GALILEO HACKATHON by GNSS.asia

Galileo Open Online Course

Galileo Hackathons

GALILEO NAVIGATION SOLUTIONS POWERED BY EUROPE

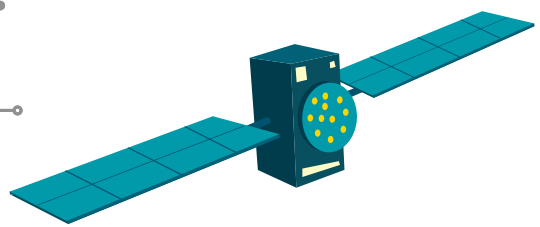
asean

EUSPA

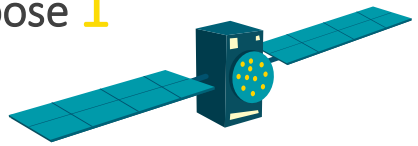
PhilSA

GISTDA

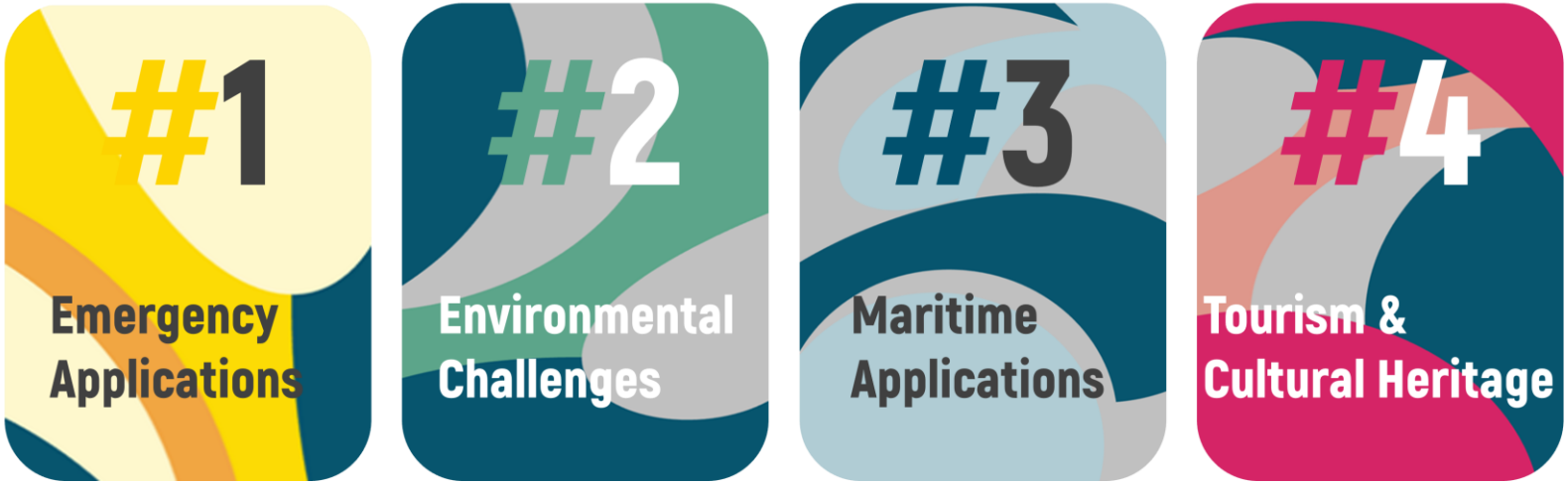
The Galileo Hackathons



Leverage EU Space data from Galileo, the European Global Navigation Satellite System, for applications in Southeast Asia. As a Hacker you have the power to choose 1 Hackathon out of many Galileo Hackathons...



...and tackle 1 of 4 challenges:



The Galileo Hackathons in Southeast Asia

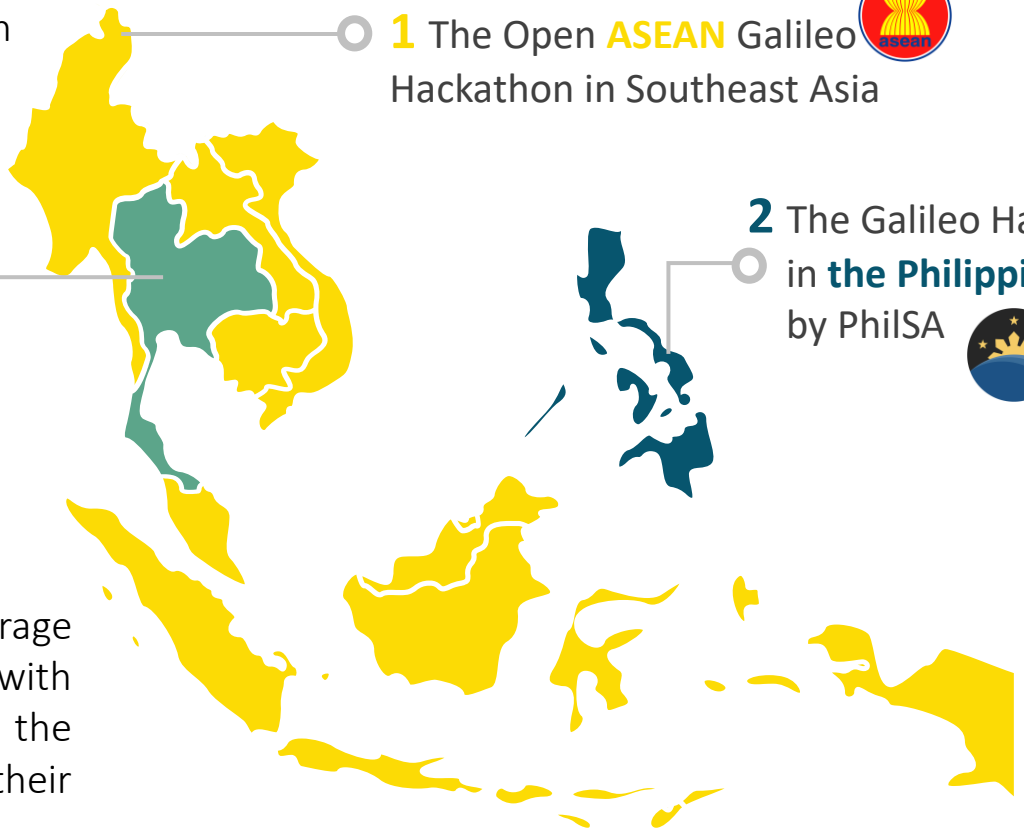
The Galileo Hackathons take place simultaneously across Southeast Asia

Hackers can choose freely which Hackathon they join!

1 The Open ASEAN Galileo Hackathon in Southeast Asia

2 The Galileo Hackathon in the Philippines by PhilSA

3 The Galileo Hackathon in Thailand by GISTDA



Each location will look to leverage Galileo to solve the 4 challenges with a focus on the problems faced by the local ecosystem. They each have their own expert mentors and prizes!

GALILEO HACKATHON by GNSS asia

WHAT IS THIS COURSE?

The Course is intended to guide you through
ALL YOU NEED TO KNOW
about Galileo, satellites, navigation and applications
to participate successfully to the Galileo Hackathons as a Hacker!

The Galileo Hackathons are inclusive and open to all disciplines and all age groups. We specifically invite participants without any prior knowledge about Galileo. This course is just meant for your own interest and is not mandatory to study for the Galileo Hackathons.

Mentors that speak English and/or your native language will be available at the Hackathon to support you!

We can't wait to see how you use Galileo to tackle challenges in Southeast Asia!

What you will learn in this course

Discover Galileo

- What is GNSS?
- What is satellite navigation?
- What is Galileo?
- Who builds and manages Galileo?
- What can I use Galileo for?
- Can Galileo help solve challenges in Southeast Asia?

If you can't get enough of Galileo and would like to learn how to use it for the Internet of Things (IoT) check out the Massive Open Online Course Point.MOOC

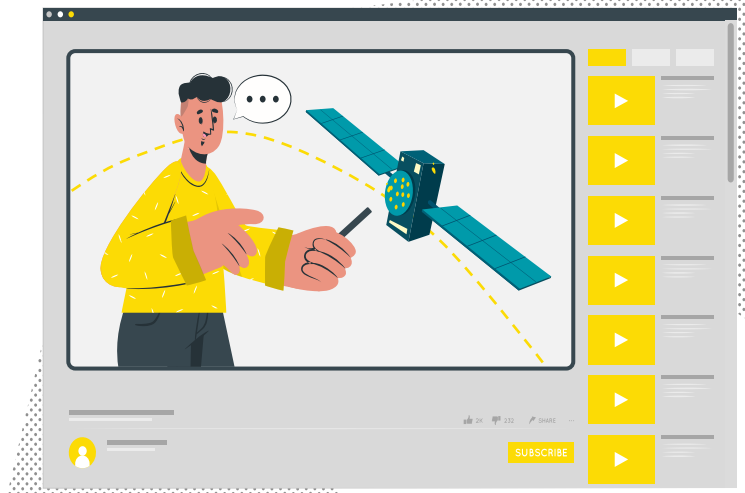
The instructors of the Point.MOOC will be available as Mentors during the Hackathon!

If you would like to watch a recording of parts of the course visit the links below
https://www.youtube.com/watch?v=ImLkELgNwBQ&t=991s
https://www.youtube.com/watch?v=Dx0Gza6pYxU&t=3826s

Resources

Just getting started using satellite positioning technologies? We have collected some important resources for you to get started:

- EGNOS and Galileo: Programme Reference Documents
- GNSS Raw measurements white paper
- Database of GNSS raw measurements
- Glossary for GPS test
- GNSS Market Report
- Galileo-enabled devices



More information:
www.usegalileo.eu

What is Galileo?

Satellite Navigation

EGNOS

Earth Observation

Copernicus
Europe's eyes on Earth

Secure Connectivity

GOVSATCOM

Space situational awareness

EUSST

GALILEO

Galileo is Europe's **Global Navigation Satellite System (GNSS)**, providing improved positioning and timing information with significant positive implications for many European services and users.

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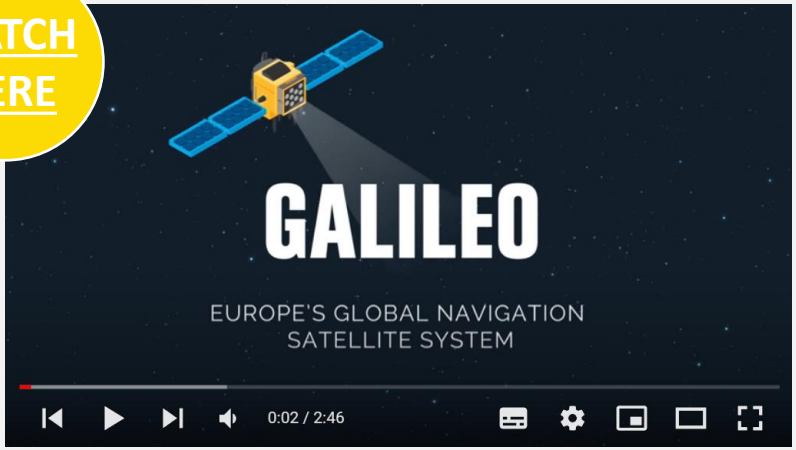


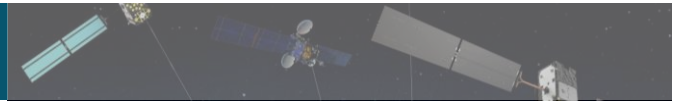
Galileo Differentiators

- **Fully interoperable** with other GNSS constellations
- Open service **free of charge**, delivering **multiple frequencies**
- Modern signal is more **resistant to multipath**
- Global **high-accuracy service** for free delivering down to 20 cm accuracy
- Only constellation that provides **signal and data authentication**

This is also Galileo

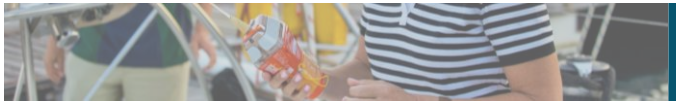
Galileo allows users to know their exact position with greater precision than what is offered by other available systems through providing **precise satellite navigation data** all over the world **free of charge**

Open Service (OS



Public Regulated Service (PRS)

High Accuracy Service (HAS)



Search and Rescue Service (SAR)

Emergency Warning Service (EWS)

Open Service Navigation Message Authentication (OS-NMA)

Who builds and manages Galileo?

The European Union Agency for the Space Programme (EUSPA) is responsible for Galileo and the user-oriented operational Agency of the EU Space Programme, contributing to **sustainable growth, security and safety** of the European Union. By fostering the development of innovative and competitive upstream and downstream sectors and engaging with the entire EU Space community worldwide, EUSPA is **driving innovation-based economic growth**.

WATCH HERE

Different technologies to provide positioning data

- **Cell Network based:** (Cell-ID, E-OTD, TDOA etc.) using the telecommunication networks
- **LPWAN Network based:** Mostly RSSI (Received Signal Strength Indicator) using the proprietary (SigFox, LoRa) networks. TDOA marginal and only on LoRa.
- **Handset based:** (GNSS) the handset itself is the primary means of positioning the user. The A-GNSS corresponds to a hybrid technology based on the GNSS but using the cellular network
- **Infrastructure based:** (Bluetooth, UWB, Wi-Fi or RFID) the position is computed by evaluating of the distance between the device and transmitters (e.g. a Bluetooth beacon/ a Wi-FI router)

	Indoor	Outdoor	Accuracy
Cellular network based	Cell-ID		200-5000m
	Cell Tower Triangulation		50-1000m
LPWAN network based	RSSI		1000-2000m
	(TDOA)		(500-1000m)
Handset based		GNSS	1-50m
Hybrid		A-GNSS	
Infrastructure based	Wi-Fi		3-10m / 20-50m
	Bluetooth		3-10m
	UWB		0.2-10m
	RFID		<3m

GNSS offers superior performance along three main axis

Ubiquity

As PNT applications continue to expand in consumer and commercial segments, demand is also growing for uninterrupted, ubiquitous, and seamless access to position information

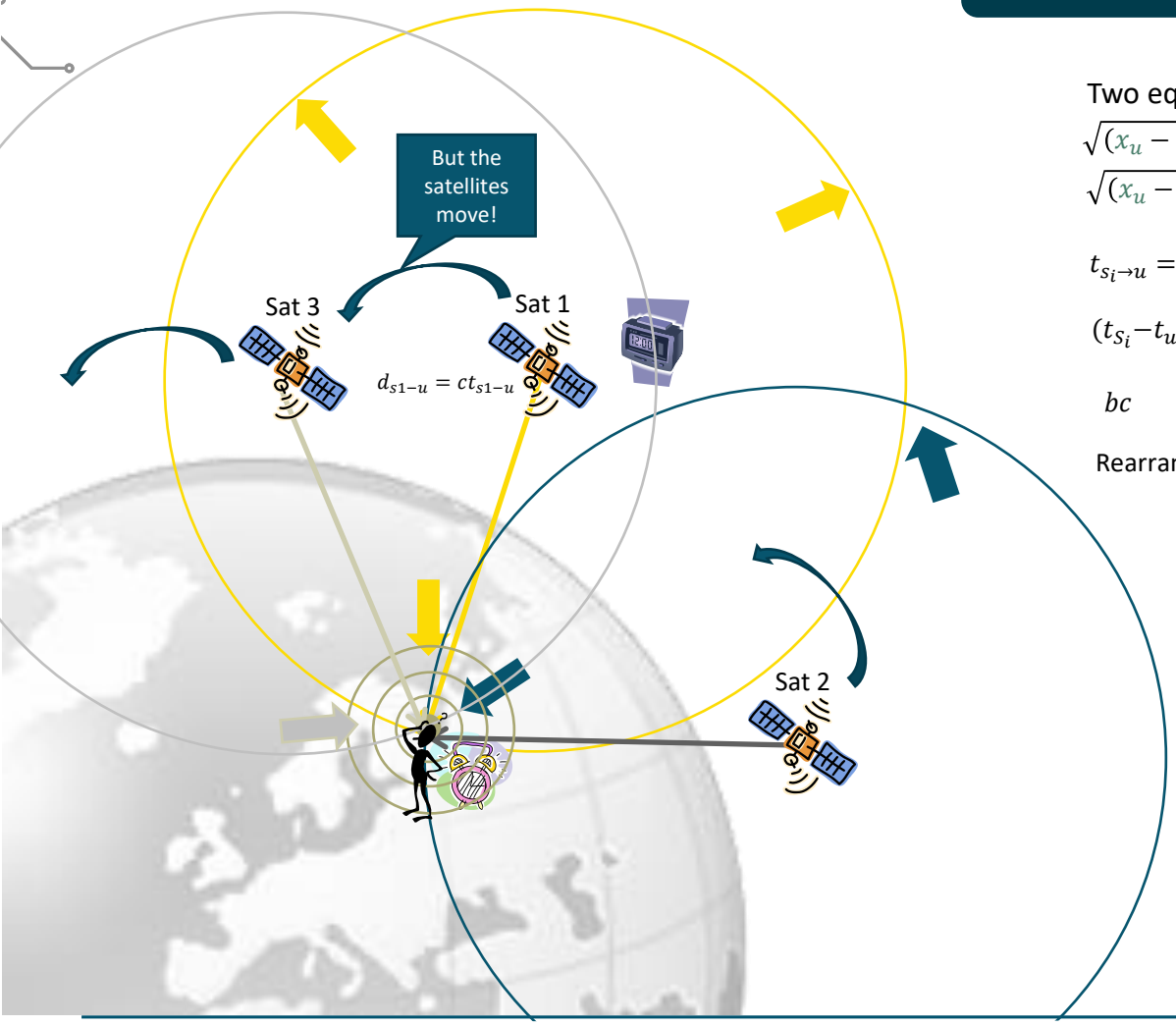
Accuracy

The development of new semi-professional applications supported by mobile devices is pulling the demand for increased location accuracy

Security

Addressing jamming and spoofing is key especially where PNT is at the core of safety-critical or commercially sensitive applications

Signal acquisition



Don't worry, you don't need these equations for the Hackathon

Two equations with two variables:

$$\sqrt{(x_u - x_{s1})^2 + (y_u - y_{s1})^2} = ct_{s1\to u}$$
$$\sqrt{(x_u - x_{s2})^2 + (y_u - y_{s2})^2} = ct_{s2\to u}$$

$$t_{s_i\to u} = t_{s_i} + b - t_u = t_{s_i} - t_u + b$$

$(t_{s_i} - t_u)c = p_i$ Pseudorange user-Sat i

bc Clock offset

Rearranging:

$$p_1 = \sqrt{(x_u - x_{s1})^2 + (y_u - y_{s1})^2} - bc$$
$$p_2 = \sqrt{(x_u - x_{s2})^2 + (y_u - y_{s2})^2} - bc$$
$$p_3 = \sqrt{(x_u - x_{s3})^2 + (y_u - y_{s3})^2} - bc$$

3 equations with 3 variables!

In a 3-dimensional world, you add a satellite, so **we need 4 satellites to get "a fix"**

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Galileo constellation

Once fully deployed:

30 satellites

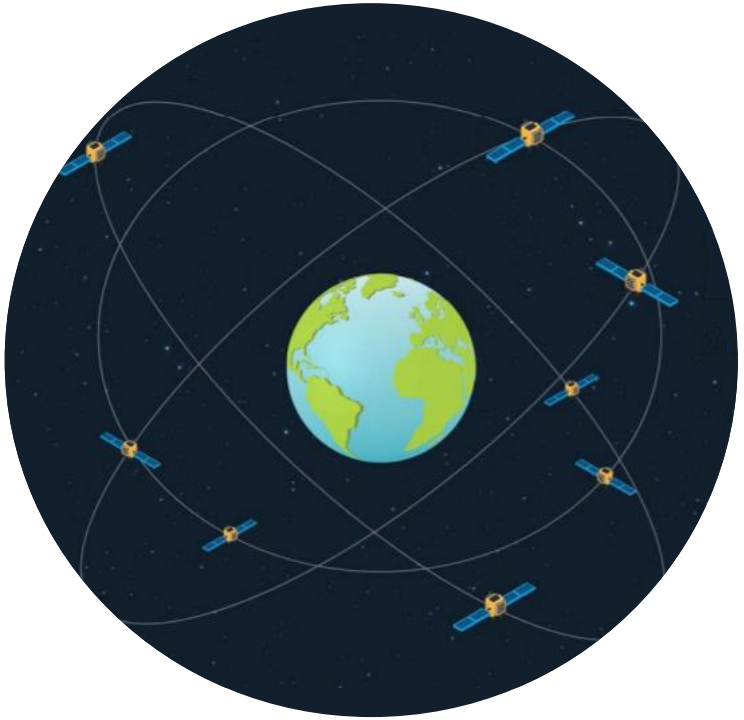
24 operational

+ 6 orbit spares

in 3 Medium Earth Orbit

(MEO) orbital planes:

23.200 km

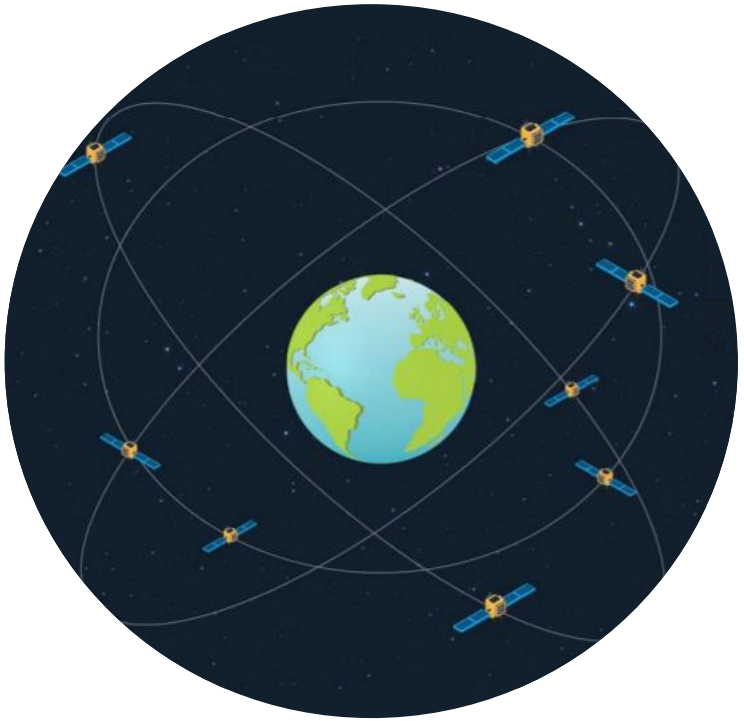


More **reliable coverage** through satellites located in a higher orbit

Galileo constellation

Nominal constellation specifications:

- circular orbits
- orbital inclination of 56°
- three equally spaced orbital planes
- nine operational satellites, equally spaced in each plane
- one spare satellite (also transmitting) in each plane



More **reliable coverage** through satellites located in a higher orbit

Galileo satellite components

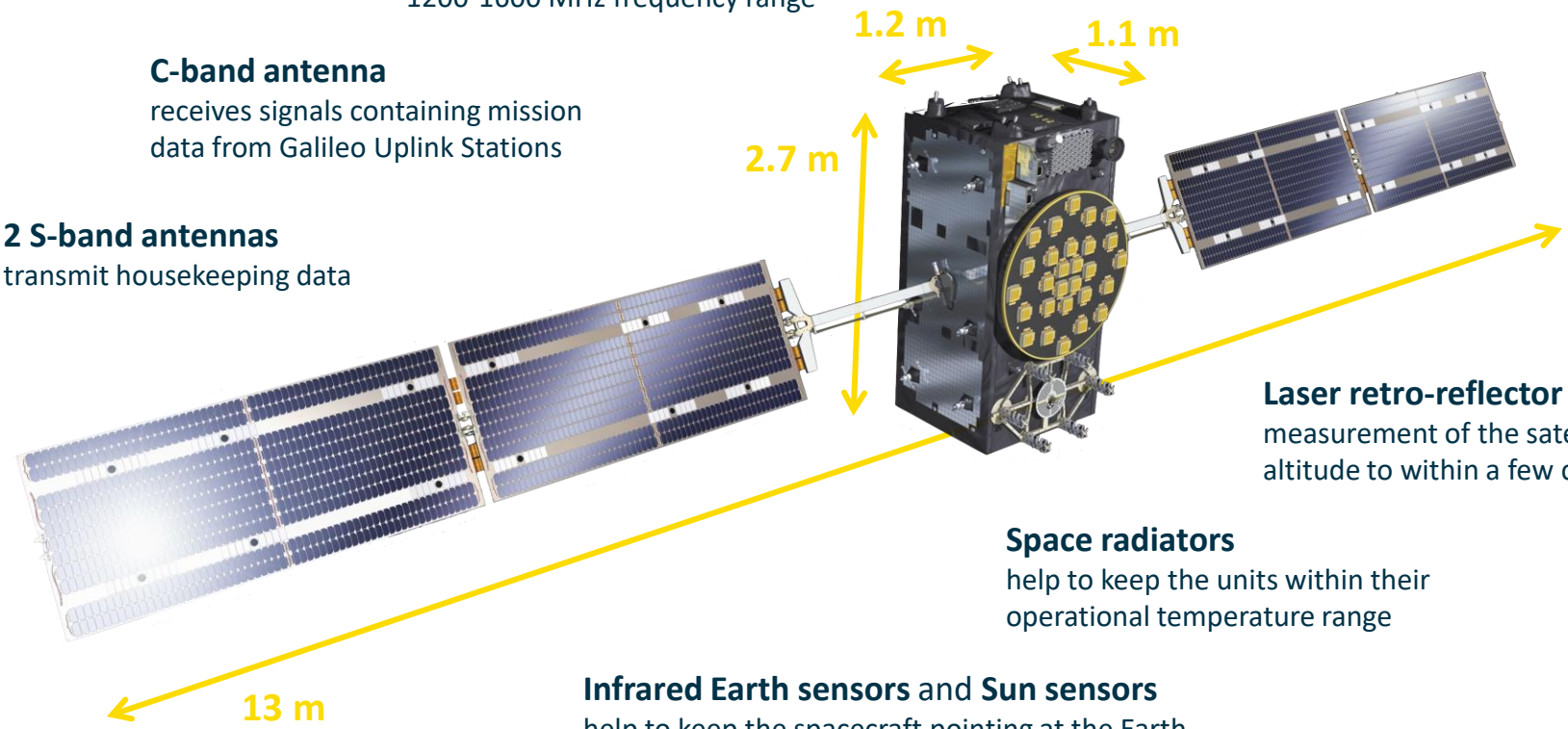
675 kg

Peak Power: 1600 W

L-band antenna
transmits navigation signals in the 1200-1600 MHz frequency range

C-band antenna
receives signals containing mission data from Galileo Uplink Stations

2 S-band antennas
transmit housekeeping data



Laser retro-reflector
measurement of the satellite's altitude to within a few cm

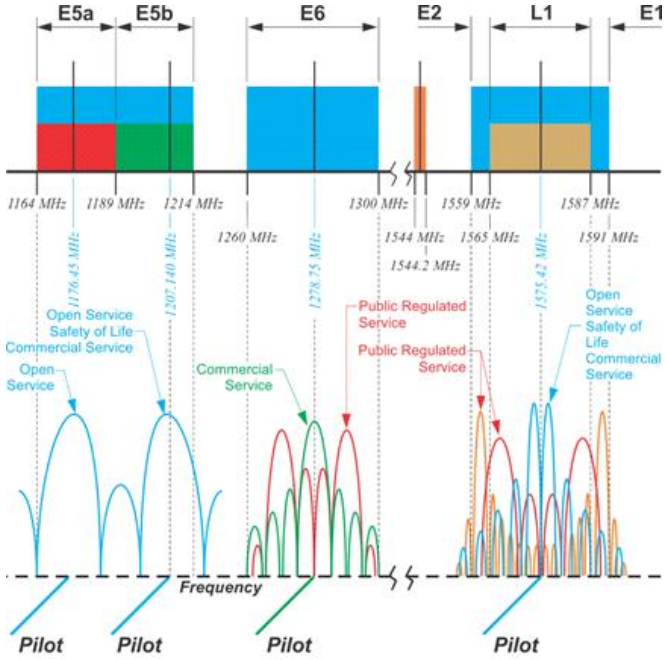
Space radiators
help to keep the units within their operational temperature range

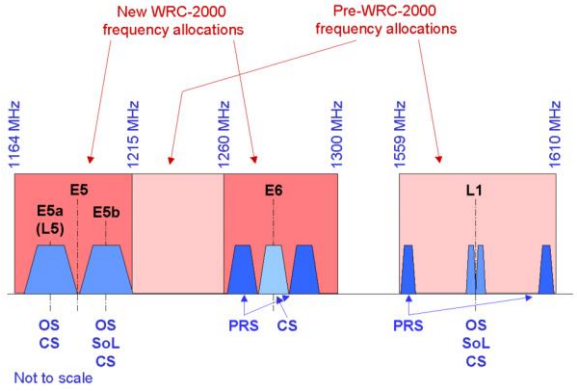
Infrared Earth sensors and **Sun sensors**
help to keep the spacecraft pointing at the Earth

SAR (Search and Rescue) antenna
picks up and transmits distress signals

Galileo Frequency & Signals

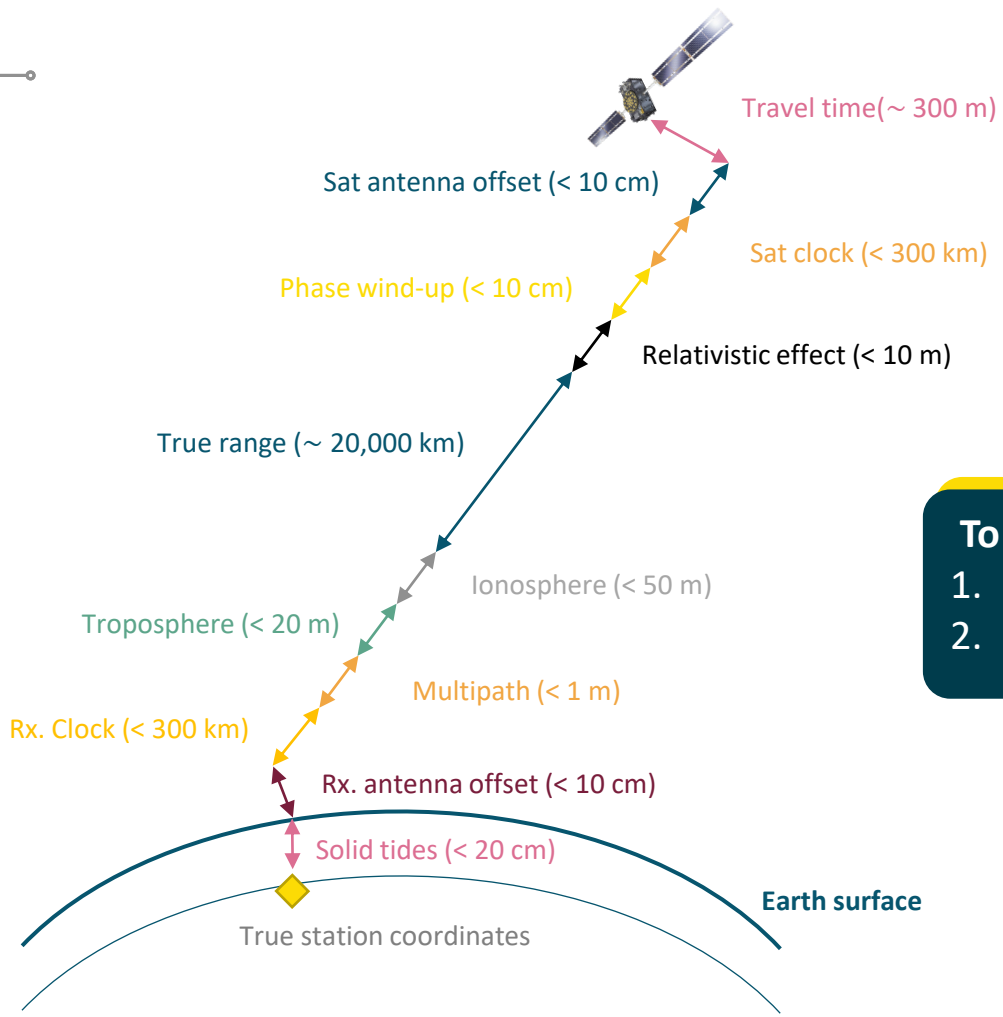
- The frequencies used by the satellites are within the 1.1 to 1.6 GHz band; a range of frequencies particularly **well suited for mobile navigation** and **communication services**
- There are **4** Galileo signals. E5a, E5b, E6 and E2-L1-E1. E5a and E2-L1-E1 overlap the existing L1 and L5 GPS signals. The minimum power received from the Galileo signals is -152dBW more than double the power of the C/A code from GPS





PRS = Public Regulated Service
OS = Open Service
SoL =Safety of Life service
CS = Commercial service

The Error budget of GNSS signals



To provide high accuracy we need

1. Access to multiple frequencies
2. Lower noise

Galileo Dual Frequency

Galileo transmits on E1 and E5 bands enabling the elimination of ionospheric errors by comparing difference between ionospheric delays on the two frequencies

Future GNSS/RNSS common frequencies, showing the potential of E5a/L5 and of E1/L1 combination

	L5/ L5OC/ E5a/ B2a	L2/ L2C/ L2OC	E6/ LEX	L1/ L1OC/ E1/ B1
GPS	30	30		30
GLONAS	24	24		24
Galileo	30		30	30
BeiDou	35		35	35
QZSS	3	3	3	3
NavIC	7			
	129	← ARNS* Bands →		122

Frequency band used by the system, which N = number of satellites

Frequency band not using the system

ARNS = Aeronautical Radio Navigation Service

Galileo Dual Frequency

Dual frequency allows for better positioning performance

Characteristics

- Wide band signal providing increased **accuracy**
- Exceptional resistance to **multipath**
- In combination with E1 providing **iono-free** solution
- All constellations support this frequency, the number of available signals will **grow rapidly**
- E1/E5 combination is recognized in **all segments**, professional, automotive and also mass market

- Red: BCM4774 (L1)
- Green: BCM4775 (L1+L5) – dual frequency

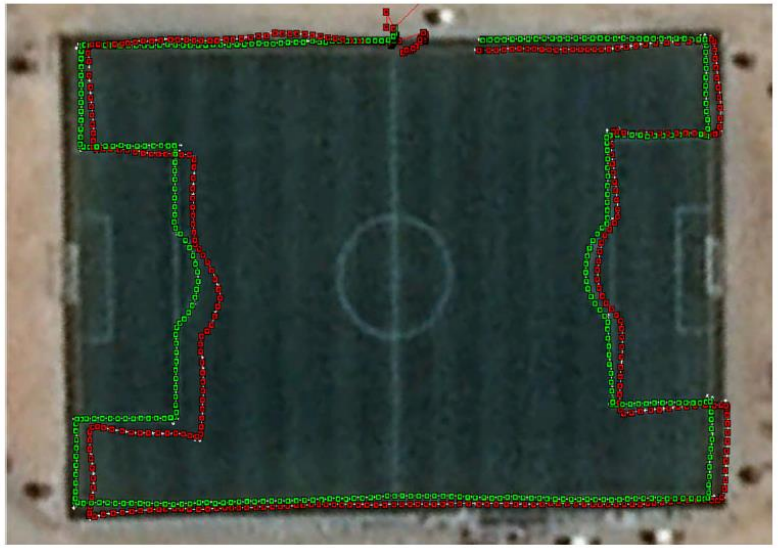


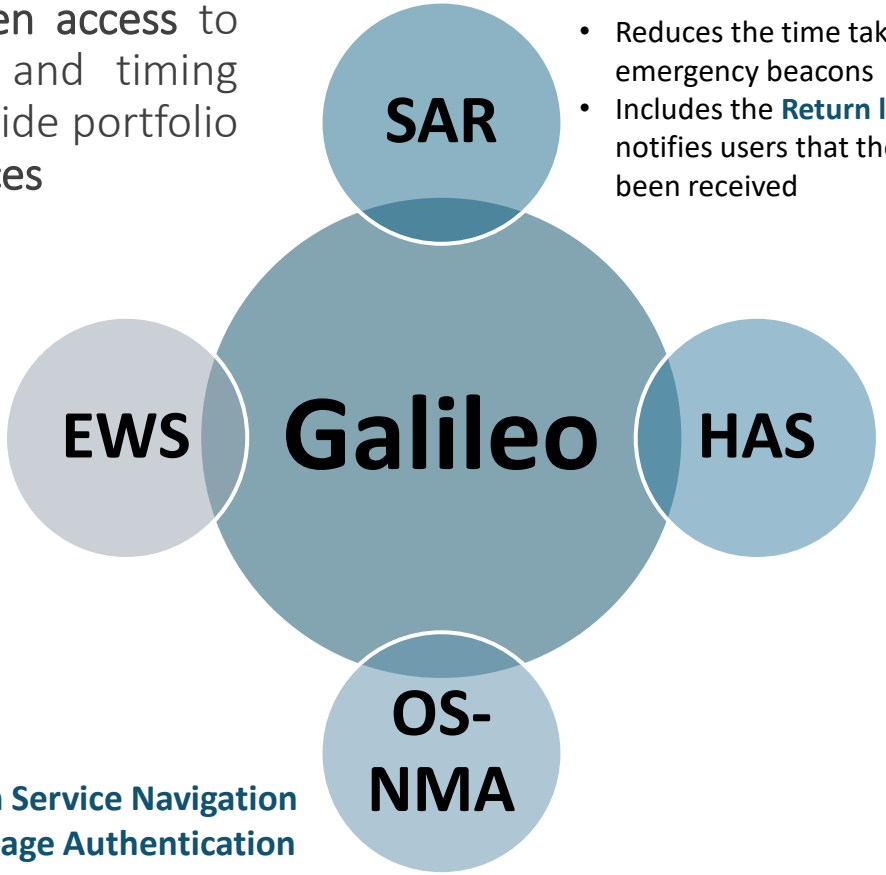
Image Courtesy of Broadcom

Is Galileo free? – YES!

WATCH HERE

Galileo services

Besides offering **open access** to precise positioning and timing data, Galileo has a wide portfolio of **value added services**



Search and Rescue Service

- Reduces the time taken to locate emergency beacons
- Includes the **Return link service** that notifies users that their distress signal has been received

Emergency Warning Service

- Leverages Galileo's messaging function
- Transmits alerts to smartphones within affected areas without relying on ground infrastructure

High Accuracy Service

- Reduces positioning errors to below 2 decimetres
- Based on the free transmission of Precise Point Positioning

Open Service Navigation Message Authentication

- Ensures the authenticity of circulating GNSS information
- Enables higher-than-before levels of service robustness
- Complemented through the **Commercial Authentication Service** that allows access to the encrypted E6-C codes

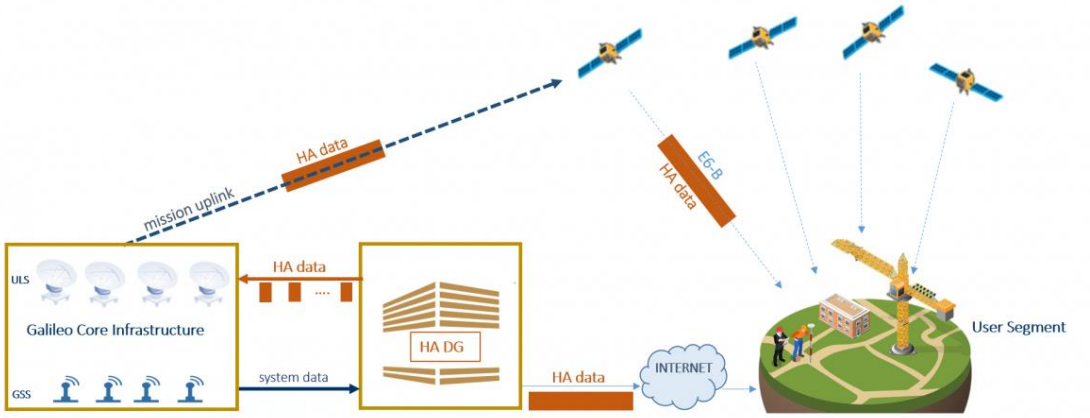
The Galileo High Accuracy Service (HAS)

HAS corrections: high accuracy corrections are composed by orbits, clocks, code and phase biases per each satellite. The HAS full service will include atmospheric corrections too

Accessible: high accuracy corrections will be accessible through two dissemination channels: E6-B Signal in Space (SiS) and a terrestrial link, which provides an alternate source to the SiS through the Internet

Multi-constellation and multi-frequency: high accuracy corrections are computed for Galileo E1/E5a/E5b/E6; E5 AltBOC and GPS L1/L5; L2C

Open format: high accuracy corrections follow a similar format to Compact-State Space Representation (CSSR)



Galileo system elements involved in the generation, provision and exploitation of Galileo HAS

The Galileo High Accuracy Service (HAS)

	Service Level 1 (SL1)	Service Level 2 (SL2)
Coverage	Global	European Coverage Area
Corrections	Orbit, clock, biases (code and phase)	Orbit, clock, biases (code and phase) + atmospheric corrections
Horizontal Accuracy (95%)	<20cm	<20cm
Vertical Accuracy (95%)	<40cm	<40cm
Converge Time	<300s	<100s
Availability	99%	99%
User Helpdesk	24/7	24/7

HAS Roadmap

Phase 0

HA Testing and Experimentation

- Validate dissemination capabilities
- HAS SiS tests and experimentation
- Leverage lessons learned for following phases

Phase 1

HA Initial Service

- Use Galileo system data (GSS) only
- Provision of Service Level 1 with relaxed performance

Phase 2

HA Full Service

- Additional data (stations) to improve the performance
- Full Provision of HA Service Level 1 and 2 with its target performance

Galileo's Search and Rescue (SAR) service

In the event of a **boat or an airplane crash**, a **SAR transmitter** will send an **emergency positioning signal** that will be received by the satellites, allowing for a **quick and accurate emergency response**

The SAR/ Galileo service is the biggest contributor to the Cospas-Sarsat MEOSAR programme in terms of ground segment and space segment assets

1. With the **Forward Link** enabled by Galileo the Cospas-Sarsat 406Mhz distress signal is relayed to the ground

2. With the **Return Link Service (RLS)** enabled by Galileo the person in distress will know the emergency services are alerted: lower stress, reduction of false alarms, remote activation

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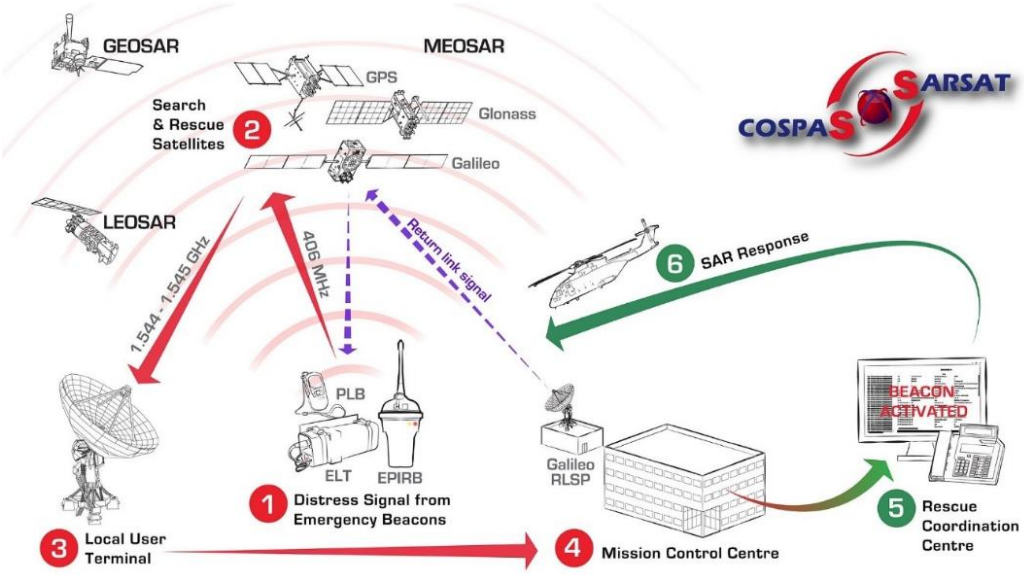
Galileo's Search and Rescue Service (SAR)

- The SAR is fully integrated into the Cospas-Sarsat system
- The SAR transponder on Galileo satellites picks up signals emitted from distress beacons in the 406 – 406.1 MHz band and broadcasts this information to dedicated ground stations (MEOLUTs) in the L-band at 1544.1 MHz
- These signals are used by the MEOLUTs to generate an independent location of the beacon, which is then relayed to first responders through the Cospas-Sarsat Mission Control Centres (MCCs)



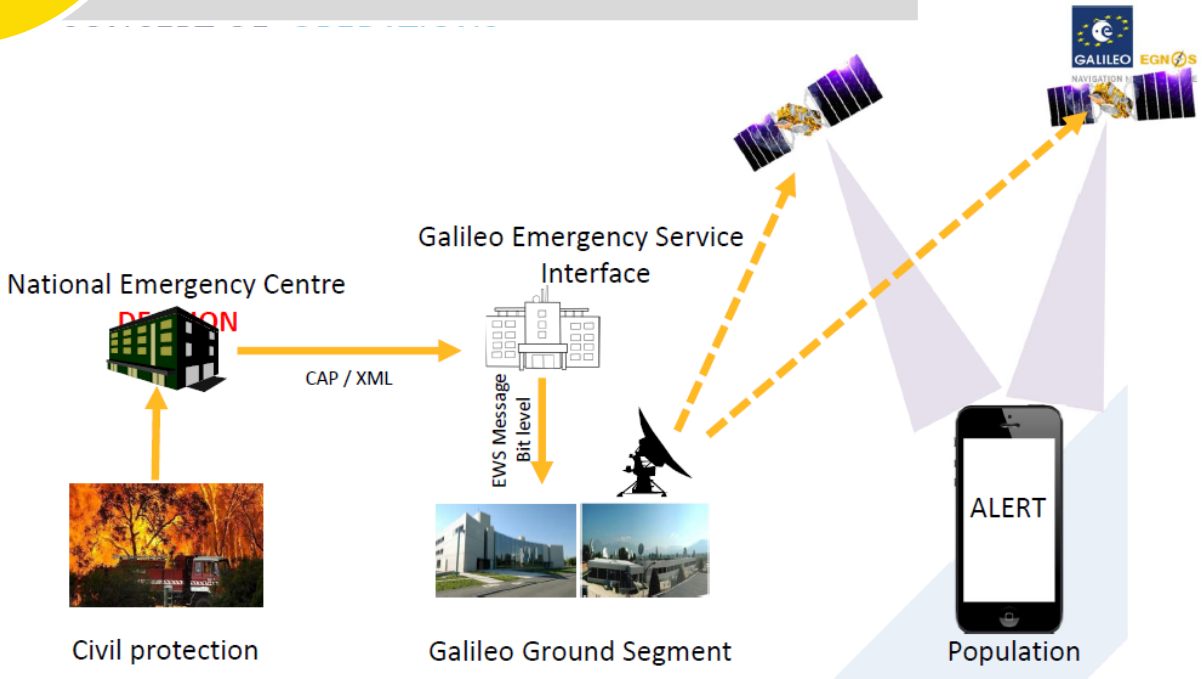
Galileo's Emergency Warning Service (EWS)

- Global coverage
- No 'mobile' connection required
- **Resilience** to ground destruction
- **Multi-hazard**
- **On-demand broadcast** of an alert message + guidance
- **Complementary** to existing systems
- Reach out population in a **timely manner (2-3 minutes)**, whatever the size of the area
- Geo-location information encoded in the message to **target only the relevant population**
- Relevant population targeted by means of an **ellipse**

EWS concept of operations

The service is realised by three components

- Civil Protection Authorities
- Galileo
- Users



Spoofing

Up until now, as a navigation satellite disseminates navigation and timing data, there is no way of confirming these data are indeed coming from their apparent originator. As a result, the data could be falsified, a phenomenon known as **spoofing**, where corrupt false signals mislead receivers about their position, misleading their users in turn, with potentially serious consequences

→ Attacker **forges a GNSS signal** and tricks the receiver so it appears to be somewhere else and not in its actual position

The Truth About Cars

Bizarre GPS Activity Means Drivers Near the Kremlin Are Always at the Airport

The closer to the Kremlin, the more likely the device will suddenly find an ... GPS spoofing overpowers a signal with a much stronger one.

30 Jan 2017

Open Service Navigation Message Authentication (OS-NMA)

- Contributes to **mitigate Spoofing**
- Implementable with relatively **small changes** in receiver design
- Fully **backward compatible**. Does not affect users who are not interested
- Dissemination on the **first Galileo frequency**
- **Open access**: asymmetric cryptography. No need to store secret keys in the Rx, just public key
- Provides **additional robustness** that is critical for many applications, specifically those where security and trustworthiness are a priority

How it works

OSNMA test signals are being broadcast by the Galileo constellation using the spare bits from the current navigation message, therefore not impacting the legacy OS receivers implementing the current OS Signal-In-Space Interface Control Document (OS SIS ICD)

OS-NMA Roadmap

Phase 0

Internal Testing Phase

The first tests used eight Galileo satellites for around two hours on November 18th. Tests have continued ever since, for intermittent periods, and will continue over the next months

This will allow receiver manufacturers and application developers to test and prepare their products

Preparation for Phase 1

The OSNMA user Signal-In-Space Interface Control Document (OSNMA SIS ICD), receiver implementation guidelines, and the necessary cryptographic materials will be published

Phase 1

Public Observation Phase

The OS-NMA signal will be publicly accessible and feedback gathered from users will be gathered to consolidate the service

The Galileo Public Regulated Service (PRS)

The Galileo Public Regulated Service (PRS) is an **encrypted navigation service** for governmental authorised users and sensitive applications that require high continuity

Resilience

Ensures better continuity of service to authorised users when access to other navigation services may be degraded

Robustness

In cases of malicious interference, PRS increases the likelihood of the continuous availability of the Signal-in-Space

Resistance

As a result of its signal and system design, PRS makes it more costly and difficult to attack its signals

Who is it for?

PRS is primarily intended for use by EU Member State government authorised users, e.g. emergency services and police. Access to PRS is controlled through operational and technical means, including governmental grade encryption. Users not granted access to the service will be unable to access any information from the signal

The Galileo Public Regulated Service (PRS)

Key elements

The service's end-to-end system design ensures the protection and availability of the signal and its associated data flows. Key elements in this design comprise:

- **Galileo Security Facility:** this includes the Galileo Security Monitoring Centre (GSMC);
- **Ground Segment:** this includes the Galileo Control Centre, which consists of the Galileo Mission System (GMS), Galileo Control System (GCS), Galileo Sensor Stations (GSS) and the Uplink Station (ULS);
- **Space Segment:** Galileo satellites broadcast the PRS signal in space
- **User Segment:** this includes individual end-users with PRS receivers and a support and management framework within in each authorised PRS participant

Galileo Sites and Ground Stations

Galileo use cases are almost limitless

The adoption of EGNSS in aviation is growing

Performance based Navigation (PBN), especially EGNOS-based approach procedures

Navigation aid

Rotorcraft operations

ADS-B (Automatic dependent surveillance – broadcast)

As of January 2019, **619 EGNOS based approach procedures** are operational at **327 airports** in **23 countries**

Major EU business **aviation and helicopter manufacturers included EGNOS** in all new models

How EGNOS and Galileo tackled challenges in aviation

Satellite navigation offers a means of global navigation, available 24/7 in all weather conditions. There is potential for navigating and approaching any runway around the globe compared to fully relying on an airport's local ground infrastructure. GNSS was therefore rapidly welcomed and used for en route navigation, or at least as a complementary means of navigation.

For landing aircraft, the situation was quite different. System requirements are far more stringent. The system has to be particularly accurate and reliable. For example the pilot has to be informed within in a few seconds when system performances are degraded and must not be used for navigation. Such satellite navigation aviation requirements are defined by the International Civil Aviation Organisation (ICAO) as seen in the table below.

As the performance of GPS is not fixed, the service cannot be guaranteed and there is no feature to alert the user in case of a failure that impacts the quality of the positioning measurement and consequently the safety of the user. This restricts the use of GPS as is as an instrument to assist in aircraft landing operations by imposing important safety buffers to compensate for the lack of precision.

The EGNOS ground infrastructure **continuously monitors GPS performance** for all of the European Union and beyond and **provides the user with error corrections**, considerably increasing the navigation accuracy of the signal.

In addition, EGNOS is able to **detect GPS satellite faults**, to assign a confidence level to the data transmitted to a user and to provide timely warnings when GPS or its data should not be used for navigation.

Satellite navigation therefore becomes within reach for Instrument Flight Rules.

GNSS enables safety increases and costs reduction in Rail

- Main line command & control systems
- Low density line command & control systems
- Asset management
- Passenger information systems
- Driver advisory system

EUSPA is focusing on inclusion of European GNSS into the future evolution of the European Rail Traffic Management System (ERTMS)

GNSS is a key enabler for both traditional and innovative maritime applications and operations

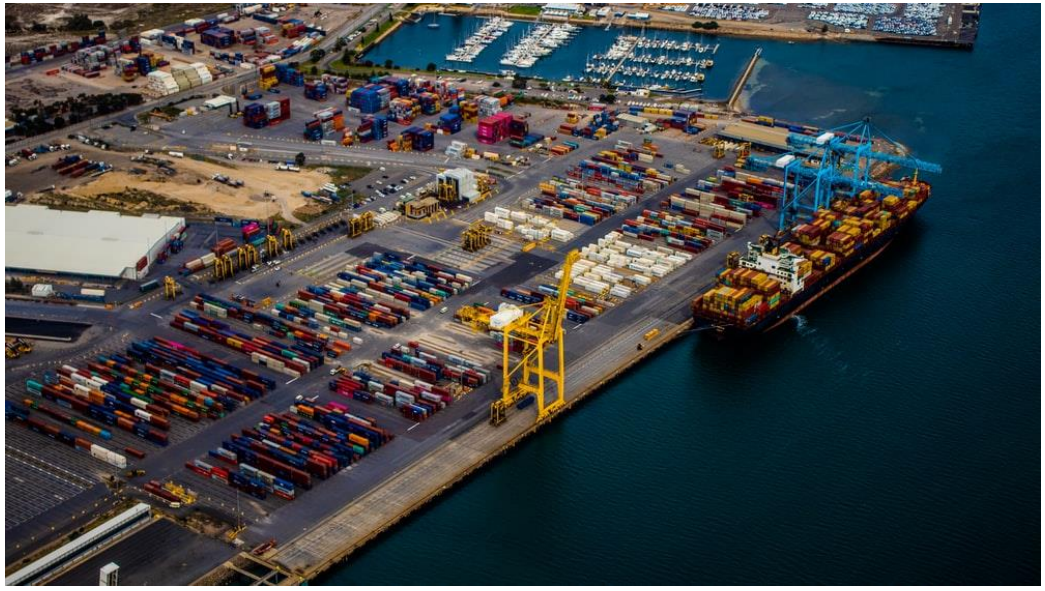
Navigation
SOLAS/ Non-SOLAS vessels
Inland Waterways (IWW)

Positioning
Traffic management and surveillance
Search and Rescue
Fishing vessel control
Port Operations
Marine Engineering

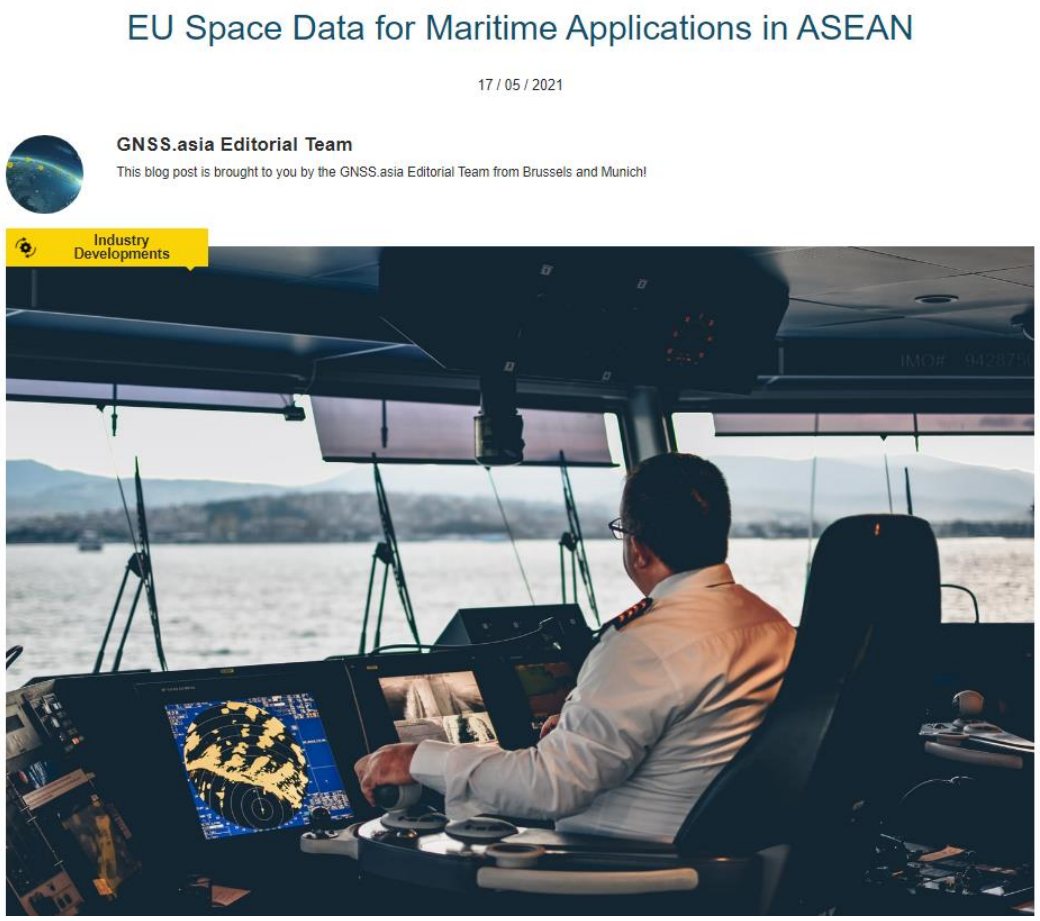
Galileo provides the maritime industry with a more effective exchange of information between vessels and stations, and fishermen with improved navigational aids

Emerging applications of GNSS in Ports

- **Pilotage Operations** for safe entrance to ports: New developments needed in Portable Pilot Units to integrate HAS (E6 or via internet connection (wifi/ mobile network))
- **Port Terminal Automation** – Straddle Carrier automation and port terminal container yard management
- **New Vessel Traffic Services** – EGNSS contributes to the attitude characterisation of Digital Ship Twins, useful for situational awareness systems integrated with interacting objects in port, that allow safe trajectory planning

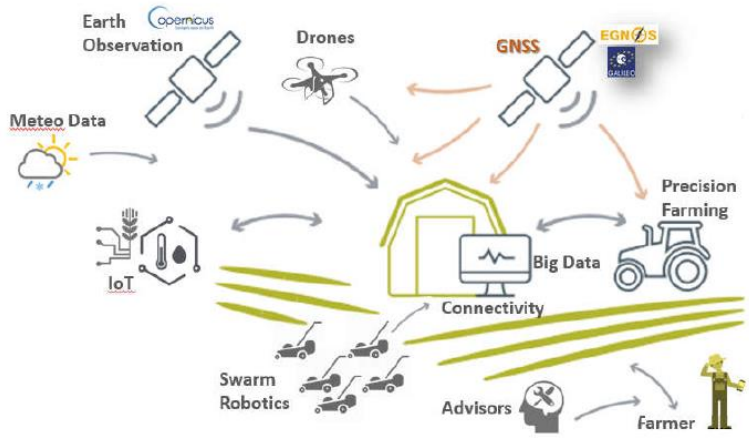


Example of a Use Case on our Blog



https://gnss.asia/blog/eu-space-data-for-maritime-applications-in-asean/

EGNSS in synergy with Copernicus is at the centre of digital farming



- Precision Farming
- Drones
- Swarm and Autonomous Machinery
- IoT
- Synergies with Copernicus

GNSS is a **core component** and **complement** to other technologies in the digital farming ecosystem (e.g. integrated farming management) and together with Copernicus a driver of the new CAP

Example of a Use Case on our Blog

The impact of GNSS technologies on agriculture – the case-study of New Zealand

06 / 04 / 2020

GNSS.asia Editorial Team

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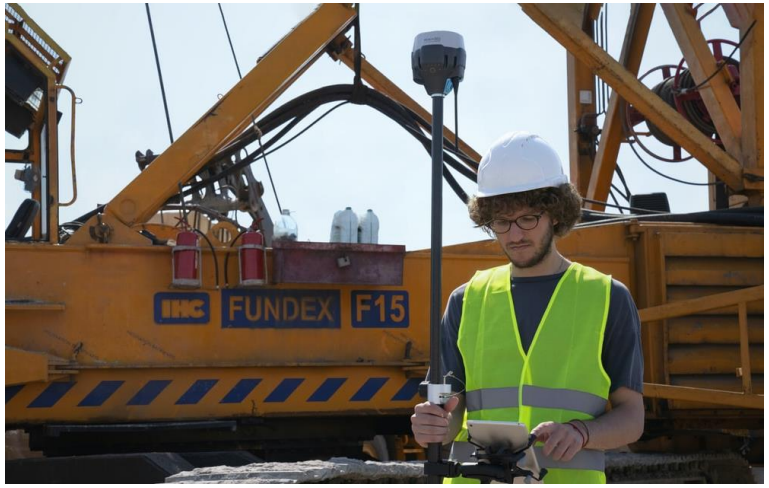
Industry Developments

https://gnss.asia/blog/the-impact-of-gnss-technologies-on-agriculture-the-case-study-of-new-zealand/

GNSS high-accuracy positioning plays a crucial role in many emerging applications



Cadastral surveying
Construction surveying
- Machine control
- Person-based applications

Mapping & GIS
Mine Surveying
Infrastructure Monitoring
Marine Surveying

Most RTK providers in Europe have upgraded or started to **upgrade to Galileo** and all major PPP providers utilise Galileo
Over 50% of receivers are Galileo-capable and around 80% of models are EGNOS compatible

GNSS timing capability is at the core of vital infrastructures

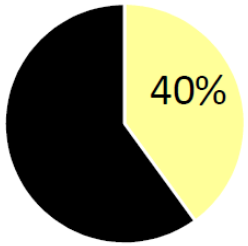
Telecommunication applications
- Digital Cellular Network (DCN)
- Public Switched Telephone Network (PSTN)
- Professional Mobile Radio (PMR)
- Satellite Communication (SATCOM)
- Small cells

Energy operators
- Phasor Measurement Units

Finance applications
- Banks
- Stock Exchanges

Regulation and 5G to seize new market opportunities

Smart lighting: GNSS enhances street light system performance



Lighting can account for up to 40% of a city's energy consumption.

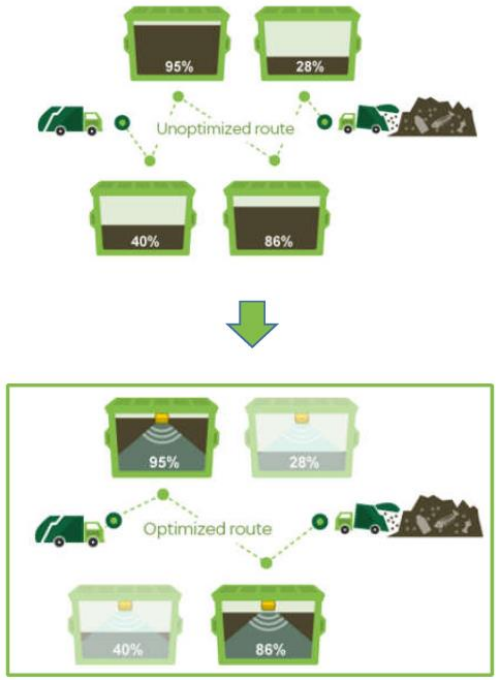
Cities and other agencies operating large grids of street lights are looking for ever more efficient ways of operating them

Operation of each lamp could be remotely monitored and controlled to **maximize energy efficiency** and to determine when maintenance is required.

In this solution, each streetlight is equipped with a low cost GNSS receiver and connected to mesh radio network which relays its data to a Cloud Gate Gateway device for review and analysis in a centralized location.

In this way defective lamps communicate their status in real-time and can be precisely located for replacement.

Garbage collection: GNSS based Smart Waste Management system optimises routes



Until now the collection of waste and recyclables has been done using fixed schedules where containers are collected every day or every week, regardless if they are full or not.

New generation garbage containers transmit signals to indicate that they are almost full and should be emptied.

Via the mobile communications network, the signals with location information are sent to a central software application used by the waste management company.

This information is taken as a basis to plan the best route for waste collection—garbage trucks travel only to those containers that actually need to be emptied.

Example of a Use Case on our Blog

India will use GNSS to become tollbooth free by 2022

17 / 09 / 2021

Varadarajan Krish
India Project Manager of GNSS.asia

https://gnss.asia/blog/india-will-use-gnss-to-become-tollbooth-free-by-2022/

Galileo-enabled devices provide new security-related applications

- Security applications
- Coastguard
- Border control authorities
- Emergency warning
- Search and rescue (SAR)
- Natural disasters

Galileo signals play a **crucial role in civilian protection and humanitarian operations**, such as in harsh environments

Example of a Use Case on our Blog

EU Space Data for Emergency Applications in ASEAN

17 / 05 / 2021

GNSS.asia Editorial Team

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https://gnss.asia/blog/eu-space-data-for-emergency-applications-in-asean/

GNSS is a fundamental tool for our daily lives

- Sharing economy
- Mobile applications
- Covid Mitigation
- Tourism

The integration of **accurate positioning signal receivers within mass-market consumer electronic devices** brings Galileo directly into our daily lives and fundamentally transforms the way we live and work

Example of a Use Case on our Blog

Chasing pokemons – a dive into the GNSS-based gaming industry

09 / 10 / 2020

GNSS.asia Editorial Team

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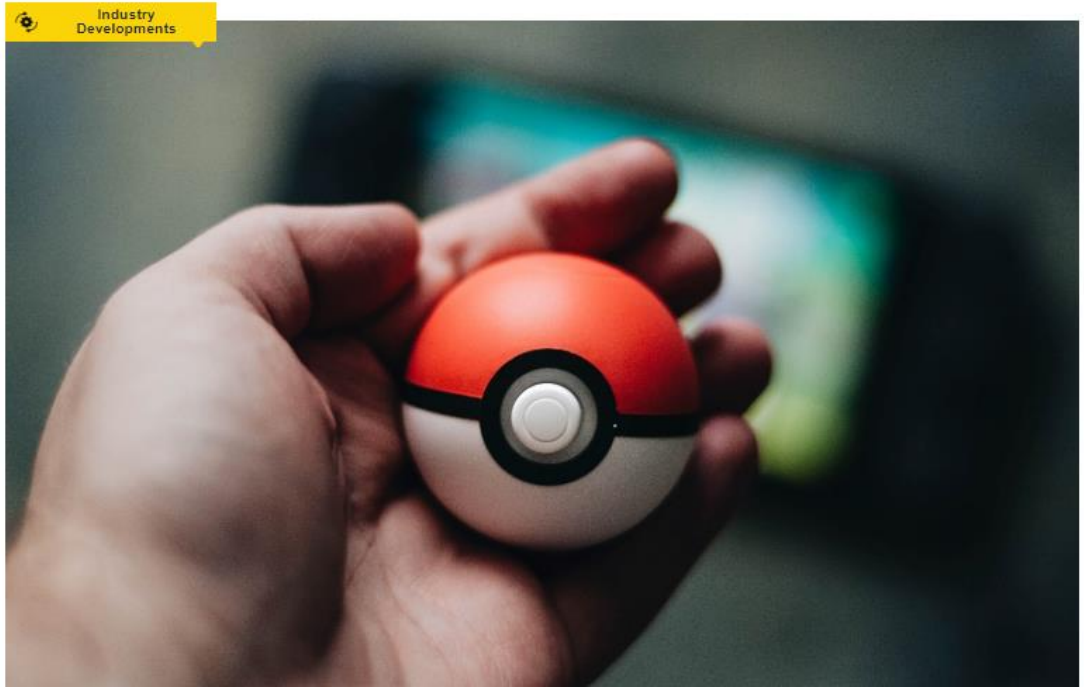
Industry Developments



https://gnss.asia/blog/chasing-pokemons-a-dive-into-the-gnss-based-gaming-industry/

GNSS is a key driver for smart mobility

- Fleet management
- Navigation
- Transport security (e.g. GeoKey)
- Smart Mobility

Galileo improves the way we use vehicles, meaning increased traffic safety and efficiency.
In road transport, Galileo's highly accurate and reliable signals play an important role for smooth shipment.

Container tracker: Traxens using GNSS-based solution for on-the-route positioning

TRAXENS, container monitoring devices

Traxens has developed a specific low-energy technology for devices allowing them to be energy autonomous for the active life of a container.

These smart devices can decide what information is needed and when to make the best use of energy by only communicating when necessary and by sharing the duty of power transmissions with other neighbouring devices.

All the data gathered by the devices is available for customers through a dedicated platform service.

Containers are the **optimal target for GNSS** in a multimodal perspective since they are widely adopted and their capacity is high enough to invest in a GNSS-based device.

GNSS is complemented by other sensors for relative positioning to the vessel or truck

Geofencing autonomous logistics: Smart Factory solutions

Geo-fencing enabled autonomous logistics at Ingolstadt

To make sure components arrive punctually at the factory at just the right time for the most efficient assembly, Audi uses geo-fencing technology.

More than 70,000 transport containers have to be delivered to the plant every single day and arrive at the right time to keep production running smoothly.

Every time one of the long-haul truck approaches the Ingolstadt factory, the “Quick Check-in” app activates when it is 50km away, and informs the plant that goods are approaching.

The app sends its GNSS coordinates, as well as information about the load to the Ingolstadt logistics centre.

Another checkpoint occurs when its 20km away, comparing the ordered materials with what is present on the truck.

Finally, as the truck comes within 3km of the plant, the goods are switched from “in-transit” to “in-factory” and it becomes a part of the plant’s internal logistics processes.

Without having to check in at the truck control room, the driver can directly follow the navigational instructions from his smartphone to bring his load to one of the 60 off-loading points at the plant

Example of a Use Case on Blog

GNSS technology redefines shared and urban mobility in China

11 / 11 / 2020

Tiantian Qi
GNSS.asia Project Manager China
Link to Biography

Industry Developments

https://gnss.asia/blog/gnss-technology-redefines-shared-and-urban-mobility-in-china/

GNSS is necessary for operating Drones

Beyond visual line of sight operations (BVLOS)

Line of sight operations (LOS)

Return to Landing (RTL) safety measure

Positioning

Autonomous Navigation

The drone market is booming and is set to outstrip any other GNSS user base in aviation and open up new business opportunities for application developers.

GNSS is **essential for the safe and reliable navigation of drones**, and GNSS receivers are implemented on almost all new commercial drones as standard

Drones equipped with GNSS support fight against parasites

The prevalent infestation of fall armyworm in China has resulted in reduced yields, threatening food security and the livelihood of smallholders. It's impractical to conduct manual spraying over farmlands larger than 5 hectares, and this also runs both the risk of wasting large amounts of pesticides and chemical poisoning.

Given the situation, smart agriculture devices such as drones have come in handy for fixing these problems, with minimal environmental impacts. In China, professional farmers and agricultural service providers have already harnessed existing drone technology to conduct appropriate chemical sprays to safeguard the country's crop production.

The XAG XMission drone has centimetre-level navigation and can operate fully autonomously over complex terrain and easily adapt itself to different spraying conditions for various crop species through Univcore's high-precision dual-antenna GNSS module. Farmers are therefore relieved from much physical effort while no longer risking their health in the battle against fall armyworm.

Example of a Use Case on Blog

South Korea's dreams of a drone future – insights into the Korean Urban Air Mobility (K-UAM) roadmap

02 / 12 / 2020

In-Seung Kay

Consultant at SpaceTec Partners / South Korea Project Manager of GNSS.asia

Link to Biography

Industry Developments

https://gnss.asia/blog/south-koreas-dreams-of-a-drone-future-insights-into-the-korean-urban-air-mobility-k-uam-roadmap/

Outlook into the future

Coming up soon:

OS-NMA and **HAS**

The **second generation** of **Galileo satellites**

These satellites will offer lots of improvements compared to the previous generation, including;

- Electrical propulsion system to bring the satellites from the launch orbit to the operational orbit
- Inter-satellite link to make satellites able to cross-check their performance to reduce their dependency on ground stations
- Improved navigation antenna
- Improved atomic clock
- Updated anti-jamming and anti-spoofing systems

Opportunities

Career Chances in ASEAN with UNESCAP

The Economic and Social Commission for Asia and the Pacific (ESCAP) is the most inclusive intergovernmental platform in the Asia-Pacific region. The Commission promotes cooperation among its 53 member States and 9 associate members in pursuit of solutions to sustainable development challenges. ESCAP is one of the five regional commissions of the United Nations.

https://www.unescap.org/jobs

EUSPA is looking for highly qualified professionals and experts ready to take up the challenges linked to the EU Space Programme and turn the EU space ambitions into a reality.

Join the team! EUSPA offers a stimulating multicultural and multidisciplinary environment, which promotes work-life balance and invests in people

https://www.euspa.europa.eu/about/careers-euspa

Find out more!

Website: www.gnss.asia

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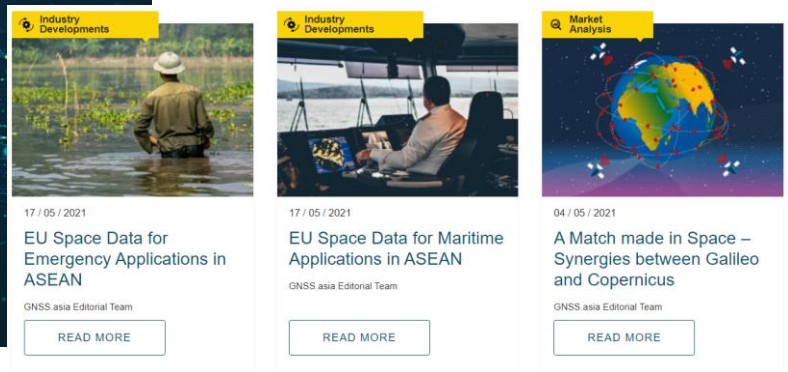
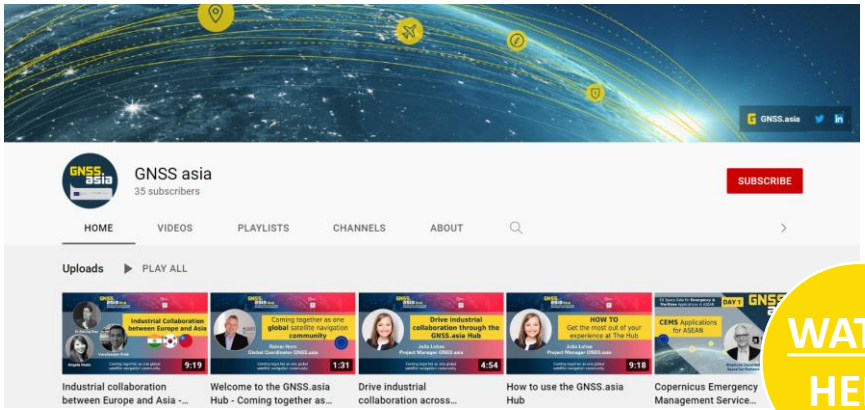




Check out our YouTube channel, we have curated a Playlist for you as preparation to the Galileo Hackathons

WATCH HERE

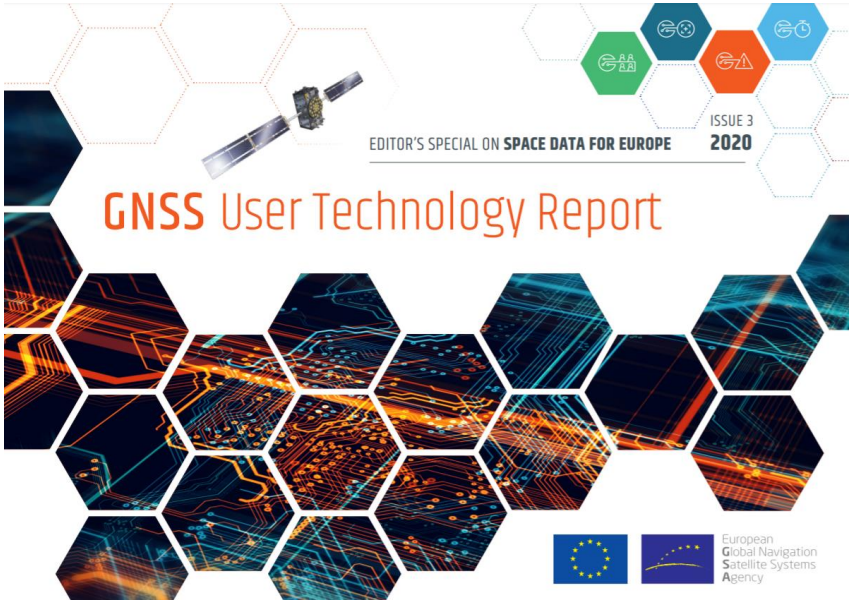
GALILEO HACKATHON by GNSS.asia

Galileo authority and reports

Designed specifically for civilian applications & managed by civil authorities

GNSS Market Report from EUSPA

GNSS User Technology Report from EUSPA



GALILEO HACKATHON by GNSS asia

Galileo authority and reports

Designed specifically for civilian applications & managed by civil authorities

Market & Technology Trends Report from GNSS.asia

The GNSS.asia Team

Got questions? Drop us an e-mail at hello@gnss.asia

One of us will get back to you with the answer.

Questions?

If you have Questions during the Hackathon, contact your Mentors through Discord or write general Questions in our FAQ channel

https://discord.com/invite/wc8DcsqGAP

Community Platform

- Work together on your project with your team
- Consult Mentors when you need help
- Receive notifications for Hackathon Updates

GALILEO HACKATHON by GNSS.asia

You are ready!

If you have any questions, please refer to our FAQs