Dual Frequency Multiconstellation SBAS Key Concepts
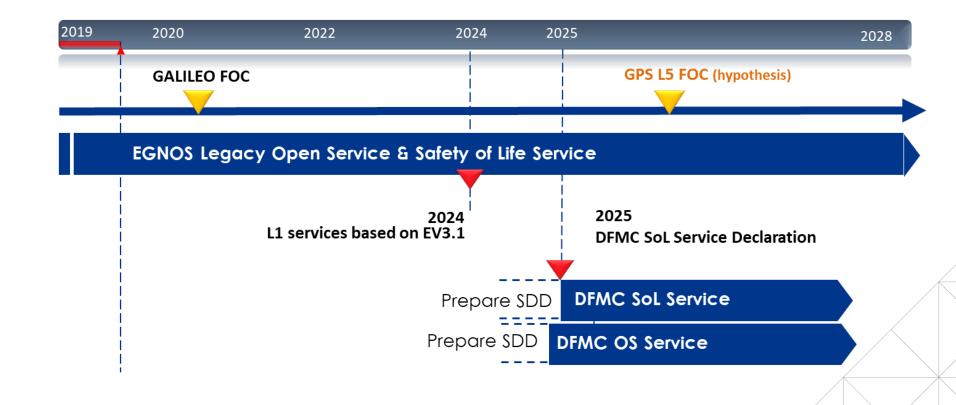
EGNOS Workshop – Rome, 24-25 Sept. 2019

Nathalie Ricard – EGNOS Service Engineering Manager

From EGNOS L1 to EGNOS DFMC

2019 2020 2022 2024 2025 2028

GALILEO FOC

GPS L5 FOC (hypothesis)

EGNOS Legacy Open Service & Safety of Life Service

2024
L1 services based on EV3.1

2025
DFMC SoL Service Declaration

Prepare SDD **DFMC SoL Service**

Prepare SDD **DFMC OS Service**

DFMC service versus L1 service: what's better?

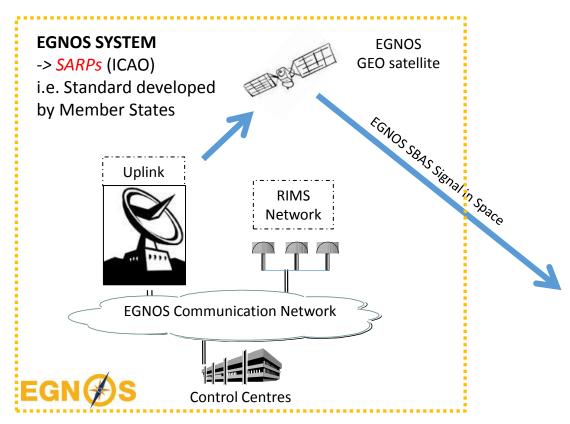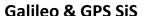| SBAS L1 service	SBAS DFMC service
Single frequency augmentation service	Dual frequency augmentation service
GPS and GLONASS	**GPS**, **Galileo**, GLONASS and BeiDou
SiS broadcast via GEO satellites	SiS broadcast via **any type of satellite**
Operational services down to LPV200	**Enhanced performance** that enable operational services beyond LPV200 (**VAL = 10m**)
Sends ionospheric corrections, to be used by the receiver	**No need for ionosphere corrections**: easier receiver implementation
No robustness against GPS constellation failure	**Robustness** against ionospheric scintillation and poor satellite geometry Robustness against constellation failure

EGNOS DFMC services

- The EGNOS DFMC service is broadcast on the L5 frequency (1176.45 MHz) independently of the EGNOS L1 service; EGNOS will provide both L1 and DFMC services.

- EGNOS DFMC **does not impact** current SBAS L1 operations, standards or certified receivers

- DFMC user receivers need to include new message types.

- The service area for DFMC services will be larger (esp. LPV200)

DFMC SBAS: status of standards

EGNOS SYSTEM
-> *SARPs* (ICAO)
i.e. Standard developed by Member States

EGNOS GEO satellite

Uplink

RIMS Network

EGNOS SBAS Signal in Space

EGNOS Communication Network

Control Centres

Galileo & GPS SiS
-> *SARPs*
Interface Control Document
+ Service Definition Documents

0111110
1011011

Galileo + GPS Signal in Space

DFMC RECEIVERS
(GPS + Galileo with SBAS + ARAIM)
-> *MOPS* (EUROCAE/RTCA)
-> *(E)TSO (EASA / FAA)*
i.e. Standard for products

DFMC SBAS SARPs "Technical Baseline" released to States by ICAO Electronic Bulletin on 12 April 2019; validated SARPs by end 2020

DFMC MOPS: EUROCAE ED-259 published in February 2019; next update with H-ARAIM end 2020

DFMC SBAS messages

Content of SBAS Message Types	DFMC Message Type	L1 Message Type
Do NOT use for safety critical applications	MT #0	
Satellite Mask	MT #31	MT #1
Integrity Information	MT #34 - #36	MT #2 - #6
Satellite clock-ephemeris error corrections and covariance matrix	MT #32	MT #2-#5, #24, #25 and MT #28
SBAS Ephemeris and covariance matrix	MT #39 and MT #40	MT #9 and #28
Degradation Parameters and DFREI Scale	MT #37	MT #10
Almanacs of SBAS satellites	MT #47	MT #17
SBAS Network Time/UTC	MT #42	MT #12
Internal Test	MT #62	
Null message	MT #63	
Ionosphere messages only used in L1	-	MT #7, #18, #26, and #27

Details available in DFMC SBAS SARPs "Technical Baseline"
https://www.icao.int/airnavigation/Pages/DFMC-SBAS.aspx

Linking space to user needs

Get in touch: **www.GSA.europa.eu**

EGNOS-portal.eu   GSC-europa.eu   UseGalileo.eu

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