

FIG

FIG WORKING WEEK 2017

Helsinki Finland

29 May - 2 June 2017

*Presented at the FIG Working Week 2017,
May 29 - June 2, 2017 in Helsinki, Finland*



Surveying the world of tomorrow -
From digitalisation to augmented reality

Organised by



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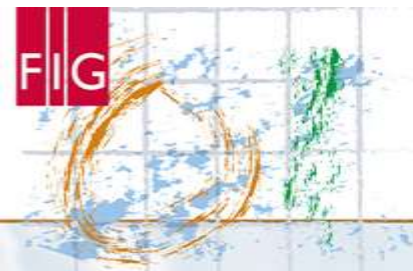
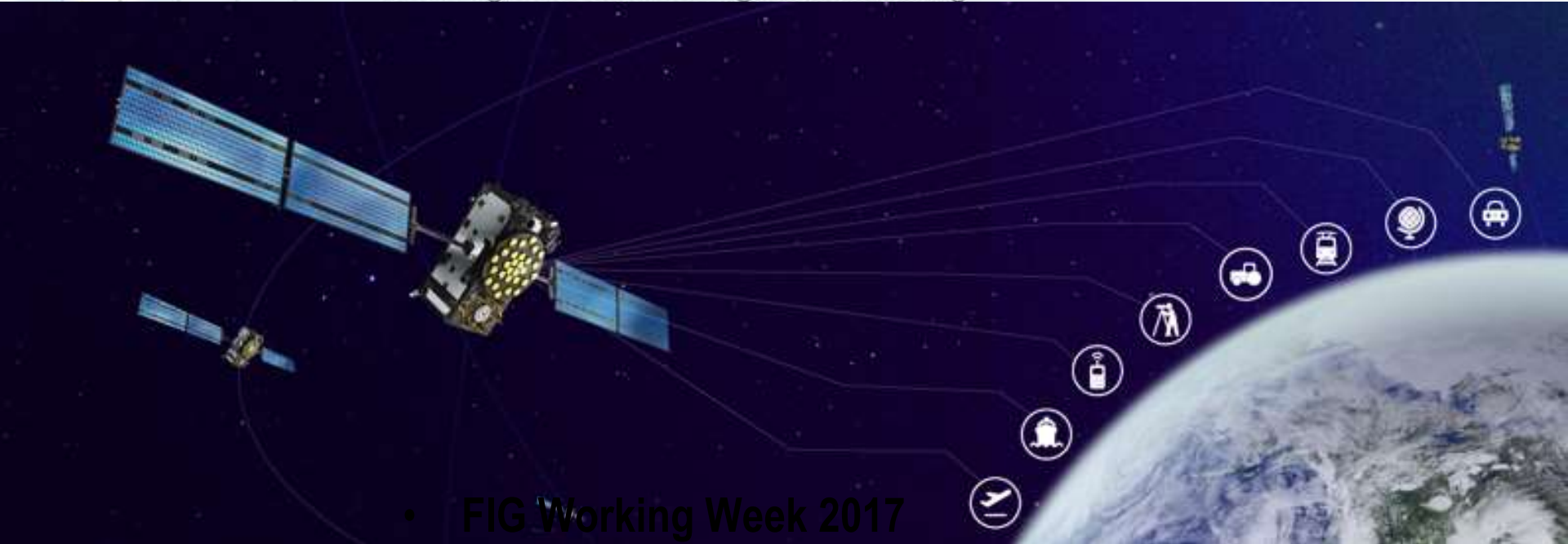


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• FIG Working Week 2017

European GNSS for Surveying and Mapping

Reinhard Blasi, Alina Hriscu

Market Development, European GNSS Agency (GSA)



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-  **E-GNSS: Status, Implementation Plan & Current Services**
-  **Market and Technology Trends in Surveying**
-  **European GNSS for Surveying**
-  **Update on GSA Activities**



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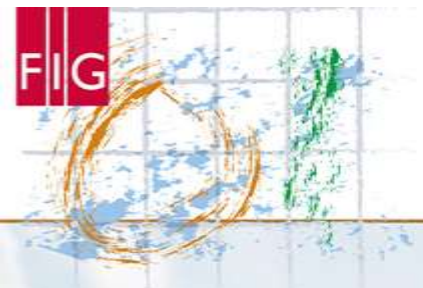


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European GNSS Agency (GSA)



- Staff: 135
- Nationalities: 21
- Headquarter: **Prague, Czech Republic**
- Security monitoring centres: **Swanwick (UK) and St Germain en Laye (France)**
- European GNSS Service Centre (GSC): **Torrejon (Spain)**



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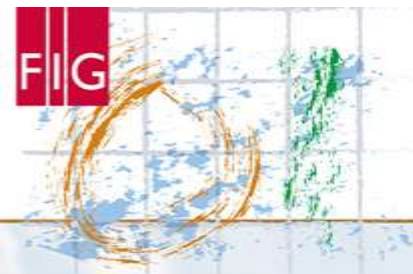


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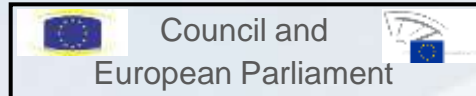
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From digitalisation to augmented reality

How GSA fits in the EU structure



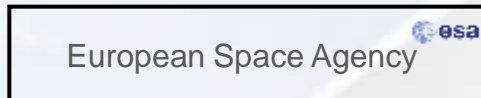
Political oversight



Programme management



Execution



Delegation

Assistance and delegation



Development contracts

Deployment contracts



Market Development

Security

GSMC operation

GNSS exploitation



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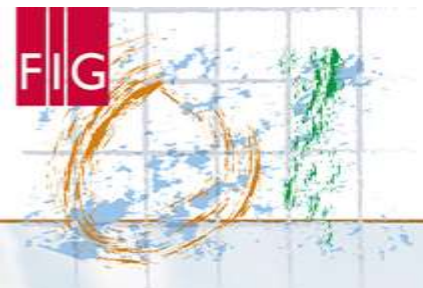


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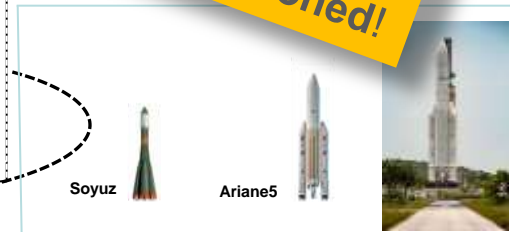
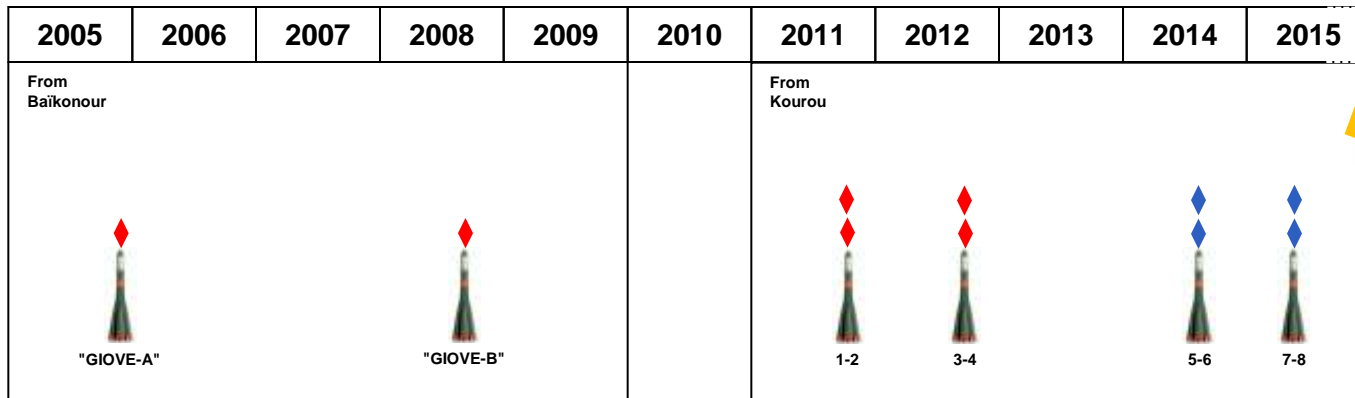
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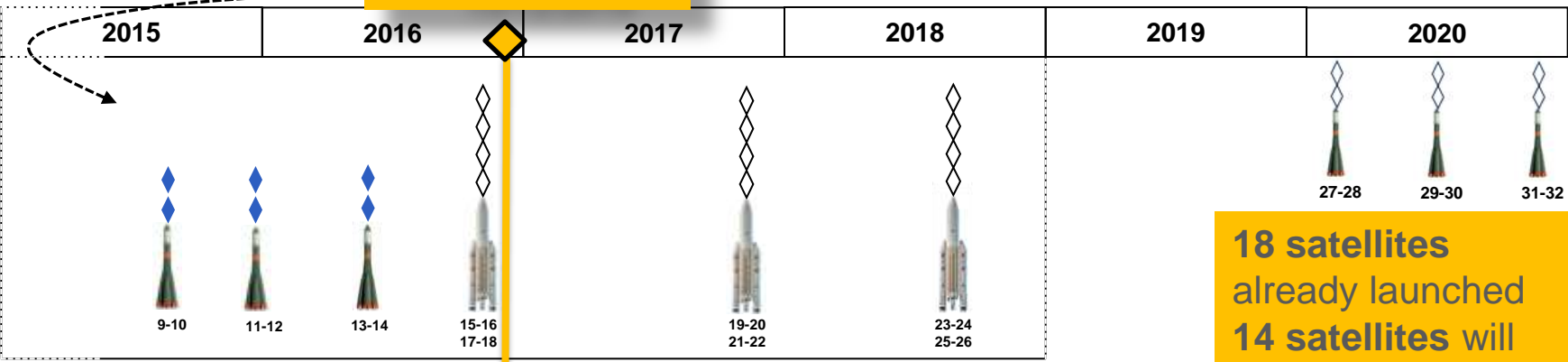
Galileo's implementation is progressing towards Full Operation Capability in 2020



2 satellites of November 2016 Ariane 5 launch just commissioned!



15/12/2016



Galileo Initial Services

**18 satellites already launched
14 satellites will follow by 2020**

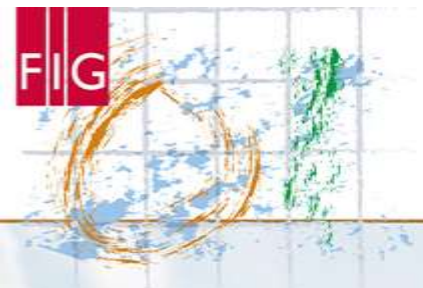


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Galileo goes live to deliver concrete benefits to users!



New GSA website documents strong growth of Galileo-enabled devices

Galileo products and devices and search for devices by market segment



www.useGalileo.eu



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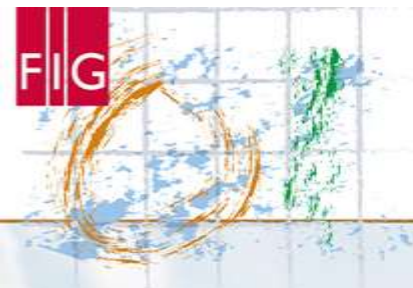


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EGNOS already available serving EU citizens and industry



- Satellite Based Augmentation System (SBAS)
- Improves GNSS performance
- European coverage (under extension in other regions, e.g. North Africa)
- Available NOW, free of charge and widely adopted in off-the-shelf

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	



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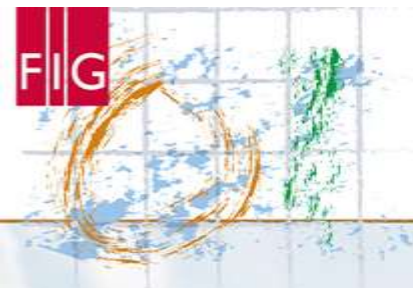


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Galileo is the European GNSS offering four services



- Worldwide navigation system “made in EU”
- Fully compatible with GPS
- Open service free of charge, delivering dual frequencies
- Signal authentication will provide trustability



Open Service (OS)	Freely accessible service for positioning 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	



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esri



Trimble



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The European GNSS Service Centre provides interface with the users



GSC Nucleus

- Web portal
- Information on:
 - System status
 - Almanacs
 - User notifications
- Electronic Library
 - Iono Doc, OS SIS OSD, OS SIS ICD, future SDD
- Helpdesk:
 - User queries
 - Galileo incident reporting



www.gsc-europa.eu



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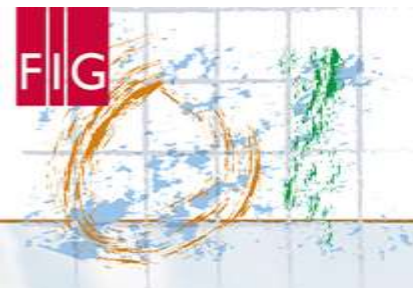


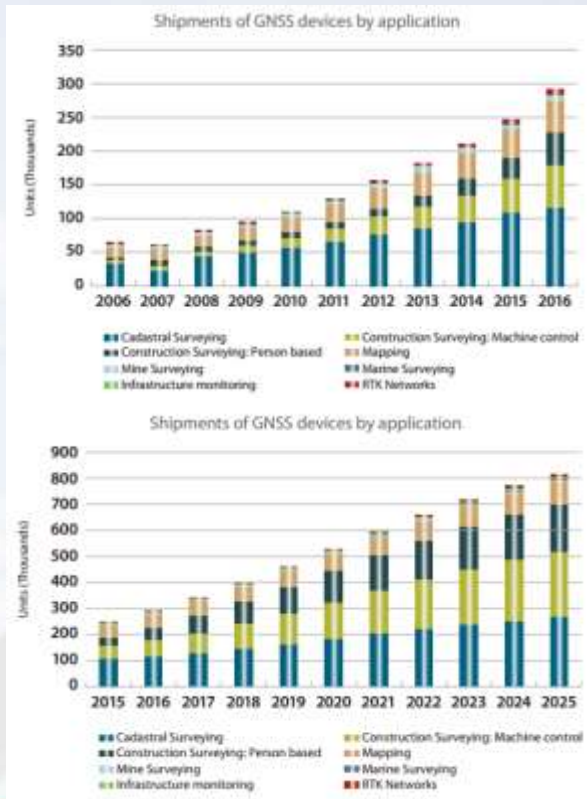
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Construction, mapping and cadastral industries stimulated growth in shipments of GNSS surveying equipment



Surveying, Mapping and Construction (both person-based and machine control), together, accounted for 95% of the shipments of GNSS devices in high precision market in 2016

In the coming decade, the total amount of shipments is expected to reach 815,000 units worldwide, representing almost a 4-fold increase over 2015



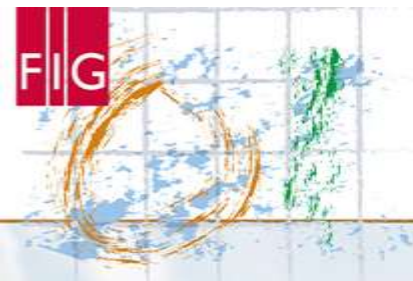


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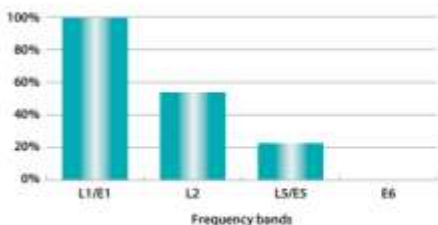
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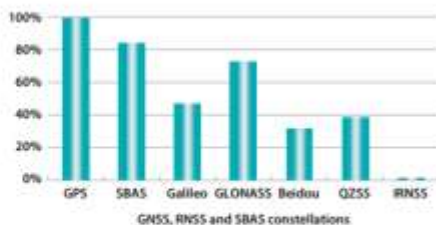
Multi-constellation and multi-frequency are widely adopted to fulfil stringent accuracy requirement

Frequency capability of GNSS receivers¹



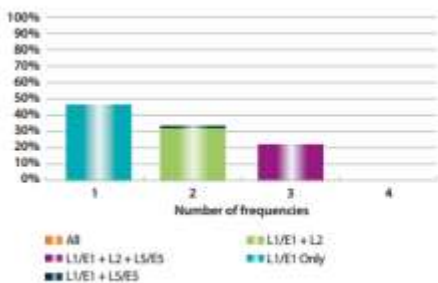
¹ shows percentage of receivers supporting each frequency band

Constellation capability of GNSS receivers²



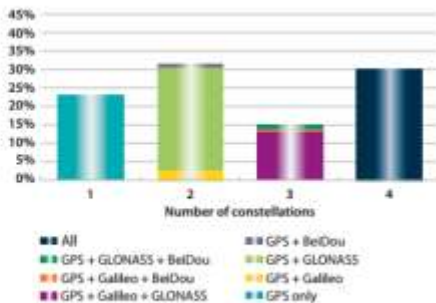
² shows percentage of receivers capable of tracking each constellation

Supported frequencies by GNSS receivers³



³ shows percentage of receivers capable of tracking 1, 2, 3 or all the 4 frequencies

Supported constellations by GNSS receivers⁴



⁴ shows percentage of receivers capable of tracking 1, 2, 3 or all the 4 GNSS constellations



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Technology developments will soon enable low-cost receivers capable of cm-level precision



Main drivers and trends:

- Increased availability of low-cost equipment capable of down to cm-level precision (with multi-frequency and multi-constellation support)
- Uptake of PPP
- Integration of GNSS with other complementary technologies (LIDAR, robotics, mobile mapping, etc.)
- Synergies between GNSS and Earth Observation
- UAV penetration into mapping



Key Performance Parameter (KPP)	EGNOS contribution*	Galileo contribution*
Availability		••
Accuracy	••	•••
Integrity	•••	
Robustness		•••



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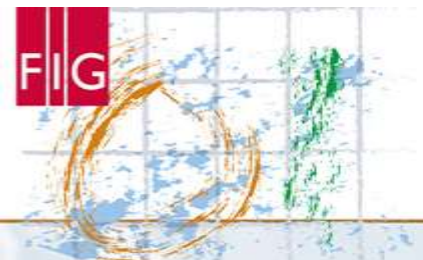


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Augmentation service providers are accelerating the adoption of Galileo



RTK

PPP



HW: Majority of RTK providers upgraded or have started to upgrade

- SWEPOS (SE), GeoSoft (ET), SAPOS (DE), SOGEI (IT), GEONET (JP), etc.

NovAtel TERRASTAR

INSIDE

President and CEO of NovAtel, Michael Ritter stated
 “Our OEM customers are already benefiting from the enhanced reliability, availability and accuracy the Galileo constellation adds to the GNSS.”

SW: RTK Network: Galileo functionality under implementation and challenge with interoperability of different brands within one network

FUGRO G4

Anders Haneborg, Fugro commercial manager said
 “Galileo’s Initial Services operations [...] a key consideration for our customers during critical positioning operations”

First field tests prove benefits of adding Galileo to RTK

- Better reliability, continuity and availability,** resulting in **better operation in difficult environment**

veripos

Graham Purves, President and CEO of Veripos stated
 “.....we are particularly proud and excited about the opportunities the Galileo services create for our customers. The reliability and safety enhancements made possible through these new services

GSA workshop: SWEPOS RTK
 “Based on our test results, we clearly recommend Galileo corrections to our customers needing reliable high precision”



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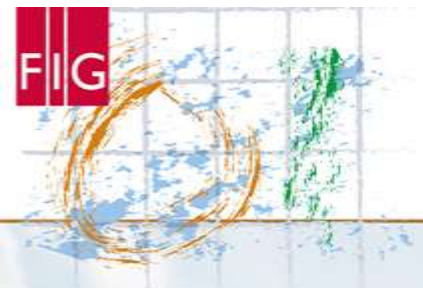


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Overview of signals

Open service / Commercial service / E6 ranging

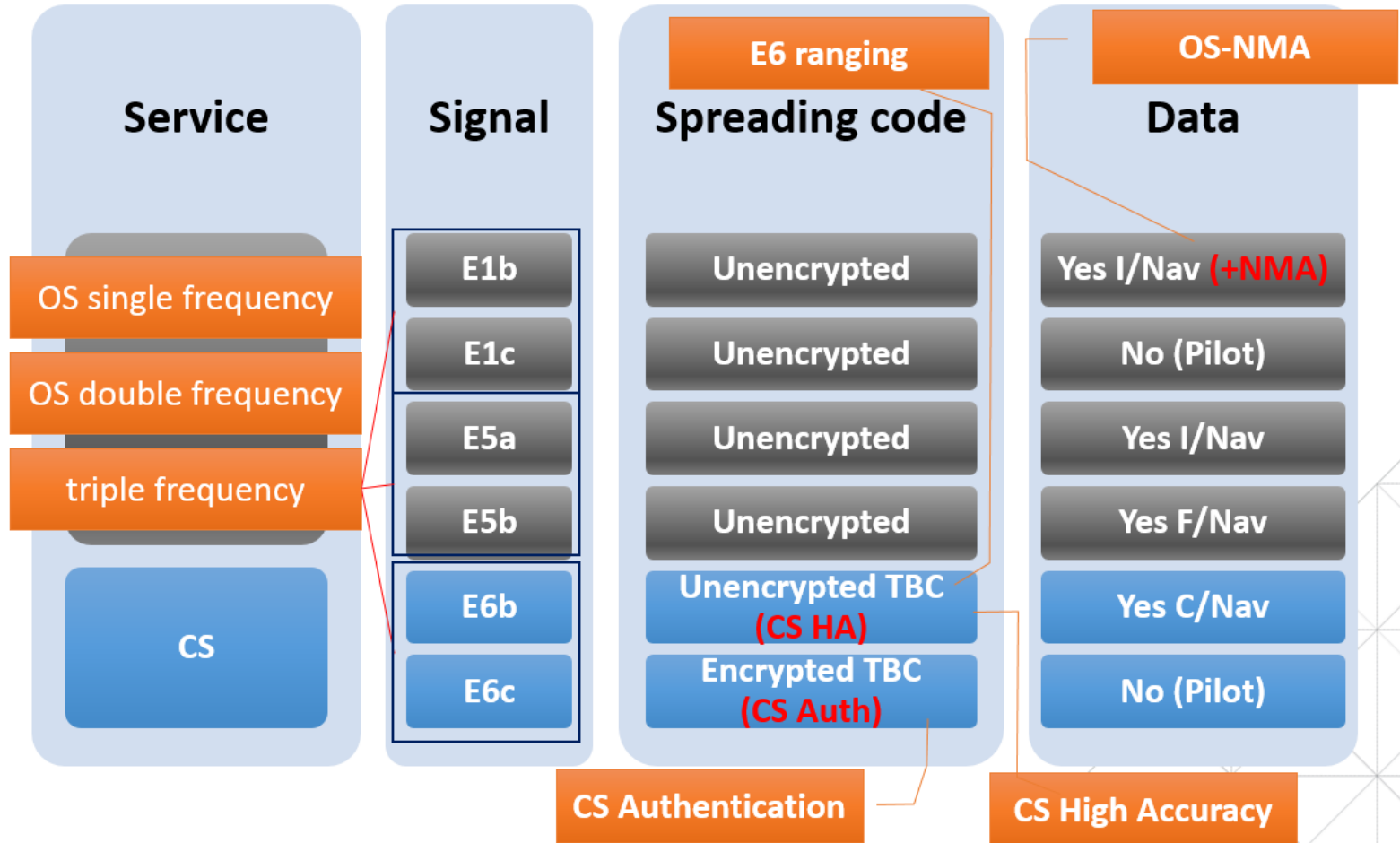




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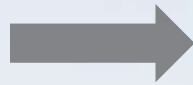
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Galileo Open Service: Key points



**Advantages of Galileo OS
E1/E5 bands**

(some of them starting with Initial Services)



Easier mitigation of multipath errors

Higher SNR (signal-to-noise ratio)

Multi GNSS : provides additional advantages

- **Increase availability, continuity and reliability**
- **Improved geometry**

Better results in harsh environment
(urban canyons, tree canopy, etc.)

OS-NMA: **spoofing detection**



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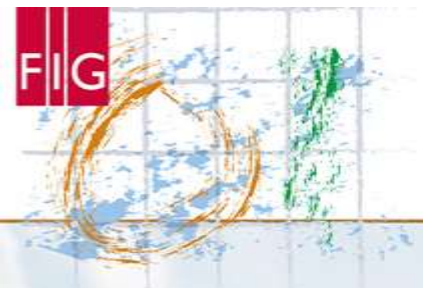


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Galileo Commercial Service: Key points



Advantages of Galileo CS-HA



The European Commission and the European GNSS Agency (GSA) confirm that the **first generation of Galileo** will already **provide users with High Accuracy and Authentication services**

High Accuracy (CS-HA): receiver positioning accuracy with an **error below one decimetre**

Broadcast external data in real time across the globe (**PPP – Precise Point Positioning**) via Galileo E6 **without the need for an additional communication channel**

Does not require proximity to base stations to access corrections

Triple frequency to further **reduce convergence time**

Improved line-of-sight and **better coverage at high latitudes**



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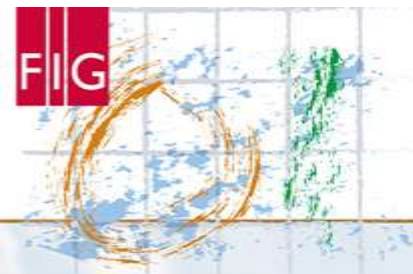


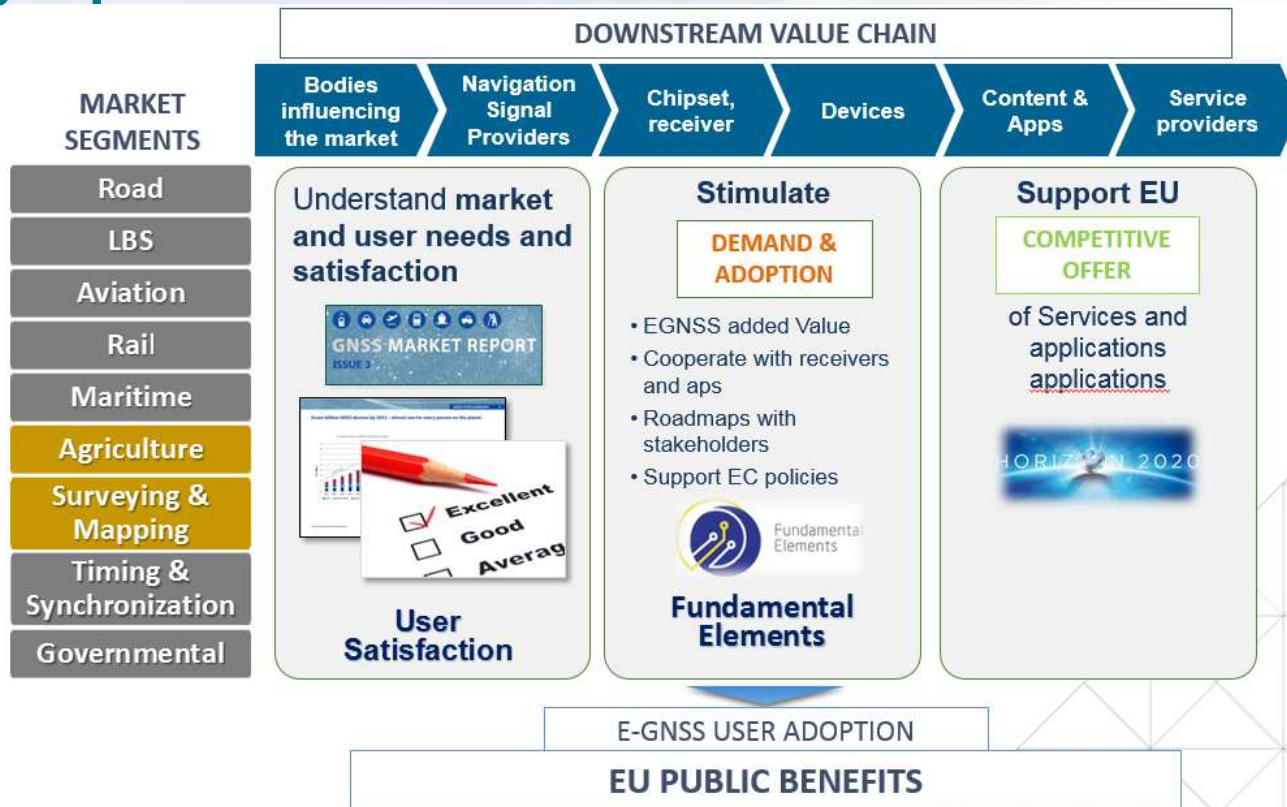
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Three main pillars towards E-GNSS adoption The bigger picture



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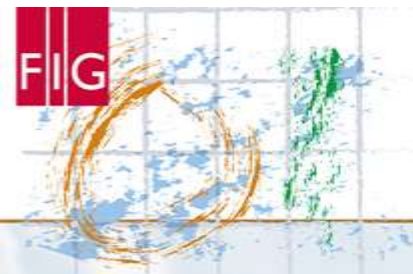


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A full analysis of GNSS receiver capabilities is available in the GSA's Technology Report



Available for download



[HTTP://BIT.LY/2CGARXF](http://bit.ly/2CGARXF)



Just released! Available for download

An in-depth analysis of 3 GNSS Macrosegments :

- MASS MARKET SOLUTIONS
- TRANSPORT SAFETY AND LIABILITY-CRITICAL SOLUTIONS
- HIGH PRECISION, TIMING AND ASSET MANAGEMENT SOLUTIONS



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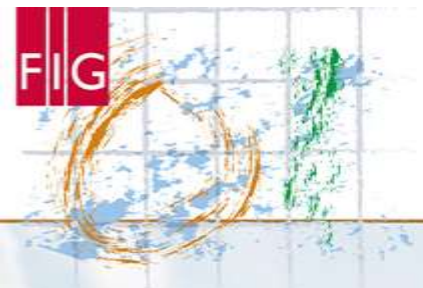


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The GSA's funding mechanisms promote the development of Galileo compatible solutions



Aims to foster adoption of Galileo and EGNOS mostly via content and application development and supports the integration of services provided by these programmes into devices and their commercialisation.

8 €mIn budget dedicated to high precision market in the 3rd H2020 call – under evaluation



Fundamental Elements

Fundamental Elements projects focus on fostering the development of innovative Galileo- and EGNOS-enabled receivers, antennas and chipsets technologies. The objective is to achieve products that address user needs in priority market segments

€75.5 M for non-PRS projects

<http://www.gsa.europa.eu/r-d/gnss-r-d-programmes>



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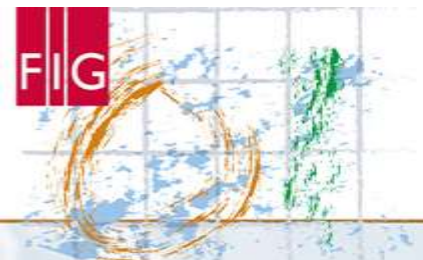


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GSA supports Young Surveyors



CLGE Annual Young Surveyors' Prize: fresh ideas to feed the surveying industry evolution



GSA is sponsoring a special prize dedicated to Galileo, EGNOS and Copernicus as part of the annual Council of Geodetic Surveyors' Young Surveyors prize

2016 winner has been announced in Intergeo in Hamburg in October 2016

Cecile Deprez, PhD student at the University of Liege in Belgium, proposed an idea potentially bringing considerably higher precision to mass-market applications, relying on Google's provision of access to GNSS raw measurements for Android users by using of Galileo E5.



2017 edition open

Deadline: 07 August 2017

Award @ InterGEO, Berlin



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Linking space to user needs



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[GSA Twitter - @EU_GNSS](#)
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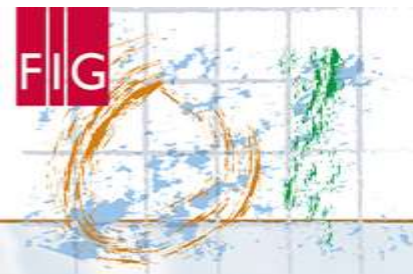
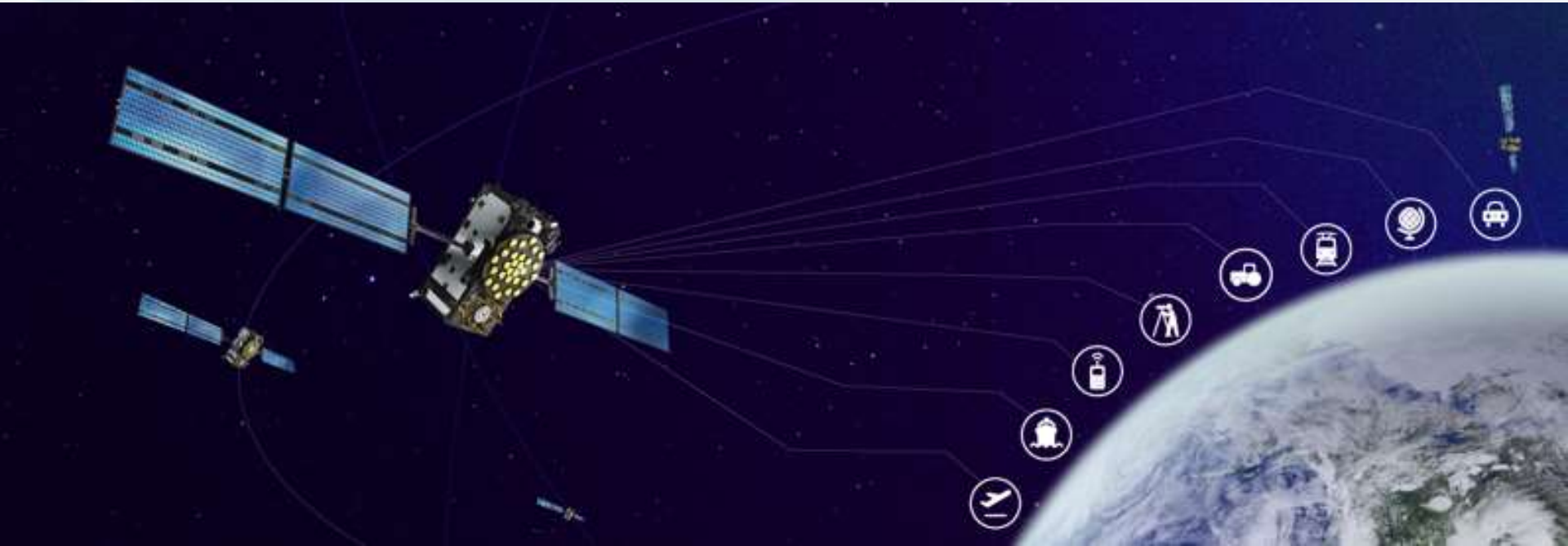


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