Galileo and EGNOS Programmes
Status Update

Christian Siebert, European Commission

Ninth ICG Conference, Prague, 10 November, 2014

European Commission

GALILEO EGNOS

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- 1. State of Play: EGNOS
- 2. State of Play: Galileo


EGNOS

Recap: EGNOS System Architecture and Service Area

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6 Navigation Land Earth Stations

40 Ranging & Integrity Monitoring Stations (RIMS)

GPS signals

2 Support Facilities

4 Mission Control Centres

EGNOS Service Area

GEO Satellites

EGNOS Satellite Footprints

Geostationary satellites

- INMARSAT AOR-E 3F2 (15.5 W)
- INMARSAT IOR-W 4F2 (25 E)
- SES 5 – commissioning phase (5 E)
- ASTRA 5B – commissioning phase (31,5 E)

Recap: EGNOS Services

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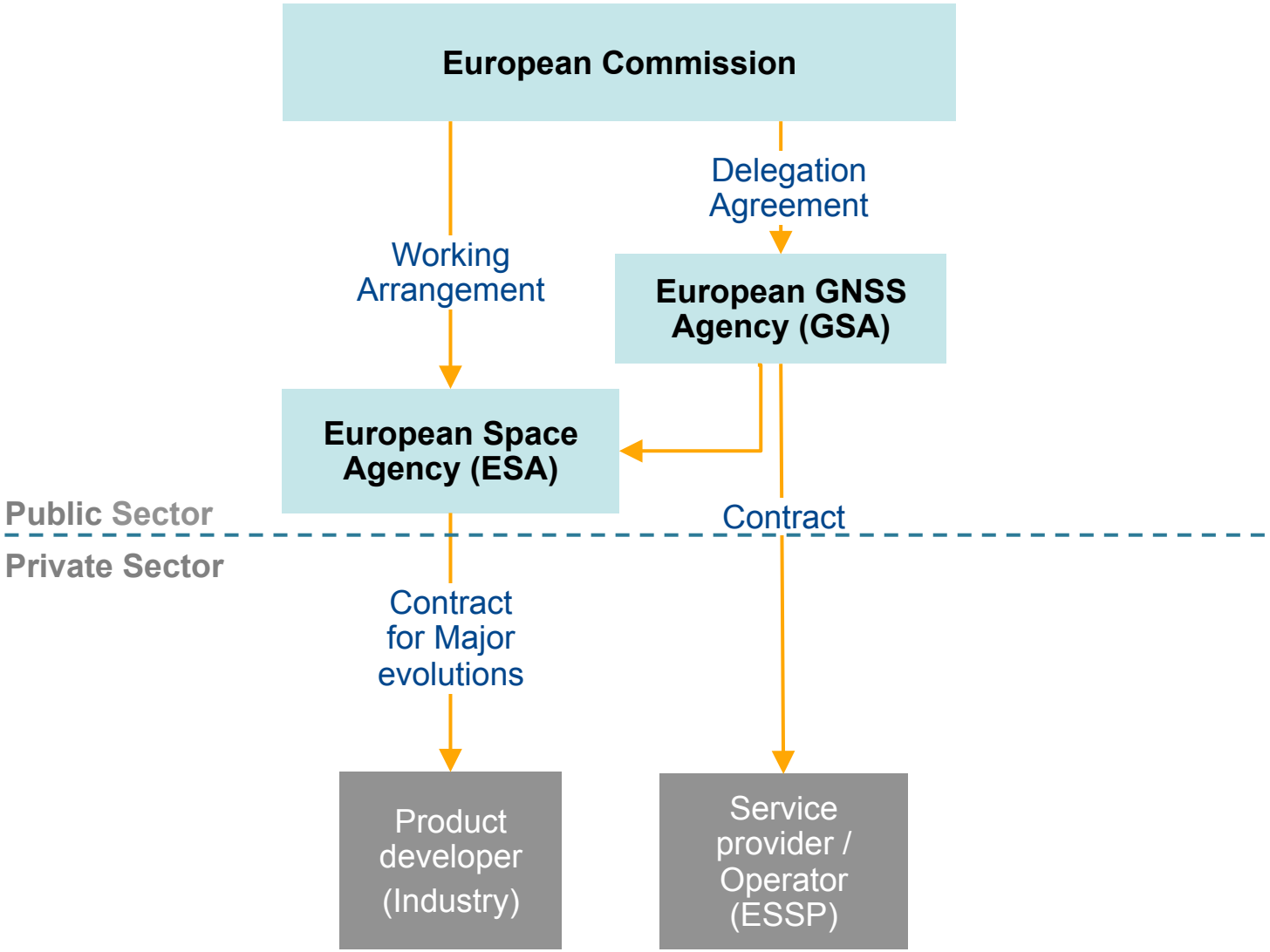
EGNOS will deliver its services on a long-term basis (>20 years)

Service	Characteristics	Service Status	
Open Service	accuracy ~1m, free	available since October 2009	
Safety of Life Service	accuracy ~1m, compliant to aviation standards	Available since March 2011	
EDAS	accuracy <1m, corrections are provided by terrestrial networks	experimental service since 2008; official service made available in 2012	

(EDAS: EGNOS Data Access Service)

EGNOS – Organisation and contractual frameworks



(ESSP: European Satellite Service Provider)

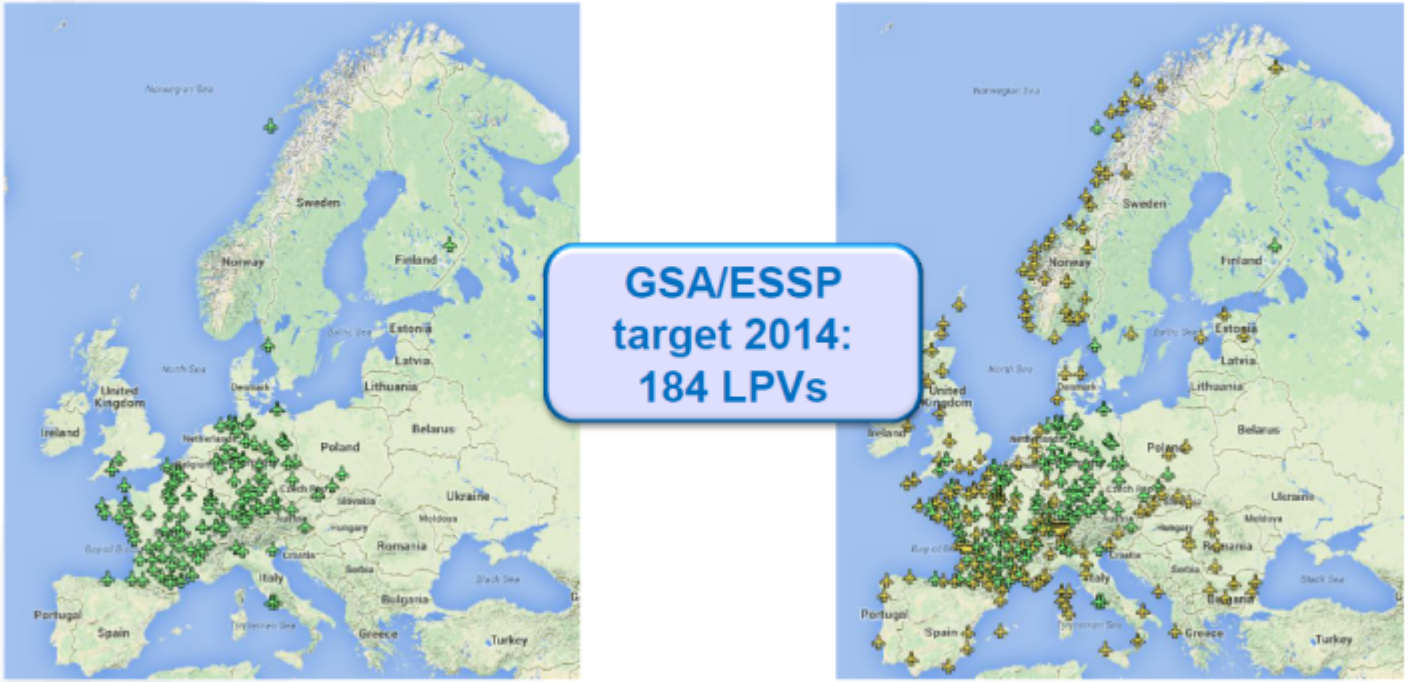
IMPLEMENTATION STATUS

As of 18th Sept 2014

128 LPV serving 86 airports
76 runways served by EGNOS enabled APV Baro

Plans by 2016

>320 LPV planned by 2016



GSA/ESSP target 2014: 184 LPVs

Check link: http://egnos-user-support.essp-sas.eu/egnos_ops/lpv_map/map.php

(APV Baro: Approach Procedure with Barometric Vertical guidance. LPV: Localizer Performance with Vertical guidance)

Other examples of increasing uptake of EGNOS

- The French air navigation service provider (DSNA) plans to modernise and rationalise their landing system infrastructure, taking into account that EGNOS-aided landing is equivalent to that of ILS Cat I

- The options list for new Airbus A350 aircraft now includes EGNOS-aided landing. Out of 750 firm orders, most have chosen this option
  - Qatar Airlines expects to fly the first A350 commercial flight by early 2015 (using EGNOS when certified approaches are available)

(ILS: Instrument Landing System)

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EGNOS services will further improve over time

2014

- ★ Publication of new version of the Service Definition Documents for the OS, SoL and EDAS planned for end of 2014, beginning of 2015

Medium term

- ★ Full coverage of 28 EU Member States' territory (geographically located in Europe)
- ★ Implement LPV200 service level

Long term

- ★ EGNOS version with dual (L1/L5) frequencies, also to enable augmentation of Galileo and potentially other GNSS
- ★ Subject to conclusion of necessary contracts and agreements, extension of the EGNOS coverage to EU neighbouring countries and regions, including Africa.

(SoL: Safety of life, LPV: Localizer Performance with Vertical guidance , EDAS: EGNOS Data Access Service)


GALILEO

Secure Foundations

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REGULATION (EU) No 1285/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 11 December 2013

on the implementation and exploitation of European satellite navigation systems and repealing Council Regulation (EC) No 876/2002 and Regulation (EC) No 683/2008 of the European Parliament and of the Council

- ✓ A stable 7 years perspective
- ✓ A subtantial budget
- ✓ A new governance scheme driven by exploitation

2014-2020

- ❑ **1,930 B€ for Galileo Deployment**
- ❑ **3 B€ for Galileo Exploitation**
- ❑ **1,580 B€ EGNOS Exploitation**

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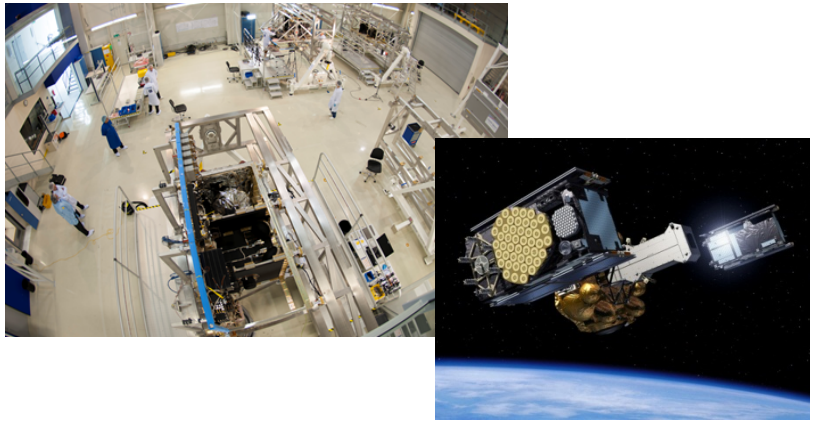
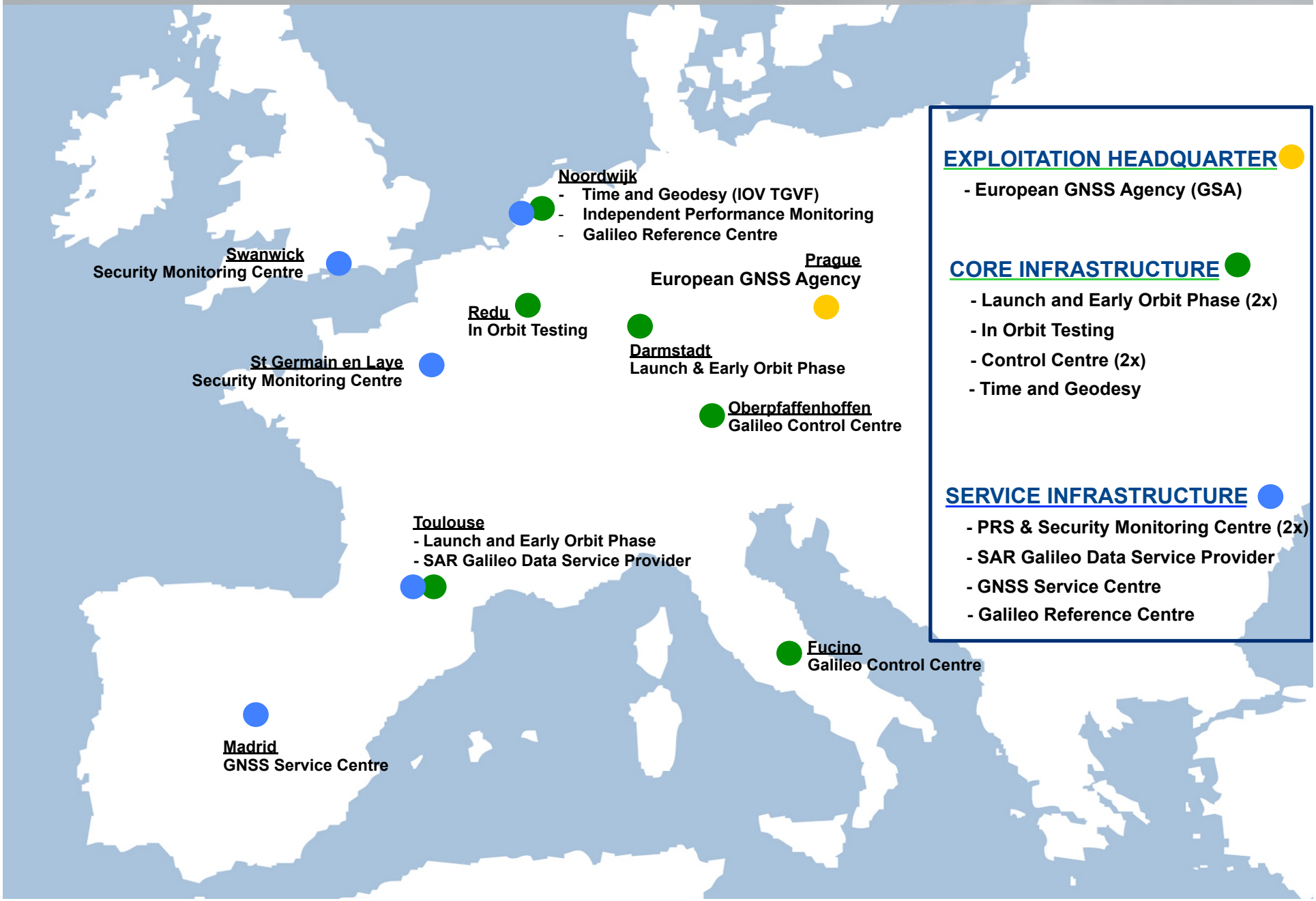
- New governance for the programme put in place
- Galileo In Orbit Phase successfully concluded
- Ground infrastructure deployment finalised for initial operations



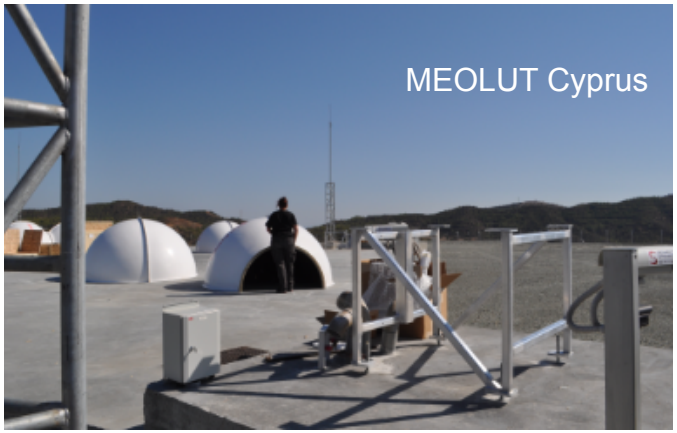
- Preparation of service delivery and system exploitation

- New satellite design qualified
- Soyuz Launch Anomaly

Geared for Service Delivery



Gaining ground



Photos: ESA, EC

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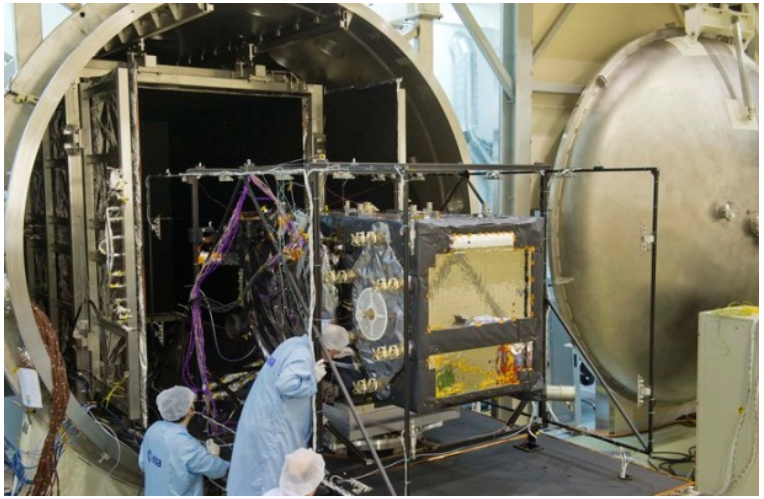
The deployment plan for the Galileo constellation is secured

- 26 satellites in total have been ordered:
  - 4 IOV + 22 FOC
  - The launcher service contracts for the full constellation have been signed with Arianespace:
    - Soyuz: 7 launches for 14 satellites (incl. the launches in 2011, 2012 and 2014)
    - Ariane 5: 3 launches for 12 satellites

(IOV: In-Orbit Validation, FOC: Full Operational Capability)
Photo: ESA, Arianespace

New satellite design on track

- FOC Satellites built by OHB with navigation payload from Surrey Satellite Technology Ltd
- Satellite production proceeds at a good pace



Photos: OHB, Arianespace

Not the first Gremlins in space…

- ★ 1st launch of Galileo FOC satellites on August 22nd
- ★ Satellite injection anomaly detected shortly after the end of the launch phase
- ★ Satellites under control but in elliptical orbit and different plane inclination

- ★ Inquiry Board established by Arianespace investigated source of launch anomaly
- ★ EC-ESA analysing best options to adapt the mission for those two satellites
- ★ Follow-up launch sequence to be confirmed when as soon as possible

Photos: Arianespace

At your service

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★ Galileo Service Center operated by the GSA

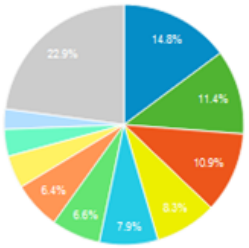
www.gsc-europa.eu

★ Regular publication of Notice Advisory to Galileo Users (NAGUs) and state of Galileo constellation

✓ **Visiting countries**

EU-28	Non EU Europa	Asia	America	Africa	Oceania
28	9	26	12	9	2

		Pageviews	%
1.	Spain	1,589	
2.	Belgium	1,095	
3.	Germany	999	
4.	Netherlands	254	
5.	Czech Republic	238	
6.	United Kingdom	156	
7.	Italy	121	
8.	France	114	
9.	United States	106	
10.	Poland	105	
	Other		



* **USA:** 93 visits; 3.89 % of total
India: 42 visits; 1.76 % of total
Japan: 34 visits; 1.42 % of total
China: 23 visits; 0.93 % of total
Russia: 18 visits; 0.75 % of total

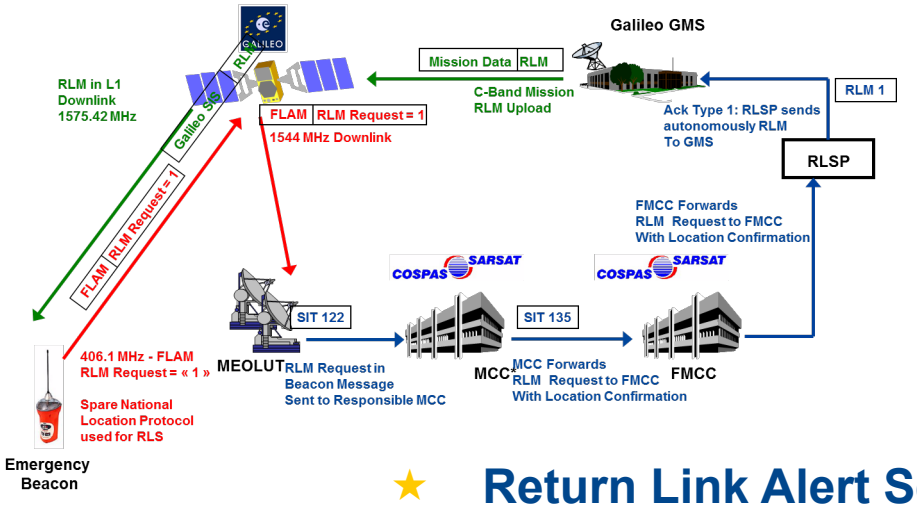
★ Growing number of visits and user queries

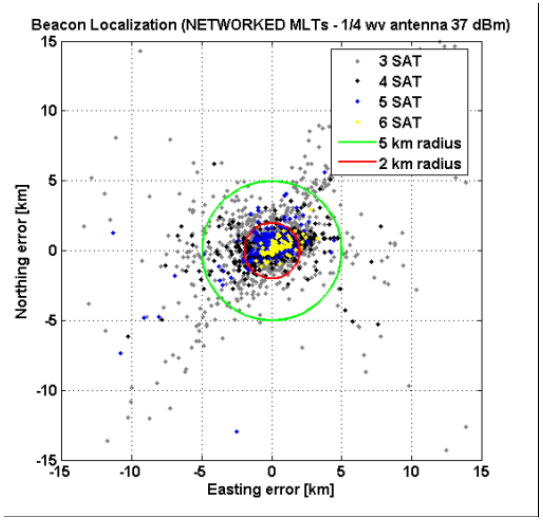
★ New functionality being developed for early services

- ➢ Subscription services soon available
- ➢ Monthly service reporting

★ **The Forward Link Alert Service**: contribution to the Cospas-Sarsat MEOSAR Programme

- ★ Successfully tested networked ground segment, April 2014
- ★ Positioning accuracy exceeds expectations





★ **Return Link Alert Service**: provides users in distress an acknowledgment message informing them that the alert has been detected and located

- ★ End-to-end link tested successfully, Oct 2013 and March 2014

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★ Main objective of the Commercial Demonstrator

- ★ Test and characterise the high accuracy and authentication performance obtainable with Galileo CS.

★ First results are extremely promising:

- ★ High accuracy PPP enhancement for both Galileo and GPS was already demonstrated through information transmitted via the E6B signal
- ★ Authentication schemes are currently under test, including data authentication and spreading code encryption.
- ★ Access control and signal encryption and key management also under test.

(PPP: Precise Point Positioning)

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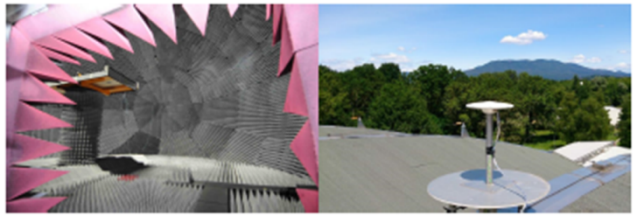
Receiver Test campaign

- Support manufacturers to ensure that Galileo is well implemented in chipsets and receivers
- Develop dialogue with the user receiver segment.
- Understand the market situation and follow-up adoption of Galileo

Campaign organised by GSA with technical testing by EU's Joint Research Center (JRC) and European Space Agency (ESA)

Test Campaign Organisation (2014-2015)

- Consumer (mass market) chipset: 7 companies involved (90+% market share in total)
- Professional receiver: 8 companies involved.
- E-call specific testing: 8 companies involved.



Looking Around…

- **Galileo will deliver reliable, high quality services to the world and continue to evolve and introduce innovative features**
- **In the near future, the trend for most user communities is towards service levels based on a multi-constellation approach, it is therefore crucial to:**

- Continue improving signal compatibility and service interoperability with other providers
- Cooperate on multi-constellation service provision

Looking ahead

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In 2015, Galileo will be facing the challenges of the early phase of service delivery…

- ★ Gradual service introduction approach
- ★ Strong interaction with users
- ★ Need to run early services with continued infrastructure deployment

…and

- ★ Conduct a service validation campaign
- ★ Finalise Commercial Service definition
- ★ Develop a long term evolution plan for Galileo


Keep watching…..
GALILEO
EGNOS
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http://ec.europa.eu/galileo