

ESA/CNES/ARIANESPACE-Service Optique CSG, S. Martin

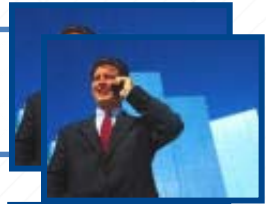


## IGNSS 2018 - Sydney



## Open Service (OS)

- Freely accessible service for positioning, navigation and timing



## Public Regulated Service (PRS)

- Encrypted service for greater robustness and higher availability



## Search and Rescue (SAR) - contribution

- Assists locating people in distress and confirms that help is on the way



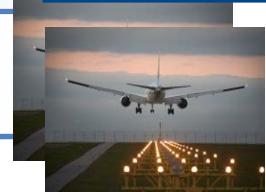
## Commercial Service (CS)

- Authentication and high accuracy services for commercial applications



## Safety-of-Life (SoL) - contribution

- Provides vital integrity information for life-critical applications



# GALILEO INITIAL SERVICES DECLARED IN DECEMBER 2016

## ■ Open Service

- Free
- Interoperable with other GNSS
- worldwide access



## ■ Public Regulated Service

- Access controlled by "Competent Authorities"
- Worldwide coverage



## ■ Search and Rescue

- Free
- Worldwide coverage (Cospas-Sarsat)
- Locate emergency beacons



# GALILEO SYSTEM LAUNCHES

FIRST FOUR SATELLITES (IOV)  
LAUNCHED IN 2011 AND 2012

SATELLITE 5 & 6 ARE RECOVERED  
AND SAFE ON IMPROVED ORBITS

SATELLITE 7 & 8 LAUNCHED  
ON 27 MARCH 2015

SATELLITE 9 & 10 LAUNCHED  
ON 11 SEPTEMBER 2015

SATELLITE 11 & 12 LAUNCHED  
ON 19 DECEMBER 2015

SATELLITE 13 & 14 LAUNCHED  
ON 25 MAY 2016

SATELLITE 14 & 15&16&17 LAUNCHED  
ON 17 NOVEMBER 2016

30 SATELLITES IN ORBIT BY 2020



# GLILELO OS PERFORMANCE - NAVIGATION

Definition		Committed Target	Worst Case Dec 2016 July 2017	August 2017	Sept. 2017	Oct. 2017	Nov. 2017
Ranging accuracy (DF, 95%)	Worst Satellite month	< 7.0 m	461 m	0.50 m	0.50 m	0.61 m	0.60 m
	Constellation Average	< 2.0 m	35.8 m	0.41 m	0.38 m	0.45 m	0.44 m
Ranging accuracy (SF, 95%)	Worst Satellite month	< 7.0 m	461 m	0.66 m	0.76 m	0.63 m	0.67 m
	Constellation Average	< 2.0 m	35.9 m	0.55 m	0.56 m	0.50 m	0.50 m
Availability of DF Ranging (global average)		> 87%	95.48%	100%	100%	100%	100%
Per Satellite Availability of SiS (monthly, OS, global average, healthy SF/DF)		> 87%	94.71%	98.18%	100%	99.35%	99.09%
UTC Time Diss. Uncertainty (DF, 95% over campaign period)		< 30 ns	11.7 ns	9.3 ns	9.3 ns	9.3 ns	9.0 ns
UTC Freq. Diss. Uncertainty (DF, 95% over campaign period)		< 3e-13	6.7E-14	5.7E-14	5.7E-14	5.7E-14	2.7E-14
Availability of UTC dissemination (%)		> 87%	95.48%	100%	100%	100%	100%
GST-GPS time offset uncertainty (95% over campaign period)		< 20 ns	7.3 ns	7.2 ns	7.2 ns	7.2 ns	7.0 ns
GST-GPS time offset availability (%) (over campaign period)		> 80%	92.52%	97.9%	97.8%	97.7%	97.9%

# GALILEO IMPROVES SEARCH AND RESCUE



# INITIAL SERVICES QUARTERLY PERFORMANCE REPORTS





# GALILEO REFERENCE DOCUMENTATION

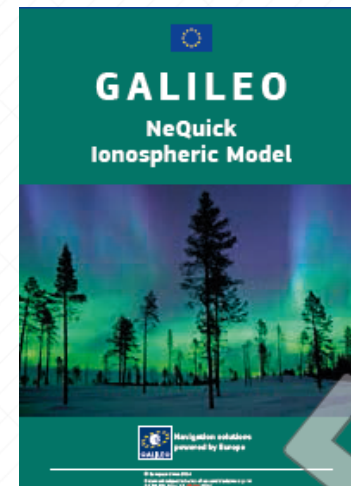


## Galileo Open Service Signal In Space Interface Control Document (OS SIS ICD)

Version 1.2 to be published  
end 2015

## Galileo NeQuick Ionospheric Model

Version 1.1 published  
in April 2015



## Galileo SIS Operational Status Definition

Version 1.0 published  
in September 2015

## Galileo OS Service Definition Document

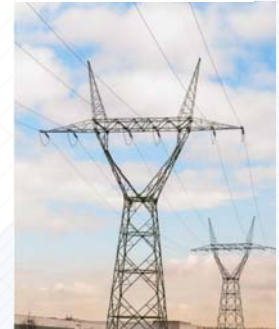
First version in 2016 with Initial Service performance  
Updated version in 2017-18 with more  
consolidated FOC performance





# NEW SERVICES TO COME: **HIGH ACCURACY AND AUTHENTICATION**

- **High Accuracy** will be based on PPP transmission in E6B.
  - **Free of charge to the users**
  - Gradual implementation between **2018 and 2020**
- **Authentication** will be based on a
  - **Navigation Message Authentication:**
  - Integrated in the E1 OS. Aimed at consumer users and offered for free. Already prototyped and under testing
  - **Spreading Code Authentication:** based on the E6 Spreading Code Encryption.

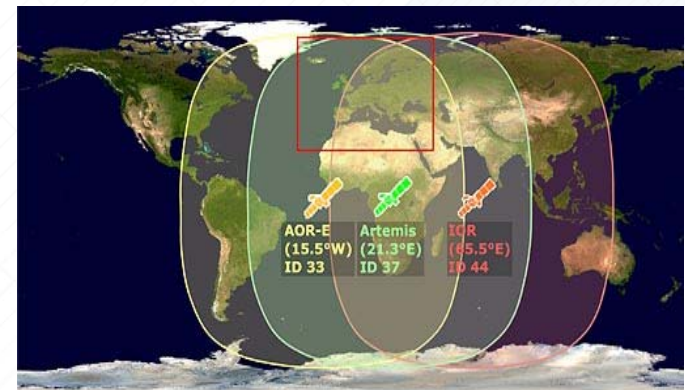


# SEARCH AND RESCUE RETURN LINK IN 2018



# EGNOS IS FULLY OPERATIONAL

- EGNOS Open Service is operational since October 2009
- Its Safety of Life service has been declared operational in March 2011
- The EGNOS Data Access Service (EDAS) was declared in July 2012
- Around 249 approach procedures making use of EGNOS for aircraft landings approved in 20 Countries



# GALILEO - INCREASINGLY CRITICAL TO EU POLICIES

- ENERGY UNION policy: more energy-efficient, modern and cleaner mobility solutions
- Road: eCall, Digital Tachograph, eTolling
- Aviation: PBN, Drones, Surveillance & Tracking, ....
- Timing for Critical Infrastructures
- Approved as a Global Maritime Distress & Safety System



**NEW**

- European Radio-Navigation Plan
  - modernise infrastructure
  - rationalise investments
  - synergies between sectors



# ALREADY THERE : eCALL COMPULSORY AS FROM APRIL 2018



# COMING SOON: GALILEO FOR AUTONOMOUS VEHICLES

**Autonomous vehicles** need robust, high accuracy positioning  
– human lives will be at stake.

## The self-driving vehicle revolution

An illustration of potential growth



# COMPATIBLE RECEIVERS

**2010**



**2017**

**TIMING**



**SMARTPHONES/MASS MARKET**



**AUTOMOTIVE**



**UAVs**

**HIGH PRECISION**



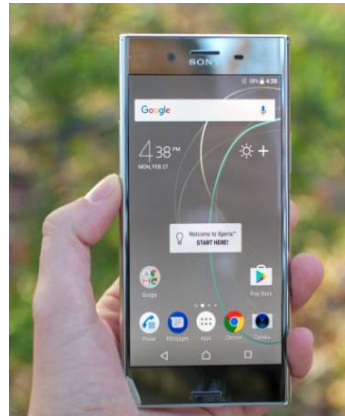
**95% of global supply**

# GALILEO-ENABLED PIONEERS

**Bq Aquaris X5**  
**July 2016**



**Sony Xperia XZ**  
**March 2017**



**Huawei P10**  
**March 2017**



**Samsung S8**  
**April 2017**








**Apple Iphone 8,  
8s and X**  
**Sept 2017**





# GNSS MARKET MACROTRENDS

GNSS essential in major technology developments: the Internet of Things, Big Data, mHealth, Augmented Reality, Smart Cities, and Multimodal Logistics.

Internet of Things (IoT)		<p>A major development in the role of the internet, the IoT allows physical devices, vehicles, buildings and other objects to be <b>interconnected</b> and <b>controlled remotely</b> across network infrastructures.</p> <p>IoT is relying on a wide range of <b>different sensors</b> and technologies, one of them being <b>GNSS</b> which provides <b>localisation</b> and <b>timing information</b>.</p>
Big Data		<p>With traditional data processing unable to deal with the skyrocketing volumes of data that are produced every single day, <b>complex systems</b> are being created to allow for <b>big data processing</b>.</p> <p>GNSS is a major data source providing <b>location</b> and <b>timing information</b> to the world of Big Data. The proliferation of GNSS devices is boosting the quantity of location and timing data.</p>
mHealth		<p><b>Mobile Health (mHealth)</b> is a sub-segment of eHealth and covers medical and public health practice supported by mobile devices.</p> <p>Key mHealth application categories include <b>disability assistance</b>, <b>preventive medicine</b> and <b>emergency</b>, and leverage fusion of big data with GNSS.</p>
Augmented Reality (AR)		<p><b>AR</b> integrates <b>digital information</b> with the user's <b>environment</b>. Unlike virtual reality, which creates a totally artificial environment, AR uses the existing environment and overlays new information on top.</p> <p><b>GNSS</b> provides a globally available source of georeferenced information that <b>brings augmented reality into the open</b>. GNSS allows the creation of a direct link between the surrounding reality and digital objects.</p>
Smart Cities		<p><b>Smart Cities</b> feature an integrated system for collecting, measuring, collating and broadcasting city data and for making it easily <b>accessible</b> to citizens, municipalities and city planners.</p> <p>GNSS is one of the key technologies used within <b>infrastructure design</b> and <b>mobility</b> of smart cities, offering numerous opportunities to <b>citizens</b>, <b>local governments</b> and <b>city planners</b> alike.</p>
Multimodal Logistics		<p>Multimodal logistics refers to the transport of goods by at least two different modes of transport in the framework of a single multimodal transport contract.</p> <p>Logistics service providers draw on GNSS for <b>efficiency</b>, <b>security</b> and <b>safety</b>. GNSS contributes to the monitoring of <b>cargo</b> along the entire supply chain and enables pivotal <b>asset management</b> applications.</p>

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# GNSS MARKET REPORT



[https://www.gsa.europa.eu/system/files/reports/gnss\\_mr\\_2017.pdf](https://www.gsa.europa.eu/system/files/reports/gnss_mr_2017.pdf)

# DESIGNED FOR SERVICE: GALILEO SERVICE CENTER (MADRID)

- ★ Operated by GSA



[www.gsc-europa.eu](http://www.gsc-europa.eu)

- ★ Publication of Galileo official documents
- ★ Publication of the state of the constellation, NAGUs (Notice Advisory to Galileo Users) and Galileo performance
- ★ Helpdesk



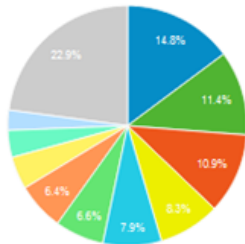
**Evolution of number of visits / unique visitors**



## ✓ Visiting countries

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

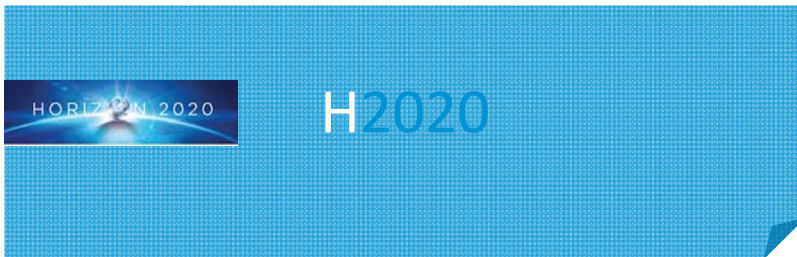
- Spain
- Belgium
- Germany
- Netherlands
- Czech Republic
- United Kingdom
- Italy
- France
- United States
- Poland
- Other



\* 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

Pageviews	%
1,589	
1,095	
999	
254	
238	
156	
121	
114	
106	
105	

- ★ Increased number of user visits and questions



## **R&D programme launched for GNSS in the context of Horizon 2020: ~408M€**

- Promote applications
- Develop Infrastructure & Technology
- Define Mission and Services

## **FUNDAMENTAL ELEMENTS**

### **Fundamental Elements: ~112M€**

- Promote the development of Galileo and EGNOS enabled chipsets and receivers



## CALL — EGNSS MARKET UPTAKE 2019-2020

Topics	Type of Action	Indicative budget (€ million)		
		2018	2019	2020
SPACE-EGNSS-1-2019-2020: <b>EGNSS applications fostering green, safe and smart mobility</b>	IA		10.0	10.0
SPACE-EGNSS-2-2019-2020: <b>EGNSS applications fostering digitisation</b>	IA		4.0	5.0
SPACE-EGNSS-3-2019-2020: <b>EGNSS applications fostering societal resilience and protecting the environment</b>	IA		4.0	5.0
SPACE-EGNSS-4-2019: <b>Awareness raising and capacity building</b>	CSA		2.0	

## OTHER ACTIONS FOR 2018-2020 (SUB-SET)

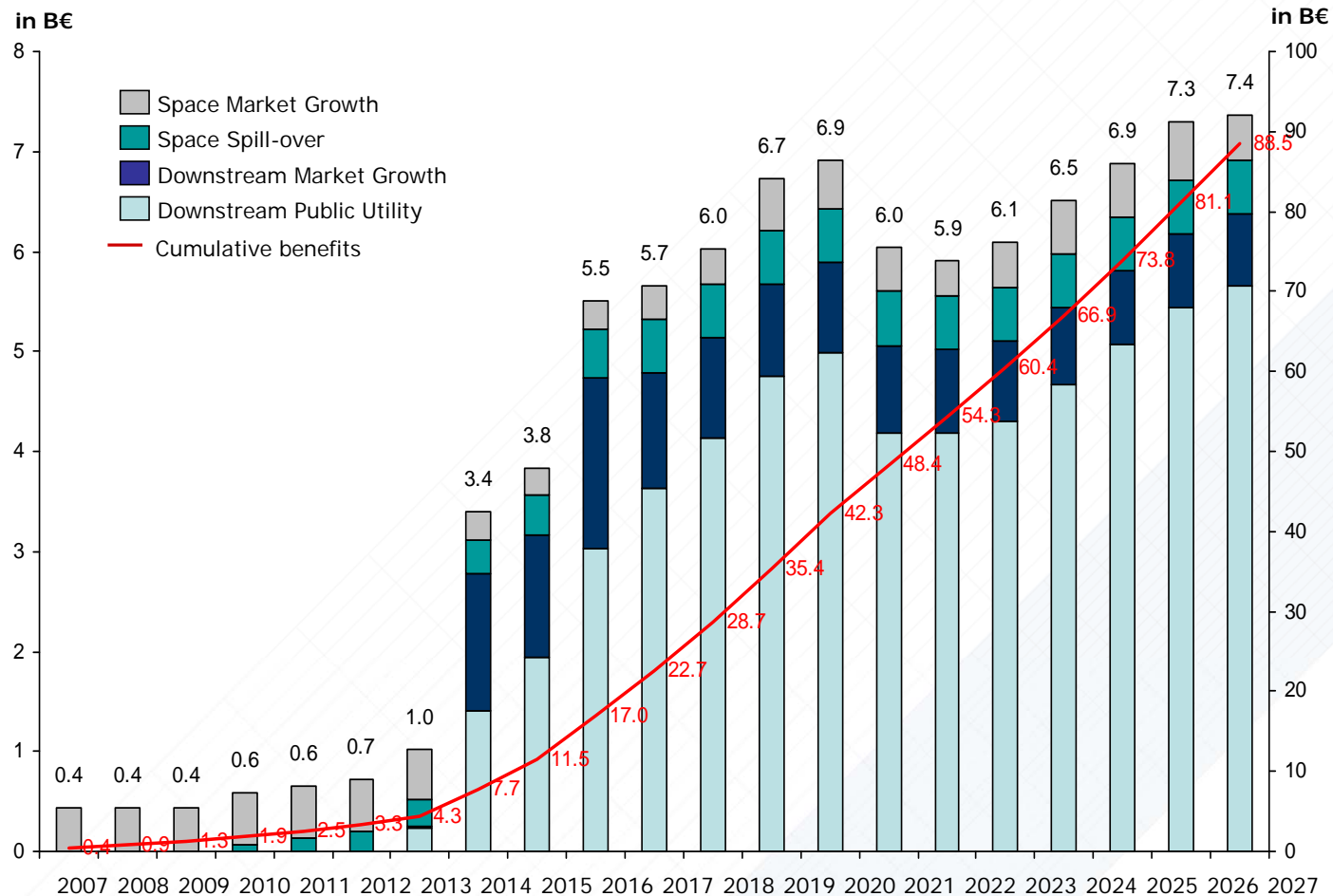
Topics	Type of Action	Indicative budget (€ million)		
		2018	2019	2020
Activity 7 – <b>Galileo Evolution, Mission and Service related R&amp;D activities</b>	Public Procurement		2.6	1.8
Activity 8 – <b>EGNOS Mission and Service related R&amp;D activities</b>	Public Procurement		0.4	0.2
Activity 9 – <b>GNSS evolution, infrastructure-related R&amp;D activities</b>	DA - ESA	36.0	31.0	10.0
Activity 13 – <b>Horizon 2020 project monitoring and audits EGNSS</b>	Expert Contracts		0.5	0.5

## International cooperation is **crucial** for the development of European GNSS

### Objectives of international cooperation

- Promoting and expanding worldwide the use and uptake of the services offered by the European GNSS programmes;
- Ensuring access to relevant key technologies and the security of its supply for the exploitation of the European GNSS systems;
- Coordinating with other GNSS providers on issues such as frequency questions, interoperability and security.

EGNOS and Galileo will provide cumulative indirect benefits of around 90 B€ over the next 20 years to the EU

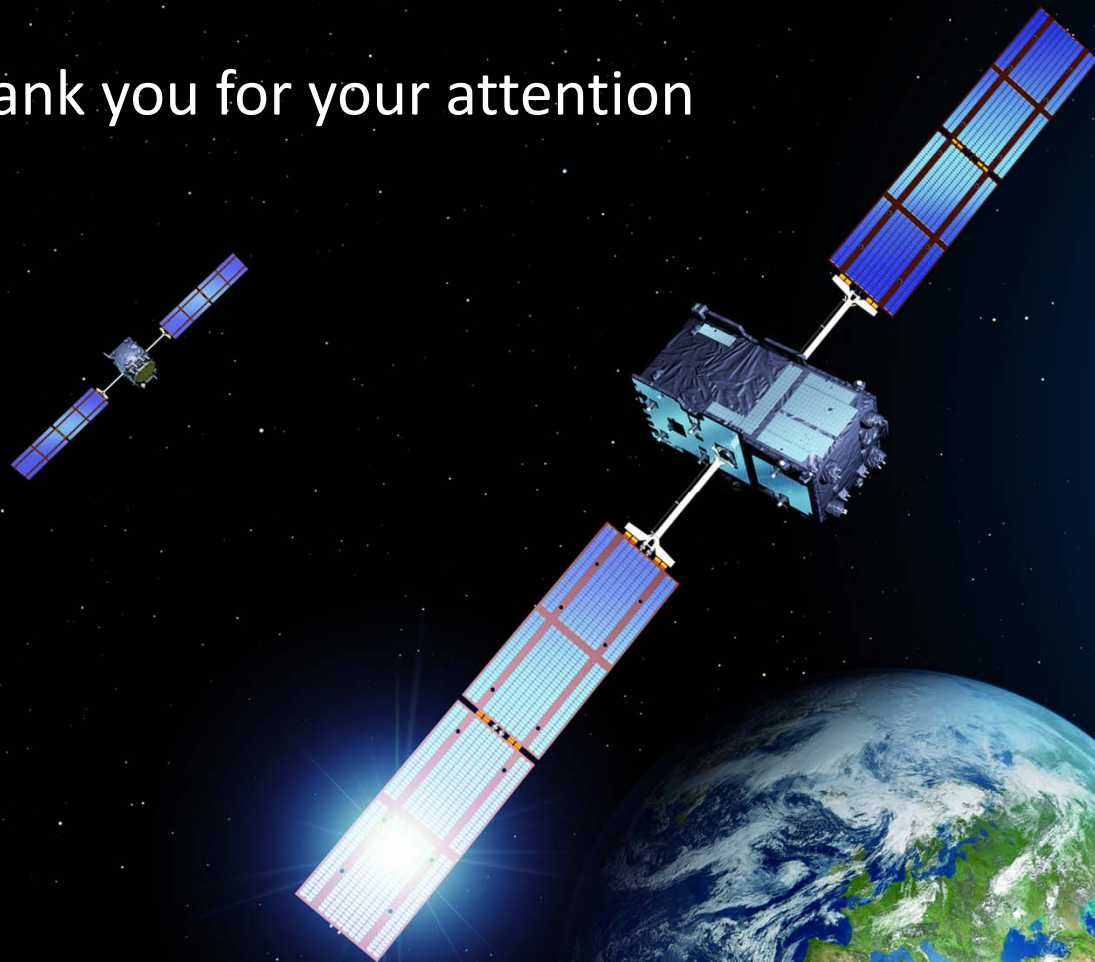


## Possible mutual benefit cooperation on:

- Market development and responses to user requirements;
- System and service development, including ground or space-based augmentation systems;
- Frequency issues, including coordination of frequency planning;
- Radio-navigation planning;
- Promotion of industrial collaboration;
- Development of standardisation policy and certification methodology for applications;
- Training and exchange of experts.



Thank you for your attention



<http://ec.europa.eu/galileo>  
<http://ec.europa.eu/egnoss>