Status of Galileo and EGNOS

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ICG#7, Beijing

5 November 2012


European
Commission
GALILEO

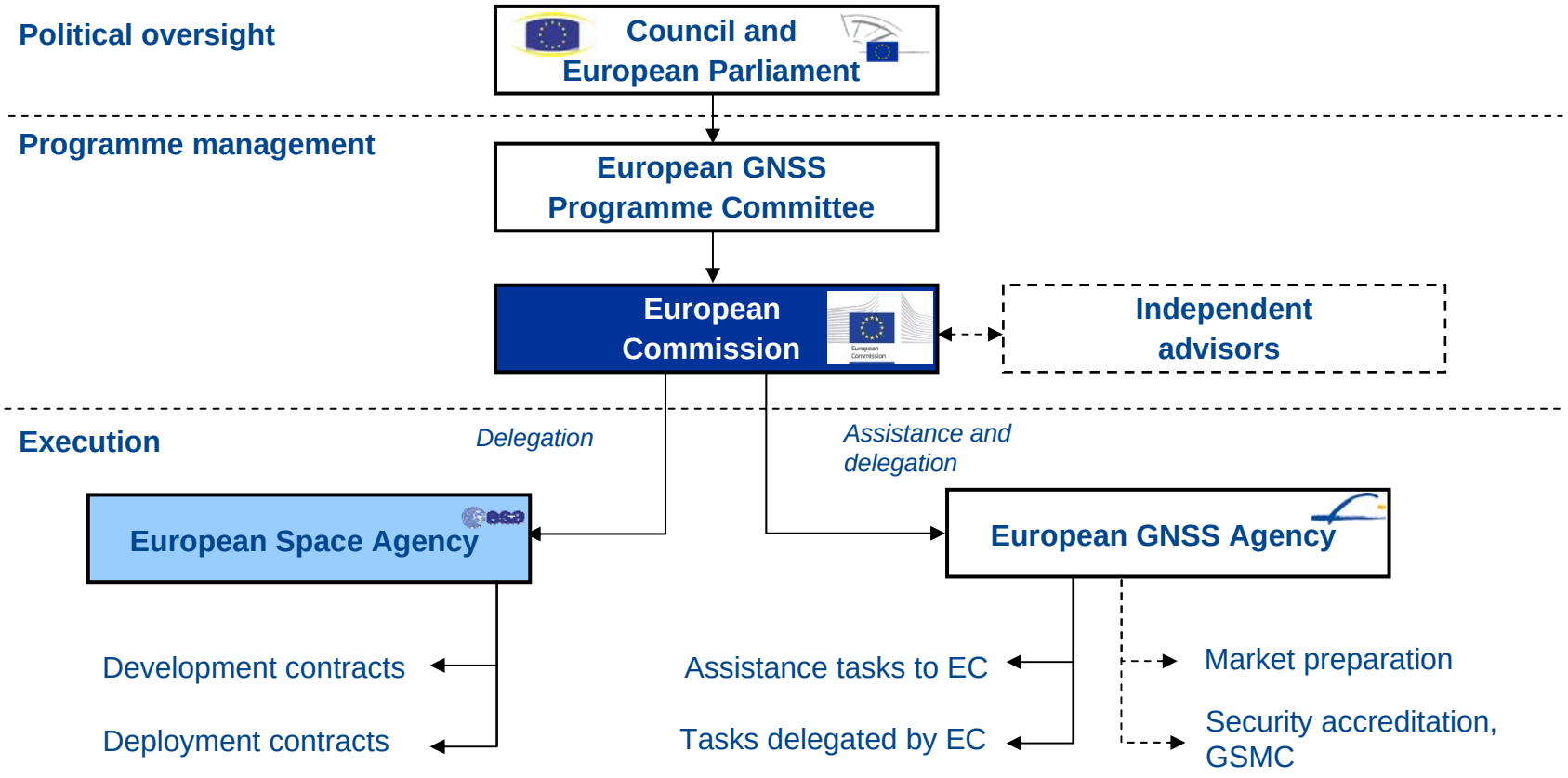
Key achievement since the last ICG – four Galileo satellites launched!

Navigation solutions powered by Europe

- **21 October 2011**, the first two operational satellites launched from Europe's Spaceport in Kourou, French Guiana
- First Soyuz launch from French Guiana
- **12 October 2012**, two further satellites launched from Kourou
- All satellites successfully released into target orbits at 23,222 km
- Operations nominal
- 2005/08 GIOVE test satellites are retired
  - Secured frequencies and tested key technologies

IOV: In-Orbit Validation
Photos: ESA

The GNSS Regulation entrusts the European Commission with the role of programme manager



GSMC: Galileo Security Monitoring Centre

Galileo timeline

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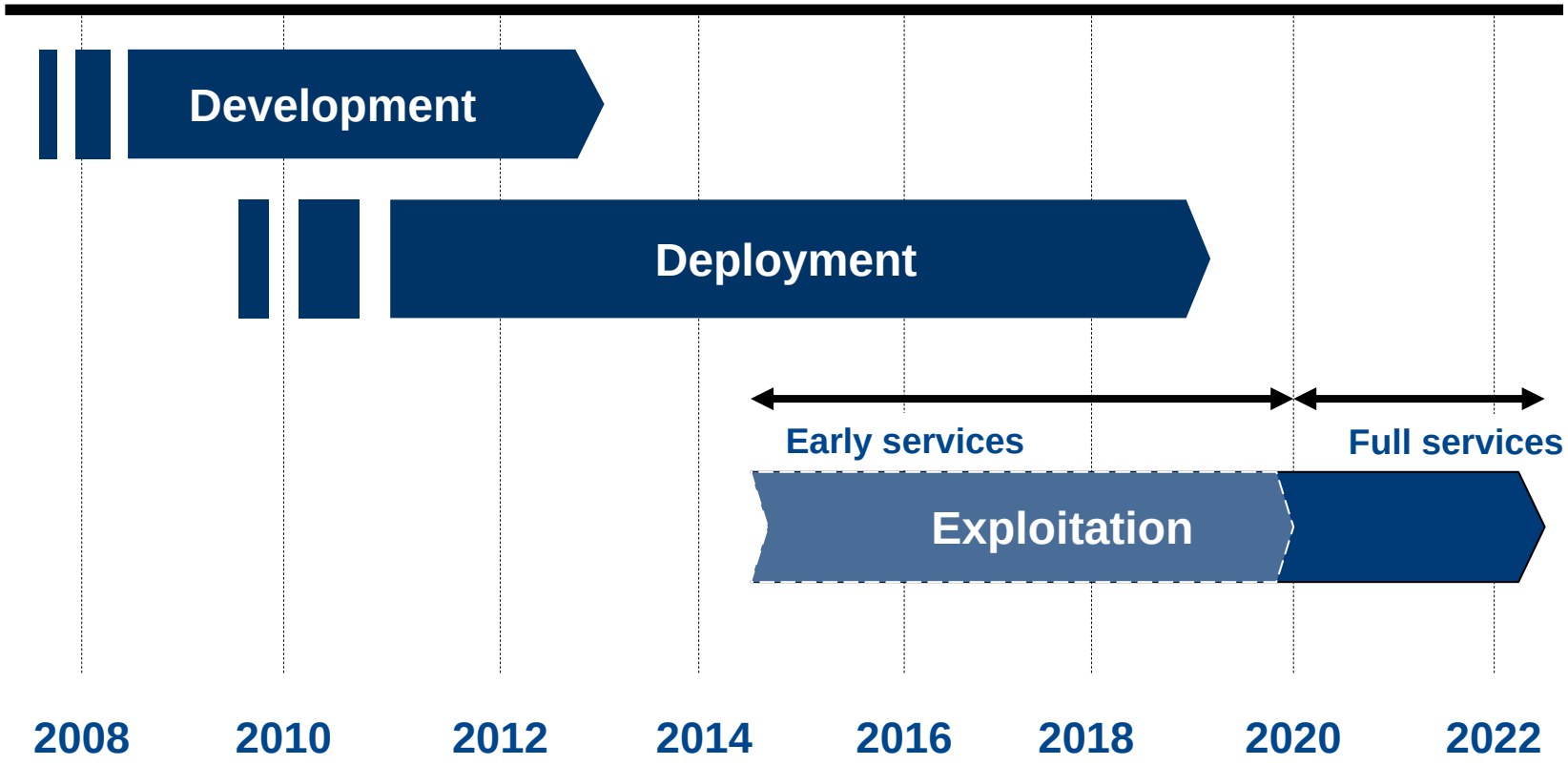
Galileo is moving from the development phase to the deployment phase



Galileo implementation plan

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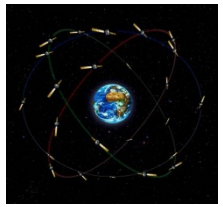
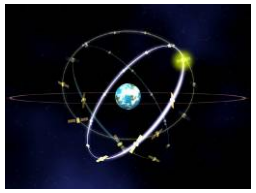
Galileo is implemented in a step-wise approach

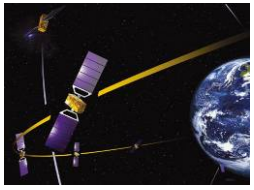
Full Operational Capability
Full services, 30 satellites
2020



Initial Operational Capability
Early services for OS, SAR, PRS, and demonstrator for CS
2014



In-Orbit Validation
4 fully operational satellites and ground segment
2013

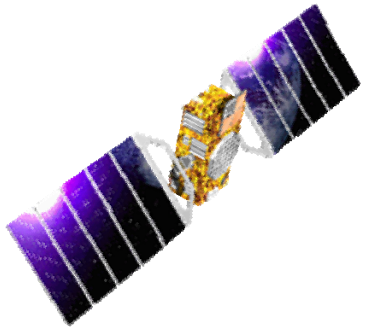


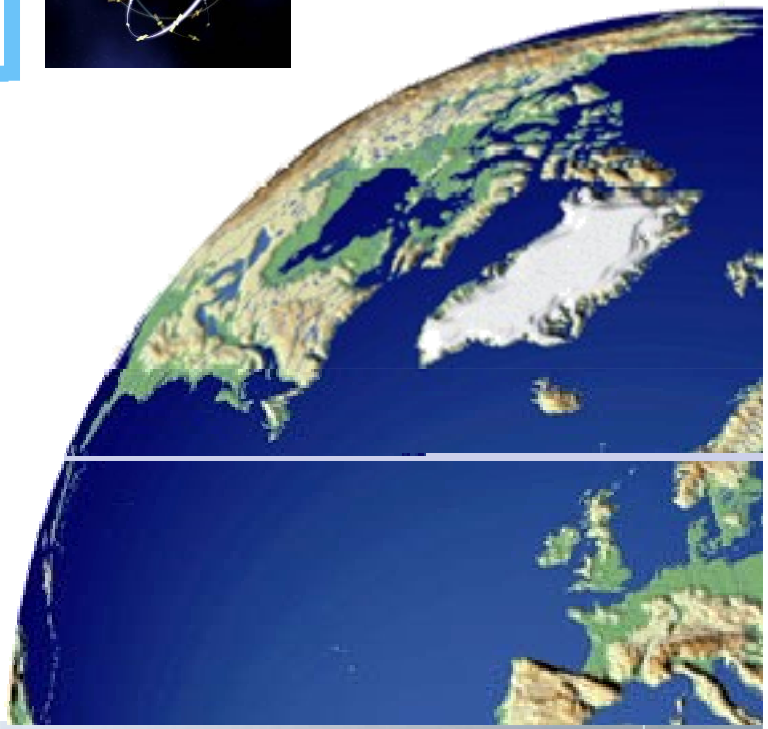
GIOVE A/B
2 test satellites
2005/2008

GALILEO
GIOVE

Galileo System Testbed v1
Validation of critical algorithms
2003

GALILEO
GSTB-V1





Galileo services provision timeline

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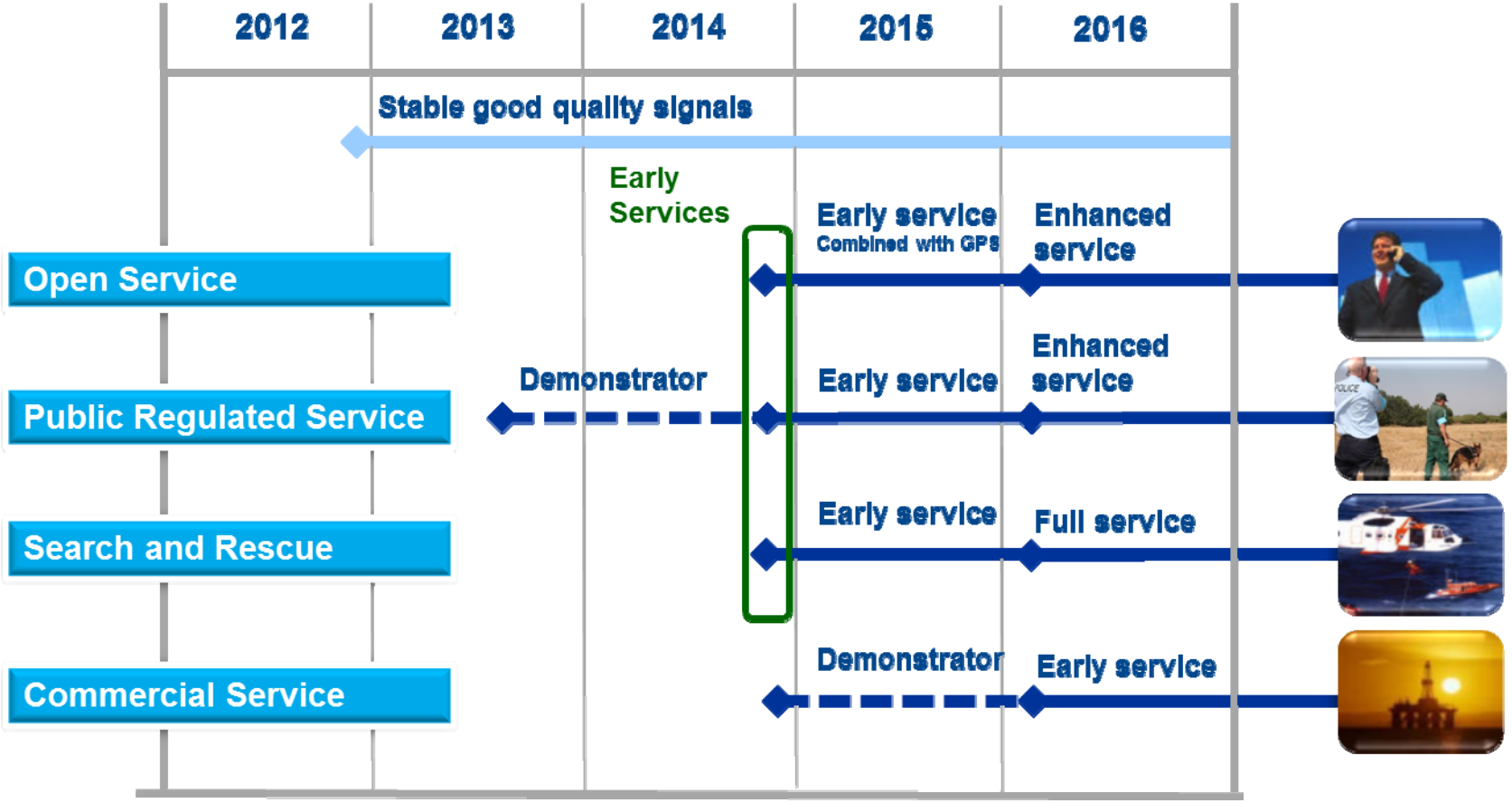
Early services will be provided from 2014 with a gradual transition towards full services as more satellites become available



Navigation solutions powered by Europe

Early services for OS, SAR and PRS will be provided from 2014

Open Service (OS)	Freely accessible service for positioning, navigation and timing	
Public Regulated Service (PRS)	Encrypted service designed for greater robustness and higher availability	
Search and Rescue Service (SAR)	Assists locating people in distress and confirms that help is on the way	
Commercial Service (CS)	Delivers authentication and high accuracy services for commercial applications	

The former "Safety-of-Life" service is being re-profiled:

Integrity Monitoring Service	Provides vital integrity information for life-critical applications	

Galileo procurement

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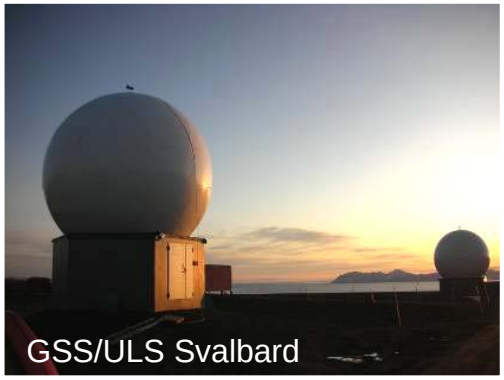
All six contracts awarded for: system support, ground segment, 22 satellites, ten satellite launches, and operations

Work Package	Contract Signature Date	Contract awarded to
WP1 System Support	January 2010	**Thales Alenia Space** (Italy)
WP2 Ground Mission Segment	June 2011	**Thales Alenia Space** (France)
WP3 Ground Control Segment	June 2011	**Astrium** (UK)
WP4 Space Segment	January 2010 February 2012	**OHB System** (Germany) for 14 satellites **OHB System** (Germany) for 8 additional satellites
WP5 Launcher Services	January 2010	**Arianespace** (France)
WP6 Operations	October 2010	**SpaceOpal** (Italian-German joint venture)

WP: Work Package

Several important ground installations have been set up around the globe



TTC: Telemetry, Tracking and Command GSS: Ground Sensor Station ULS: Uplink Station

Photos: ESA

As remote as it gets... Jan Mayen Island

Photos: ESA

Galileo ground segment for IOC

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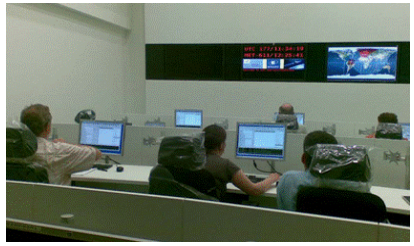
Note: Target set-up for IOC. Not all facilities are shown. USNO to host the Galileo to GPS time offset facility. IOC: Initial Operational Capability

The two Galileo Control Centres control the satellites and manage the navigation mission



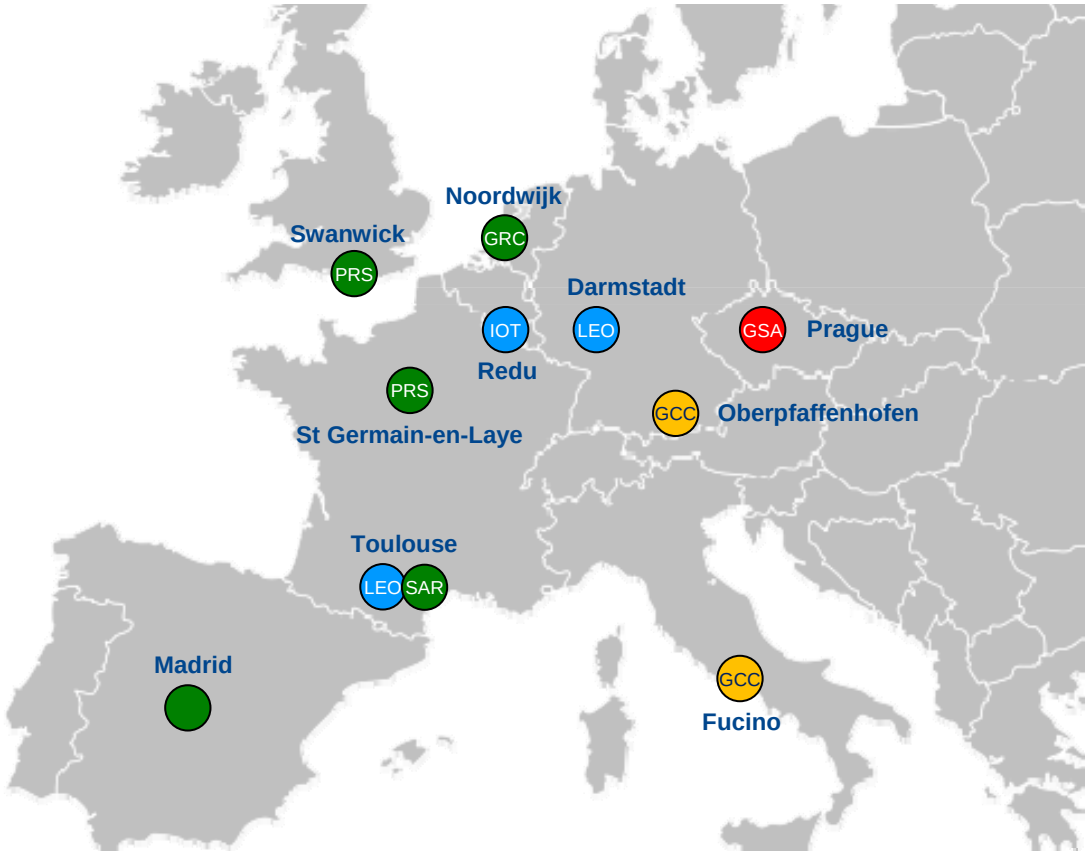
Oberpfaffenhofen, Germany

Fucino, Italy

Photo: ESA

Navigation solutions powered by Europe

Major Galileo centres and facilities are being built throughout Europe



- GSA — European GNSS Agency
- GCC — Galileo Control Centre
- IOT — Galileo In-Orbit Testing Centre
- LEO — LEOP Centre
- GRC — Galileo Reference Centre
- PRS — Galileo Security Monitoring Centre (PRS)
- Galileo Service Centre (OS/CS/Integrity)
- SAR — SAR Data Provider Centre

Note: Only major centres, facilities and stations are shown. Not all of them are (fully) implemented yet.

The first two Galileo satellites are transmitting signals

- ★ Oct/November 2011: satellites launched and control passed to the **Galileo Control Centre** in Oberpfaffenhofen
- ★ Galileo SIS in E1: 10 December 2011
- ★ E5, E5a/b signals: 14 December 2011
- ★ PRS signals successfully received on 14 February 2012
- ★ Latest two satellites: LEOP completed due to start transmissions soon

IOV: In-Orbit Validation
Photo: ESA

Galileo key achievements in 2011-2012

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Policy

- ★ Publication of PRS access rules
- ★ Publication of a Commission Decision with regard to the ground-based centres and stations
- ★ "Elements of Consensus" signed with China
- ★ Adoption of Council general approach for new EGNSS regulation

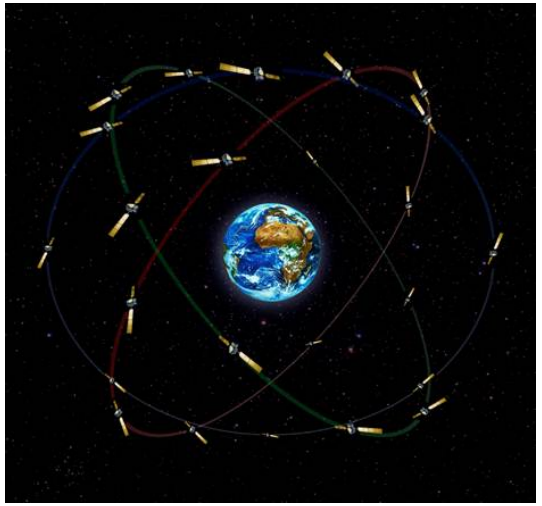
Programme implementation

- ★ Signature of the final industrial contracts
- ★ Successful launch of the first four Galileo satellites aboard a Soyuz rocket from Kourou
- ★ Contract placed for 8 additional satellites and for adapting Ariane-5 to launch four satellites, as well as "booking" an Ariane-5 launch
- ★ Numerous ground facilities established

On the 2020 horizon, Europe plans to establish itself as a reliable and attractive partner for satellite navigation services worldwide

Policy challenges

- ★ Implement new GNSS regulation from 2014
- ★ Further improve cooperation with other GNSS providers
- ★ Build confidence and attract users



Programme implementation challenges

- ★ Deliver early Galileo OS/SAR/PRS services from 2014
- ★ Deliver early Galileo CS services from 2016
- ★ Achieve full Galileo constellation of 30 satellites by 2020 and deliver full services

GNSS: Global Navigation Satellite System

European Commission

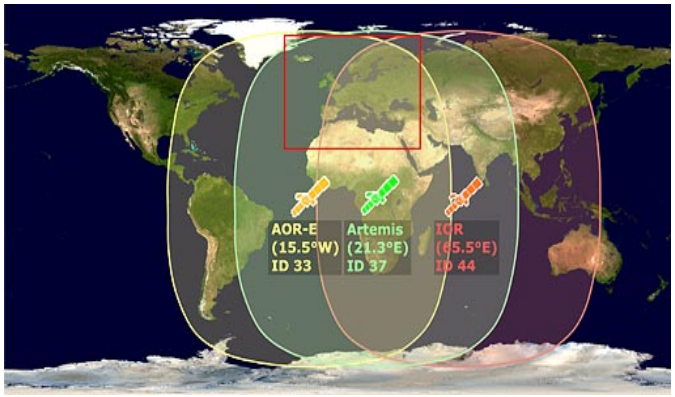
EGNOS

‘It’s there, use it’

EGNOS is fully operational

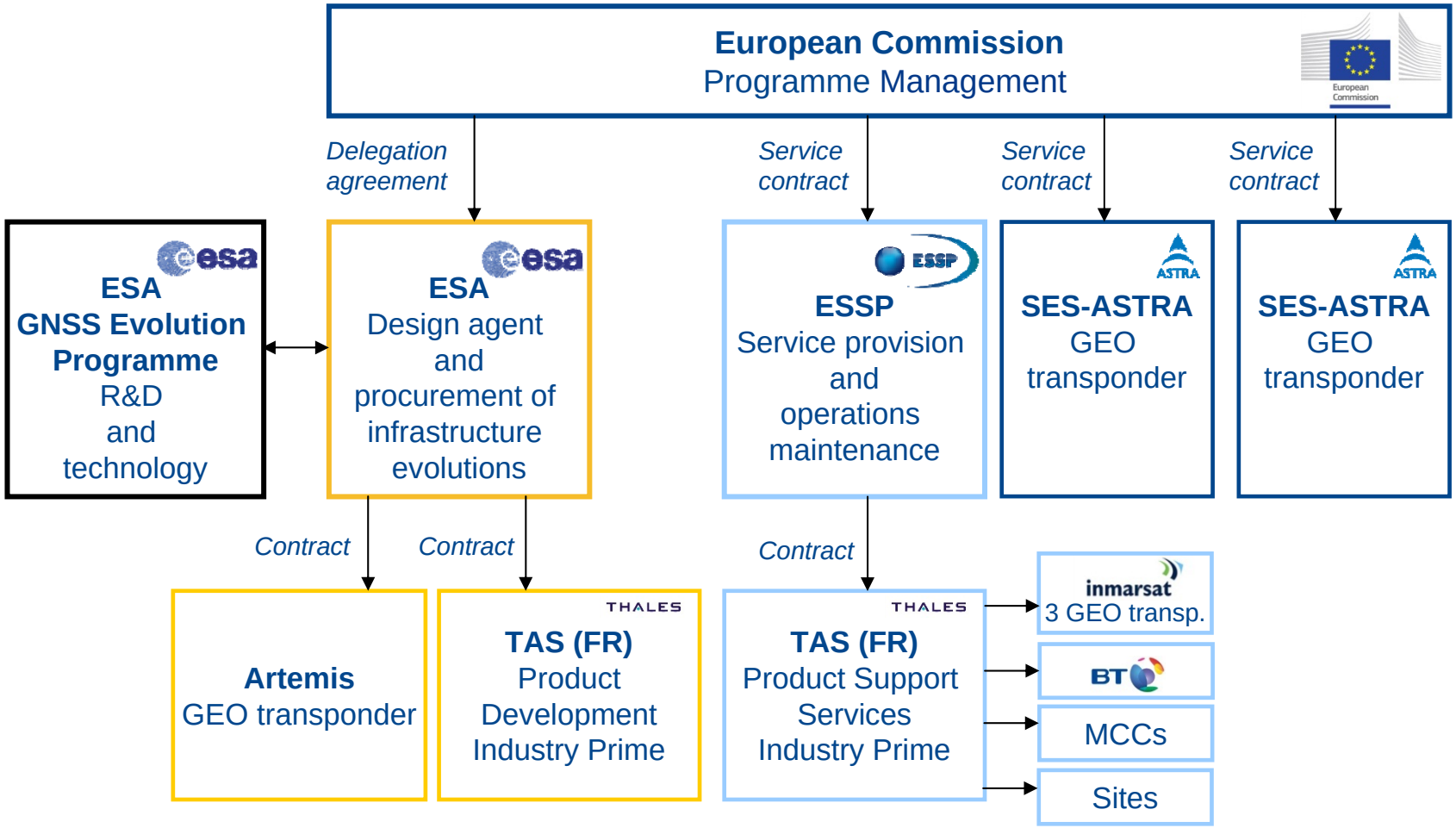
Navigation solutions powered by Europe

- **EGNOS Open Service is operational** since October 2009
- **Safety of Life** service declared operational March 2011
- Since December 2011, the EGNOS-based LPV procedures at Alderney airport (Channel Islands) are the first in Europe enabled for **revenue services on commercial flights**
- Around **100** approach procedures are approved to use EGNOS for aircraft landings
- The **EGNOS Data Access Service** (EDAS) was declared in July 2012



LPV: Localizer Performance with Vertical guidance

The European Commission is the EGNOS programme manager



GEO: Geostationary Earth Orbit MCC: Mission Control Centre

EGNOS timeline

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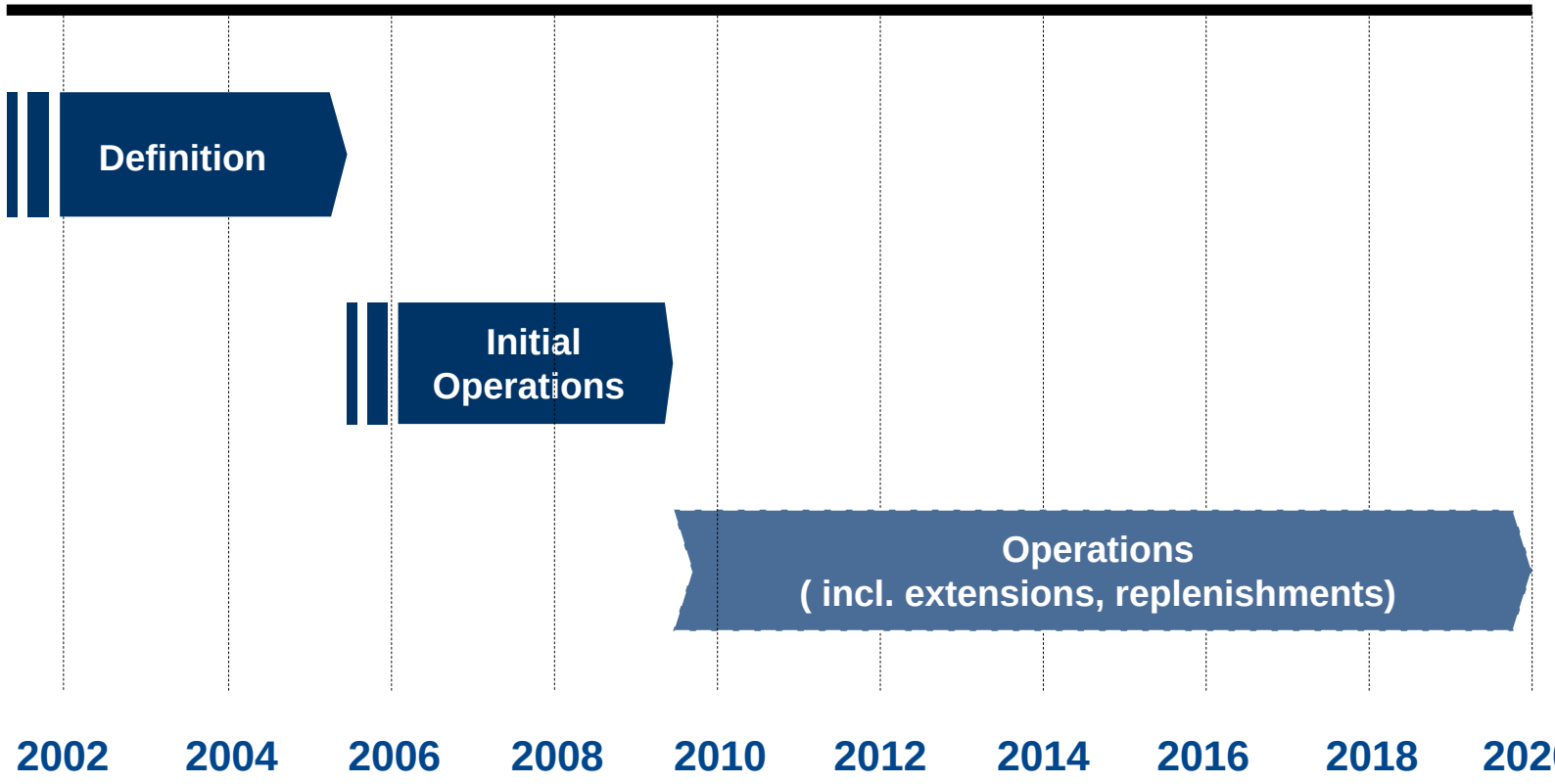
EGNOS is delivering a free Open Service since October 2009 and a Safety of Life Service for aviation since March 2011



Navigation solutions powered by Europe

EGNOS services will be delivered on a long-term basis (> 20 years)

Open Service (OS)	Accuracy ~1m, free	Available since October 2009	
Safety of Life Service (SoL)	Accuracy ~1m, compliant to aviation standards	Available since March 2011	
EGNOS Data Access Service (EDAS)	Accuracy <1m, corrections provided by terrestrial networks	Available since July 2012	

Navigation solutions powered by Europe

EGNOS has entered into its operational phase

- EGNOS programme management and assets transferred to the European Union (April 2009)
- Service provision contract with ESSP signed (September 2009)
- Open Service declared operational (October 2009)
  - EGNOS now achieves almost 100% availability
  - EGNOS now enables 1m GPS performance in central Europe ESSP certified as air navigation services provider (July 2010)
- Safety of Life Service declared operational (March 2011)
- Around 100 procedures making use of EGNOS approved in Europe (end of 2012)
- New Geo-1 Transponder launched on Astra satellite (July 2012)
- EGNOS Data Access Service (EDAS) declared (July 2012)

APV: Approach with Vertical Guidance ESSP: European Satellite Services Provider

Existing and planned EGNOS procedures

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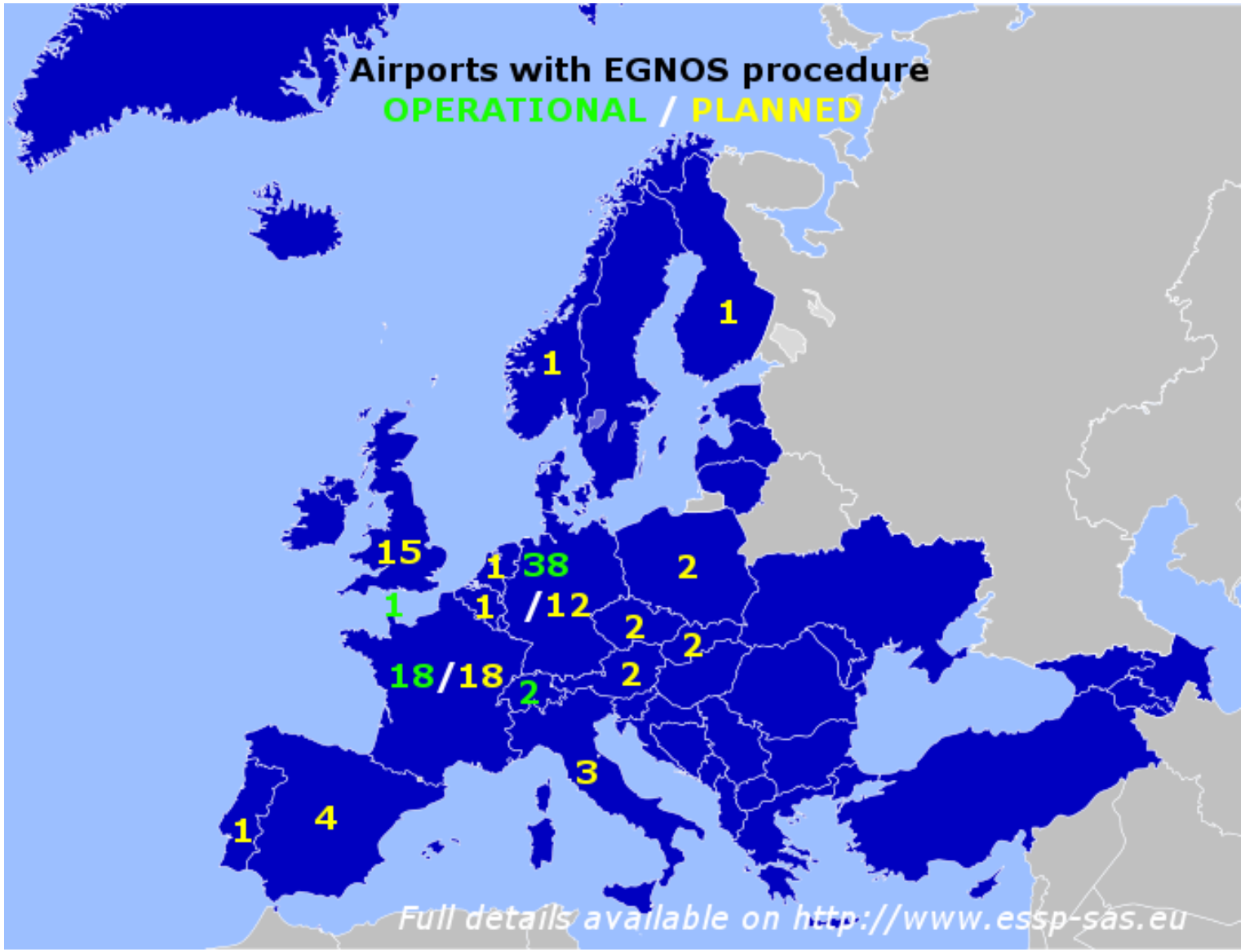


EGNOS services will further improve over time

2012

- ★ Declare EGNOS coverage extension for a large number of EU countries
- ★ Provide full EGNOS Data Access Service (EDAS)

Medium term

- ★ Implement LPV200 service level
- ★ Extend coverage to South Africa

Long term

- ★ Make use of E5a/E5b frequencies
- ★ Implement augmentation of Galileo and potentially other GNSS

LPV: Localizer Performance with Vertical guidance

International cooperation is crucial for the development of European GNSS

- **Objectives of international co-operation**
  - Compatibility and interoperability with other GNSS providers
  - Fostering uptake of EGNOS and Galileo worldwide,
  - Also: Development activities, Standardisation, Galileo applications, Research, SBAS and EGNOS extensions, Security, Trade matters

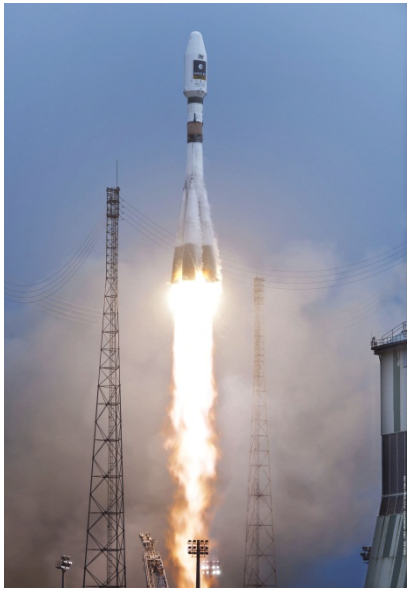
- **Implementation**
  - Conclude GNSS co-operation agreements
    - In place for: PR China, USA, Israel, South Korea, Ukraine, Morocco, Norway
    - Under discussion for: Russia, Switzerland, Brazil, Chile, Argentina
  - Expansion of EGNOS to cover the whole of Europe and then to extend to Africa

Galileo and EGNOS Summary

Navigation solutions powered by Europe

- **EGNOS is operational**
  - EGNOS OS since October 2009
  - EGNOS SoL service since March 2011
  - EGNOS Data Access Service since July 2012

- **Galileo is taking off**
  - All procurement contracts awarded
  - First four operational Galileo satellites launched in October 2011 and in October 2012
  - Deployment is being accelerated
  - Early Galileo OS/SAR/PRS services from 2014
  - Early Galileo CS services from 2016



- **International coordination is key**
  - Ensure compatibility with other GNSS as a minimum
  - Achieve interoperability when mutually beneficial

Photos: Eurocontrol, ESA


We’re getting there!
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EGNOS
Navigation solutions powered by the European Union
http://ec.europa.eu/galileo