Geospatial Strategy for national and regional development: European GNSS opportunities

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European GNSS Agency

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Agenda

- European GNSS Agency
- EU-GNSS potential
- EU-GNSS Research & Development FP7- experience and results
- EU-GNSS Research and Innovation: Horizon2020 opportunities

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Agenda

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European GNSS Agency (GSA) – key figures

- Main tasks:
  - **Market Development** for the adoption of EU-GNSS
  - Ensuring the **Security** of the European GNSS Programmes
  - **Exploitation of EGNOS**
  - **Exploitation of Galileo**

- Staff: **100**

- Headquarter: **Prague, Czech Republic**

- **Security monitoring centres** in UK and France

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Integrated market development activities to foster EU-GNSS adoption

[redacted]

[redacted]

- ✓ Analyse the market and Public benefits
- ✓ Application R&D
- ✓ User requirements
- ✓ Inputs for regulation
- ✓ Engage receiver manufacturers
- ✓ Convince users and decision makers
- ✓ Adoption Roadmap

E-GNSS USER ADOPTION

EU PUBLIC BENEFITS

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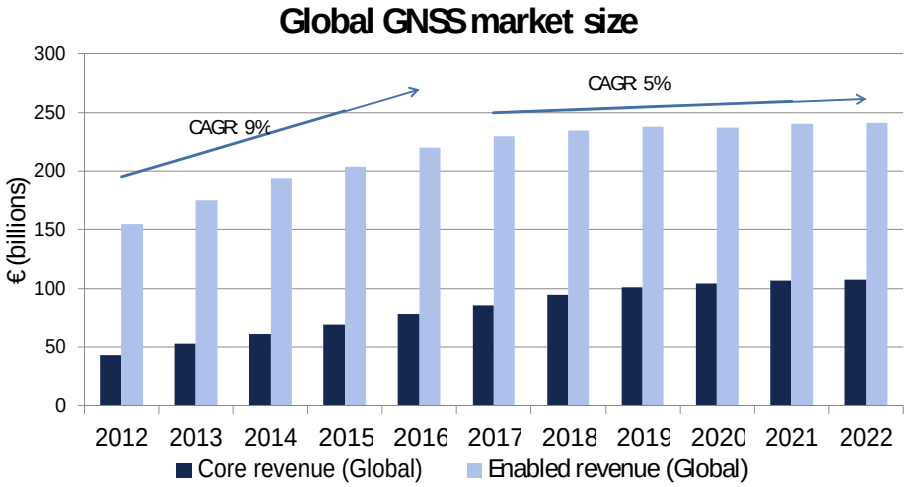
EU-GNSS potential

Reap the EGNSS Market opportunity



GNSS capabilities of today's receivers

- 7 bln GNSS devices expected by 2022 – almost one for every person on the planet
- Galileo already present in more than 30% of receiver models, ahead of its full operational capability.

Be ready for the Galileo Early Services in 2014 – include Galileo in your product roadmaps today

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Source: GSA analysis based on GPS World Survey 2013. Percentages based on number of models available, not sales

The European GNSS Programmes: EGNOS and Galileo

Galileo

- Global Navigation Satellite Systems (GNSS)
- Fully interoperable with GPS*
- Currently 4 operational satellites
- Target 30 satellites
- Early services starting late 2014
- Open service free of charge and delivering dual frequencies (better performances)

EGNOS

- Satellite Based Augmentation System (SBAS)
- Improves GPS performance
- Sends corrections to users via satellite or terrestrial links (EDAS)
- EU coverage under extension in other regions (North Africa and East Europe)

EGNOS
'It's there, use it'

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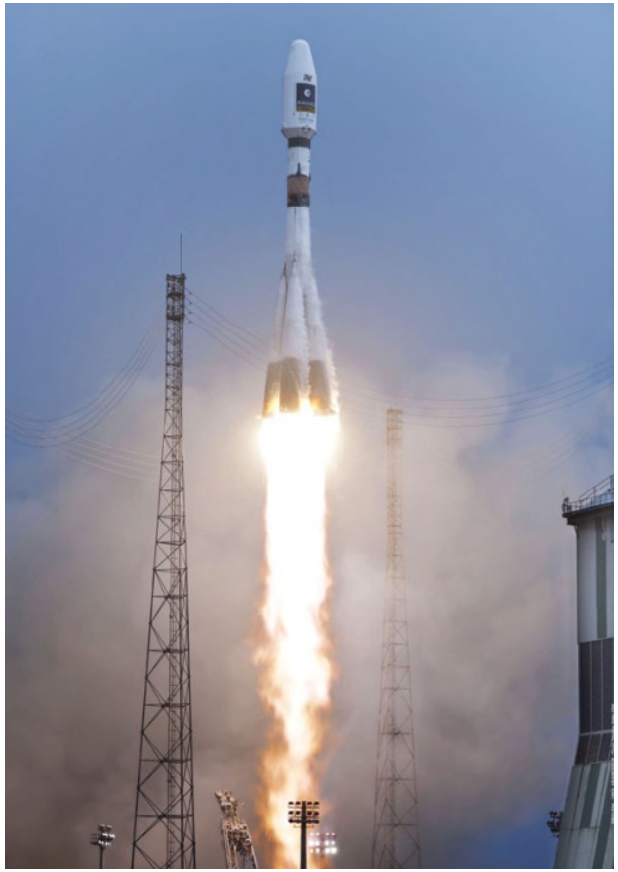
*GPS: Global Positioning System

Galileo is under way



- 4 **operational validation satellites** launched and usable as of today
- **The first Galileo-only fixed position was achieved 12 March 2013**
- All **industrial contracts** necessary have been signed to ensure up to **26 satellites**:
  - ✓ Early Galileo services in 2014
  - ✓ A launch planning for having 10 satellites by 2015 has been confirmed by ESA

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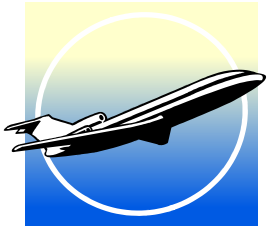
EGNOS adoption results in four key markets

Road

- EGNOS is inside the EU largest road user charging scheme deployed after 2009 service declaration
- Top three EU service providers endorse EGNOS

Aviation



- 186 approach landing procedures in 100 airports
- 15 operators

Agriculture

- 2/3 of farmers using GNSS adopted EGNOS

Mapping

- EGNOS only receiver in the market since 2012

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EU-GNSS Research & Development FP7- experience and results

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EU-GNSS Research & Development: FP7 results in a nutshell

EU-GNSS FP7 1st, 2nd and 3rd Calls

- **10** Patents/registered trademarks (also on-going)
- **33** Commercialised products/services
- **69** Working prototypes

and more is expected…

- **3** calls for proposals on GNSS Applications
- Portfolio of **~90** R&D projects with a budget of **~€70 mln**
- **425** beneficiaries

- **40%** of **GNSS funds** to **Small and Medium Enterprises** vs. **EU FP7 average <15%**

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FP7 projects are providing new products on the market …

SAFEPORT: Safe Port Operations using EGNOS SoL

- ✓ EGNOS improves vessel traffic management
- ✓ Development of Active vessel Traffic Management and Information System and EGNOS enabled Portable Pilot Unit
- ✓ Successful prototype demonstration in Dublin port.

On the Market from Jan 2013

WalkEGNOS: a social web 2.0 mapping solution generating and leveraging on the brand "EGNOS Powered"

WalkEGNOS offers:

- ✓ A web site following the **social network** approach:
  - hikers and bikers have the possibility to share theirs tracks
- ✓ New opportunities for high quality leisure/ touristic services
- ✓ Value for search and rescue operations
- ✓ A post processing EGNOS server relying on **EGNOS data**:
  - data available will be post-processed and validated
  - free log devices for database population

Already Available
Register online: walkegnos.net

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…and bringing public/ social benefits

GOLDEN-ICE: EGNOS accuracy in precise salt spreading for road safety

GOLDEN-ICE: The large quantities of salt required has environmental impacts and high economical costs

On the Market

A new green solution for highway companies and municipalities daily involved in winter maintenance operations

INCLUSION: Innovative LBS for Social/Public Dimension

Inclusion is a location-based service (LBS) solution offering motor-impaired persons improved mobility in safe conditions, helping them navigate traffic safety problems and limited accessibility of public transport.

During the **European Space Solution 2012** in London, the INCLUSION solution was tested by Peter Norfolk, British wheelchair tennis player.

On the Market

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The information on FP7 projects and their results is available on GSA website

Project	Product	Market Entry Date
ASPHALT	*High precision applications in road construction, fleet management and logistics using EGNOS*	
	MOBA Compaction Assistant (roller system)	2012
	MOBA Pave-IR Scan (paver system)	2013
SCUTUM	LCS: Solution supporting EGNOS services adoption in the transport of dangerous goods in Europe: 300+ trucks been equipped.	Dec 2011
COSUDEC	system for enhanced surveying of coastal waters through using standard navigation equipment, as an alternative to traditional Hydro-surveyors and high precision instruments	Jan 2011
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SafePort	GNSS based Piloting Software for iPad / Tablets	July 2013

..there are more tangible results…

Visit: http://www.gsa.europa.eu/r-d/gnss-project-portfolio

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EU-GNSS Research and Innovation: Horizon2020 opportunities

EGNOS

GALILEO

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Horizon2020 is the new EU Framework for Research and Innovation for 2014-2020

EU-GNSS concrete opportunities for industry – Location Based Services

Applications

Personal navigation, advertising, emergency caller location, gaming, sport and entertainment, weather information and news, social networking

Recent developments

- Augmented reality
- Indoor positioning

Devices

- Integration of positioning into devices such as cameras, watches, and binoculars

Technology

- Various positioning technologies integrated into one device.
- Switching from outdoor to indoor positioning.

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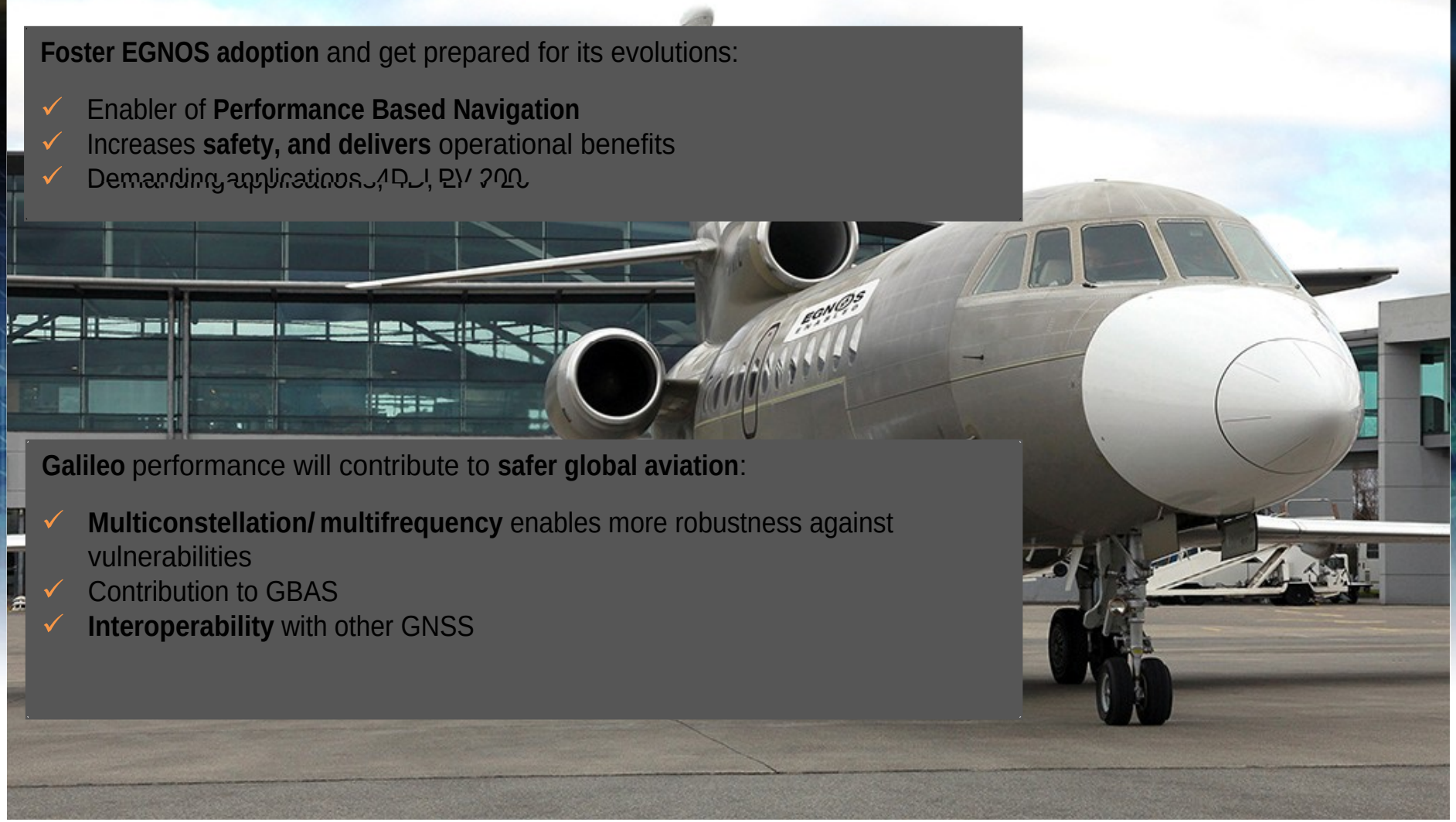
EU-GNSS concrete opportunities for industry – Aviation

Communication, Navigation and Surveillance applications for all phases of flight will rely on EU-GNSS

Foster EGNOS adoption and get prepared for its evolutions:

- ✓ Enabler of **Performance Based Navigation**
- ✓ Increases **safety, and delivers** operational benefits
- ✓ Demanding applications, ADS-B, PBN, ...



Galileo performance will contribute to **safer global aviation**:

- ✓ **Multiconstellation/ multifrequency** enables more robustness against vulnerabilities
- ✓ Contribution to GBAS
- ✓ **Interoperability** with other GNSS

EU-GNSS concrete opportunities for industry – Maritime

Examples of applications:

- ✓ General navigation
- ✓ Automatic collision avoidance
- ✓ Track control
- ✓ Traffic management
- ✓ Port operations
- ✓ Fisheries monitoring

Galileo will efficiently contribute to international SAR operations

- ✓ Europe's contribution to the MEOSAR system of COSPAS-SARSAT
- ✓ Forward link: Time reduction in the detection and localization of SAR alert
- ✓ Return link: Sends detection acknowledgement message from the SAR operator to the distress emitting beacon

EU-GNSS concrete opportunities for industry – Intelligent Transport Systems

- **Pay as you drive, Distance based road pricing:** more accurate and trustable positioning enhance performance

- **Intelligent driving, Advanced Driver Assistance (ADAS), Connected vehicles:** intelligent support to drivers for both comfort and safety (robust and accurate lane level positioning)

- **Digital Tachograph:** GNSS is a second source of data and register starting-ending time of the journey

- **Dangerous goods tracking**: robust positioning requirements uptake in EU Member States

EU-GNSS concrete opportunities for industry – Rail

EGNOS and Galileo can contribute to a more efficient train command and control as well as better asset management supporting multimodal logistics

- **Train signalling**: GNSS as an enabler of economically more viable signaling solutions providing more precision and saving valuable resources
- **Asset Management:** including functions such a fleet management
- **Passenger Information:** systems on-board train showing the real-time location of the train along its route

EU-GNSS concrete opportunities for industry – Agriculture

With the emergence of Galileo, multi-constellations and dual-frequency use will sustain current high growth rates

Examples of business opportunities:

- ✓ **Farm management solutions:** use of real-time information for monitoring the location and status of farm equipment
- ✓ **Tractor guidance**
- ✓ **Variable Rate Applications:** leveraging local conditions on the field for precise control over farming inputs (e.g. fertilisers, nutrients)
- ✓ **Automatic steering solutions**

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Pictures' sources:
http://innovationstelevision.com
http://news.cision.com
http://agreport365.com

EU-GNSS concrete opportunities for industry – Mapping and Surveying

Use of Mapping based on EGNOS will be complemented with Galileo providing benefits for Surveying

The emergence of **new constellations and multiple frequencies** along with **decreasing device prices** will open up the market of Surveying and Mapping

EGNOS to be complemented with Galileo

- ✓ GNSS devices more and more accessible at lower cost (EGNOS enabled)
- ✓ ...and with increased performance (leveraging Galileo)

Technology trends for EGNSS

Galileo CS (HP surveying)
- Accuracy, continuity
- Reliability with Authentication (tbc)
- Resistance against multipath

EGNOS and Galileo OS Double Frequency (basic precision for mapping)
- Autonomous basic accuracy solution for low cost

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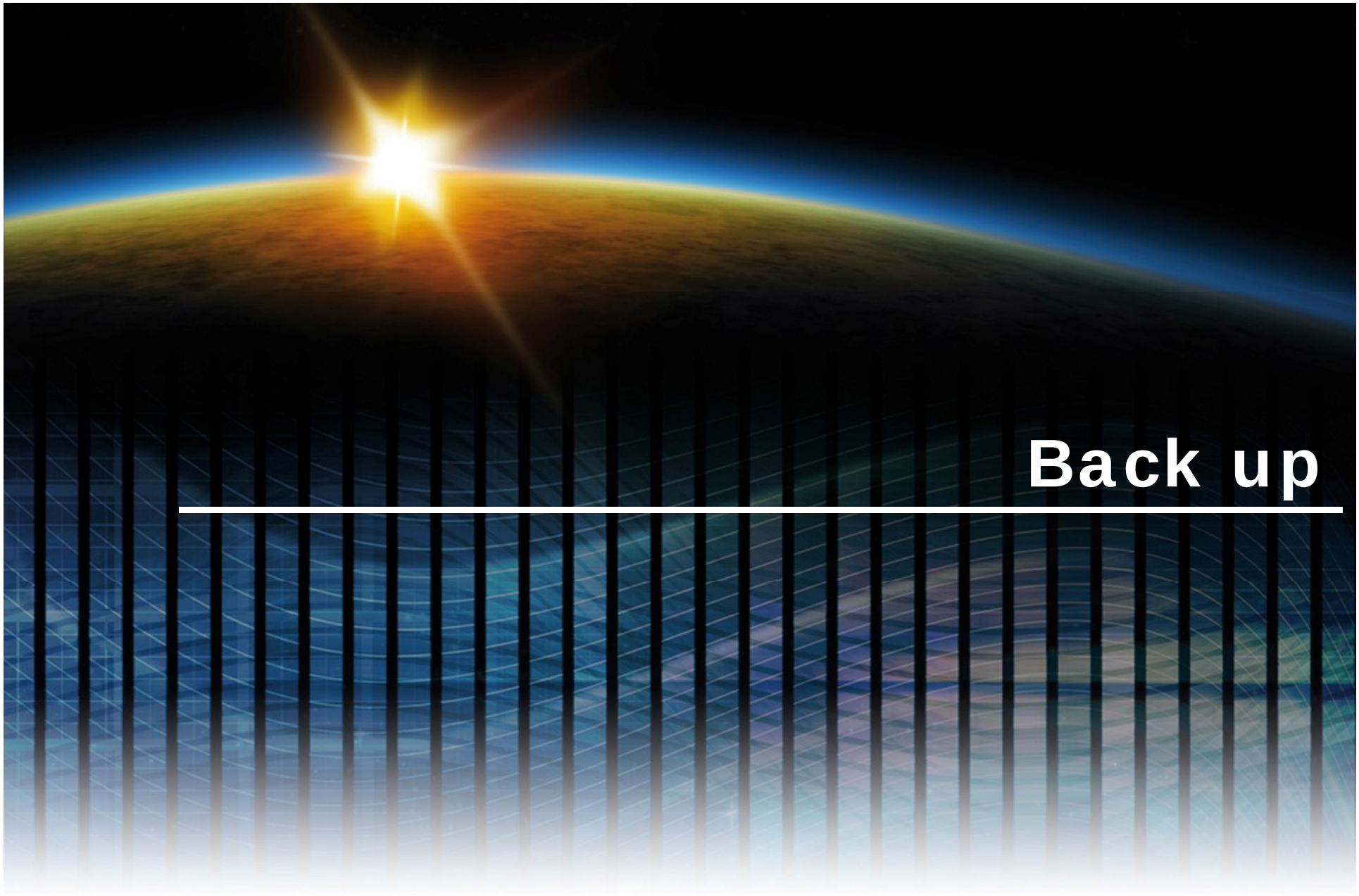

Back up

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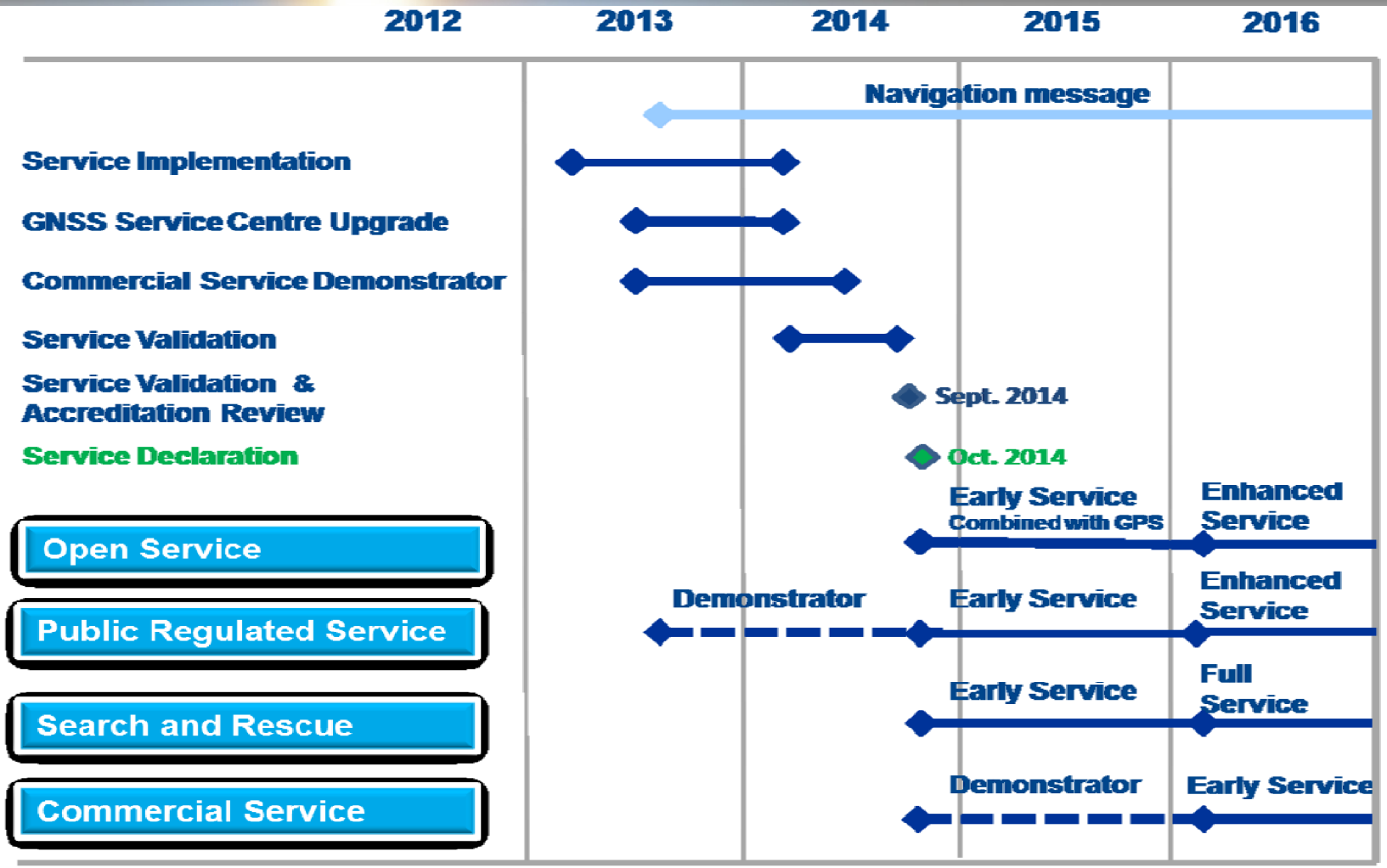
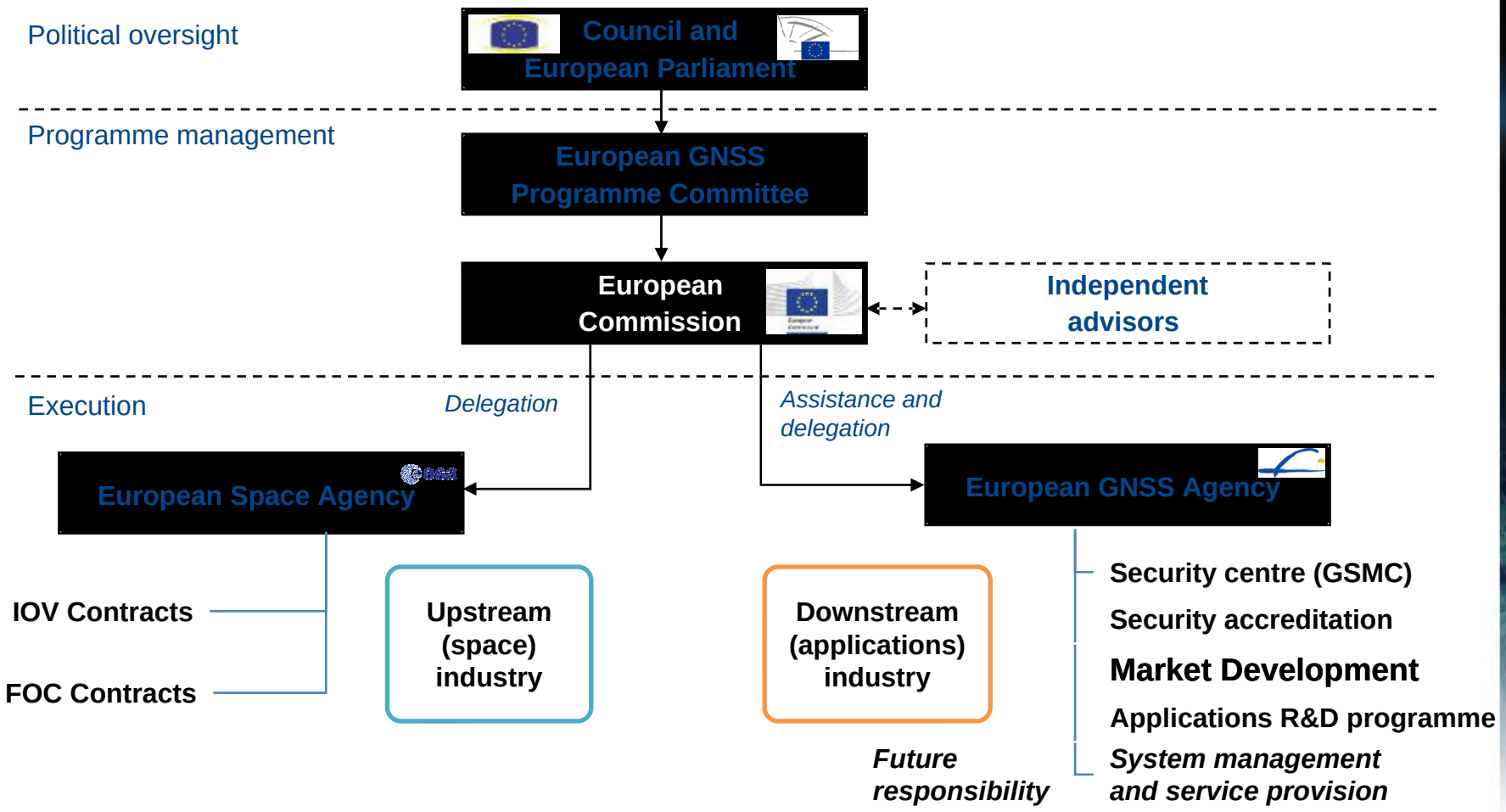
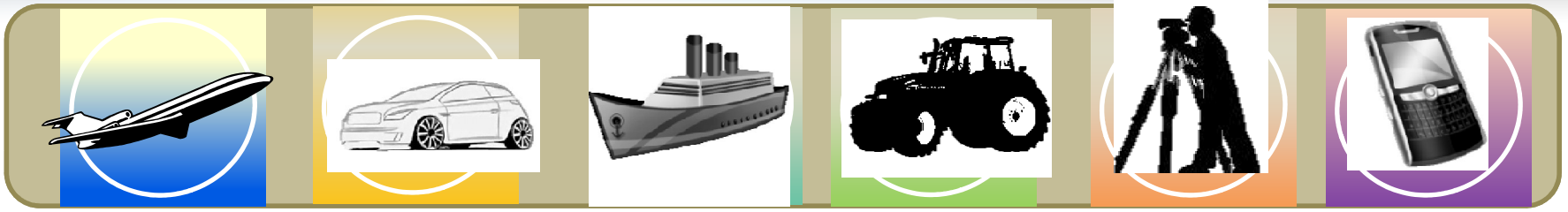
Galileo Services Roadmap



The European GNNS Agency supports the European Commission in the EU-GNSS programme



EXAMPLES OF CURRENT GNSS APPLICATIONS IN EU



Aviation:

-Approaches with vertical guidance (SBAS APV)

-Advances procedures for approach and landing

Road:

-Navigation

-Road tolling

-eCall

-ITS

-Logistics

-ADAS

Maritime:

-Entering ports

-Coastal navigation

-Open sea navigation

-Inland waterways navigation

Agriculture:

-Tractor guidance

-Automatic steering

-Variable Rate Technology

-Asset monitoring

Surveying:

-Cadastral surveying

-Construction surveying

-Mapping

-Mining

-Marine surveying

LBS:

-Location based applications

-Weather info, gaming, social media, advertising

-Personal navigation

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Galileo will deliver better performance mostly in terms of availability and accuracy

Service name	Description	Main benefits	Main applications
Open Service (OS)	Freely accessible service for position, navigation and timing	Availability Accuracy	LBS Road navigation
Commercial Service (CS)	Delivers authentication and high accuracy services for commercial applications	High precision Authentication	High precision in agriculture and surveying Authentication in RUC, PPUI, secure transactions (e.g. mobile payments)
Search and Rescue Service (SAR)	Assists locating people in distress and confirms that help is on the way	Near real time delivery of beacon position Return link service	Maritime navigation Aviation
Public Regulated Service (PRS)	Encrypted service designed for greater robustness and higher availability	Robustness Availability Encrypted message	Defence, homeland security Critical infrastructure
Integrity Monitoring*	Provides vital integrity information for life-critical applications.	Integrity	Aviation Rail transport Road transport e.g. dangerous goods

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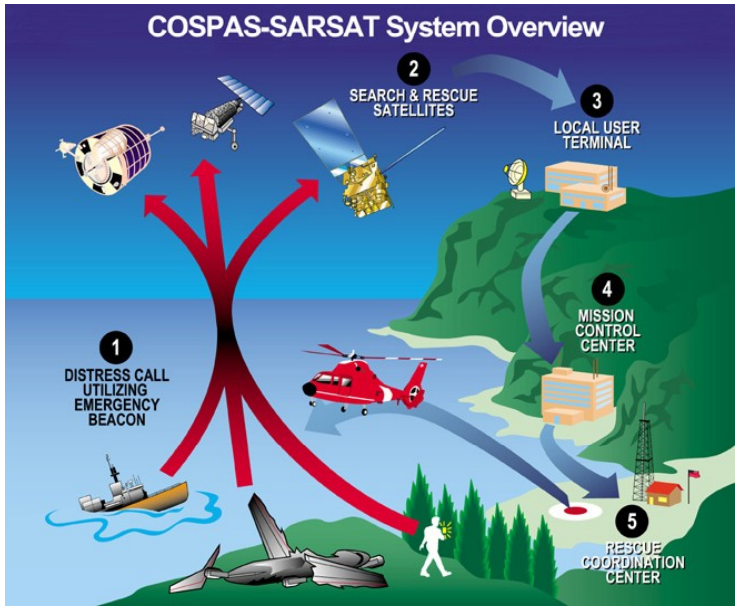
* Delivered via EGNOS

Galileo Search&Rescue for emergency response

- Europe's contribution to the international COSPAS-SARSAT co-operative effort on humanitarian Search and Rescue activities.
- As part of the Medium Earth Orbit Search and Rescue (MEOSAR) satellite system, will feature two communication links:
  - Forward link: Time reduction in the detection and localization of SAR alert augmented coverage
  - Return link: Send an acknowledgement receipt message from the SAR operator to the distress emitting beacon.



Galileo Early Services User Assistance support

European GNSS Service Centre helpdesk (GSC Nucleus)

Customer interaction functionality

- Process agreed by EC, ESA and GSA
  - Helpdesk user request management
  - User and system knowledge database
- Staffed with trained skilled people

Helpdesk
Our experts will provide answers to your questions about Galileo

Website

- General system and services information
- Scheduled satellite maintenance
- User feedback

Customer information and assistance

Status and next step

- GSC Nucleus operational
- Fully fledged version of the GSC will support Early Services

Cooperation showcase between EC, ESA, GSA and Spain

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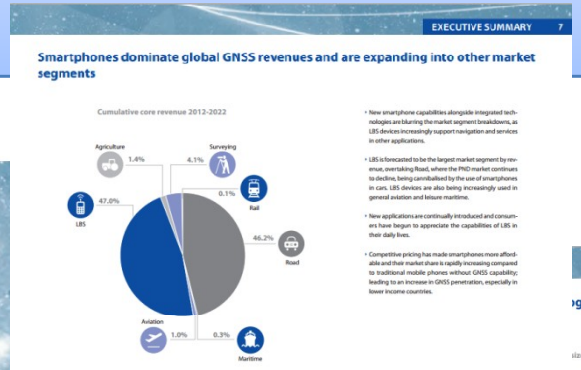
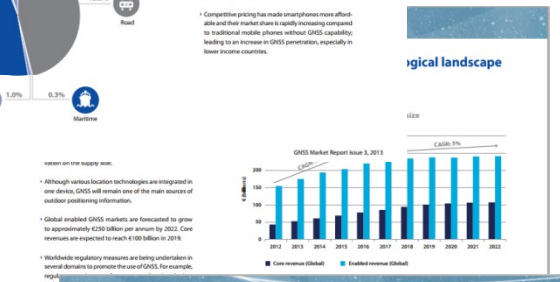
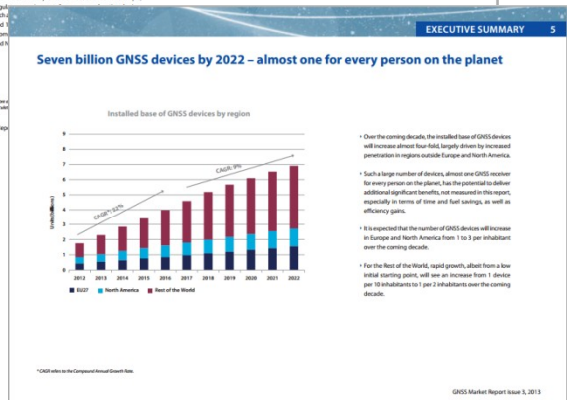
Market monitoring inputs market strategy and tracks results of implementation

WHAT IS MARKET MONITORING?

- ✓ Market segmentation
- ✓ GNSS market size and trends modelling and forecasti
- ✓ Analysis of public benefits
- ✓ Tracking of Key Performance Indicators







http://www.gsa.europa.eu/sites/default/files/GNSS_Market%20Report_2013_web.pdf

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Technology monitoring focuses on cooperation with receiver manufacturers

WHAT IS TECHNOLOGY MONITORING?

- ✓ Analysis of EGNOS and Galileo adoption across the value chain
- ✓ Tracking of GNSS technology trends
- ✓ Analysis of GNSS positioning among location technologies
- ✓ Facilitate adoption by receiver manufacturers
- ✓ Obtain feedback from first users
- ✓ Remove barriers to adoption

GNSS receivers compatibility

(% penetration in number of receiver models; 2013)

Source: GPS world survey 2013

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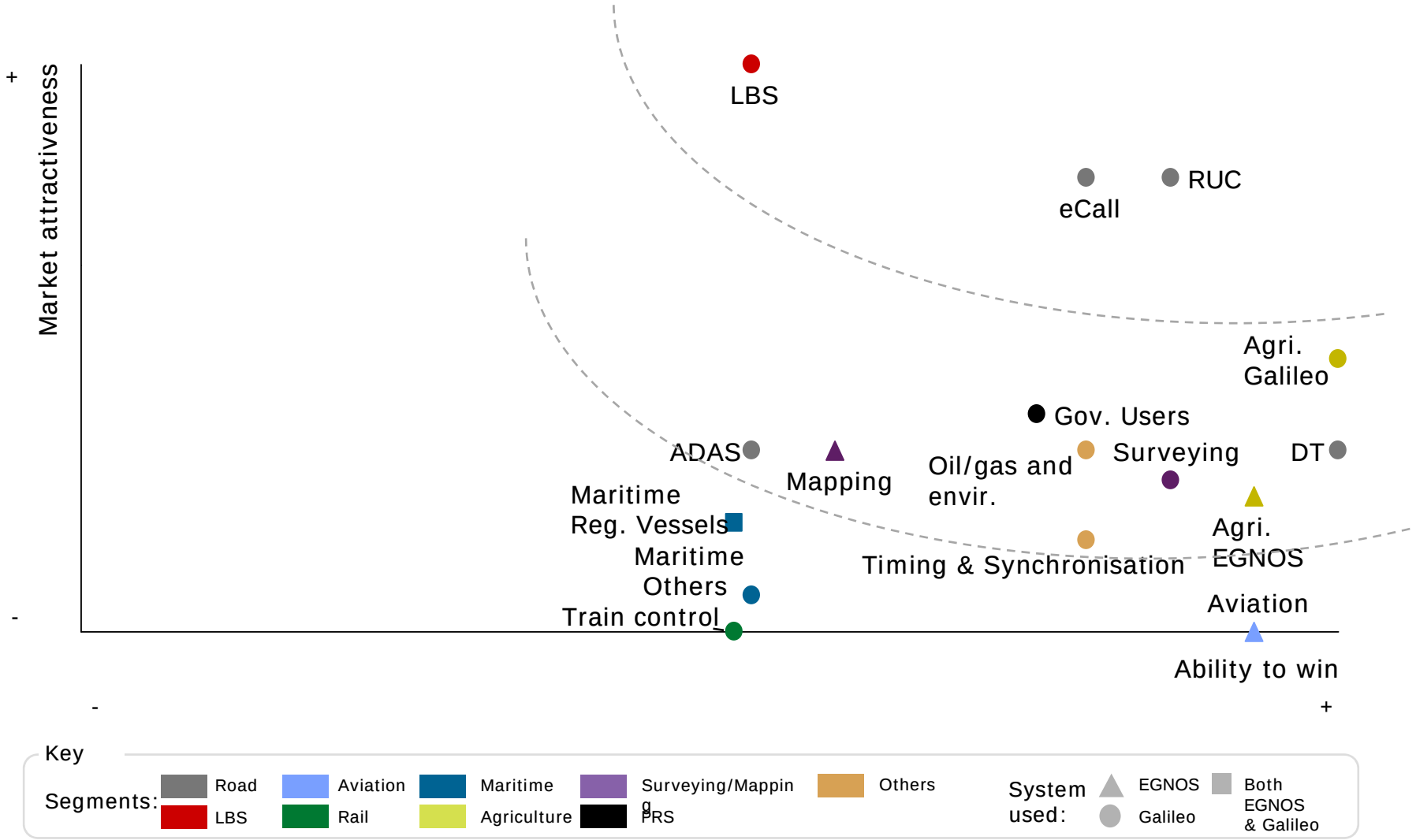
Current vertical segments and sub segments were compared in terms of attractiveness and ability to win

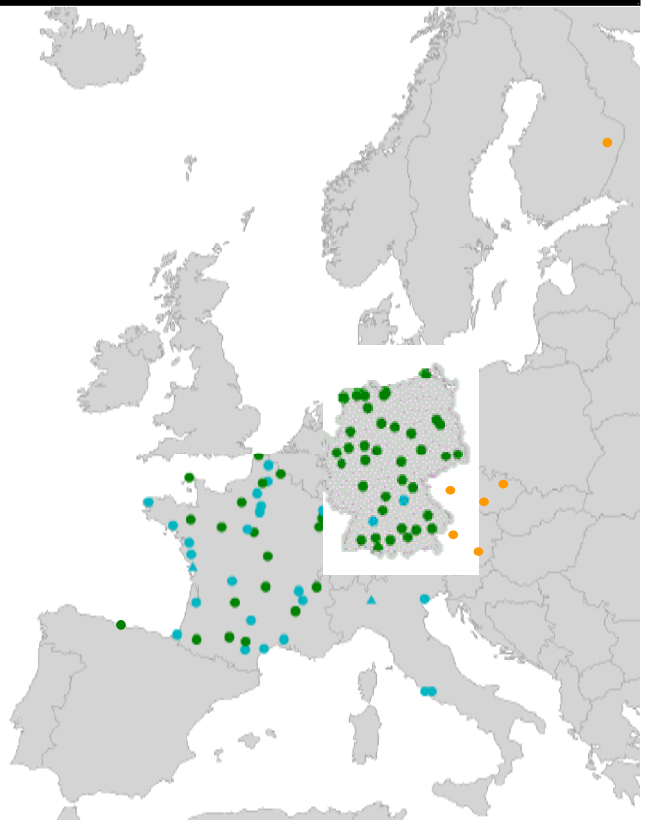


Source: Bain/Alpha Consult analysis, London Economics extract, itw with GSA MKD market leaders

States shared plans show growth by 2018 for procedures

As of 22nd Jan 2014

95 LPV serving 70 airports
(+91 'EGNOS enabled' APV Baro serving 41 airports)



Plans by 2018

>440 LPV planned by 2018

Map source: EUROCONTROL PBN Map Tool

European operators get EGNOS onboard

REGIONAL

Aurigny

2x BN2B Trislander

CityJet (VLM)

8x Fokker 50

Air Nostrum

5xATR 72-600

15x CRJ 1000

Loganair

2x Twin Otter

Hebridean Air

2x BN2B Islander

Skybus

Twin-Otter

Danish Air Transport

Coming soon

DHC8

BUSINESS

Inaer

Bell 412

NetJets

Hawker 750

Specsavers

2x Beech 350

REGA/Geneva University Hospital

Coming soon

Eurocopter EC135

GENERAL

NLR

Fairchild Metro II

Cessna Citation II

Air Charters Europe

King Air 300

King Air 1900D

Aviation South West

Piper P28A

Beechcraft 76

Royal Star-Aero

Piper PA-34 Seneca II

Dutch & MartinAir Flight Academies

4x Diamond DA42

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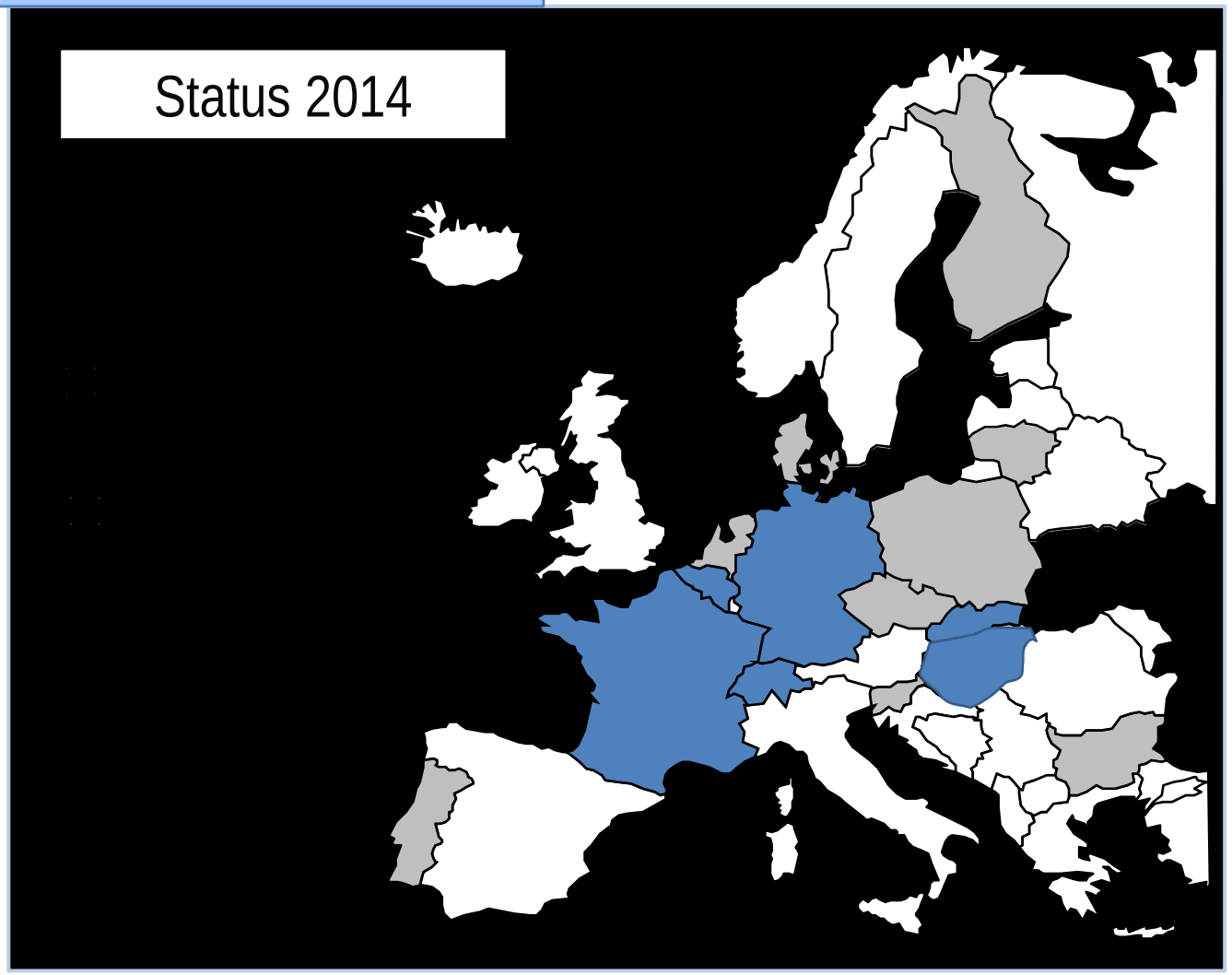
GNSS is becoming the technology of choice for free-flow Road Tolling

GSA advises European Countries

- Free flow schemes in Road Tolling
- EGNOS helps to counter fraud



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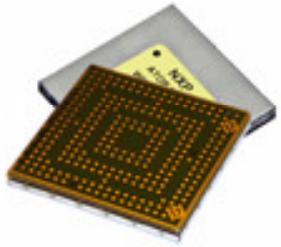
Securing E-GNSS in e-call

Users and decision makers

Provide technical guidelines for the location function:

- ✓ Set-up and drive a task force inside the European e-call Implementation Platform
- ✓ Technical guidelines for the GNSS function adopted, securing EGNOS and Galileo since the first products generation

Value Chain



Ensure EGNOS and Galileo get inside the e-call products

- ✓ Engage the main European solution providers to adopt e-call location guidelines

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High Precision – in Agriculture and Mapping, device manufacturers chose EGNOS

EGNOS has conquered a the Precision Agriculture market within four years

Claas and Leica Geosystems as GSA partners

Leica Geosystems

EGNOS ENABLED

EGNOS only receivers enter the Mapping market

EGNOS ENABLED

- SirfStarIV GPS with SiRFInstantFix and A-GPS support (48 channel) and active jammer removal
- GPS Real-Time Accuracy: 2 – 5 m / SBAS (WAAS, EGNOS)[1]: 1 – 3 m

Leica Geosystem´s ZENO 5

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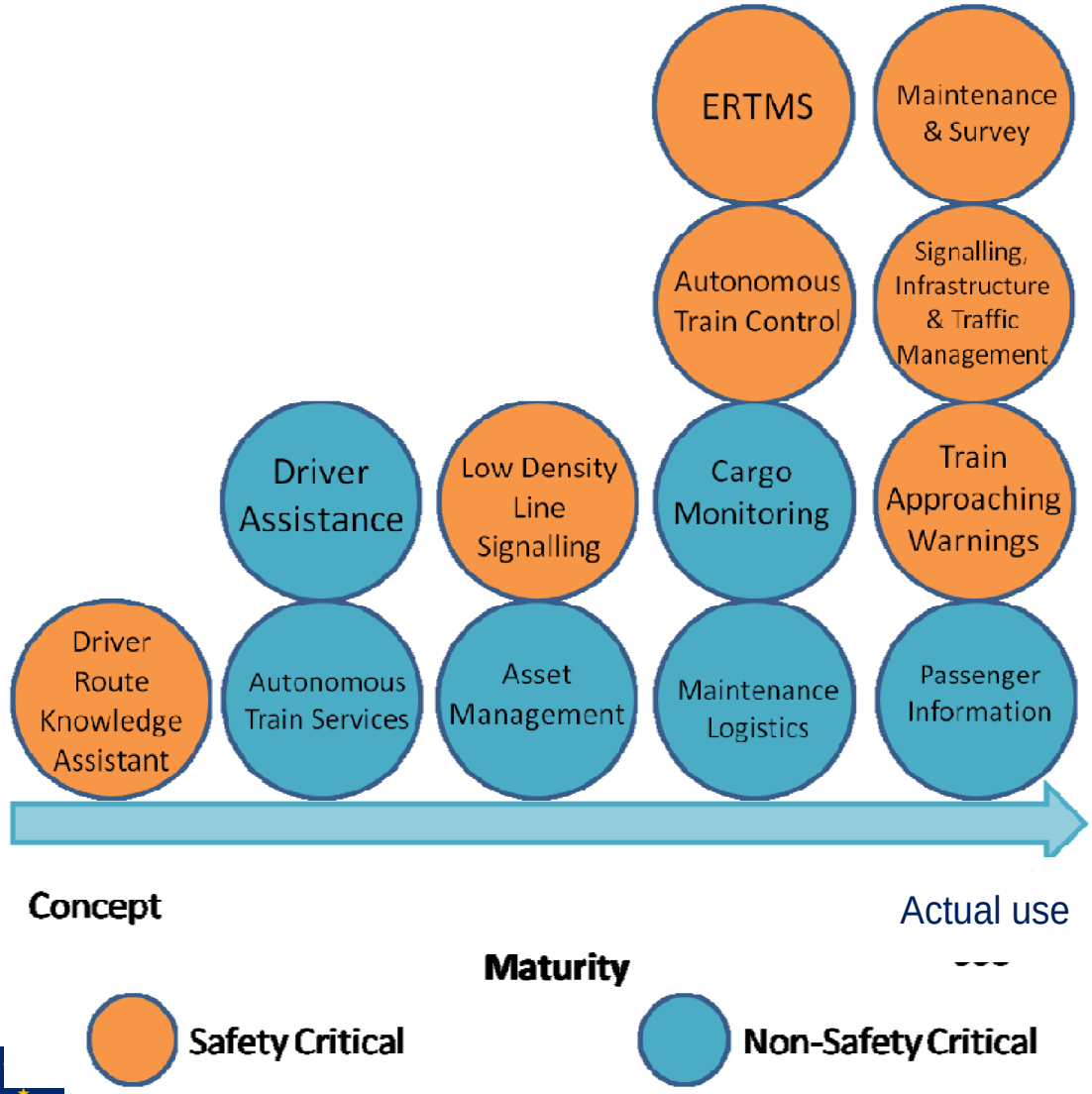
Overview of main rail applications



Low Density Line Signalling

- **Combines EGNOS with Inertial Navigation Systems**

- Has the potential to vastly **reduce the cost of signalling** as it requires very few or no line side components

- Offers significant public benefit as it may allow some low density/rural lines to remain open when they might otherwise have become uneconomic

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Main lines - ERTMS Level 3

- Augmented GNSS could have a significant role by forming a basis for absolute rather than relative positioning
- Possible replacement for odometry e.g. between balises
- Potential to reduce the number of balises (and therefore costs)
- Prerequisites:
  - Requirements definition
  - Validation of E-GNSS in Rail environment
  - Inclusion of E-GNSS into ERTMS baseline 3

Asset management

Determination of exact position of transport/ manipulation equipment enables better planning and more operational efficiency

Railway operators and lessors: Possibility of position monitoring of the rail cars along the entire network

Rail freight logistics: providing visibility of the transported goods to the LSP/ LSC independently of the infrastructure (if position is linked with the payload!!!)

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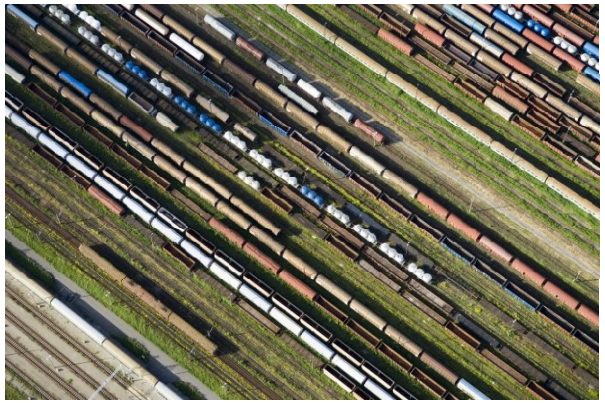
Container positioning

Localization of the cargo and communication of it s position to the LSP or LSC



Monitoring of the cargo at any time along the entire supply chain

Possibility of alerts for stakeholders in case of an unexpected container position due to different reasons (shipping errors, possible theft) which contributes to elimination of shrinkage

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Low density line signalling
FP7 Project name: GaLoROI

Objective → development of a certified safety relevant satellite based on-board train localisation unit to be used on Low Density railway Lines.

E-GNSS relevance → GaLoROI will support the adoption of EGNOS by using it as augmentation system. The usage of EGNOS is appreciated in GaLoROI especially for delivering increased accuracy

Low density line signalling
FP7 Project name: SATLOC

Objective → development and demonstration of innovative GNSS Safety of Life rail application for the train control, speed supervision, traffic control and traffic management of UIC-E lines (low density lines).

E-GNSS relevance → The innovative conception of safely integrated signalling, train control and traffic management is based on integrity powered by EGNOS.

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Mainline signalling
FP7 Project: GRAIL-2

Objective → define, develop and validate an ETCS application in high-speed railway lines based on GNSS. The proposed system is based on Enhanced Odometry, in a context of high speed lines.

E-GNSS relevance → EGNOS will offer integrity of signal, increased accuracy, coverage and a specific service level agreement

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