The European GNSS Programmes EGNOS and Galileo International Challenges Ahead

Michel Bosco

23 November 2011

Directorate-General for Enterprise and Industry

GALILEO EGNOS

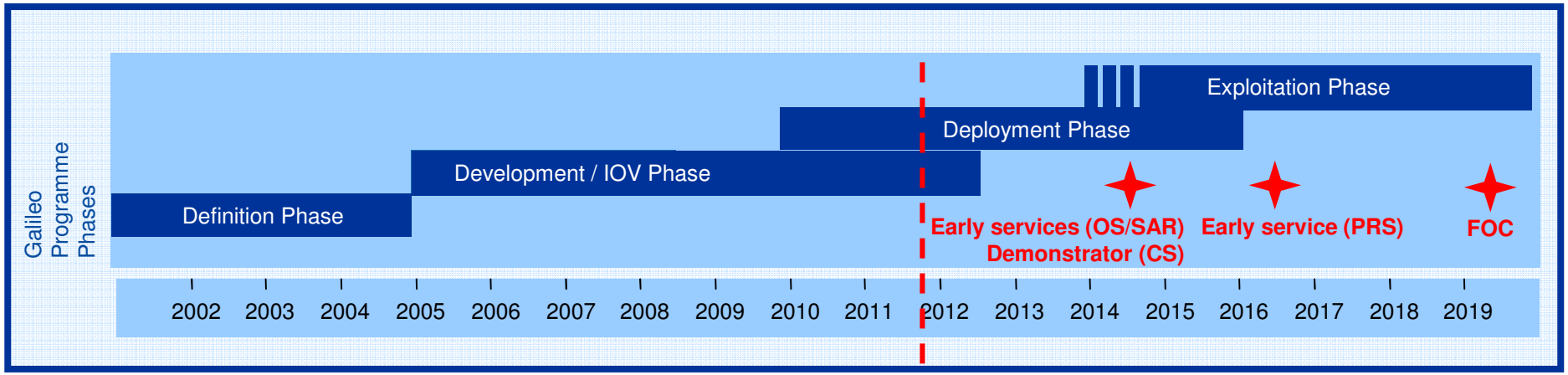
Navigation solutions powered by Europe

Programme Status

Galileo Timeline

Navigation solutions powered by Europe

Galileo is moving from the development phase (IOV) to the deployment phase



IOC: Initial Operational Capability (Early Services)
FOC: Full Operational Capability (Full Services)

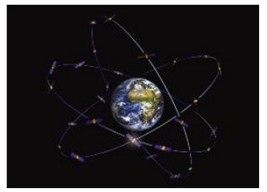
Galileo Implementation Plan

Navigation solutions powered by Europe

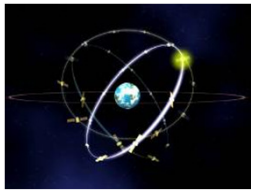
Galileo is implemented step-wise

Full Operational Capability
All services, 30 satellites
2019/2020

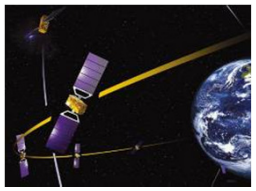
Initial Operational Capability
Early Services for OS, SAR, PRS
2014/2016



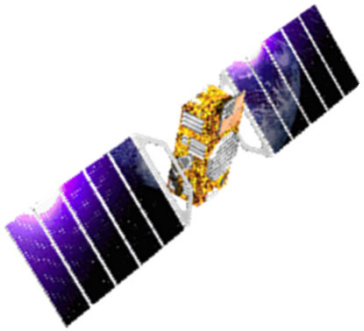
In-Orbit Validation
4 IOV satellites plus ground segment
2011/2012



GIOVE A/B
2 test satellites
2005



Galileo System Testbed v1
Validation of critical algorithms
2003



Galileo Open Service

Navigation solutions powered by Europe

**Galileo OS is open to all, free of charge,
with performances similar to GPS**

- ★ Free of charge navigation and timing service
- ★ Meets the needs of mass market applications
- ★ One of the early Galileo services to be offered in 2014
- ★ Early OS signals interoperable with GPS
- ★ Autonomous and continuous OS service available when full constellation is deployed

Galileo SAR is to provide MEOSAR infrastructure to COSPAR-SARSAT

Characteristics

- ★ Early localisation
- ★ Embedded into COSPAR SARSAT operational system
- ★ New capability: a return link

Users

- ★ Through COSPAR SARSAT

Galileo Public Regulated Service

Navigation solutions powered by Europe

Galileo PRS is an encrypted, robust and continuous service for authorised users

Characteristics

- ★ Early (IOC) Galileo PRS service will be provided by 2016
- ★ More secure and robust than Open Service
- ★ Continuous service even in times of crisis
- ★ PRS will be able to function independently of GPS

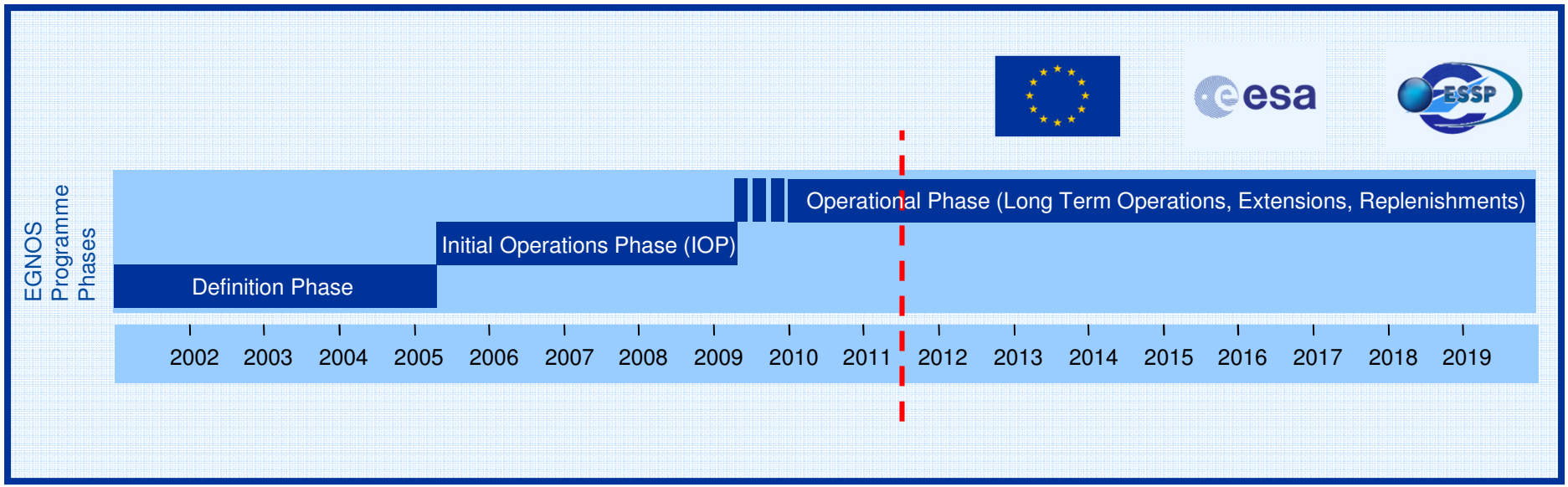
Users

- ★ Will be used by authorised users

EGNOS Timeline

Navigation solutions powered by Europe

EGNOS is delivering a free Open Service since October 2009 and a Safety-of-Life Service for aviation since March 2011



EGNOS System Architecture and Service Area

Navigation solutions powered by Europe

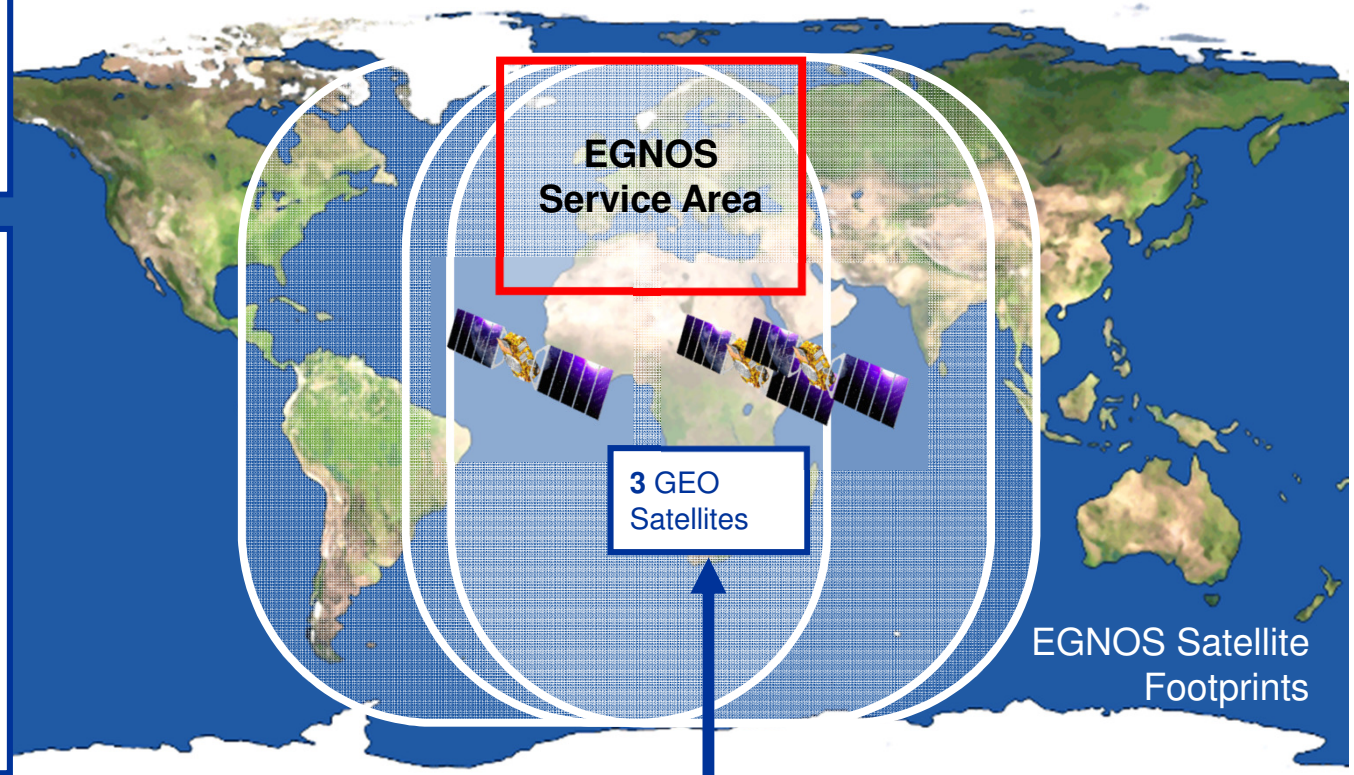
6 Navigation Land Earth Stations

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

International Challenges Ahead

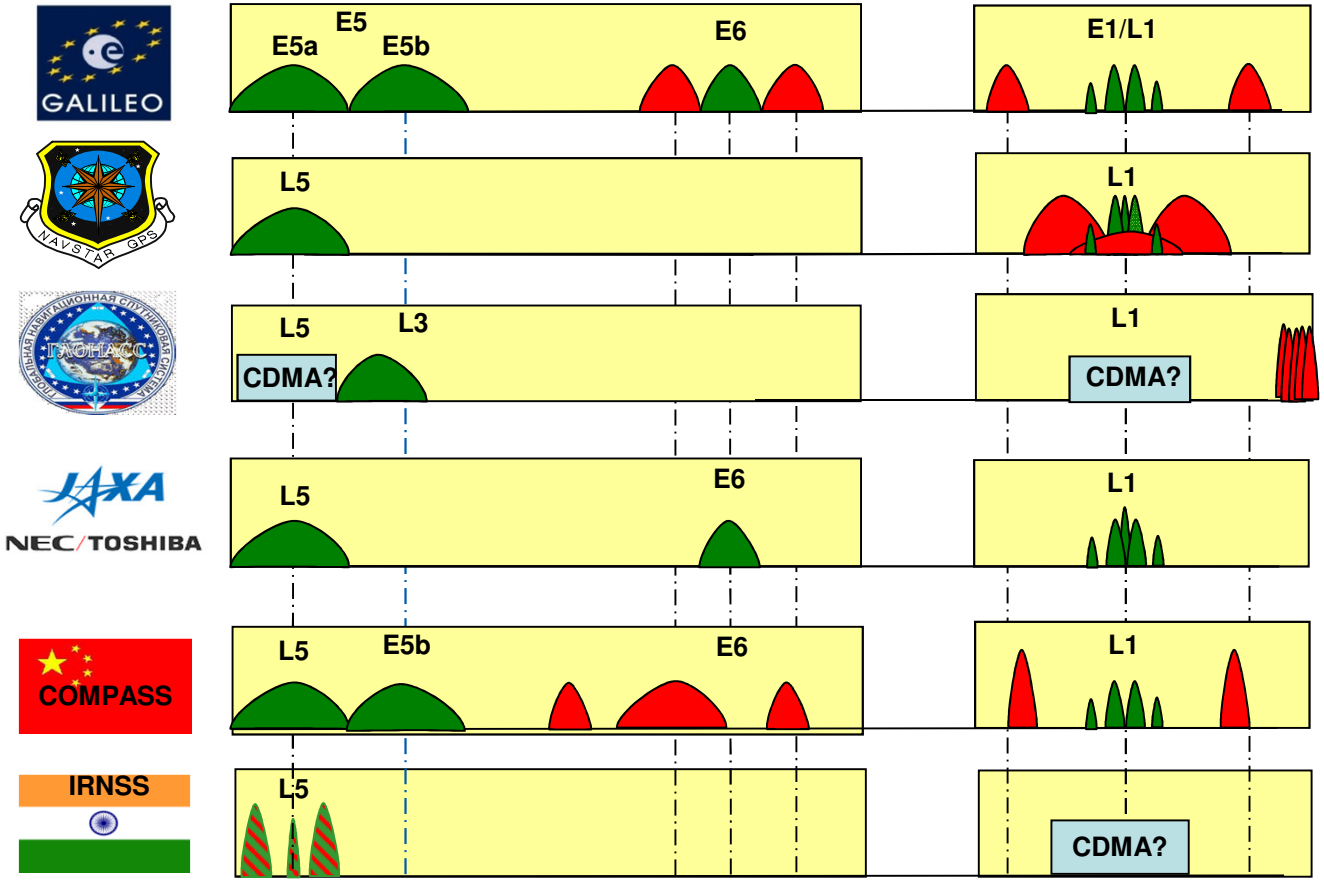
International cooperation is crucial for the EU GNSS' development

- Achieve compatibility
- Establish a network of ground stations worldwide
- Enhance the up-take of EGNOS and Galileo worldwide
- Cooperate towards interoperability with other GNSS

Signals Coordination

Navigation solutions powered by Europe

The signals used by the GNSS service providers need to be compatible and interoperable.



CDMA: Code Division Multiple Access

Galileo Test Satellites

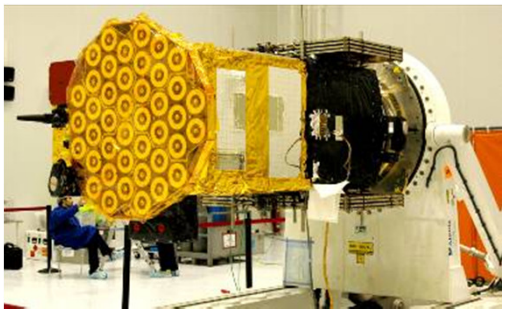
Navigation solutions powered by Europe

The two Galileo test satellites have secured the frequencies and tested critical technology in space

- Giove-A
  - Launched in December 2005
  - Securing of Galileo frequencies
  - In-orbit technology test bed

GIOVE-A

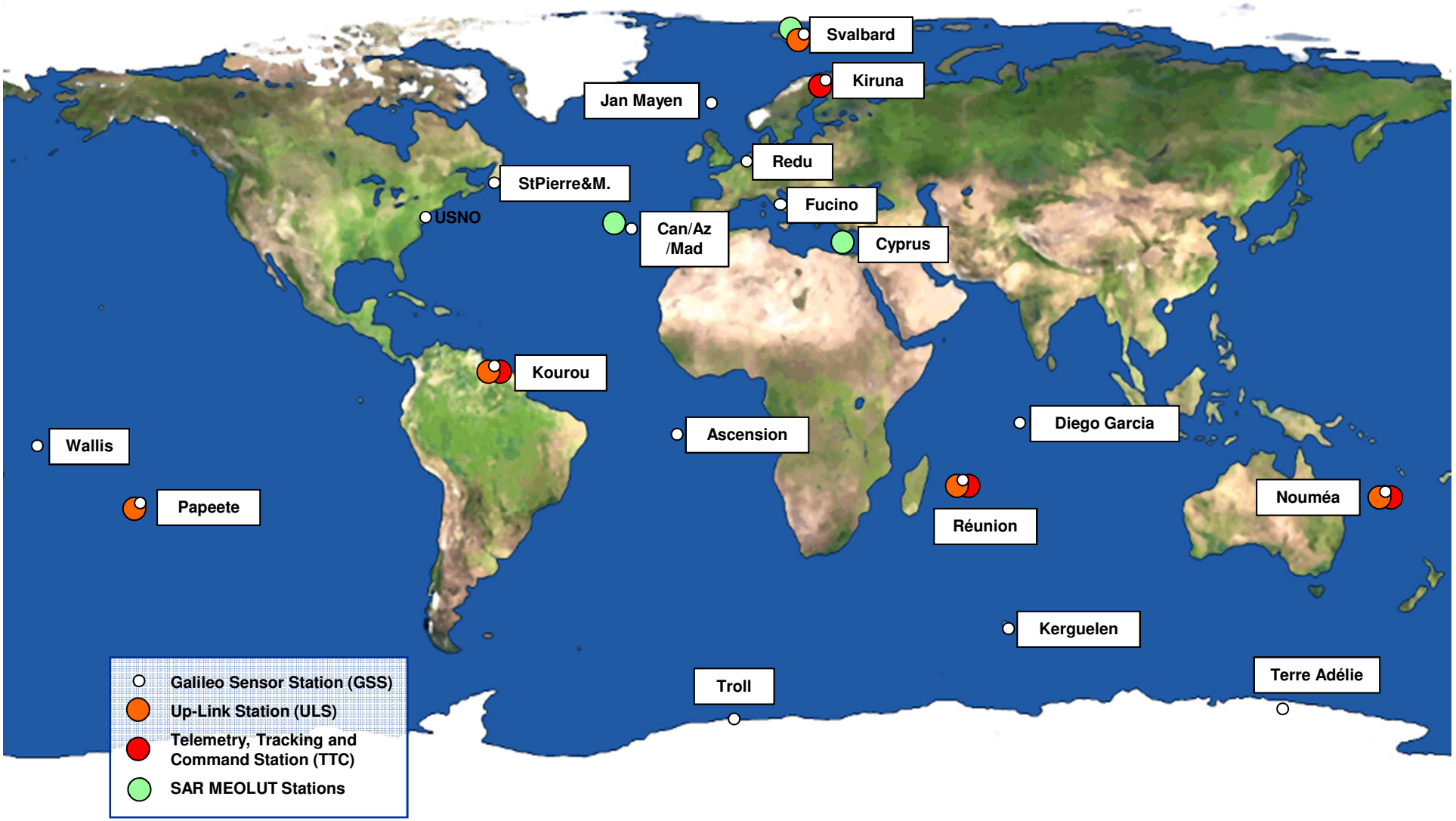
- Giove-B
  - Launched in April 2008
  - First Passive Hydrogen Maser atomic clock ever flown in space
  - Implementation of CBOC signal



GIOVE-B

Galileo Ground Sites for IOC (illustrative)

Navigation solutions powered by Europe



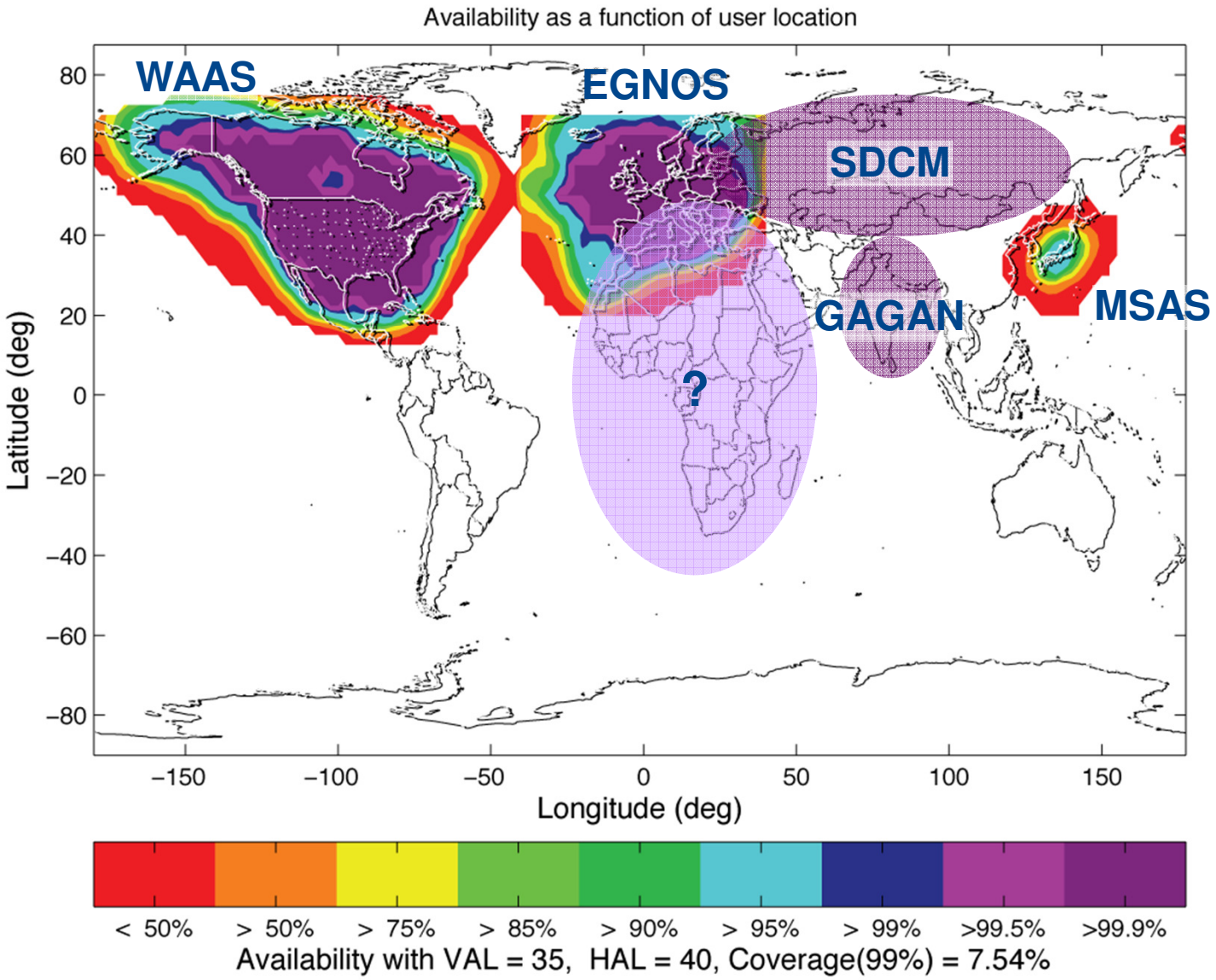
EGNOS RIMS Location

Navigation solutions powered by Europe

RIMS: Ranging & Integrity Monitoring Stations (some additional RIMS are not in view)

EGNOS contributes to worldwide SBAS coverage

Navigation solutions powered by Europe



Implementing the European GNSS international strategy in 2011: Adapting to a changing World

Navigation solutions powered by Europe

Past: Galileo to counterbalance GPS

Now: Galileo one of many

Past: Galileo funded internationally

Now: Galileo funded exclusively with EU public Money

- **Normalisation post 2007**
  - P.R. of China
  - Israel
- **Joint Declarations**
  - Chile
  - Brazil
  - South Africa
  - Israel
  - China
- **Entry Into Force of Agreements**
  - USA (entry into force)
  - Norway


Thank you for your attention
GALILEO
EGNOS
Navigation solutions powered by Europe
http://ec.europa.eu/galileo