New Services

Dublin - EGNOS WS 14/03/2024

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EUSPA
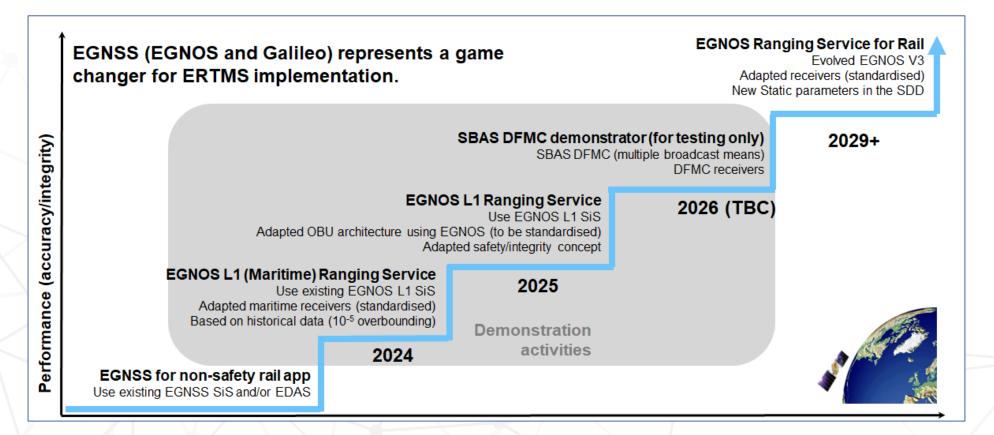European Union Agency for the Space Programme

New Services under development

- EGNOS SoL service for rail

- EGNOS V3 DFMC

- SBAS Authentication

- EDAS Evolution

- ESD (EGNSS Services Demonstrator)

EGNOS SoL Service for Rail (1/2)

- **Onboard solution**: SBAS/GNSS complemented with other sensors (multi-sensor fusion) to support safe train positioning i.e. computation of safe confidence intervals and speed on estimated position.

- EGNOS SoL application for rail users within ERTMS under definition.

EGNSS (EGNOS and Galileo) represents a game changer for ERTMS implementation.

EGNOS Ranging Service for Rail
Evolved EGNOS V3
Adapted receivers (standardised)
New Static parameters in the SDD

2029+

SBAS DFMC demonstrator (for testing only)
SBAS DFMC (multiple broadcast means)
DFMC receivers

2026 (TBC)

EGNOS L1 Ranging Service
Use EGNOS L1 SiS
Adapted OBU architecture using EGNOS (to be standardised)
Adapted safety/integrity concept

2025

EGNOS L1 (Maritime) Ranging Service
Use existing EGNOS L1 SiS
Adapted maritime receivers (standardised)
Based on historical data (10^{-5} overbounding)

Demonstration activities

2024

EGNSS for non-safety rail app
Use existing EGNSS SiS and/or EDAS

Performance (accuracy/integrity)

EGNOS SoL Service for Rail (2/2)

EGNOS SoL service demonstrator for rail in the short-term (2025+)

- Based on the current operational EGNOS system augmenting GPS L1 and/or DFMC SoL Datasets from service demonstrators.

- Guaranteed performance at Signal in Space (SiS) level (alarms, satellite and iono corrections) for SBAS L1, and/or "committable" performance for DFMC service based on Service demonstrator.

- Barriers against local feared events and nominal environmental conditions modelling to be managed by the Onboard Localisation Unit (OBU).

- Definition of an ICD / "SARPs appendix" type of document to enable railway SoL services (pseudorange domain integrity service).

EGNOS SoL service for rail safety in the long-term (2029+)

- Additional integrity service in the range domain for DFMC (Galileo and GPS) rail applications via L5 SiS and/or terrestrial dissemination (Service Provision Scheme under discussion with ERJU).

- Potential two incremental steps:

  - An initial EGNOS DFMC SoL service for rail safety based on EGNOS DFMC messages disseminated via the GEO SiS providing performance commitments at pseudo-range level.

  - A full EGNOS DFMC SoL service for rail safety broadcasting additional parameters.

EGNOS V3 DFMC

- Second generation of the EGNOS System, implementing the new Dual Frequency (L1/L5) Multi-Constellation (GPS+Galileo) augmentation.

- Improved Safety of Life (SoL) services to Civil Aviation community and potentially new applications for Maritime or Land users.
  - Second protected frequency (L5) will allow to offer a more robust and accurate vertical guidance service (increased robustness with respect to the Ionosphere).
  - Improvement of the overall robustness against increasing security risks.

A first L5 DFMC SiS is in preparation (target window Q3 2024)

V3 Releases	V3.1	V3.2
Key Features	• Legacy L1 services with improved performance over full EU + NW • Messages change: MT-27 to MT-28 transition • Full renewal of all sub-systems • Built-in security design • Integrate secured V3 sites • Integrate GEO-4	• DFMC L5 services (L1-L5 dual-Frequency, GPS-Galileo) • Coverage extension (Iceland, South&East neighborhood)
Planned entry in operations	2028	2029

- **EGNOS V3.1 (SFSC):** legacy service and improved robustness against disturbed ionosphere
- **EGNOS V3.2 (DFMC):** legacy service + dual frequency services consisting of GPS L1/L5 and GPS + Galileo Dual Frequency (L1/L5) services.

DFMC SBAS standardization activities

2021   2022   2023   *today*   2024   2025   2026   2027   2028   2029

ICAO DFMC SBAS SARPs
State Letter process and publication

ICAO ARAIM SARPs
State Letter process and publication

ED-259A - DFMC SBAS MOPS

Development and certification of avionics receiver

ED-259B - DFMC SBAS MOPS
including ARAIM and institutional scenarios

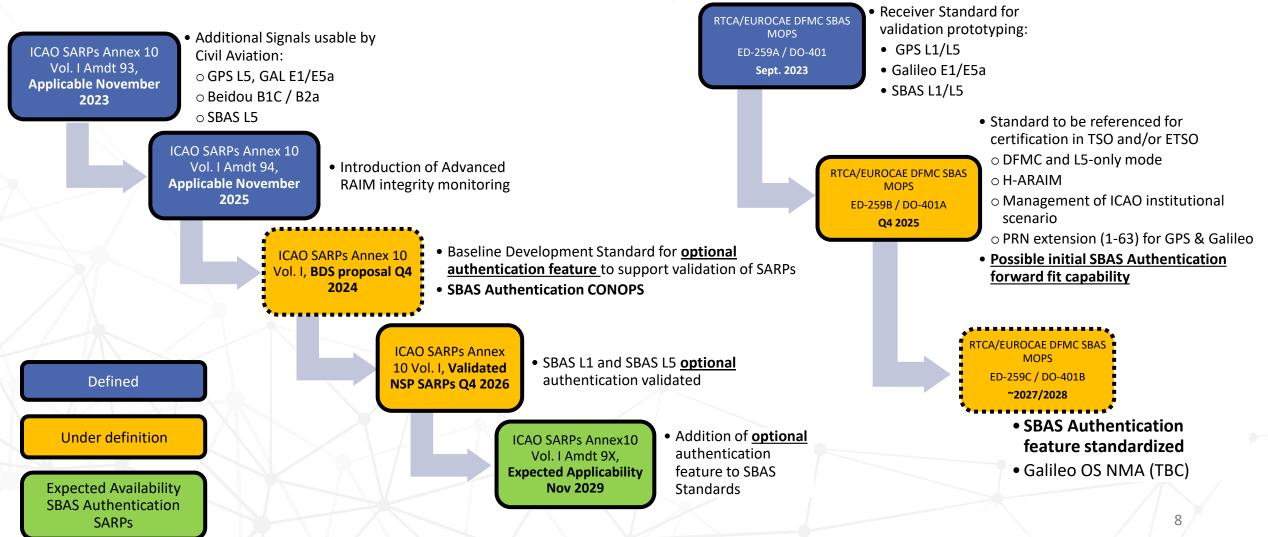L1 MT0 turned off

MT27-MT28 transition on L1

L5 MT0 turned off

SBAS Authentication

- SBAS Authentication feature concept and minimum performance is being standardized at ICAO level
- Objective: to map data of arbitrary size into a fixed length bit string
  - Deterministic
  - Infeasible to invert and reverse engineer
  - Infeasible to find two inputs with same output
  - Small change in input creates large change in output
- Solution: Retained cryptographic technique for SBAS authentication is TESLA little MAC to be implemented on current SBAS signals (I-channel).
- Implementation at Program Level:
  - EGNOS V3 Phase A (system studies for future services outside EV3 contract) study foreseen to be launched by ESA in 2025.
  - System implementation, pending ICAO standard decision, could be envisaged in a post-EGNOS V3.2 release
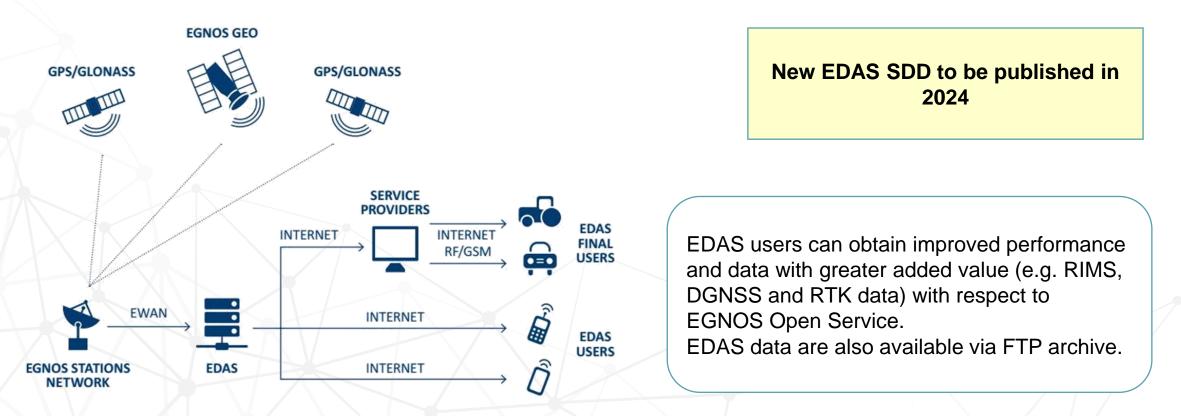
SBAS Authentication - ICAO & EUROCAE/RTCA Roadmap

ICAO SARPs Annex 10 Vol. I Amdt 93, Applicable November 2023

- Additional Signals usable by Civil Aviation:
  o GPS L5, GAL E1/E5a
  o Beidou B1C / B2a
  o SBAS L5

ICAO SARPs Annex 10 Vol. I Amdt 94, Applicable November 2025

- Introduction of Advanced RAIM integrity monitoring

ICAO SARPs Annex 10 Vol. I, BDS proposal Q4 2024

- Baseline Development Standard for **optional authentication feature** to support validation of SARPs
- **SBAS Authentication CONOPS**

ICAO SARPs Annex 10 Vol. I, Validated NSP SARPs Q4 2026

- SBAS L1 and SBAS L5 **optional** authentication validated

ICAO SARPs Annex10 Vol. I Amdt 9X, Expected Applicability Nov 2029

- Addition of **optional** authentication feature to SBAS Standards

RTCA/EUROCAE DFMC SBAS MOPS ED-259A / DO-401 Sept. 2023

- Receiver Standard for validation prototyping:
  - GPS L1/L5
  - Galileo E1/E5a
  - SBAS L1/L5

RTCA/EUROCAE DFMC SBAS MOPS ED-259B / DO-401A Q4 2025

- Standard to be referenced for certification in TSO and/or ETSO
  o DFMC and L5-only mode
  o H-ARAIM
  o Management of ICAO institutional scenario
  o PRN extension (1-63) for GPS & Galileo
- **Possible initial SBAS Authentication forward fit capability**

RTCA/EUROCAE DFMC SBAS MOPS ED-259C / DO-401B ~2027/2028

- **SBAS Authentication feature standardized**
- Galileo OS NMA (TBC)

Legend

- Defined
- Under definition
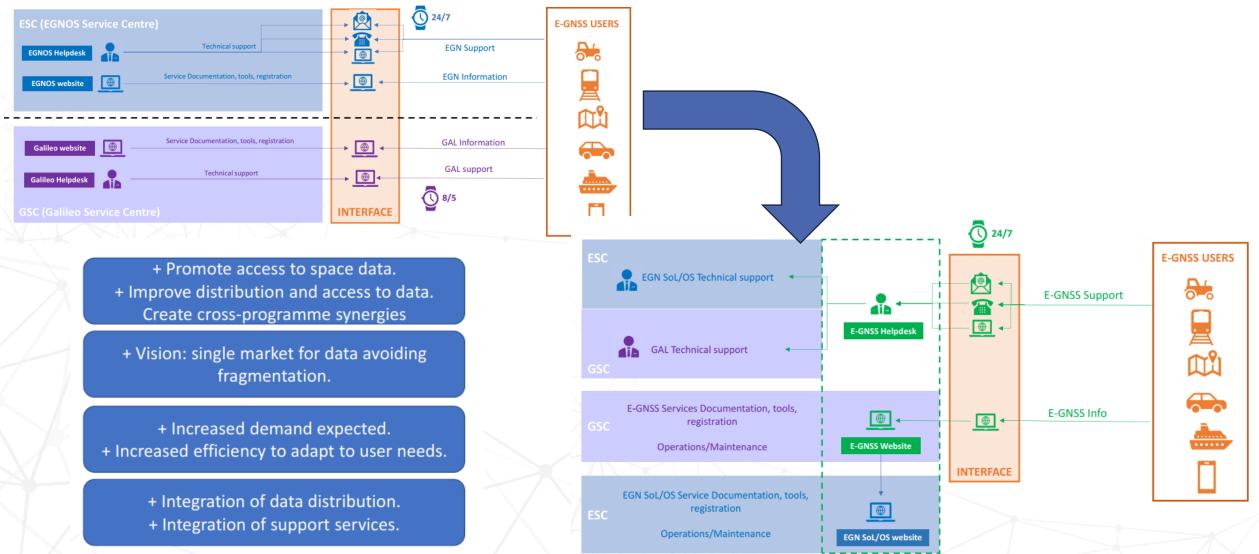- Expected Availability SBAS Authentication SARPs

EGNOS Data Access Service (EDAS)

- Since July 2012, provides EGNOS data to users who have internet connectivity as a complementary mean to the signal in space from the EGNOS geostationary satellites.

New EDAS SDD to be published in 2024

EDAS users can obtain improved performance and data with greater added value (e.g. RIMS, DGNSS and RTK data) with respect to EGNOS Open Service.
EDAS data are also available via FTP archive.

EGNSS Integrated Data Distribution Service

EGNSS Service demonstrator (ESD)

Centralised platform for the demonstration of new and enhanced end-to-end European Global Navigation Satellite System (EGNSS) services

- To support standards validation and receiver prototype activities, applications development and adoption.
- DFMC SBAS dissemination via ground and SiS, other new EGNSS service for demonstration will follow.
- Implementation of prototype algorithms, as close as possible to final ICD.

https://www.euspa.europa.eu/prior-information-notice-european-gnss-service-demonstrator-esd

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