The European GNSS Programmes
EGNOS and Galileo

Last update: 1 February 2011

Directorate-General for Enterprise and Industry

GALILEO EGNOS

Navigation solutions powered by Europe

‘It’s there, use it’

EGNOS Timeline

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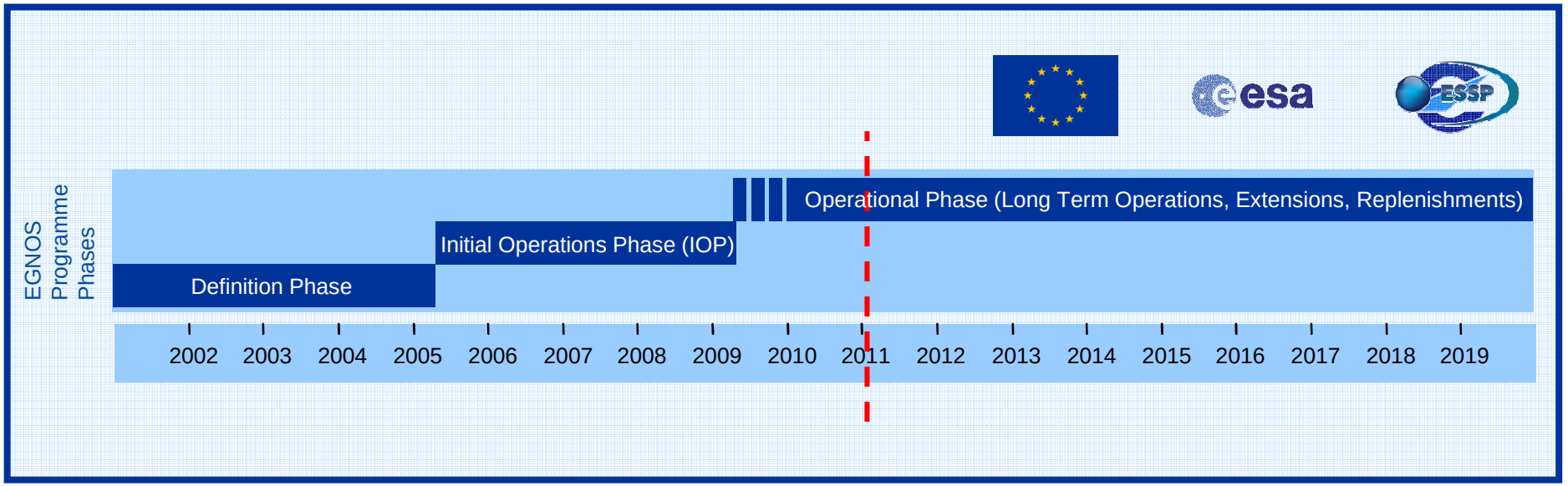
EGNOS has been delivering a free Open Service over Europe since October 2009



EGNOS System Architecture and Service Area

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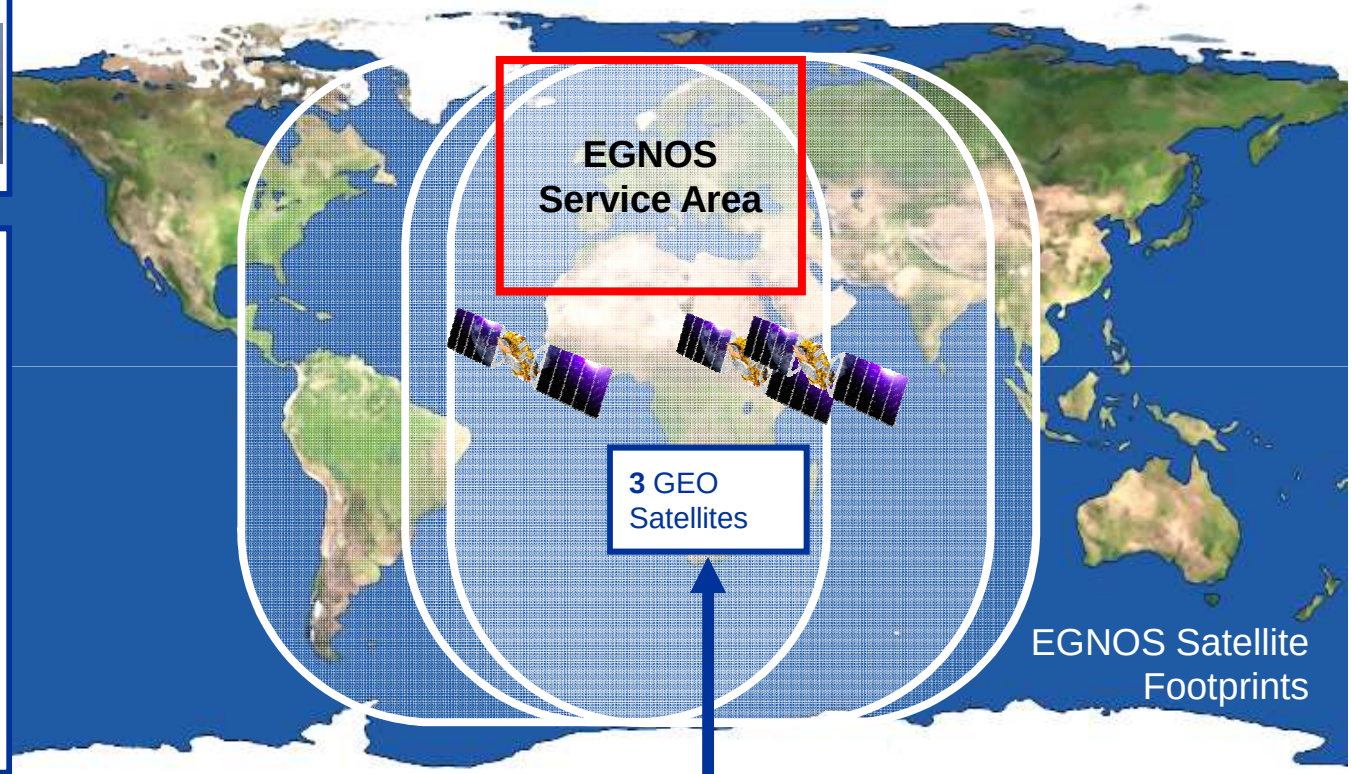
6 Navigation Land Earth Stations

2 Support Facilities

4 Mission Control Centres

34 Ranging & Integrity Monitoring Stations (RIMS)

GPS signals



3 Geostationary satellites
- INMARSAT 3F2 AOR-E (15.5°W)
- ARTEMIS (21.3°E)
- INMARSAT 4F2

Soon to be replaced by
- ASTRA SIRIUS 5
- ASTRA 5B

EGNOS Services

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EGNOS will deliver its services on a long-term basis (>20 years)

Service	Characteristics	Service Status	
Open Service	accuracy ~1m, free	available since October 2009	
Safety of Life Service	accuracy ~1m, compliant to aviation standards	to be made available beginning of 2011	
Commercial Service (EDAS)	accuracy <1m, corrections are provided by terrestrial networks	experimental service since 2008; official service to be made available in 2011	

EDAS … EGNOS Data Access Server

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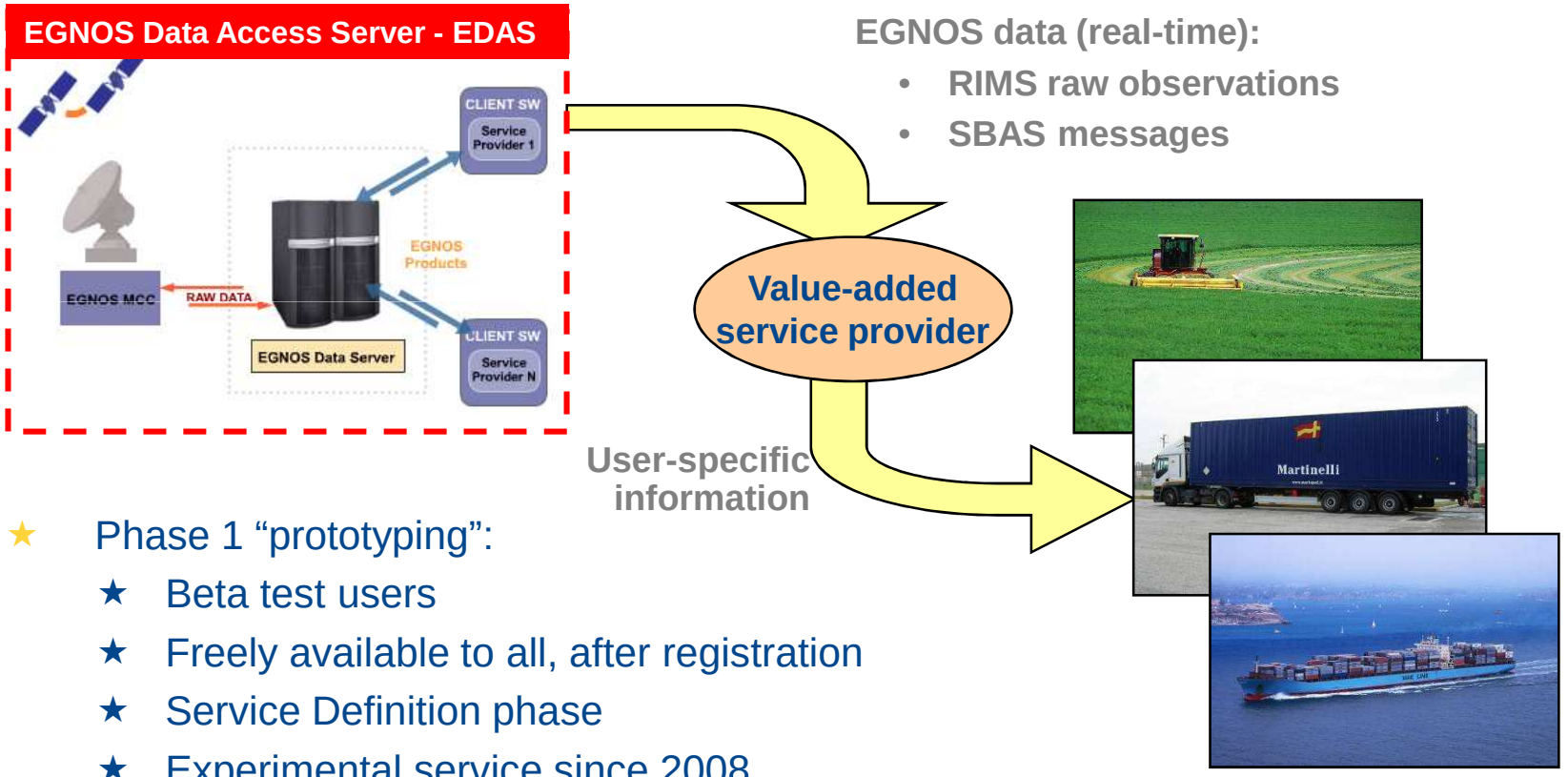
The EGNOS commercial service (EDAS) will be made available in 2011



- ★ Phase 1 “prototyping”:
  - ★ Beta test users
  - ★ Freely available to all, after registration
  - ★ Service Definition phase
  - ★ Experimental service since 2008
- ★ Phase 2: Service Provision (in 2011)

EGNOS achieves almost 100% availability

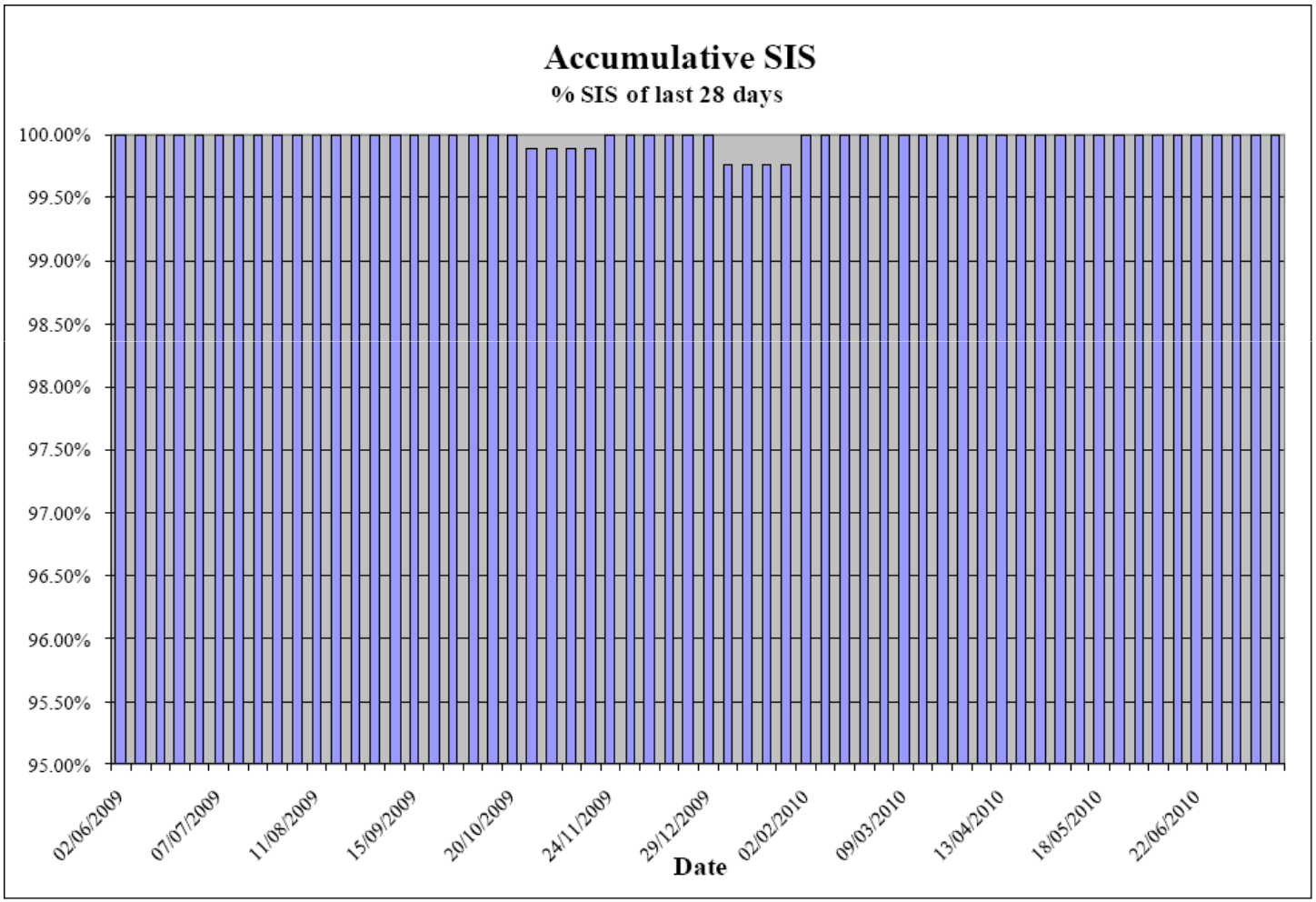
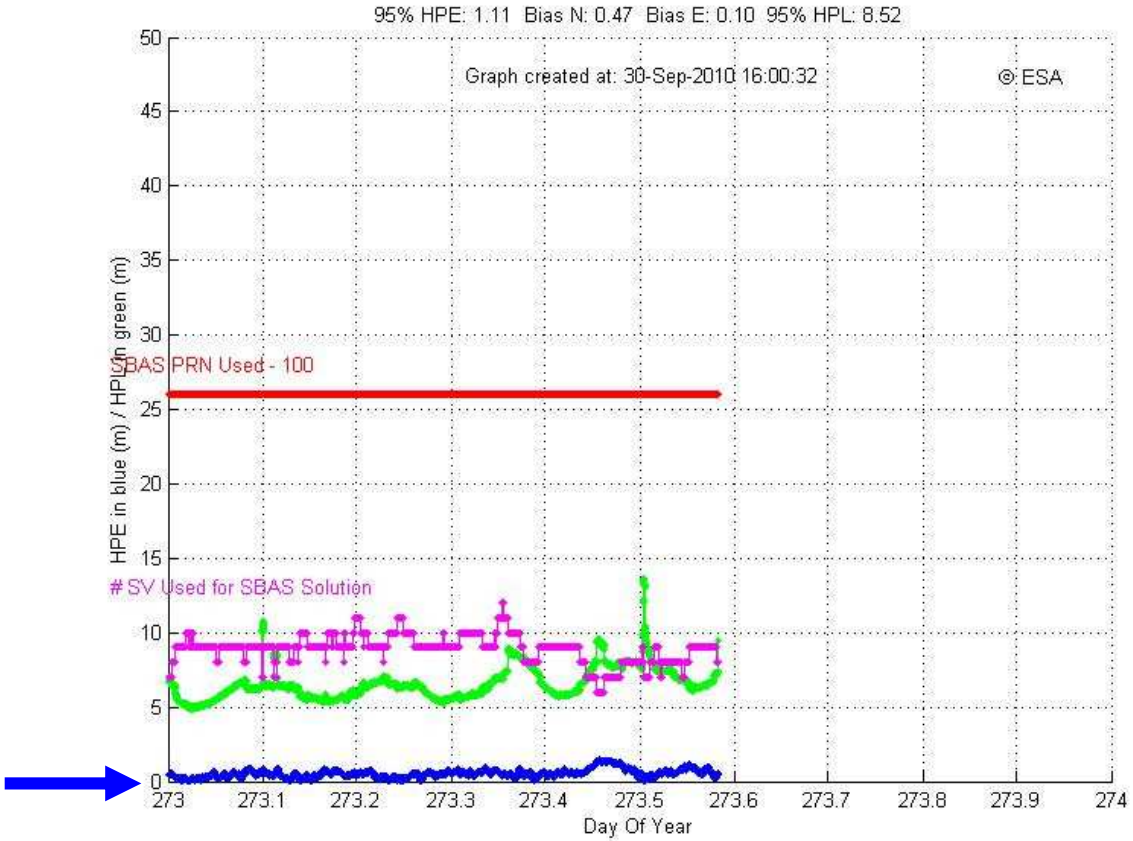


Figure 3 - Operational SIS Broadcast since June 2nd 2009

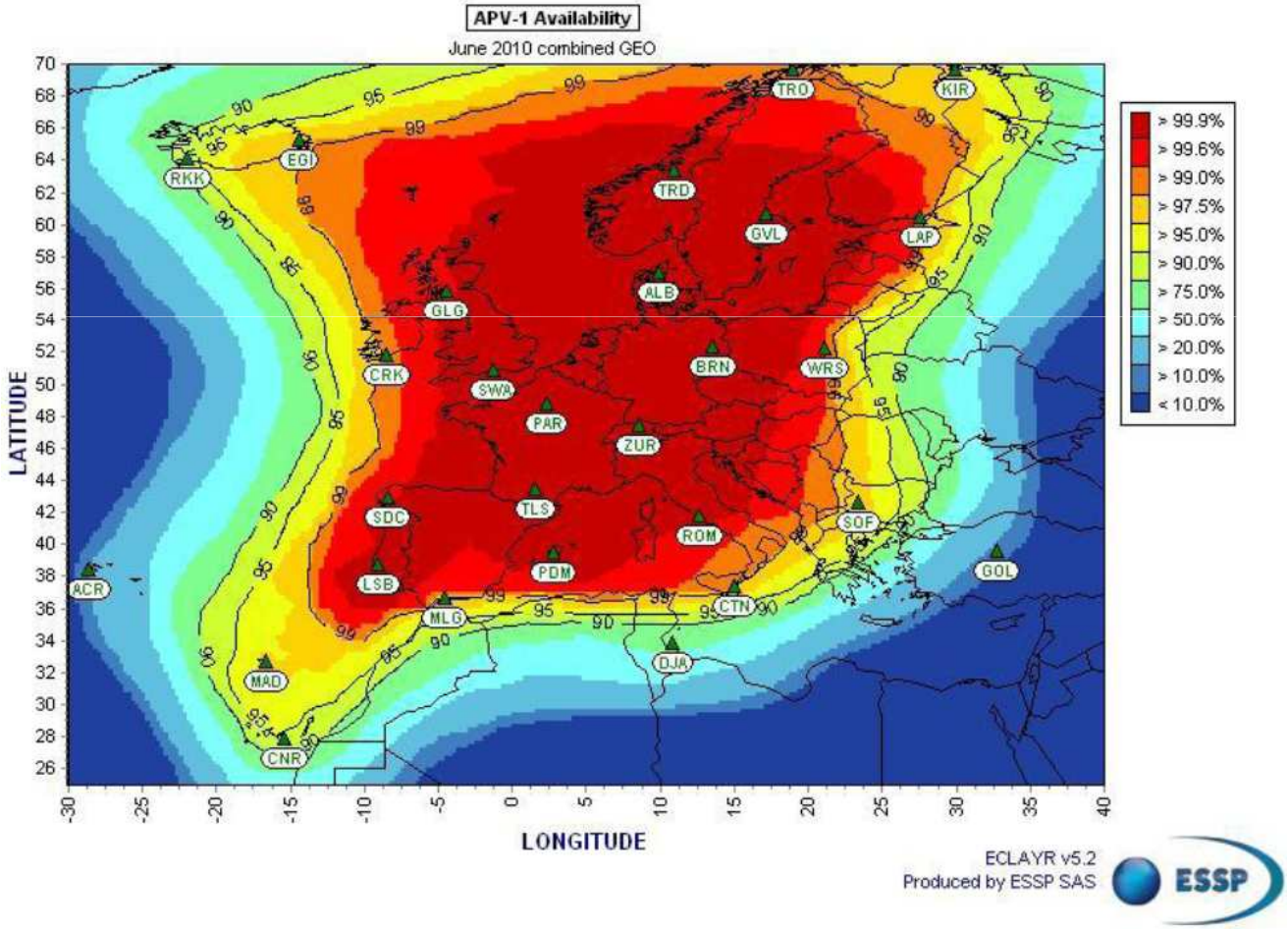
With around 1 m (blue line), the measured Horizontal Precision Error for the centre of Europe is consistently better than the requirements



HPE … Horizontal Precision Error, HPL … Horizontal Protection Level

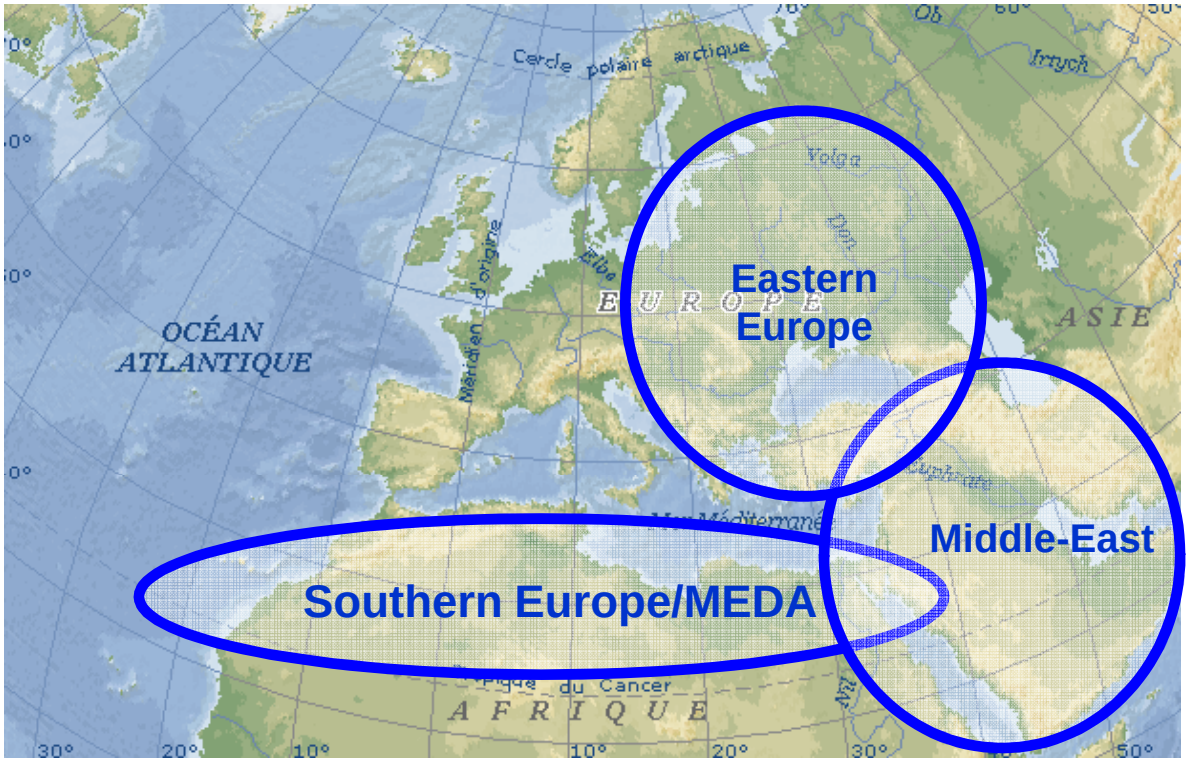
Source: http://www.egnos-pro.esa.int/IMAGEtech/perfect/real_time/view_all/toulouse.html

The deployment of additional RIMS in Eastern Europe, Southern Europe, Northern Africa and the Middle East will increase the availability area of APV-1



APV … Approach with vertical guidance

EGNOS Extensions



Depending on the extension area, technical implementation may vary from:

- ★ Homogeneous extension with deployment of additional RIMS
- ★ Regional infrastructure including additional processing capabilities

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EGNOS has entered into its operational phase

- 2009
  - Assets were transferred to the European Union on 1 April
  - Long-term service provision contract was signed on 30 September
  - **Open Service declaration** took place on 1 October
  - Procurement to replace the transponder on Artemis is finalized (Astra Sirius 5 to be launched in November 2011)
  - Procurement to replace the transponder on Inmarsat 4F2 is finalized (Astra 5B to be launched in June 2013)
  - Geographical extension is under study
- 2010
  - Certification of ESSP as air navigation services provider on 12 July
- 2011
  - **Safety-of-Life Service declaration planned for beginning of 2011**
  - **Commercial Service declaration (EDAS) planned for 2011**

EGNOS Programme Objectives

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Our top-most priority is to ensure that EGNOS is being used

- Ensure that EGNOS is used
  - Long-term programmatic roadmap
  - Liability set-up
  - Communication plan
- Launch the Safety-of-Life service early 2011
  - ESSP certified
  - Declaration of service after MT0 off observation period
- Ensure the continuity of service
  - Obsolescence
  - Maintainability
  - Deployment of new releases
- Extend coverage over Europe
  - Fully cover the ECAC area

EGNOS Evolutions

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In the long-term, further coverage extensions and service evolutions will be considered

- Service Provision Improvements ► short/medium term
- Coverage Evolution
  - Eastern Europe, Southern Europe/MEDA, Middle East/ACAC ► medium term
  - Africa ► medium/long term
- Frequency Evolution
  - Extension to the E5a/E5b frequency decided on ARTEMIS replacement
- Evolution of Standards ► long term
  - Standardisation of E5a and E5b, L1 CBOC on-going
  - Augmentation of new GNSS
- Additional Services
  - LPV200 service level ► medium term (2011)
    EGNOS capability to meet this service level currently under technical evaluation
  - EGNOS time service ► medium term
  - Possible critical communication message (ALIVE concept)

EGNOS improves GPS

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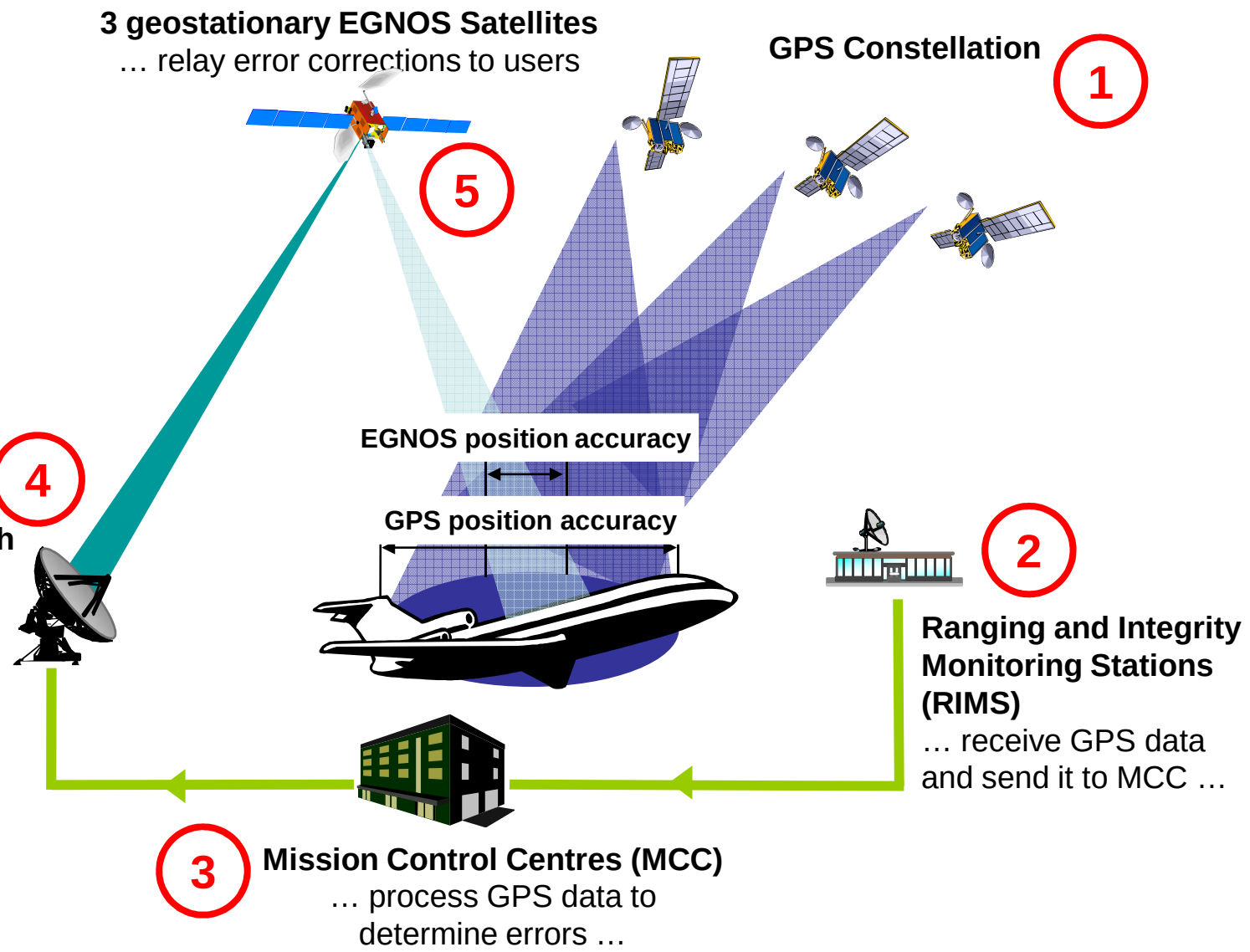

EGNOS is compliant for Aviation

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EGNOS has been verified and ESSP SaS has been certified on 12 July 2010

- Process conducted by the French air safety authority DGAC in coordination with EASA and other national air safety authorities in Europe
- EGNOS has been **verified** based on a clear demonstration that it is designed and operated in a safe manner
- ESSP has been **certified** based on the Single European Sky Regulatory package:
  - Interoperability Regulation (EC 552/2004)
  - Service Provision Regulation (EC 550/2004)
  - Regulation on the certification process for air navigation service providers (EC 2096/2005)
  - Safety Oversight Regulation (EC 1315/2007)
- Already 35 EGNOS APV procedures written in 7 EU countries

EGNOS contributes to worldwide SBAS coverage

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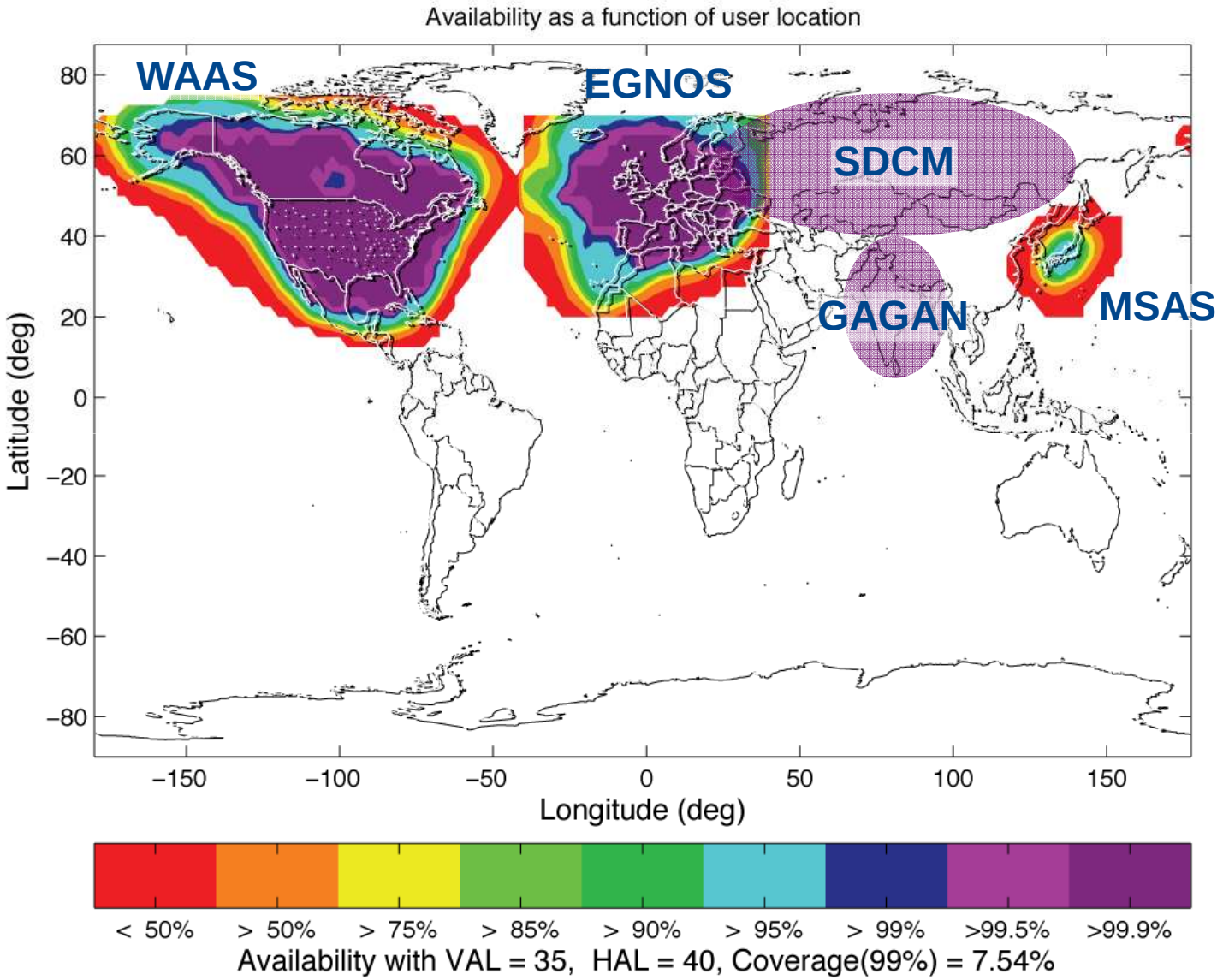

EGNOS Improvement on Precision

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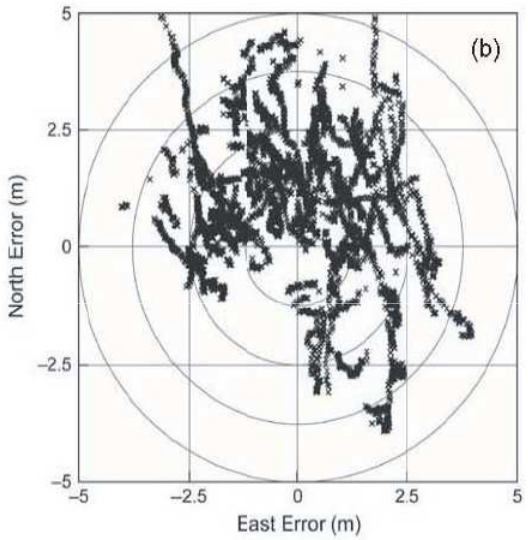
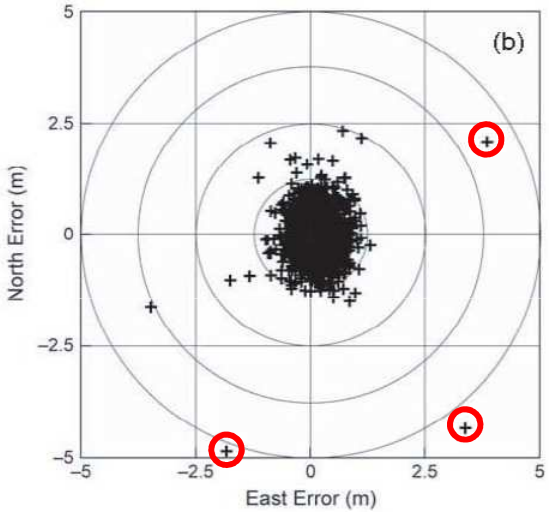
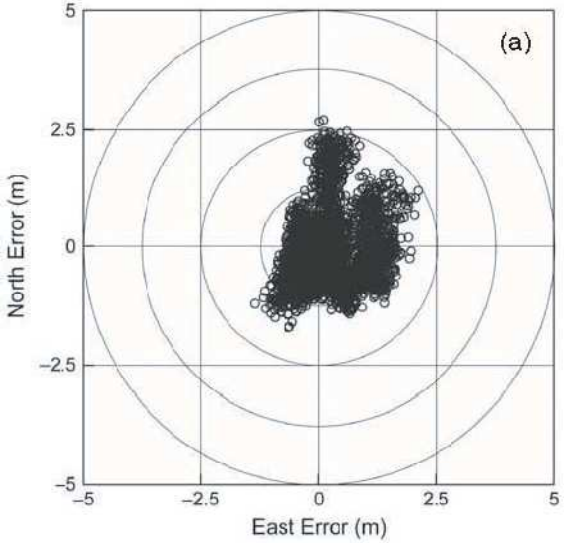


GPS



D-GPS



SBAS (EGNOS)

EGNOS benefits Aviation

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EGNOS provides significant benefits for passengers, airports, airlines and the environment

- ★ **Safer landings** at airports not equipped with ground-based navigation aids
- ★ **Low-cost** alternative to ground-based navigation aids (ILS CATI)
- ★ **Increased airports capacity**
- ★ **Less delays, diversions and cancellations**
- ★ **Lower fuel consumption**
- ★ **Lower noise levels**

Aviation first to recognize EGNOS benefits (mostly GA and small-medium airports)

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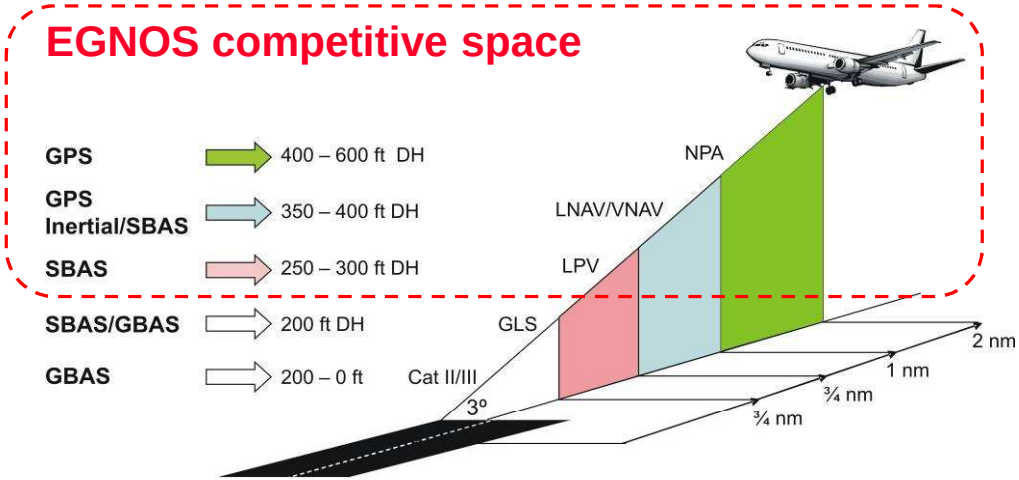
EGNOS enables a reduction in the decision height

- General operational benefits
  - Reduction in angle of approach (direct and curved)
  - Better lateral guidance



- Allows for IFR-like operation in non ILS-equipped airports
- Increase in airports capacity
- Increase in safety
- Increase in flight capability (e.g. helicopters)
- Expensive land based navaids can be avoided
- Enables their long term decommissioning => lower terminal charges

Long-term

EGNOS procedures developed or in development

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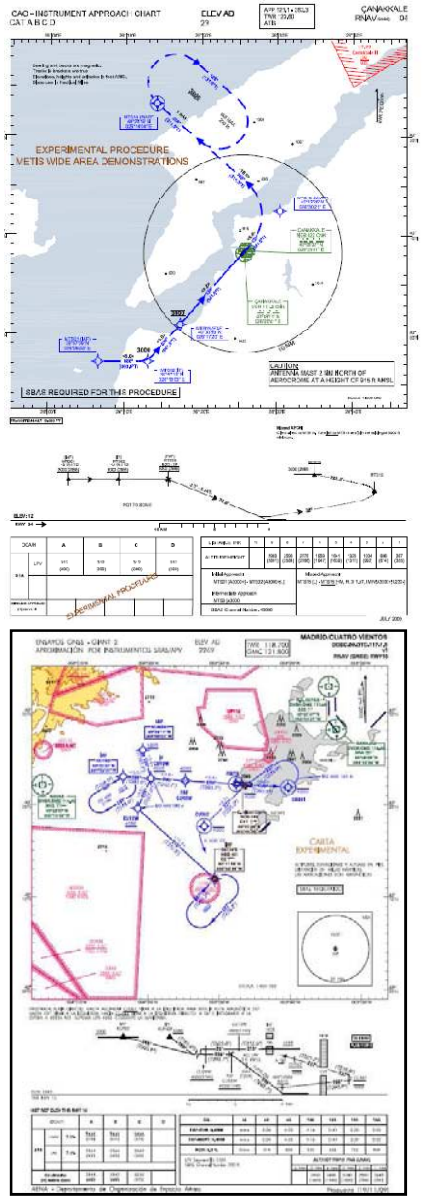
Already 35 procedures, more planned and commitments to follow ICAO's recommendation for 100% coverage

- ★ **Spain** : 14 procedures at San Sebastian, Valencia, Almeria, Granada, Salamanca, Malaga, La Palma, Cuatro Vientos, Cordoba, Santander
- ★ **Germany** : 1 procedure at Donauwörth Heliport; further procedures planned
- ★ **Italy** : 2 procedures at Çanakkale and Perugia; further procedures planned for Bari, Bologna, Palermo and Venezia
- ★ **France** : 8 procedures at Pau, Toulouse, Clermont Ferrand, Le Bourget, Toussus, Albert Bray, Bordeaux and Marseille Heliport; objective to cover 100% of the instrumental runways by end 2016
- ★ **UK** : 5 procedures at Alderney, Southampton, Campbeltown, Benbecula and Barra
- ★ **Switzerland** : 3 procedures at Berne Heliport, Les Eplatures, St-Gallen-Altenrhein
- ★ **Poland** : 2 procedures planned at Mielec and Katowice



EGNOS benefits Agriculture

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In Agriculture, EGNOS provides significant benefits in terms of costs and environmental impact

- **Less costly** than RTK**,** yet sufficiently precise for many high precision agriculture applications
- **Reduced environmental impact** through lower use of pesticides and fertilizers (more precise spraying)

EGNOS benefits Road

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In Road, EGNOS provides significant benefits in terms of costs, speed and effectiveness

- ★ Automatic road tolling is **less costly** than toll booths
- ★ Allows pay per use insurance, which is **more fair to the user**
- ★ Many other benefits in terms of **reduced transport time**, **more effective** logistics, **more effective** emergency management ...

EGNOS opens the door to new applications

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EGNOS allows many new applications requiring a high degree of positioning precision

- ★ Guiding the blind
- ★ Rescuing people falling overboard at sea
- ★ Rescuing people in difficult environments like mountains
- ★ Eco-driving
- ★ Eco-road maintenance
- ★ ...

EGNOS is continuously maintained and upgraded

Navigation solutions powered by Europe

New services will be launched, coverage will be extended, technical improvements will be implemented

- The transponder on Artemis will be replaced by a transponder on Astra Sirius 5 (November 2011)
- The transponder on Inmarsat 4F2 will be replaced by a transponder on Astra 5B (June 2013)
- The **Commercial Service** EDAS, currently in experimental mode, will be launched in 2011
- The geographical coverage will be extended to the **full ECAC zone** in 2011
- The delivery of **LPV 200** is planned for 2011/2012
- Coverage **extension to Middle East and Africa** is under study
- The **extension to the E5a/E5b frequency** is under study
- The **augmentation of GLONASS** is under study

EGNOS and Galileo

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