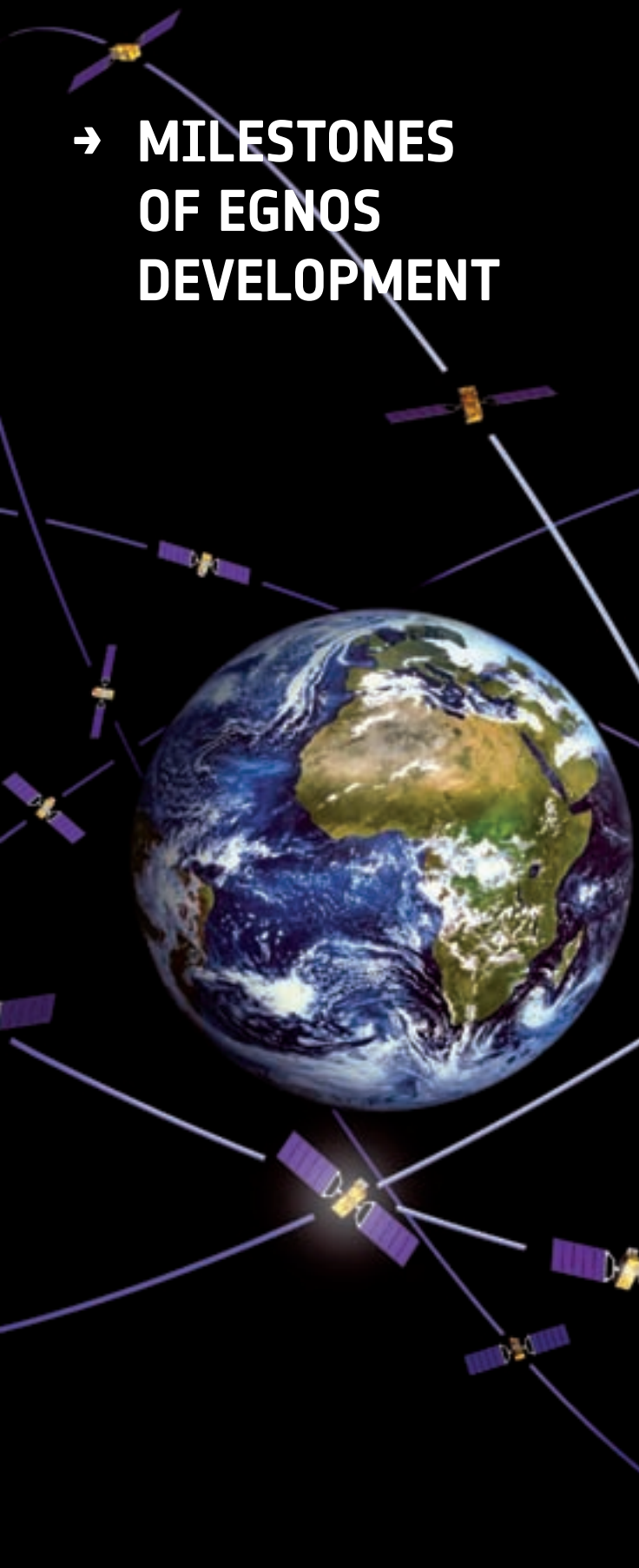
→ MILESTONES OF EGNOS DEVELOPMENT



1995 Start of system definition phase by ESA

1998 Signature of EC/ESA/ Eurocontrol agreement

1998 Signature of Bilateral Agreements between ESA and seven European national Air Navigation Service Providers

1999 Start of system development phase

2000 Start of user demonstrations with EGNOS test signal

2005 Technical qualification of system

2005 Start of initial operational phase

2009 Operational qualification of certifiable version

2009 Handover of system to EC

→ FOR FURTHER INFORMATION ON EGNOS:

www.esa.int/navigation
www.ec.europa.eu/transport/egnos
www.gsa.europa.eu/
www.gnss-giant.com
www.ecac-ceac.org/
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