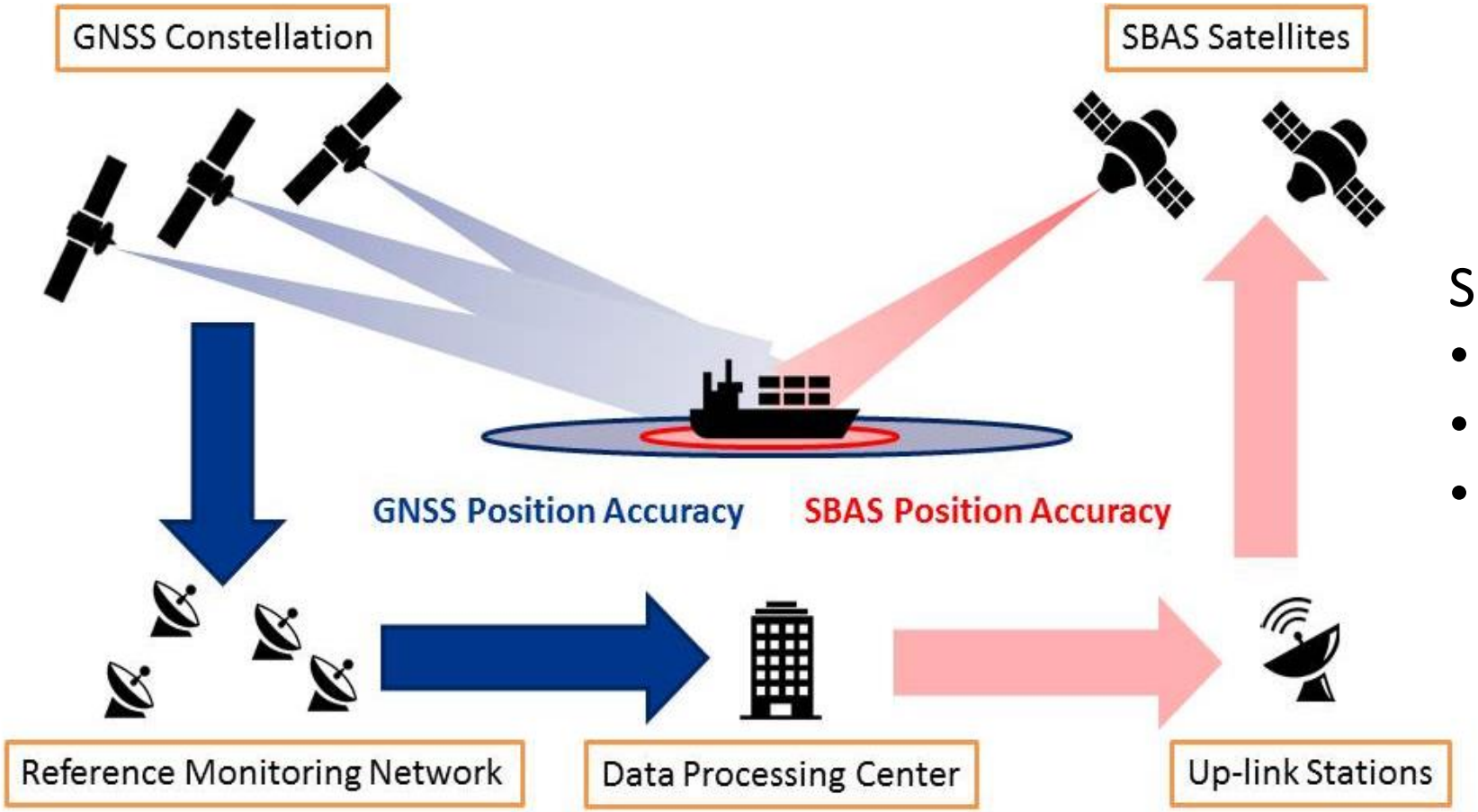
EGNSS Services for Aviation and Drones

EU Space User Consultation Platform 2022

UCP for aviation and drones

Carmen Aguilera – EUSPA

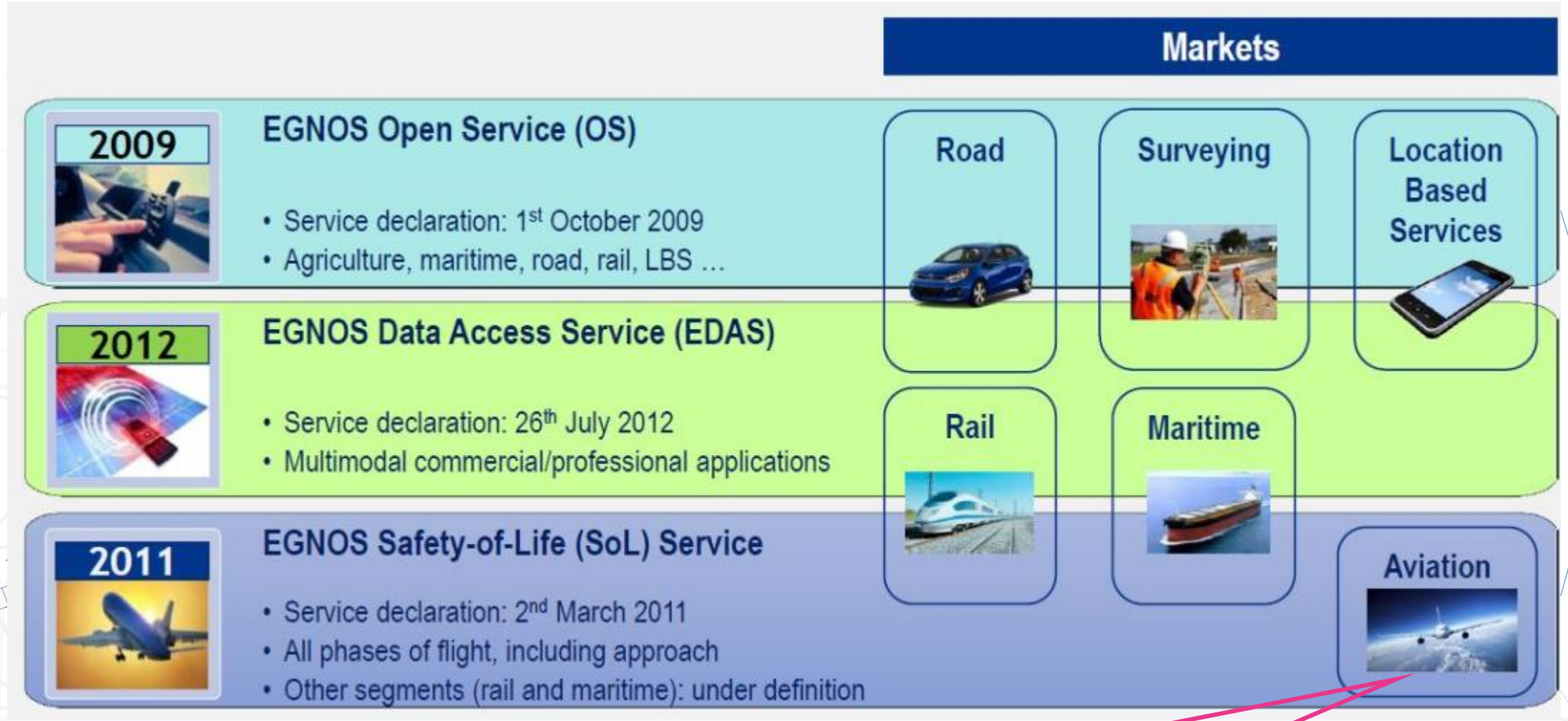
EGNOS: The European Satellite-Based Augmentation System (SBAS)



SBAS provides:

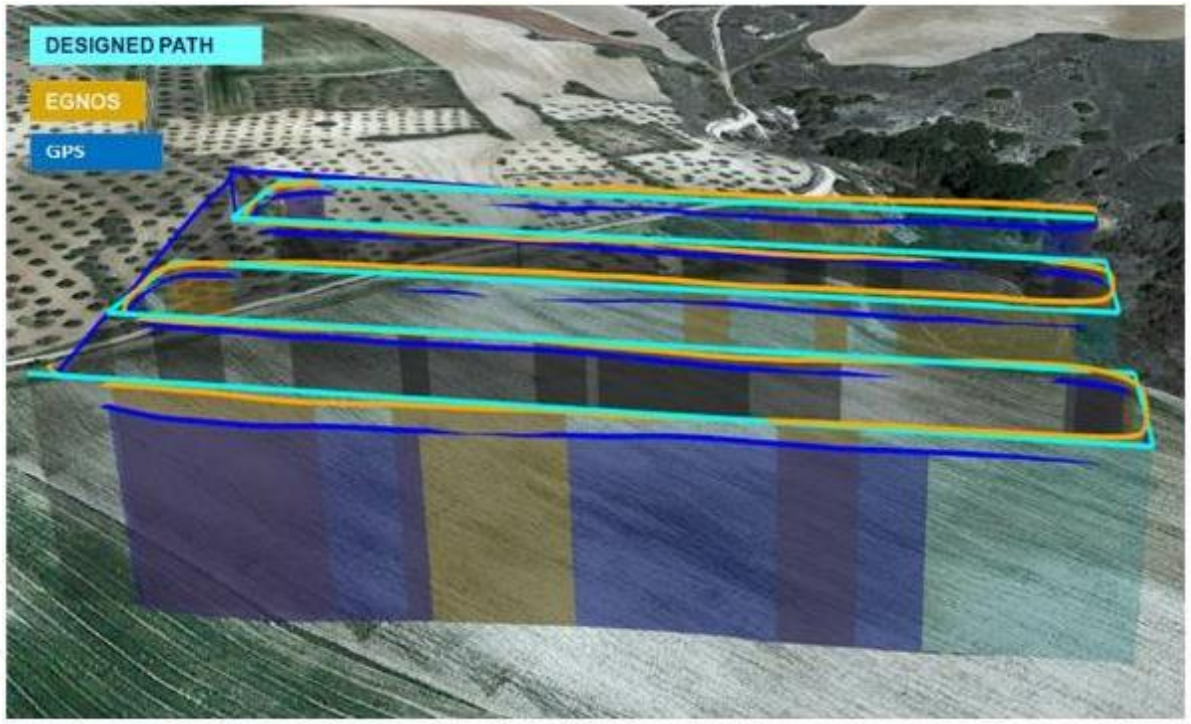
- Pseudorange corrections
- Satellite, iono & system alerts
- Better accuracy wrt GNSS standalone

EGNOS Services overview



EGNOS improves accuracy of the navigation duing the drone mission

Predefined path

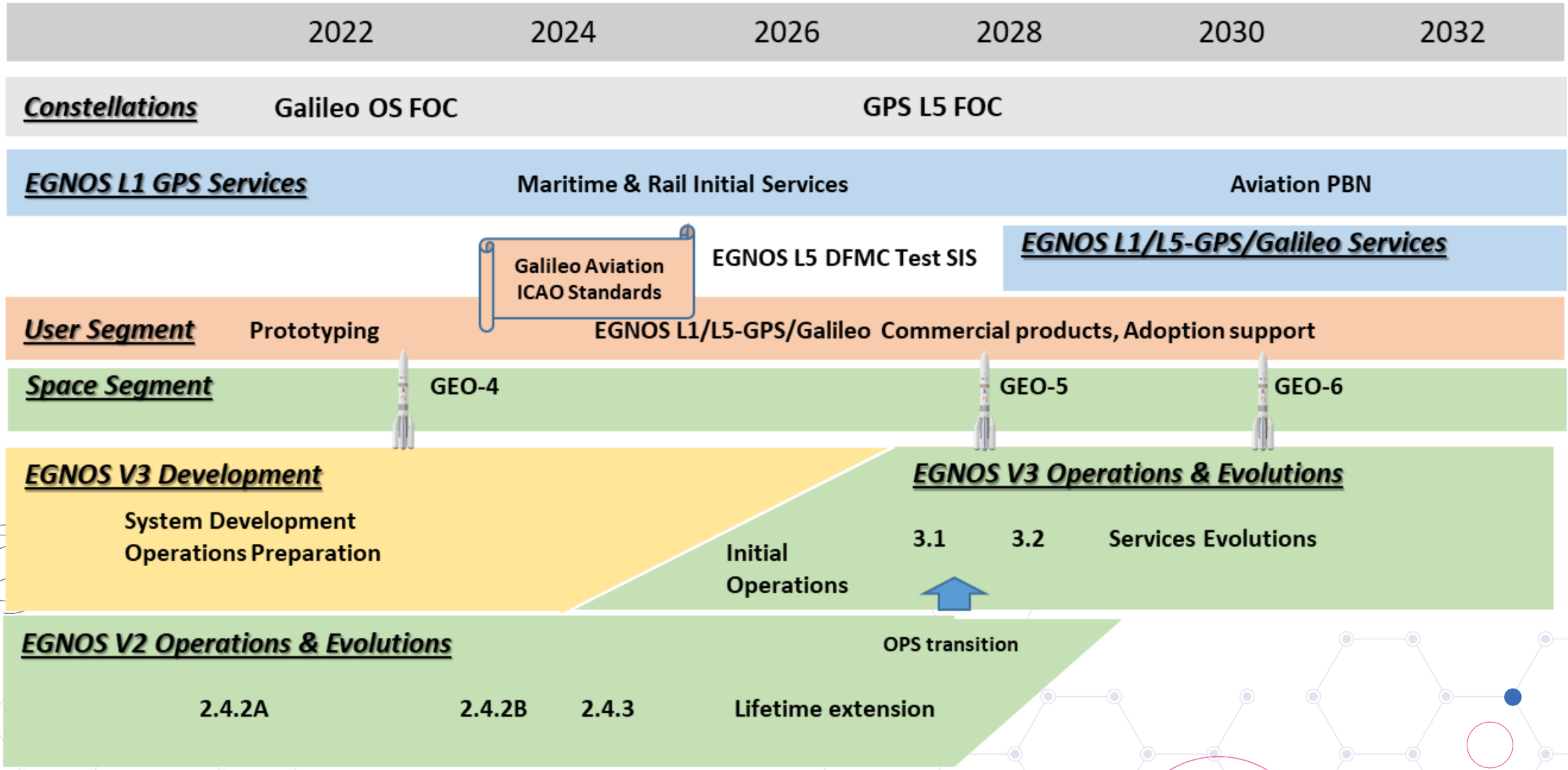


Error 95%

EGNOS H	0.95m
GPS H	1.53m
EGNOS V	1.2m
GPS V	2.6m

Flights by ESSP

EGNOS Exploitation roadmap



Galileo is the European GNSS offering a wide range of services

	**Open Service (OS)**	Galileo open and free of charge service set up for positioning and timing services. It is plan to deliver navigation message authentication (OS-NMA, 2023).
Search and Rescue Service (SAR)		Europe's contribution to COSPAS-SARSAT, an international satellite-based search and rescue distress alert detection system
	**High Accuracy Service (HAS)**	A service complementing the OS by providing an additional navigation signal and added-value services in a different frequency band. The HAS signal can be encrypted in order to control the access to the Galileo HAS services (HAS, 2023)
Public Regulated Service (PRS)		Service restricted to government-authorised users, for sensitive applications that require a high level of service continuity

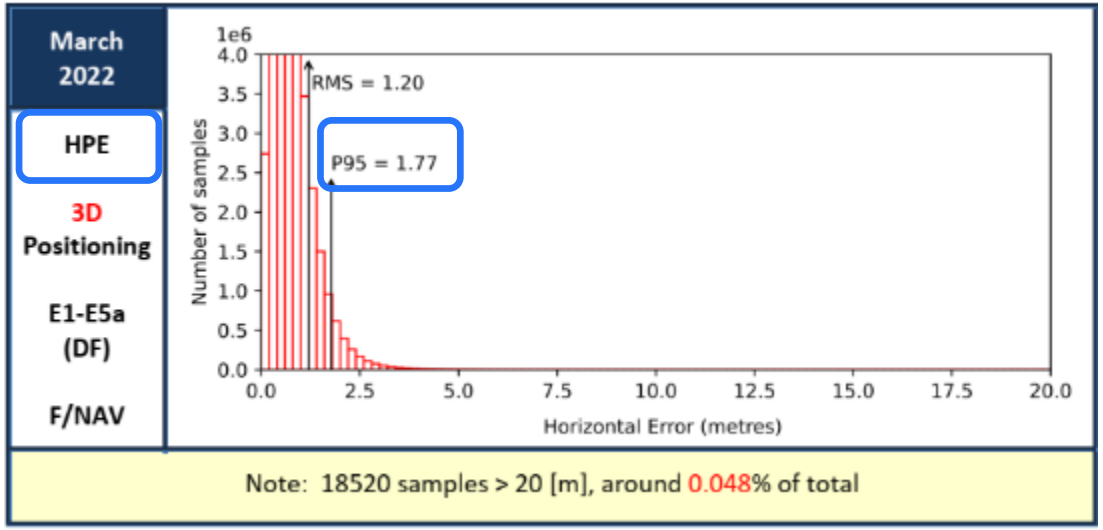
Galileo OS Accuracy

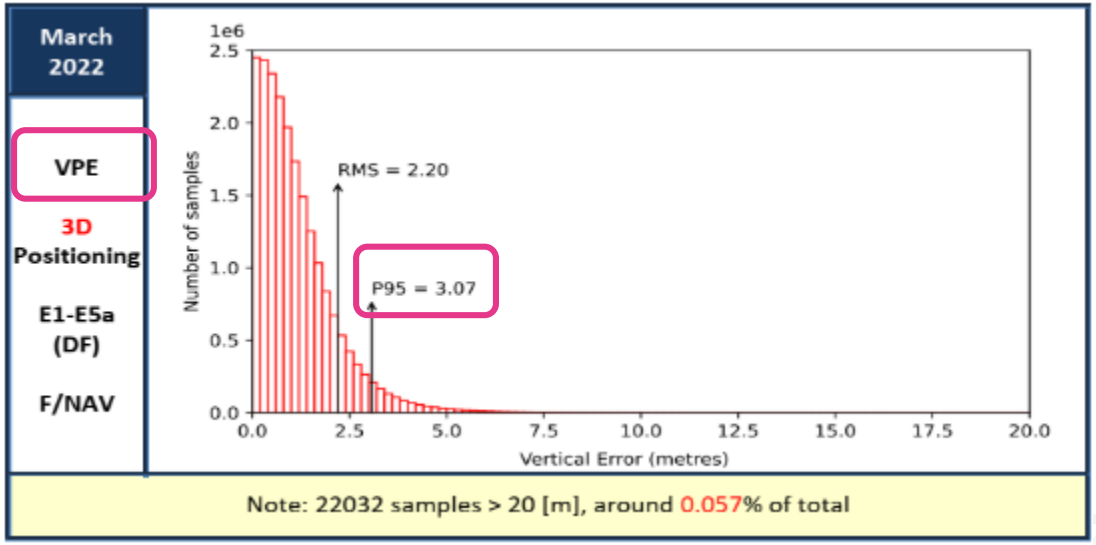
EUROPEAN GNSS (GALILEO) SERVICES

OPEN SERVICE

QUARTERLY PERFORMANCE REPORT

JANUARY - MARCH 2022





https://www.gsc-europa.eu/electronic-library/performance-reports

Galileo OS for aviation

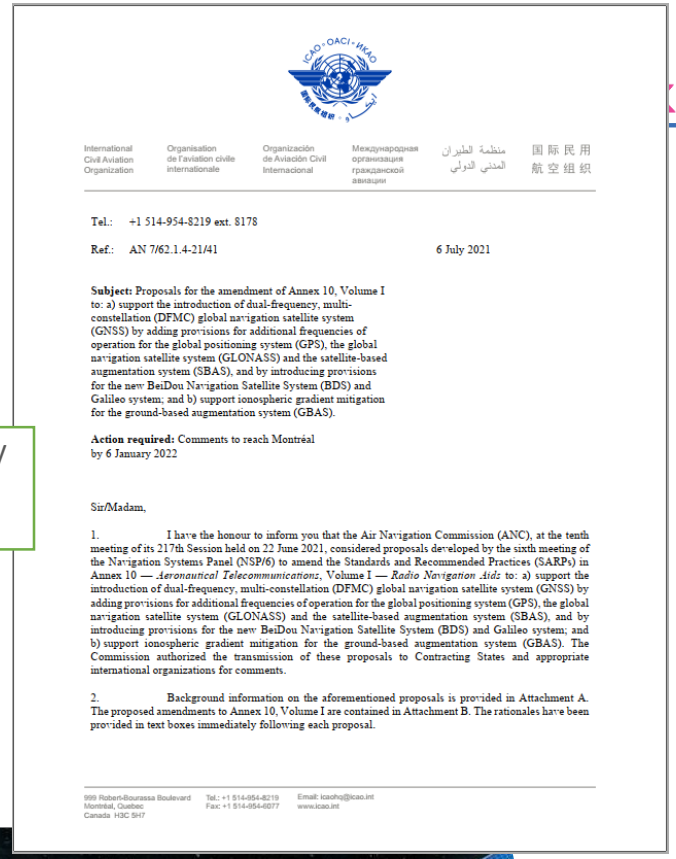
- Galileo OS has been baselined for use in aeronautical navigation by the International Civil Aviation Organization (ICAO) Navigation System Panel (NSP)

- Extensive work is being done to characterize Galileo OS performance for aviation in the frame of a formal Work Plan involving the European Space Agency (ESA), EUSPA and the European Commission (EC)

- Galileo characterization focused on SBAS and ARAIM needs for the time being; the characterization upon GBAS needs will be swiftly started

- Galileo OS performance is suitable for EGNOS V3 and already baselined in EGNOS V3 contract

Applicability expected by early 2023, enabling the use of Galileo OS signals for aviation



International Civil Aviation Organization | Organisation de l'aviation civile internationale | Organización de Aviación Civil Internacional | Международная организация гражданской авиации | منظمة الطيران المدني الدولي | 国际民用航空组织

Tel.: +1 514-954-8219 ext. 8178

Ref.: AN 7/62.1.4-21/41 6 July 2021

Subject: Proposals for the amendment of Annex 10, Volume I to: a) support the introduction of dual-frequency, multi-constellation (DFMC) global navigation satellite system (GNSS) by adding provisions for additional frequencies of operation for the global positioning system (GPS), the global navigation satellite system (GLONASS) and the satellite-based augmentation system (SBAS), and by introducing provisions for the new BeiDou Navigation Satellite System (BDS) and Galileo system; and b) support ionospheric gradient mitigation for the ground-based augmentation system (GBAS).

Action required: Comments to reach Montréal by 6 January 2022

Sir/Madam,

1. I have the honour to inform you that the Air Navigation Commission (ANC), at the tenth meeting of its 217th Session held on 22 June 2021, considered proposals developed by the sixth meeting of the Navigation Systems Panel (NSP/6) to amend the Standards and Recommended Practices (SARPs) in Annex 10 — *Aeronautical Telecommunications*, Volume I — *Radio Navigation Aids* to: a) support the introduction of dual-frequency, multi-constellation (DFMC) global navigation satellite system (GNSS) by adding provisions for additional frequencies of operation for the global positioning system (GPS), the global navigation satellite system (GLONASS) and the satellite-based augmentation system (SBAS), and by introducing provisions for the new BeiDou Navigation Satellite System (BDS) and Galileo system; and b) support ionospheric gradient mitigation for the ground-based augmentation system (GBAS). The Commission authorized the transmission of these proposals to Contracting States and appropriate international organizations for comments.

2. Background information on the aforementioned proposals is provided in Attachment A. The proposed amendments to Annex 10, Volume I are contained in Attachment B. The rationales have been provided in text boxes immediately following each proposal.

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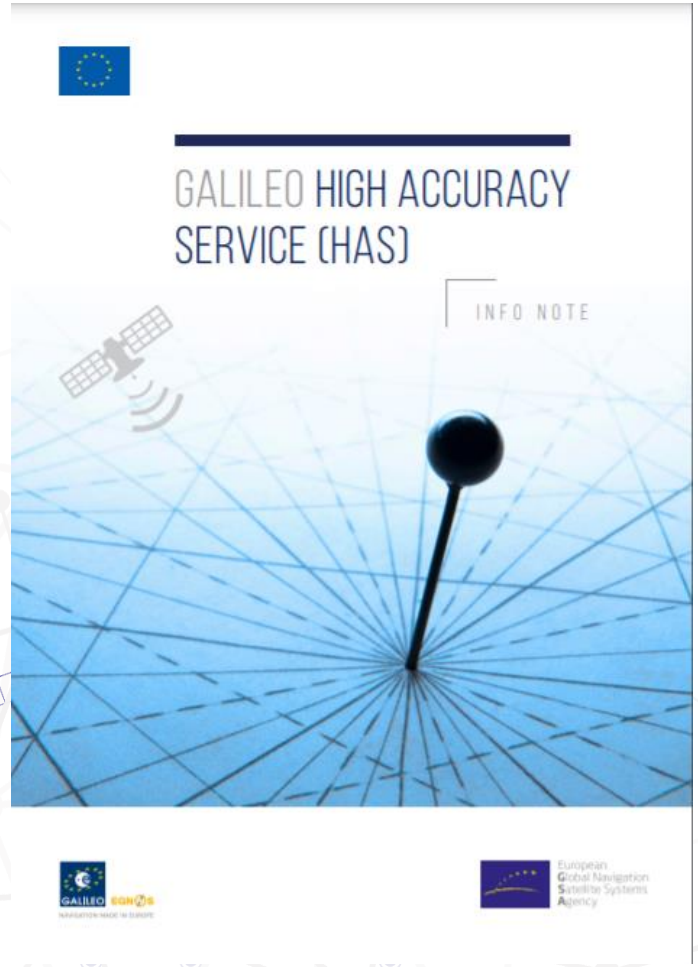
Galileo High Accuracy Service (HAS)



Galileo will be the first constellation able to provide such High Accuracy Service Globally

- The Galileo High Accuracy Service (HAS) will provide free of charge **high accuracy Precise Point Positioning (PPP)** corrections through the Galileo signal (E6-B) and by terrestrial means (Internet).
- Galileo HAS will offer real-time improved user positioning performances with **accuracy less than two decimetres** (in nominal conditions) in its full operational capability.
- Galileo HAS validation phase started in 2021. Service provision phase is expected to start in 2022.
- HAS infonote and ICD: https://www.gsc-europa.eu/electronic-library/programme-reference-documents#accuracy

Galileo Navigation Message Authentication (OS-NMA)

- Galileo OS-NMA is a new public and free of charge service:
  - will **authenticate the Galileo data** using the navigation message
  - will allow to **detect certain spoofing attacks**
  - will be **free of charge** to Galileo Users
- This mechanism provides users with an additional layer so that to be reassured about the authenticity of the information received from Galileo satellites**.**
- Initial OS-NMA Signal-in-Space transmission in test mode started in 2021.
- OS-NMA infonote, ICD and Guidelines for manufacturers available at https://www.gsc-europa.eu/electronic-library/programme-reference-documents#OSNMA

Galileo in NAV applications

Operational Target	GNSS Combination
En-route, terminal, initial approach, intermediate approach, non-precision approach (NPA), departure	Galileo (E1/E5a) + H-ARAIM GPS (L1/L5) + Galileo (E1/E5a) + H-ARAIM
En-route, terminal, initial approach, intermediate approach, non-precision approach (NPA), departure, APV-I, APV-II	GPS (L1/L5) + Galileo (E1/E5a) + DFMC SBAS Galileo (E1/E5a) + DFMC SBAS
En-route, terminal, initial approach, intermediate approach, non-precision approach (NPA), departure, APV-I, APV-II, Category I precision approach	GPS (L1/L5) + Galileo (E1/E5a) + DFMC SBAS Galileo (E1/E5a) + DFMC SBAS
En-route, terminal, initial approach, intermediate approach, non-precision approach (NPA), departure, APV-I, APV-II, Category I precision approach, Cat II/III	GPS (L1/L5) + Galileo E1/E5a + DFMC GBAS

EGNOS and Galileo differentiators support drone operations and implementation of U-Space

Availability

PVT available in challenging environments

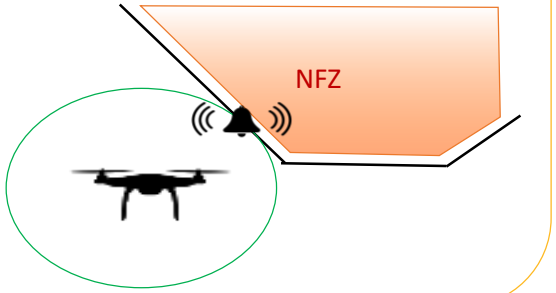
Integrity

Reliable PVT performance for the intended operation

- performance monitoring and alerting -

Detect and Avoid

Geo-fencing/caging

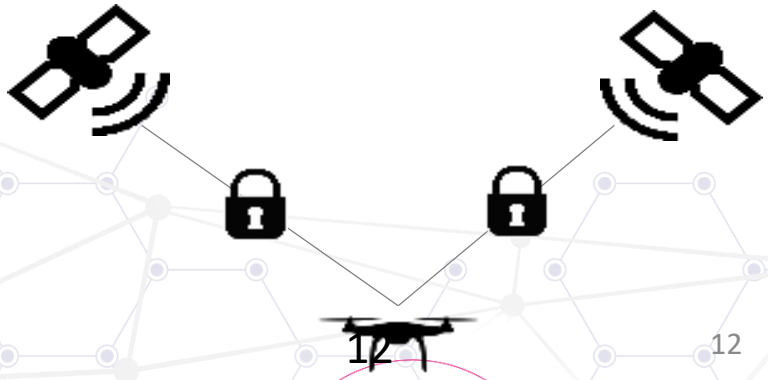


Accuracy

Unprecedented high accuracy for demanding applications also in the vertical axis, supporting integration in the airspace

Authentication

Embedded cybersecurity features



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