



Innovating with EU Space: High Accuracy Service and OSNMA

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Bringing market intelligence to EU entrepreneurs



https://www.euspa.europa.eu/sites/default/files/uploads/euspa_market_report_2022.pdf

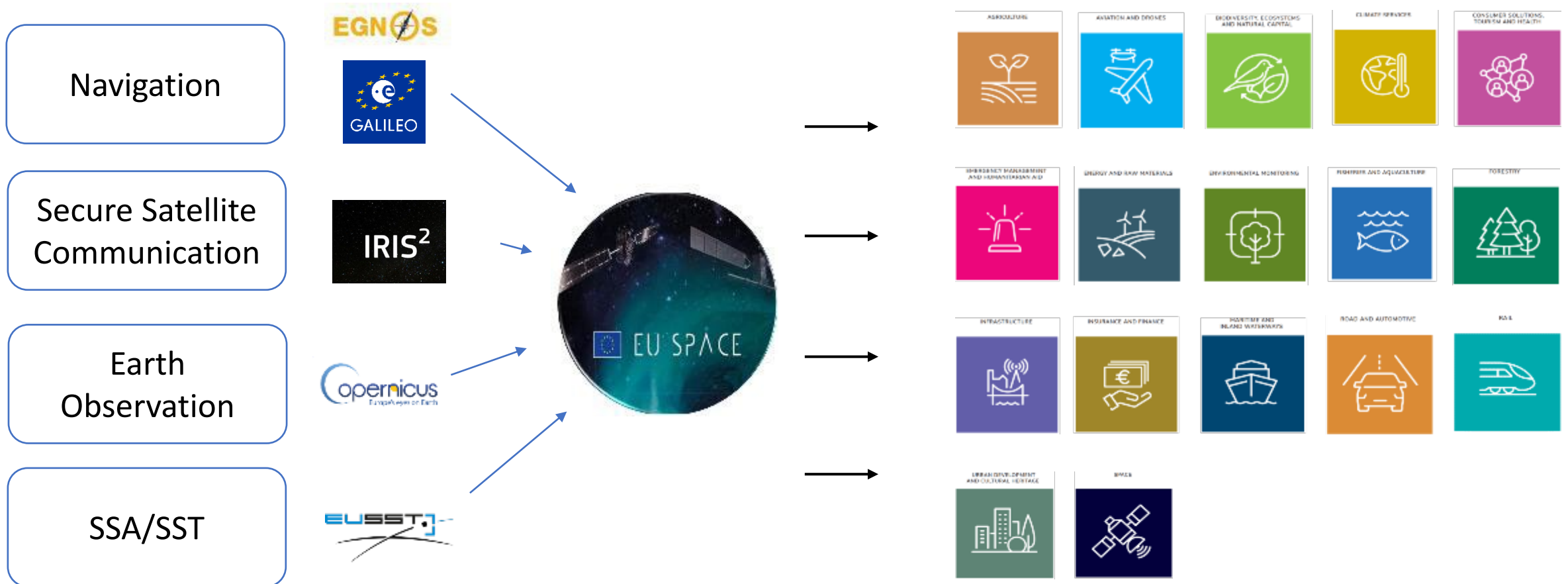
The first edition of the EUSPA's EO and GNSS Market Report includes among other topics:

- General overview of the global EO and GNSS market common to all application areas
- In-depth analysis of seventeen market segments:



- Editor's special: Innovative Solutions for Health

The EU Space synergic approach toward the market



Why the Galileo HAS

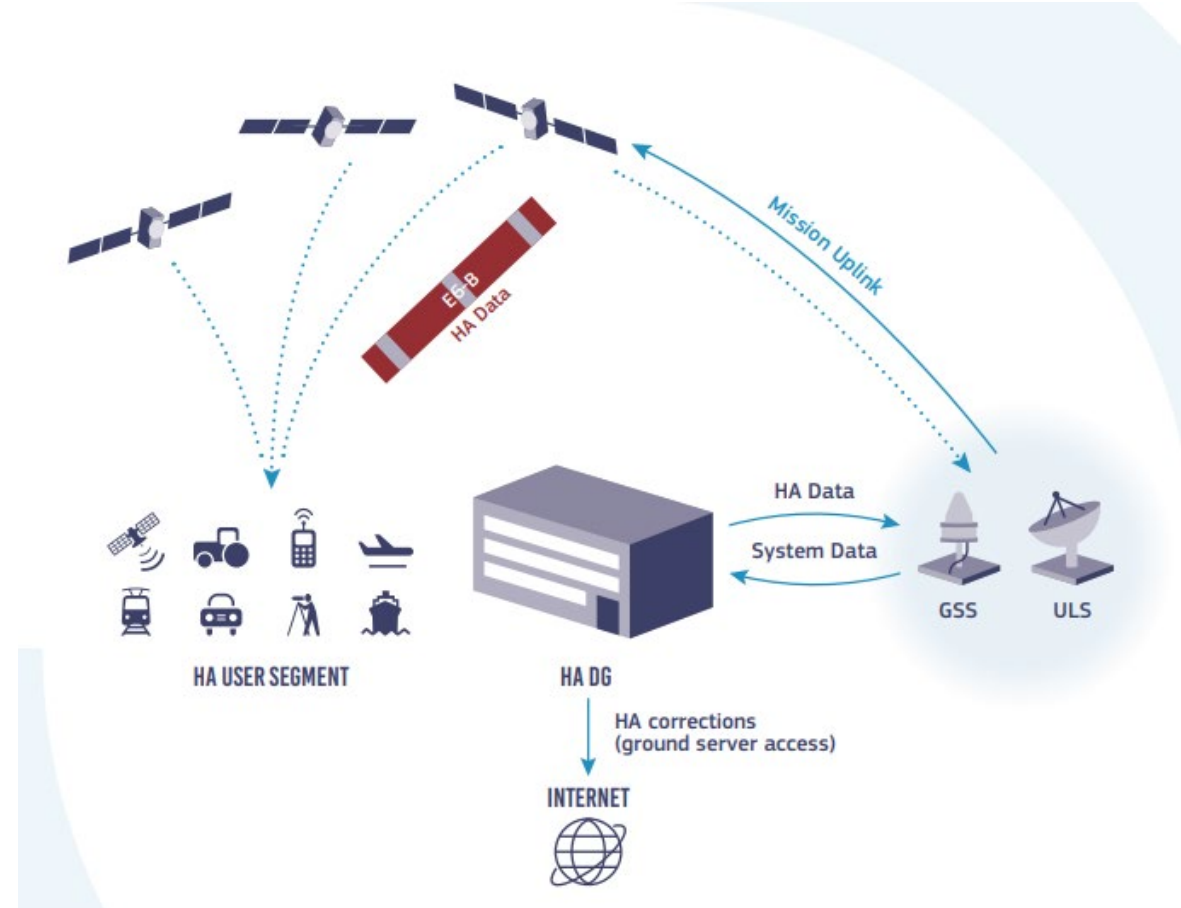


- March 2018: EU Decision to provide Galileo HAS for free, with a target 20-cm accuracy. But why?
- Follows a natural GNSS trend
- Part of an ecosystem, yet first of its kind: global, free, 24/7. And standalone
- Meets user demands
- Leaves room for classic commercial applications and user level innovation: cm/mm-level applications, PPP integrity...
- Provided with existing Galileo infrastructure



What is the Galileo HAS

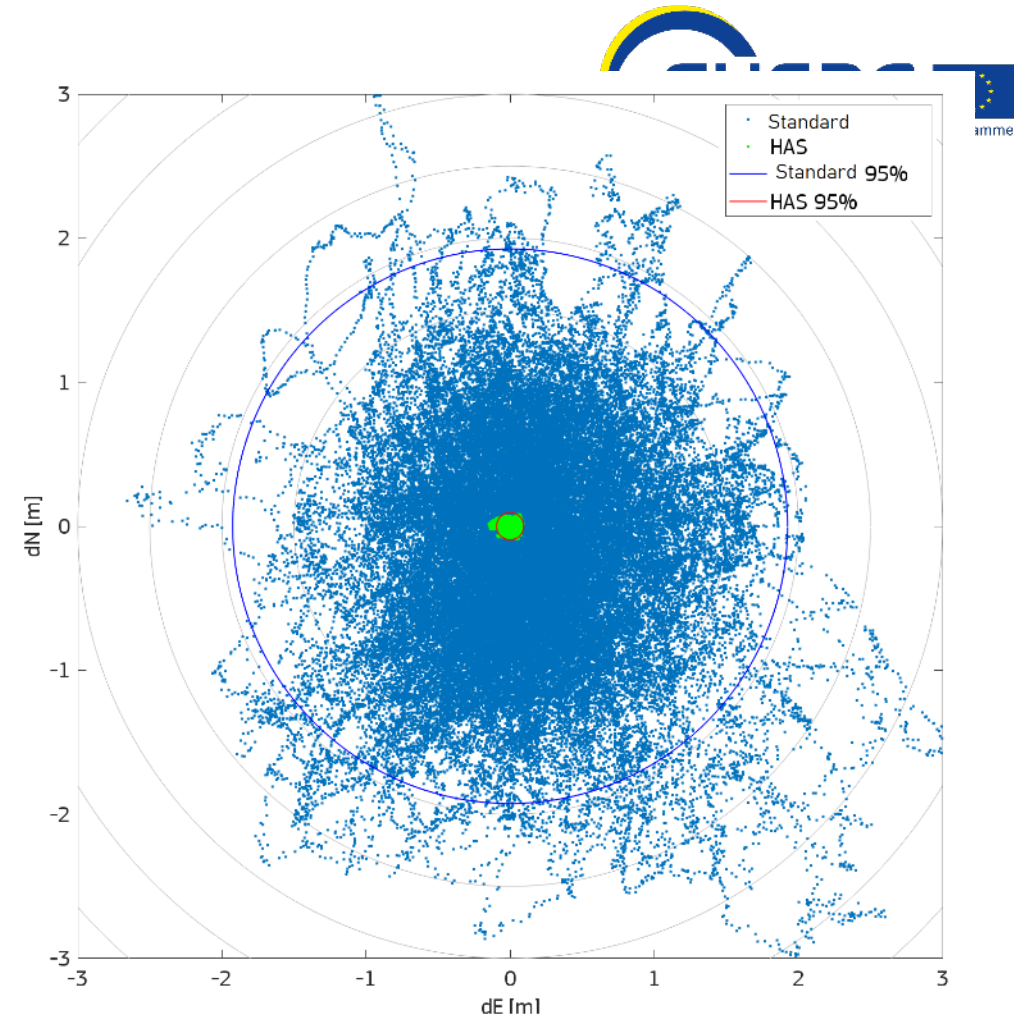
- Galileo HAS provides precise corrections for satellite orbit, clock and signal biases
- Galileo HAS corrections distributed via
 - Galileo satellites, E6-B signal (1278.75 MHz)
 - Internet
- Typical accuracy in the decimetre level (after convergence), with Precise Point Positioning (PPP) receivers
- (Almost*) global coverage and free



**global coverage of corrections but no global performance commitment yet*

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Galileo/GPS single epoch standard positioning vs. HAS positioning
Horizontal position error, JRC, Ispra (IT), 7/Sept/2023
(Gal E1-E5b/GPS L1CA-L2C single epoch solution vs. HAS float solution)

Standard horizontal accuracy 95%: 1.925 m

HAS horizontal accuracy 95%: 0.094 m

What is HAS – Ground Infrastructure



GNSS Service Center / HA data generator



14+1 Galileo sensor stations



Ground Control Centers



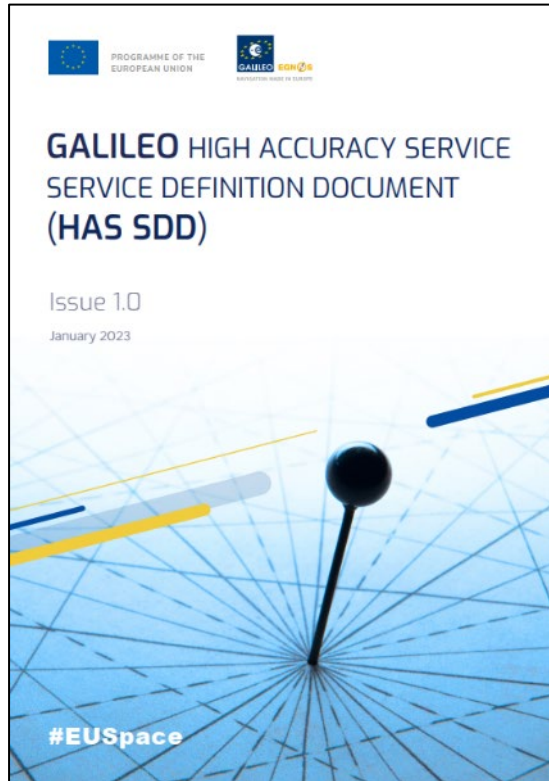
Up-Link Stations



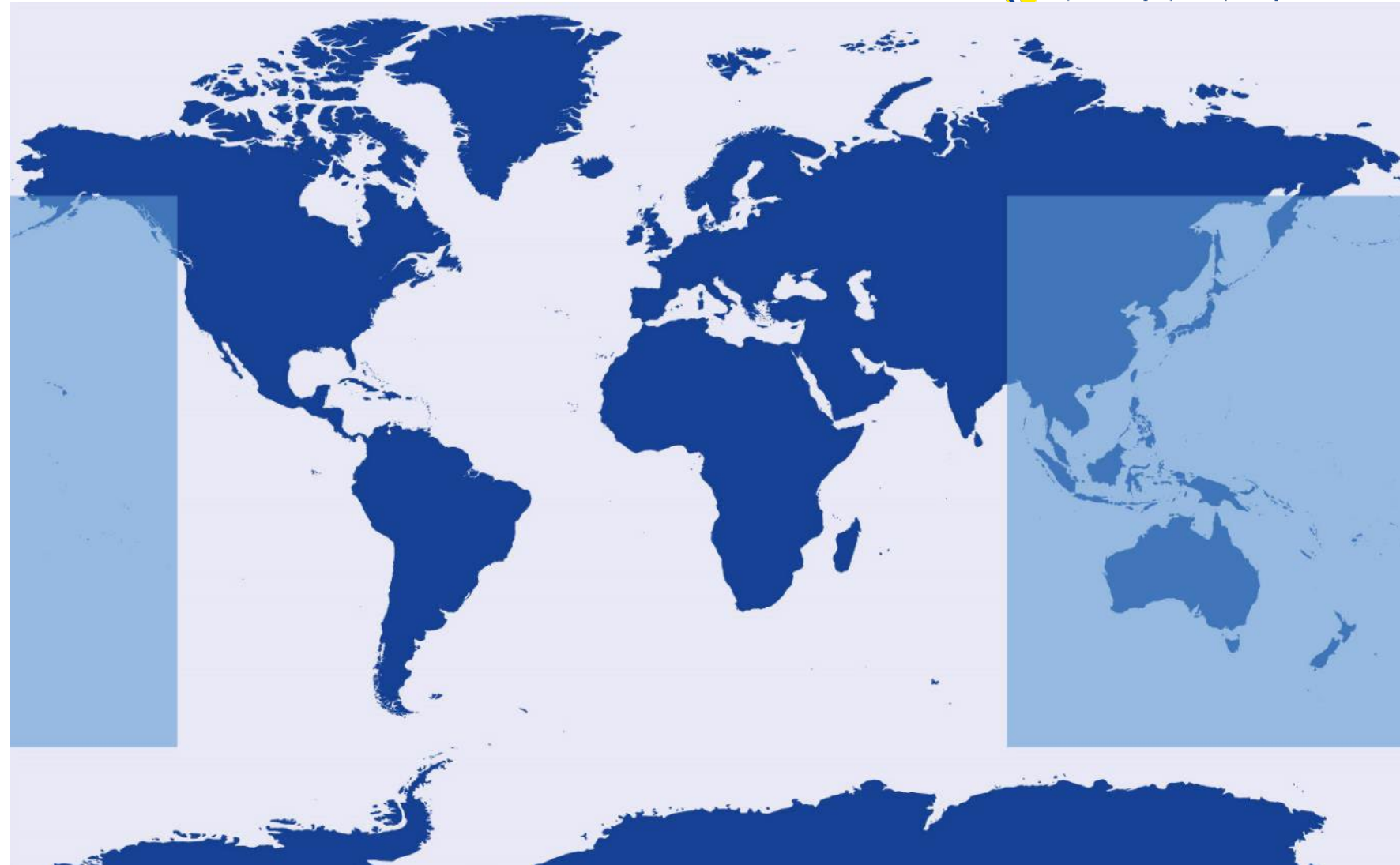
Space segment



What is HAS – Initial Service Area



**European Union Agency for the Space Programme
(EUSPA), HAS SDD [Online]:**
[https://www.gsc-
europa.eu/sites/default/files/sites/all/files/Galileo_H
AS_SDD.pdf](https://www.gsc-europa.eu/sites/default/files/sites/all/files/Galileo_HAS_SDD.pdf)



Galileo HAS service area

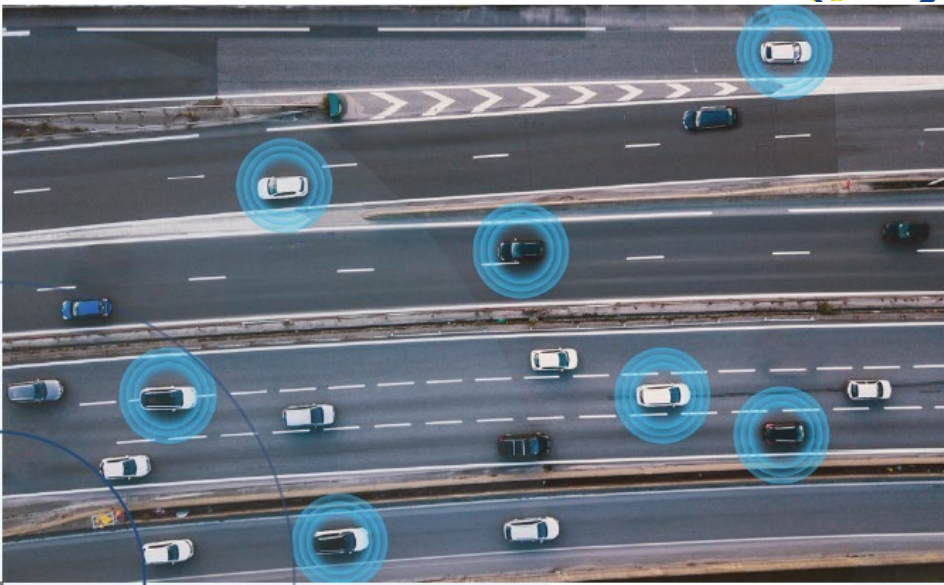
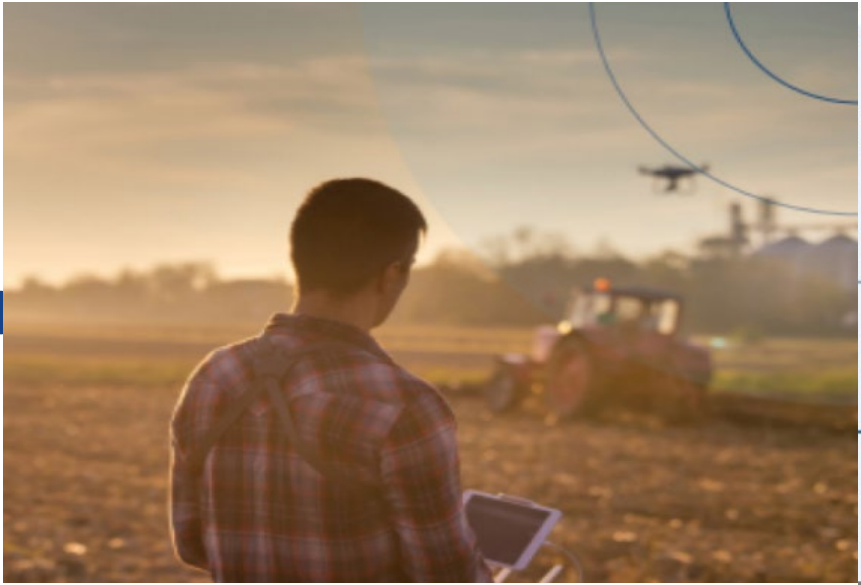


Area currently excluded from Galileo HAS service area

Galileo HAS Users and Applications



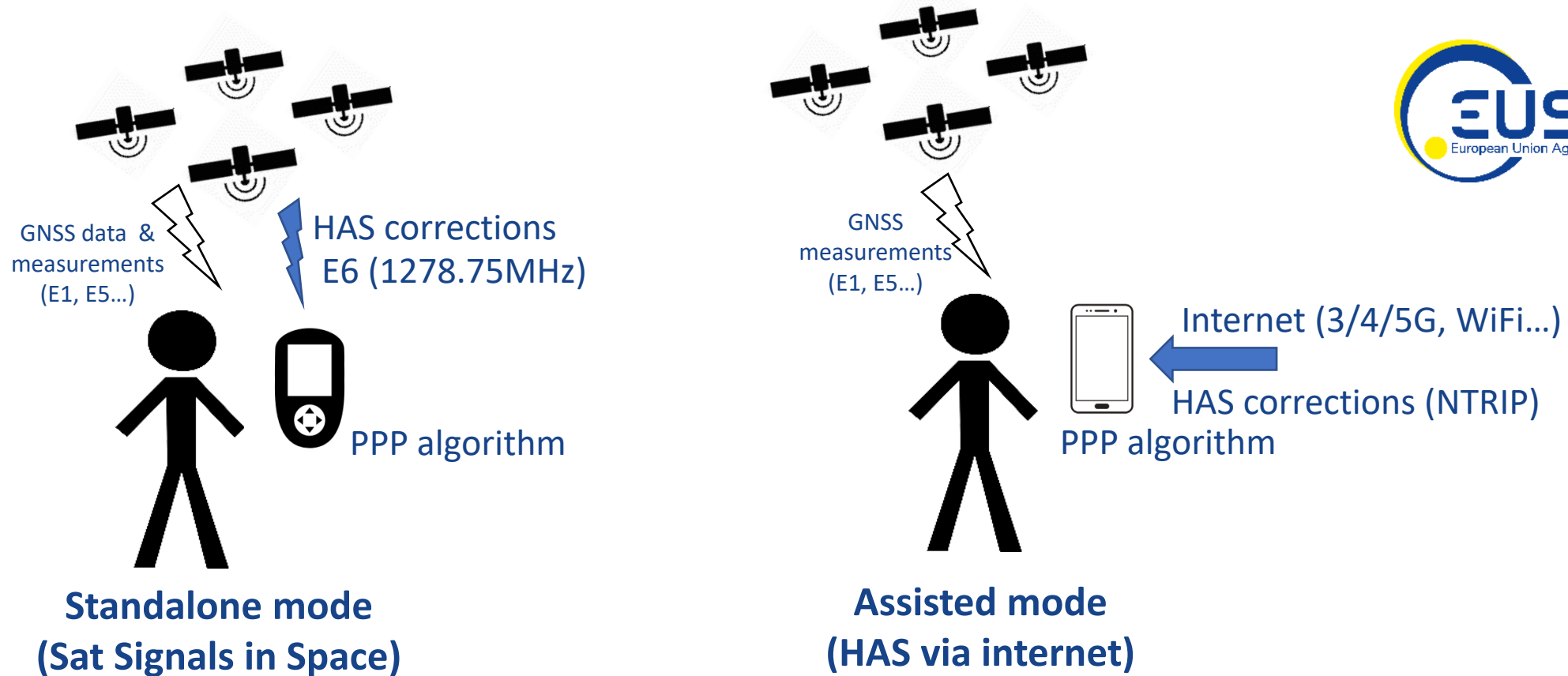
- Galileo for trade and industry
- It will transform the transport sector



Galileo HAS Users and Applications



What does a user need to benefit from HAS?



Users need GNSS (Gal/GPS) E6 capable or connected RX with a PPP algorithm

Galileo HAS Users and Applications



- EU is supporting the early development of HAS prototype RXs since years:



- **Fundamental Elements projects:** Fantastic, eMAPs, ERASMO, ACCURATE



- **H2020 projects:** GISCAD-OV, PrepareShips, ESRIUM



- **HAUT:** HAS reference algorithm and user terminal used for the HAS Service Validation.
- **Key stakeholders** were involved in the **HAS testing** in 2021/22 to anticipate the development of their HAS prototypes

- **GNSS E1/E5/E6 Signal or Internet connected receivers are already available**

- HAS RXs will become commercially available progressively after the HAS Service Declaration **based on PPP commercial solutions** in the market since years

HAS receivers: status

Manufacturer	Model	Segment or applications	Status
ANAVS	Multi-Sensor RTK/PPP Module	Autonomous Vehicles, Robots, UAVs and Vessels	Available
BeyondGravity	PODRIX	Space, LEO POD	Available (TRL 7)
BeyondGravity	NavRIX PinPoint	Space, LEO POD	Available (TRL 7)
EOS	Arrow Gold+™	GIS, mapping, maritime pilotage	Available
Rokubun	SPEAR (SW engine)	Road, robotics, LBS, agriculture or IoT	Available
SinoGNSS		Maritime, int. driving, agriculture, GIS	Under development
Unicore Comm.		Surveying and mapping, agriculture, UAVs, and autonomous robots	Under development
Hemisphere		GIS, agriculture, and machine control	Under development
Hemisphere		Agriculture, machine control, marine, OEM	Under development
Deimos		Space, POD	Under development

Note: readiness of Receivers as stated by manufacturers (i.e. not tested by EUSPA)

Next steps:

- Continue consultation with manufacturers including simulator ones
- HAS testing in different user dynamic scenarios, eg: drone navigation, robots, maritime, airport operations

Galileo HAS

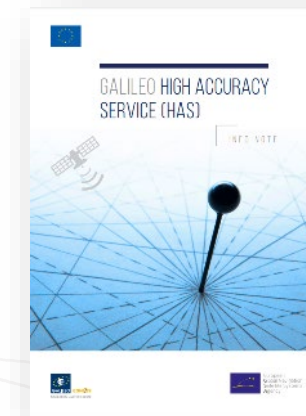
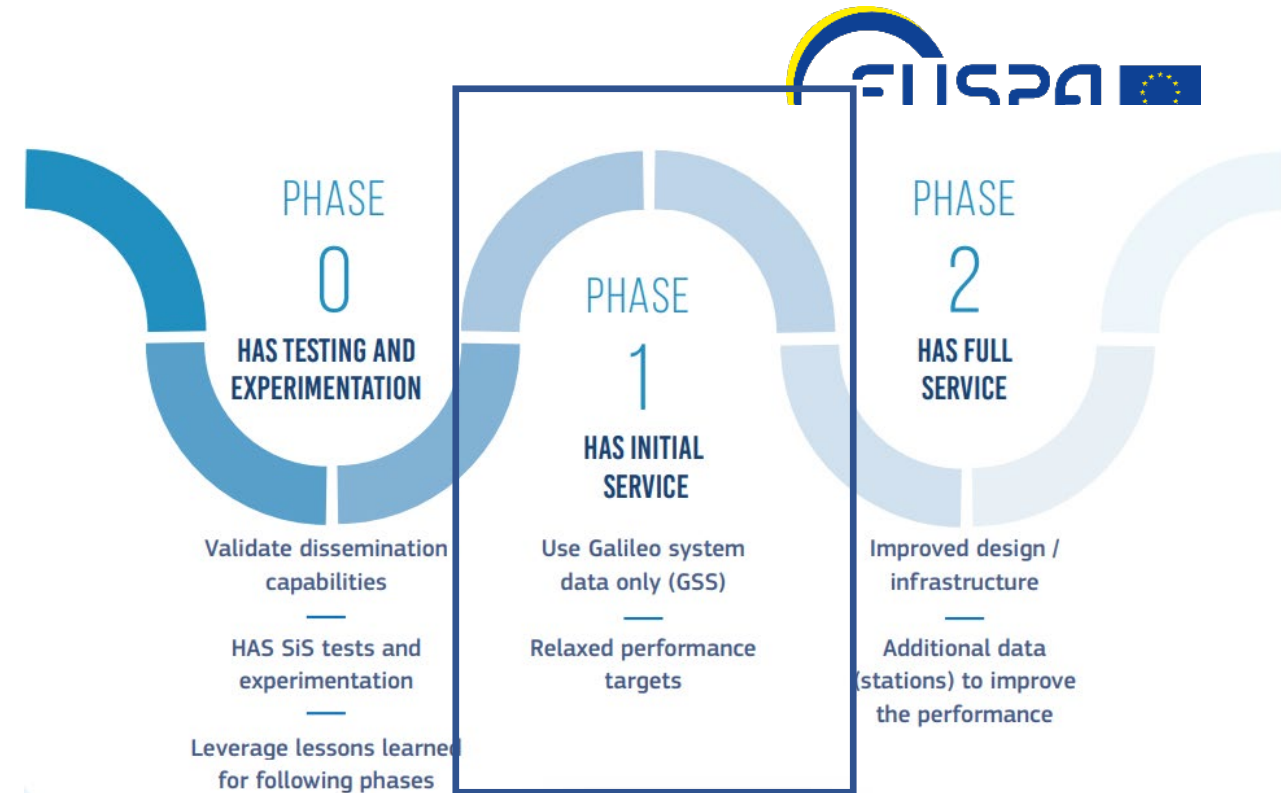
What comes next?

▪ Short-term: use it!

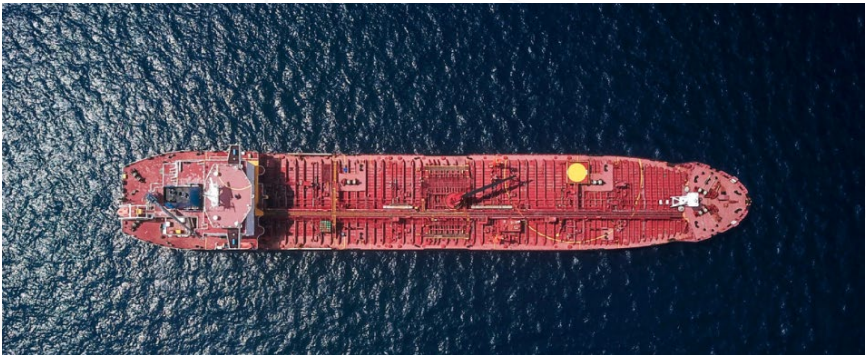
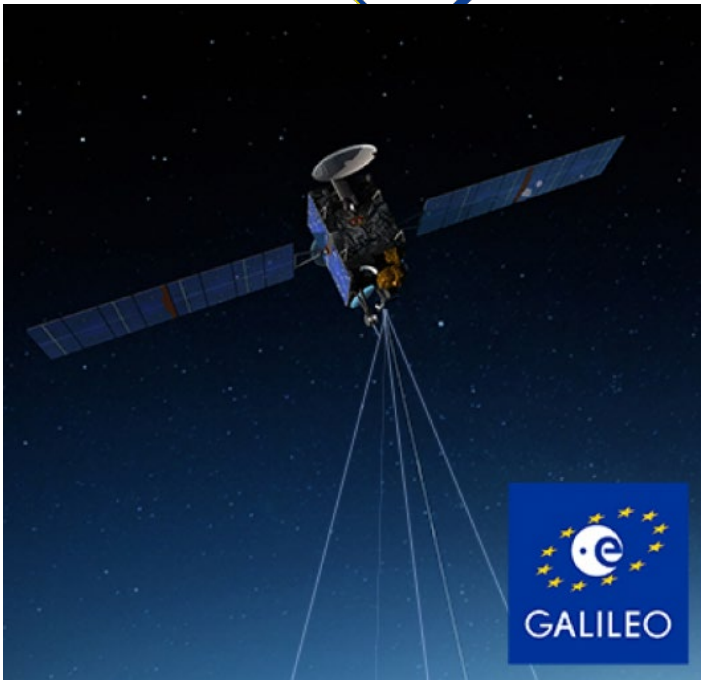
- User segment development
 - More HAS-enabled receivers
 - HAS R&D actions
 - HAS Reference Algorithm publication
- HAS based applications development

▪ Mid / long-term: HAS Full Service

- Increased global performance (e.g. better accuracy)
- Faster positioning in EU (atmospheric corrections)
- HAS authentication and error characterization



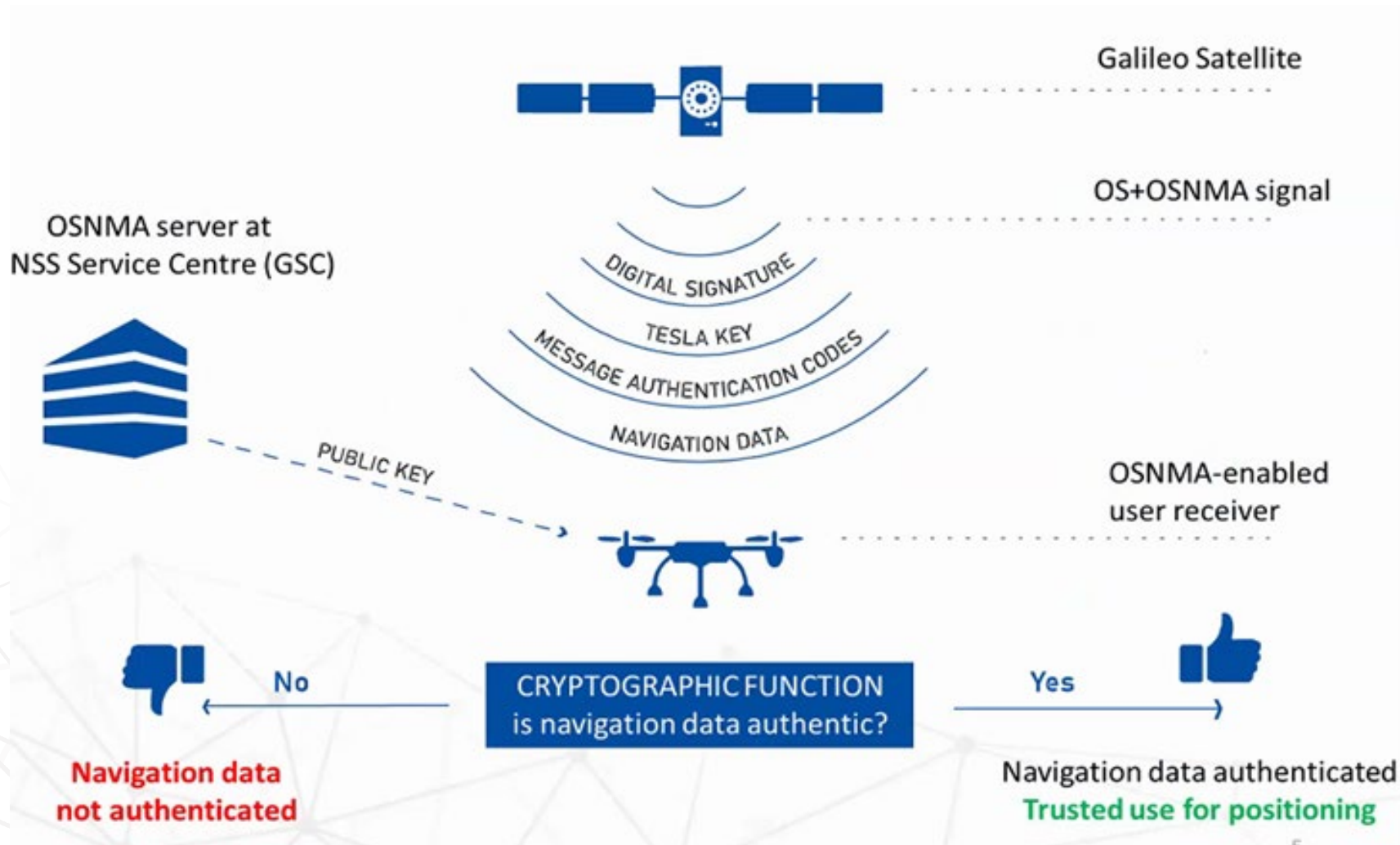
Why OSNMA



First step of the Galileo Programme to ensure robustness of user navigation solution for civil users

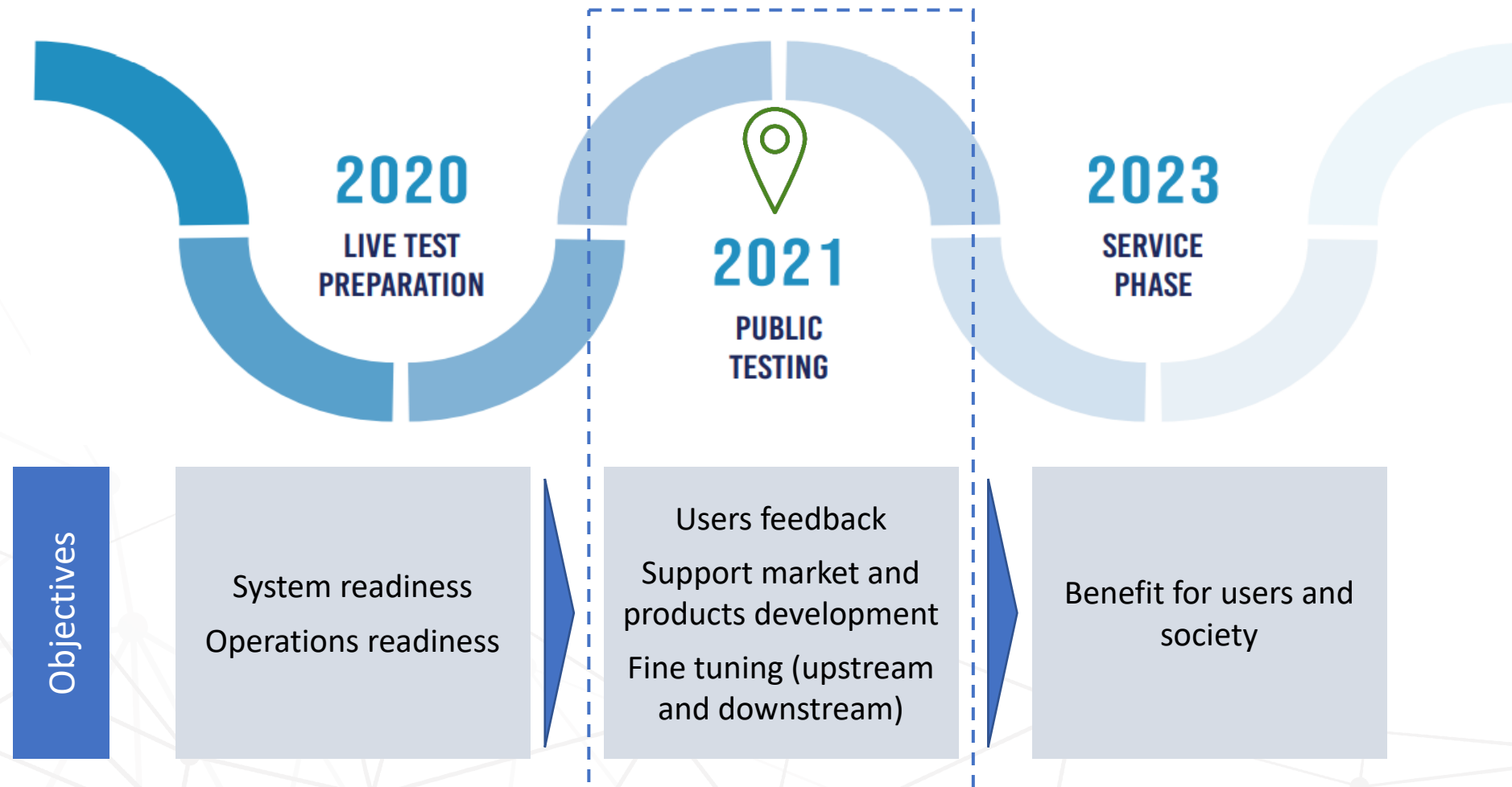
It is already here!

An OSNMA-enabled receiver can verify if the navigation message originates from a genuine Galileo satellite



CHARACTERISTIC	OSNMA
GNSS Receiver Minimal Capabilities	Single frequency E1
Object Of Authentication	Nav Data (E1B I/Nav and E5b I/Nav and capability for E5a F/Nav if required)
Required Components	E1B
Need Of Raw GNSS Signal Storage At Receiver Side	No
Navigation Signals Decryption By GNSS Receiver	No
Need Of A Network Connection	No
Authentication	Clock & Ephemeris Data (CED) and timing parameters (GGTO and UTC), delayed
Time To First Authentication	One to few minutes
Authentication Availability	High, expected above 95%
Anti-tampering Features	Light, as the receiver only stores a public key. To be considered depending on the specific application threats
Other Requirements	Time synchronisation

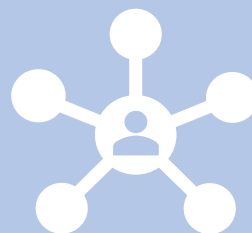
The OSNMA Roadmap: the stepstones on the way to full service provision



Objectives of the OSNMA public test phase



- Validation of critical OSNMA service elements (ICD).
- Complementary performance characterization

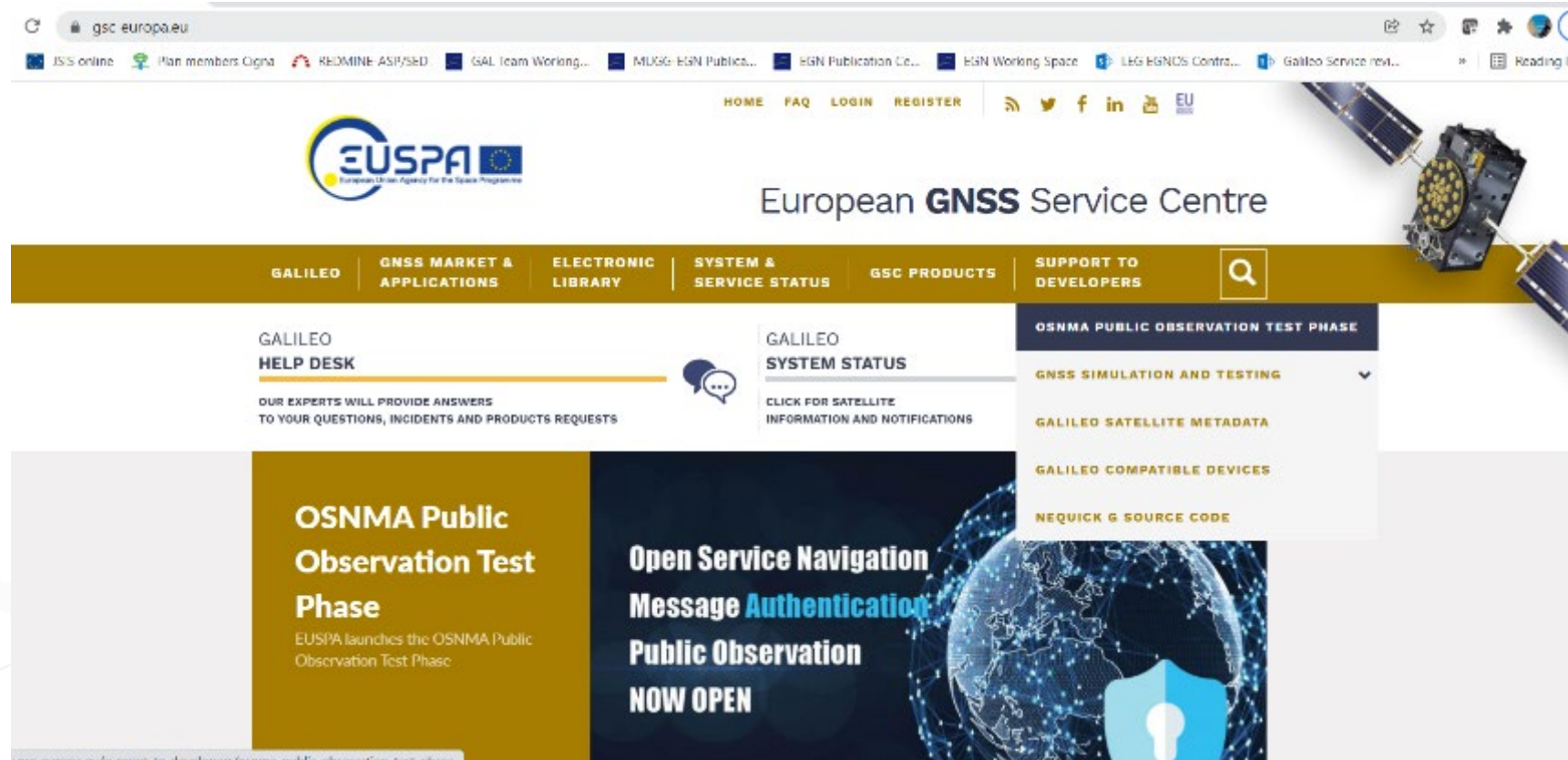


- Engage stakeholders
- Build a strong relationships with future OSNMA users
- Foster OSNMA adoption



- Gather lessons learned and recommendations towards OSNMA service provision

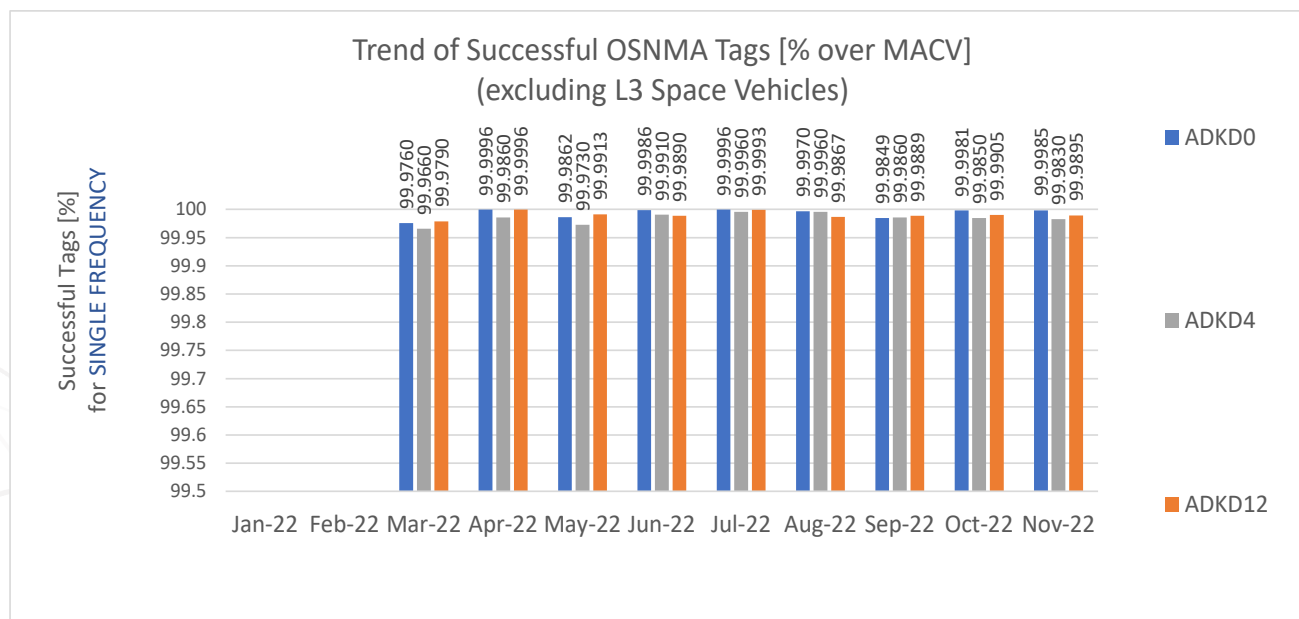
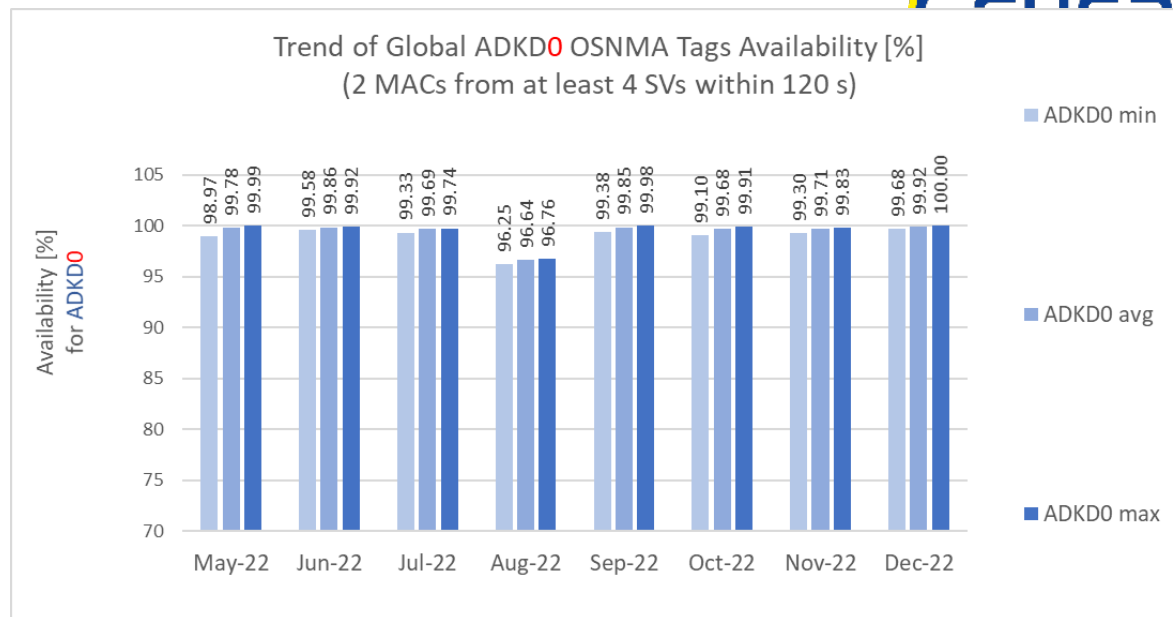
How to join the OSNMA test phase



The target users are receiver manufacturers, application developers, members of research institutions, or similar.

Very good performance during the OSNMA Public observation phase, both in terms of availability and integrity. To be improved with coming system releases in advance of service declaration.

OSNMA Performance being reported as part of the [OS Quarterly Performance Reports](#)



Available documents

- [Galileo OSNMA User Interface Control Document \(ICD\) for the Test Phase](#) **superseded by Galileo OSNMA SiS Interface Control Document (ICD) for the Service Phase**

Specifies the interface between the Galileo Space Segment and the Galileo User Segment

- [Galileo OSNMA Receiver Guidelines for the Test Phase](#) -> **superseded by Galileo OSNMA Receiver Guidelines for the Service Phase**

Instructions for the user segment implementation of the OSNMA functionality, including requirements, interfaces, and steps to be followed

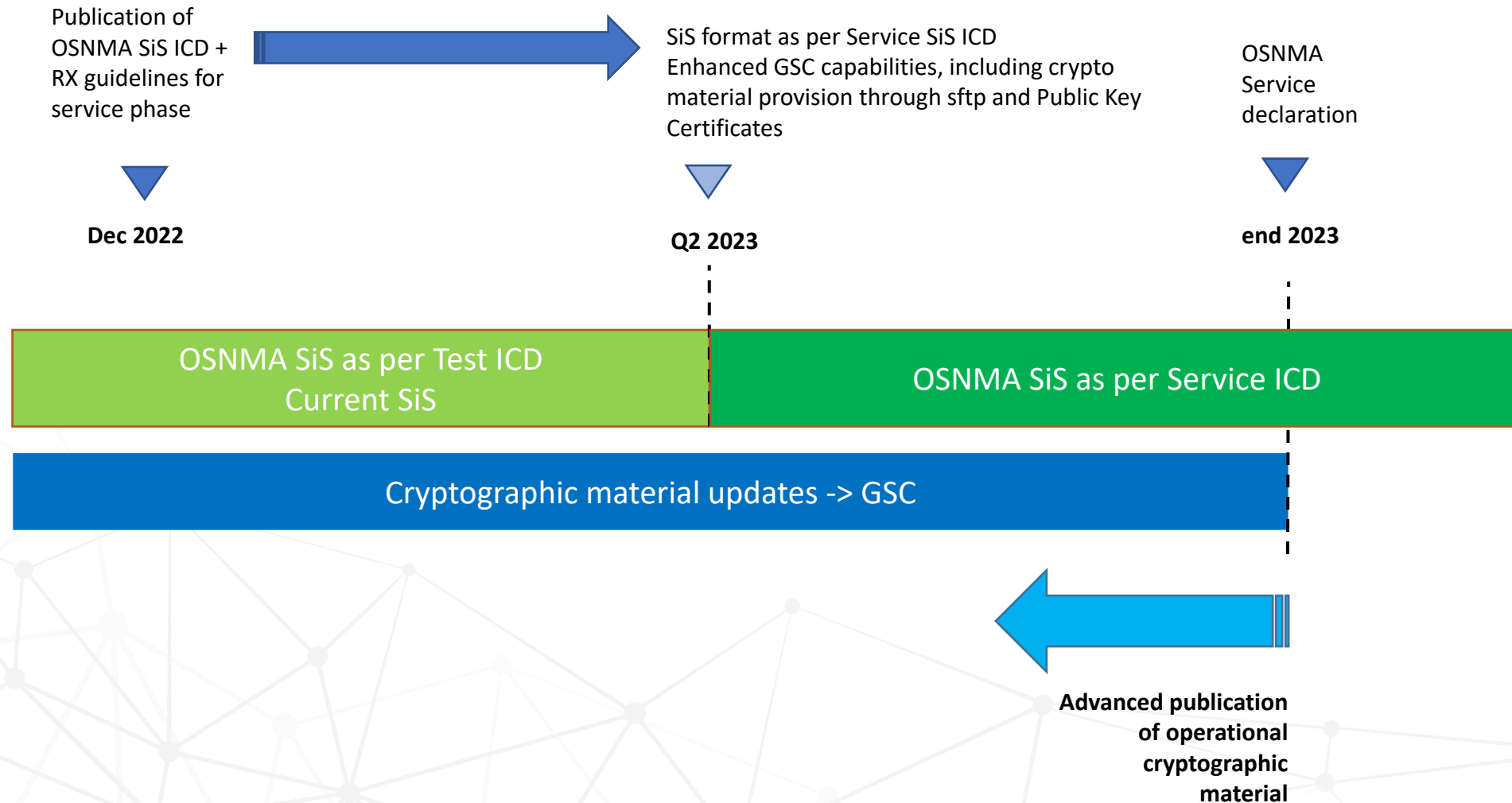
- [OSNMA Info Note](#)

Description for the Service provision phase, including high-level details about the keys' authentication process, receiver compatibility, user interface and target markets

Multiple documents and presentations available



OSNMA service roll-out logic



OSNMA is already here

Service declaration will be achieved soon

Please use it!





Linking space to user needs

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