E-GNSS APPLICATIONS IN RAIL

Europe's contribution to satellite navigation

Galileo

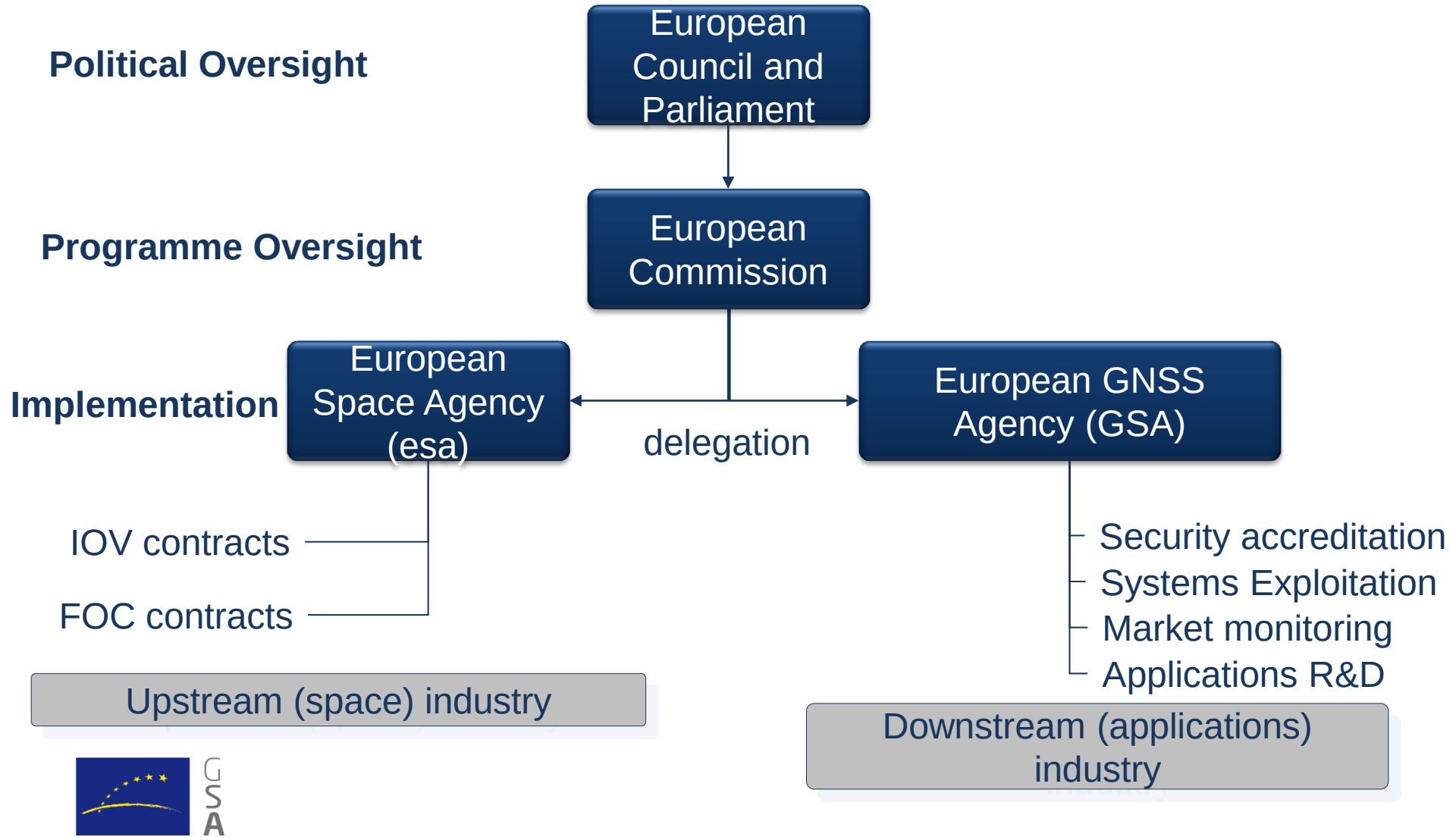
- Worldwide navigation system "made in EU"
- Fully compatible with GPS*
- Early services starting from 2014
- Open service free of charge and delivering dual frequencies (better performances)

EGNOS

- Augmentation system of GPS
- Improves GPS performance
- European coverage (but under extension in other regions, e.g. North Africa)
- Available NOW, free of charge and widely available. Certified for civil aviation in 2011.

'It's there, use it'

GSA supports European Commission on market preparation, exploitation and security



Galileo has already taken-off

- 4 **operational satellites** have been launched, as 12 October 2012 (in addition to the 2 test satellites launched in 2005/2008)
- All **industrial contracts** necessary have been signed to ensure up to **26 satellites**:

Integrated market development for E-GNSS adoption

MARKET SEGMENTS

- Road
- Aviation
- Maritime
- Rail
- LBS
- Agriculture
- Mapping
- Governmental

DOWNSTREAM VALUE CHAIN

Bodies influencing the market → Navigation Signal Providers → Chipset, receiver → Devices → Content & applications → Service providers

Market Strategy

- ✓ Market intelligence:
  - ✓ Market and technology monitoring
  - ✓ User needs and requirements for service development and evolution
- ✓ Economic analysis: socio-economic benefits and CBA
- ✓ EGNSS Value proposition/differentiators for market communication

Business development

- ✓ Application development R&D
- ✓ User technology development
- ✓ Engage receiver manufacturers for EGNSS integration
- ✓ Involve service providers for services adoption
- ✓ Support EC regulations and policy making
- ✓ Convince users and decision makers, building adoption roadmaps

User management

- ✓ User and value chain assistance
- ✓ User satisfaction measurement towards continuous improvement

E-GNSS USER ADOPTION

EU PUBLIC BENEFITS

GSA

E-GNSS strengths by market segment

Aviation

- Enabler of Performance Based Navigation, in particular APV SBAS Approaches (EGNOS i.e. E). Enabler of SBAS PinS (E).
- Availability and Resilience to interferences (Galileo i.e. G)
- GBAS Cat II/III performance (G)
- Enabler for Time-based operations (E, G)
- Galileo/SAR service is a key element of the upgraded COSPAR-SARSAT infrastructure

Road

- Availability, Accuracy, Authentication, Reliability (G)
- Integrity, Accuracy (E)

Agriculture

- High Accuracy (G)
- Entry Technology: low cost solution with basic accuracy (E)

Surveying & Mapping

- Continuity, Accuracy, Reliability, Resistance to multipath (G)
- Autonomous basic accuracy solution for low cost mapping applications (E)

E-GNSS strengths by market segment

Maritime

- Increased Availability, Accuracy, Integrity and Authentication
- Higher accuracy with multi-constellation and multi-frequencies following the IMO E-Navigation concept
- Galileo - SAR service is a key element of the upgraded COSPAR-SARSAT infrastructure (forward and return links)

LBS

- Better performance in urban canyons thanks to increased availability and more robust signal due to additional satellites, enhancing also continuity of service
- Higher accuracy in multi-constellation solution for more demanding applications (e.g. Location Based Advertising)
- Better resistance to multipath interference
- Social benefits in terms of lives saved due to quicker response time and better accuracy in emergency caller location (112 emergency number)

GSA

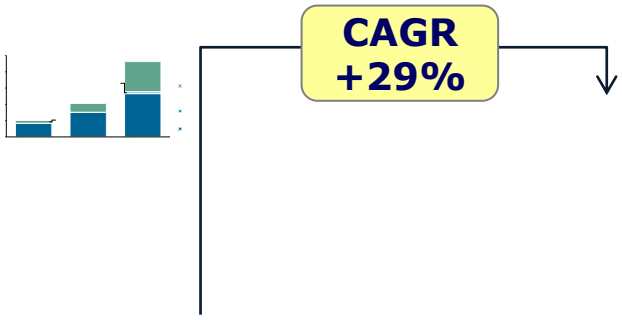
EGNSS value proposition for Rail

To improve availability and deliver integrity and accuracy for safety critical applications and specific transport/logistics applications

Rail market segment situation

- GNSS world shipments in railways grew with **CAGR 29%** from 2006 to 2012 (GNSS technology mainly used for non safety critical applications)
- **GNSS penetration in railways installed base is still below 4%**
- Safety critical applications will complement the traditional rail technologies
- Main applications
  - *Low density line network management and train control*
  - *Asset / Rolling stock management*
  - *Passenger information systems*
  - *European Rail Traffic Management System*

SHIPMENT OF GNSS DEVICES BY REGION



Potential E-GNSS applications in Rail

Signalling

E-GNSS can provide benefits in combination with
- sensors for precise train positioning relevant for signalling applications
- conventional communication technologies for logistics applications.

Logistics

Low density lines

Improve safety / reduce operational cost of low density lines

Main lines

Improve the precision of the odometry and eventually enable reduction of number of physical balises

In line with the **MoU between EC, ERA and the rail industry association** from 2012 E-GNSS can play a major role in rail safety (signalling and train control).

The possible **benefits of E-GNSS for signalling and train control depend on further evolutions of ERTMS specifications.**

Improve monitoring of the railway assets both for operators and IM´s

Asset management

Improve availability of the supply chain visibility information to the LSP/LSC.
- Georeferenced cargo status monitoring
- Corridoring, Geofencing

Cargo monitoring

Improve precision and availability of positioning for on board passenger information systems

Passenger information systems

FP7 2nd and 3rd call in Rail

GRAIL-2 → 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.

GaLoROI → development of a certified, safety relevant satellite based on-board train localisation unit suitable for low density railway lines.

SATLOC → development and demonstration of innovative GNSS Safety of Life rail application for the train control, speed supervision, traffic control and traffic management on low density lines.

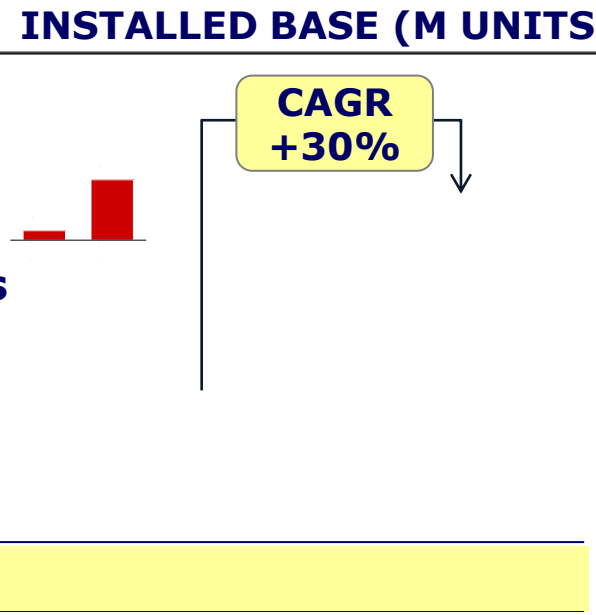
Areas of interest for GNSS research in rail

- Mature GNSS-enabled products for low density lines signalling
- Use of E-GNSS to complement ERTMS
- Evolutions of non-safety critical applications
  - Passenger information services
  - Driver assistance
  - Track Maintenance
- Multimodal applications and asset management/logistics solutions for improving supply chain visibility

Next steps

Where we want to be

- E-GNSS adopted as one of the key elements of the train **command and control solutions** enabling safe and efficient operations **on low density lines**
- E-GNSS adopted for **train positioning subsystem** fostering adoption of **ERTMS Level 3 on main freight lines**
- **Multi-constellation use of GNSS for multimodal logistics applications**



How to get there

- Support UNISIG in drafting rail requirements and defining virtual balise
- Cooperate with railway initiatives and EC to **foster the role of E-GNSS in the evolutions of ERTMS standard**
- Support EC in the **standardization and certification of EGNOS receivers** as a component of the **train positioning subsystem**
- Collaborate with **logistics industry associations** supporting the role of E-GNSS in **supply chain standards**

Next steps

1. Increased support from key stakeholders

Representatives of key RU´s and IM´s as the „extended hand“ of the member states shall raise their voice, advocating for necessary ERTMS B3 innovation

2. Space ←→ Rail coordination:

SPACE -> RAIL

- Providing technical support to UNISIG/UNIFE in relation to satellite positioning and performances
- Supporting NGTC (New generation train control) project
- Contribution through FP7 and H2020

RAIL -> SPACE

- UNISIG/UNIFE - definition of virtual balise and requirements for E-GNSS (EGNOS)
- Shift2Rail – E-GNSS in S2R innovation programmes

THANK YOU FOR YOUR ATTENTION

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