SUPPORTING EUROPEAN AVIATION

EGNOS (LPV) implementation

Network perspective (NM)

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EGNOS Workshop 2025

CONSORTIUM COORDINATOR sesar DEPLOYMENT MANAGER

FOUNDING MEMBER sesar JOINT UNDERTAKING

NETWORK MANAGER

Index

- EUROCONTROL - LPV monitoring
  - Main benefits
  - Deployment monitoring tools
  - Implementation status in ECAC

- LPV operational challenges
  - Aircraft capability
  - ATC vectoring to RNP APCH
  - GNSS RFI
  - EGNOS performance
  - DFMC SBAS

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The importance of monitoring LPV implementation in ECAC

- PBN approach to a DH not lower than 200ft.
  - Enhancing accessibility at non-ILS airports.
  - Continued operations at ILS-equipped airports during ILS unavailability.
- 3D approach with geometric vertical guidance.
  - Enhanced safety at airports using 2D approaches.
  - LPV vertical guidance is not affected by temperature/pressure variations.

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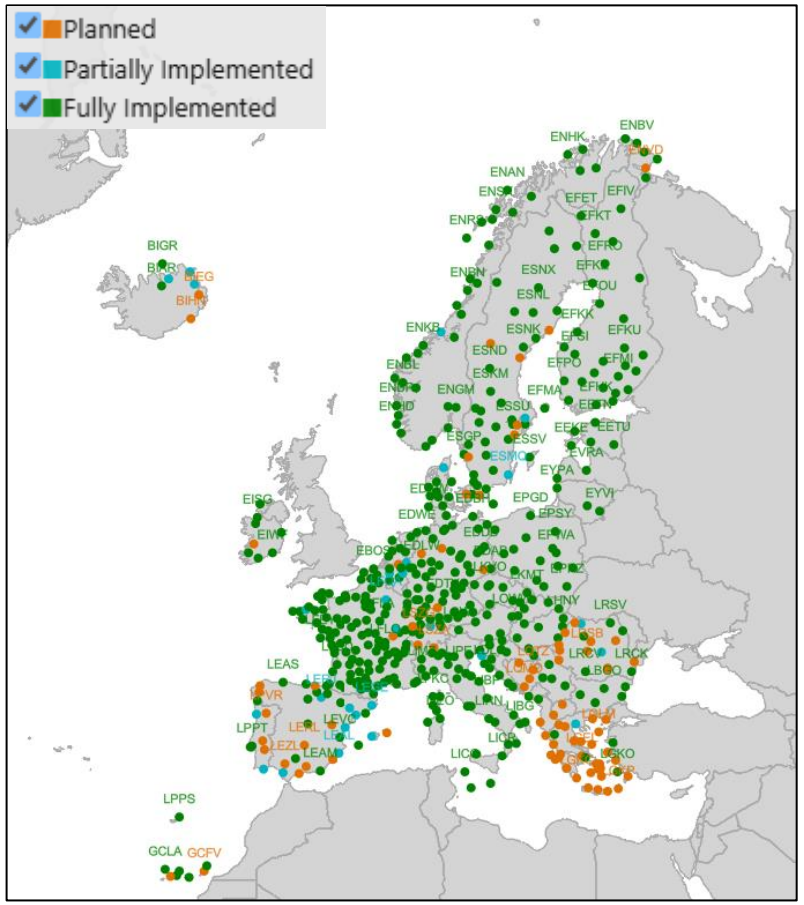
EUROCONTROL LPV monitoring (ECAC)

On ground

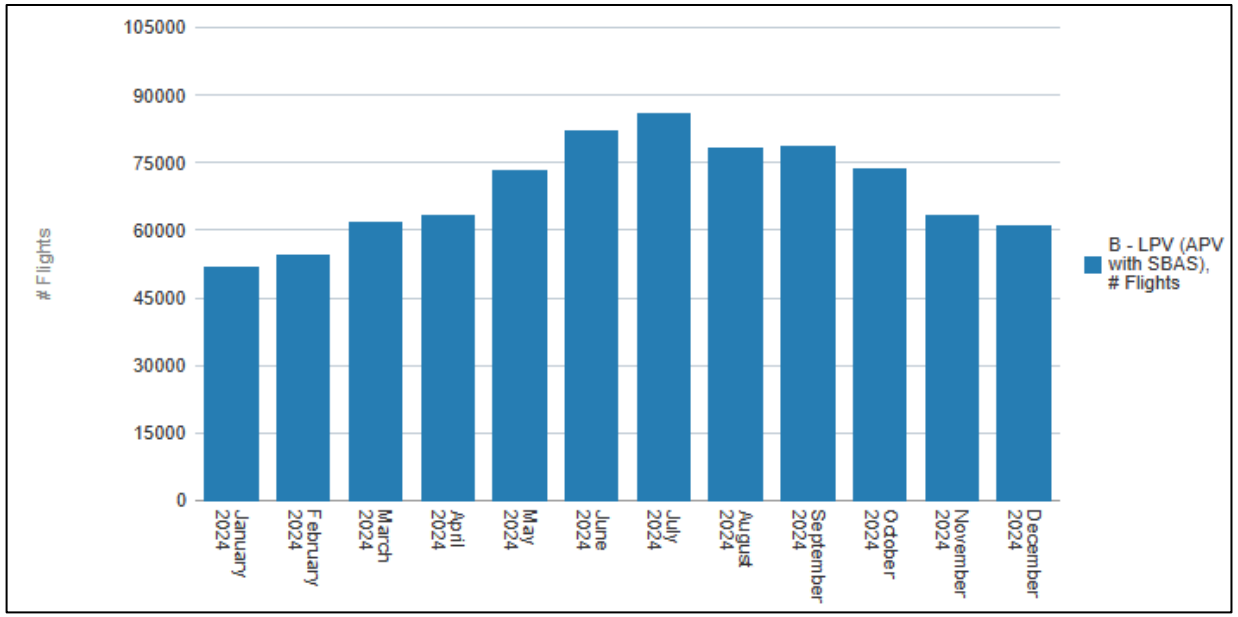
[EUROCONTROL PBN Map tool]



State's AIP + PBN Transition plans

On aircraft

[EUROCONTROL CNS Dashboard]



Aircraft capabilities (B - LPV SBAS) declared in the Flight Plan

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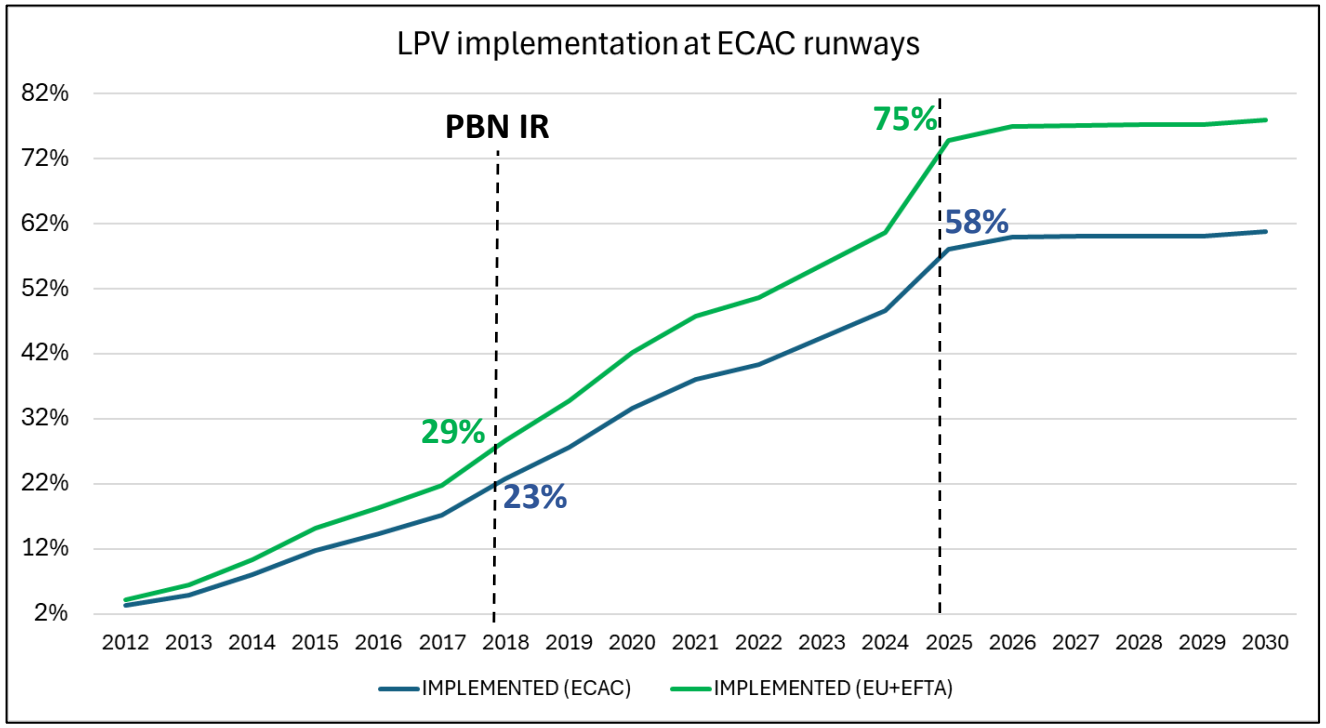
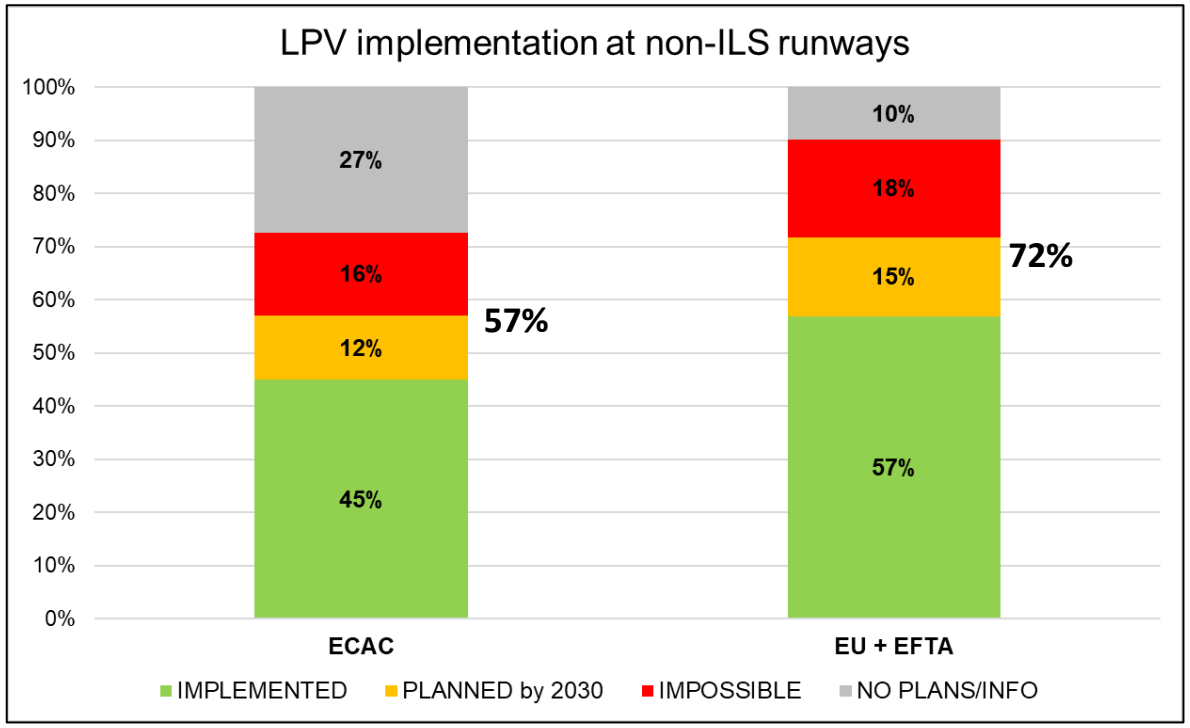
LPV implementation in ECAC





Significant ground-level implementation of LPV:
58% of runways across ECAC airports are now (2025) equipped with LPV.
(75% in EU+EFTA)

57% of non-ILS runways in ECAC will have LPV approach by 2030 .
(72% in EU+EFTA)

Source: PBN Map tool (AIRAC 2508)

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While implementing LPV at ground level is essential, it's equally important to consider the operational context.

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LPV operational challenges in ECAC

- Aircraft LPV capability

2. Airborne equipment and capabilities for Europe

	2025 Q1		2025 Q2	
	Flights	Aircraft	Flights	Aircraft
Total Nb of flights/Aircraft				
	2,284,424	23,760	2,956,680	26,601
RNP APCH				
Any means	95.72%	86.90%	96.73%	86.69%
LNAV-only	8.54%	12.91%	8.32%	13.05%
LNAV/VNAV	84.25%	62.29%	85.42%	61.04%
LPV	12.46%	29.93%	12.62%	32.10%

Source: CNS dashboard – "GNSS and PBN aircraft equipment and capabilities in Europe (2025 Q2)"

In Q2 2025, 13% of flights arriving in the ECAC area declared capability to perform LPV approaches.

- ATC vectoring to RNP APCH

- RNP APCH is coded in the aircraft computer (FMS).
- FMS reprogramming is needed to rejoin the procedure following a deviation (e.g., radar vectoring).
- Aircraft and FMS differences can affect procedure execution and system response.
- Relevant in TMAs with consistent radar vectoring, as it may increase workload.

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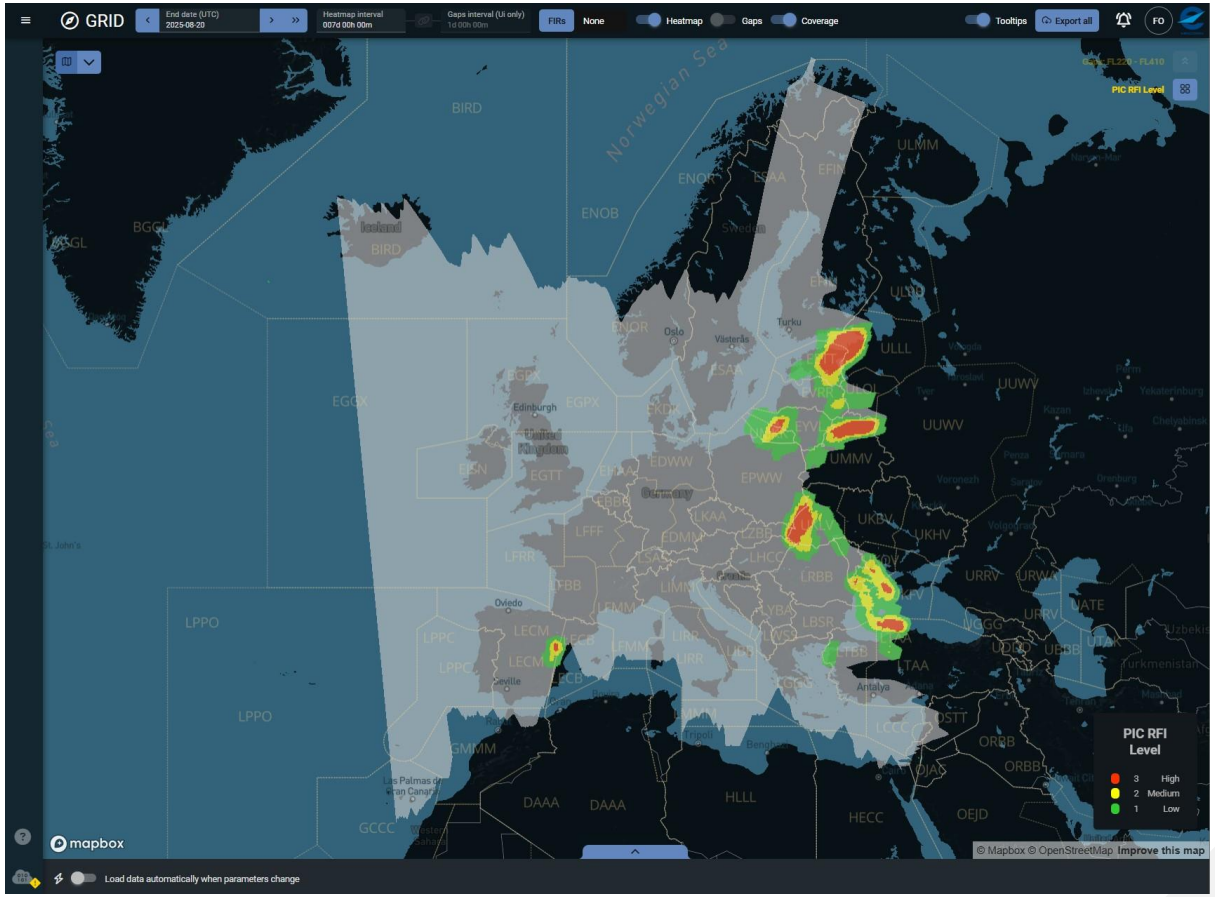
LPV operational challenges in ECAC

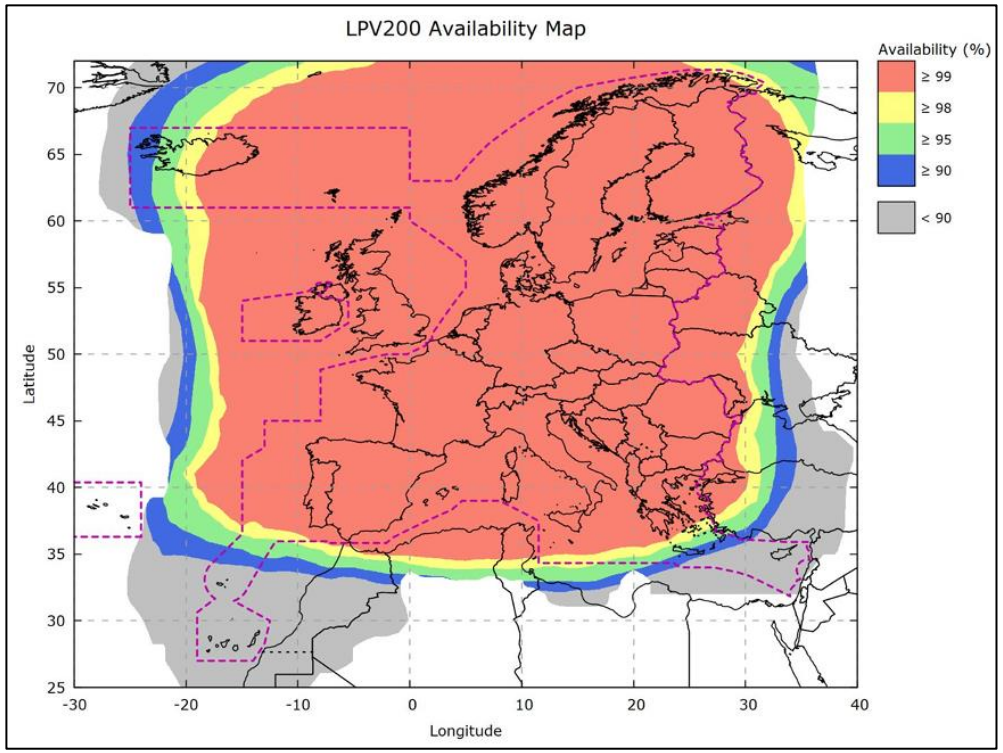
- GNSS RFI
- It has become a significant challenge for aviation operations:
  - Large-scale, permanent impact in some areas
  - Impact on all CNS systems and side effects such as latent recovery
- Main impact is generally at altitude:
  - Flying an LPV200 approach may still be feasible IF the aircraft can get to the approach intercept and receiver recovers in time
  - Combination of RFI Monitoring and Complementary PNT can enable this
  - Under development by EUROCONTROL, ICAO and many others

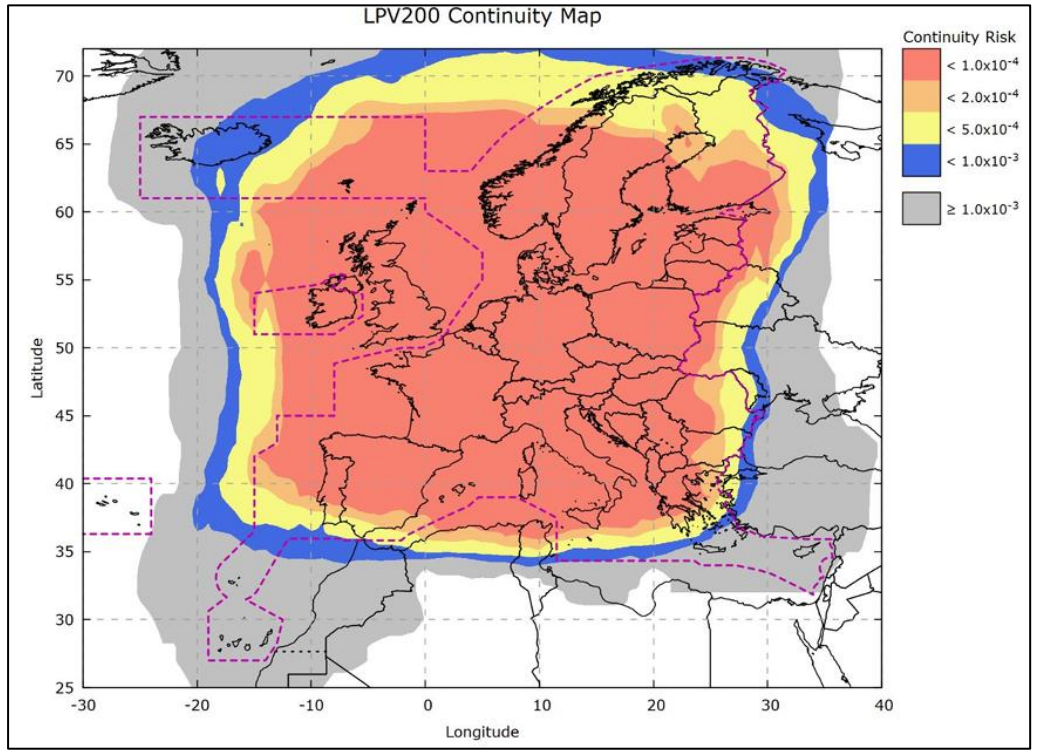


EUROCONTROL SHERLOCK/GRID tool

LPV operational challenges in ECAC

- EGNOS performance (LPV 200)





Source: EGNOS SoL SDD v3.6

- DFMC SBAS (Future)

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DFMC SBAS operational environment

Different SBAS provisions and design:

DFMC SBAS allows to augment any subset of the core constellations available for use by aviation. SBAS may support L1 SBAS or DFMC SBAS or both.

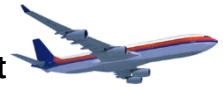
- WAAS (US) intends to support DFMC SBAS augmenting GPS only and to maintain L1 SBAS/GPS provision.
- EGNOS (EU) intends to support DFMC SBAS augmenting GPS and Galileo and to maintain L1 SBAS/GPS provision.
- BDSBAS (China) intends to support DFMC SBAS augmenting GPS and BDS and to support L1 SBAS/GPS provision.

Different DFMC SBAS receiver capabilities:

Future aircraft may be equipped with L1 SBAS receiver or DFMC SBAS receiver. DFMC SBAS receiver will include L1 SBAS in addition to DFMC SBAS. DFMC SBAS receiver may process a limited subset of the four core constellations.

SBAS L1 aircraft (E) TSO 145-146

DFMC SBAS GPS/Galileo aircraft



DFMC SBAS GPS/GLONASS aircraft

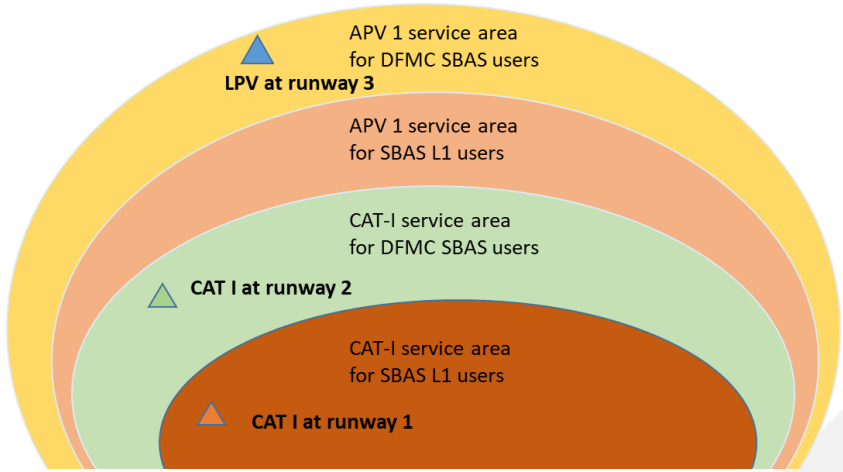
DFMC SBAS GPS/Galileo/ GLONASS/BDS aircraft

Different approach performance requirements:

- Precision approach design with APV-I criteria
  - VAL = 50 m / HPL = 40 m
  - Monitoring VPL/HPL is sufficient at airborne level to fly APV approach
- Precision approach design with CAT-I criteria (LPV-200)
  - VAL = 35 m / HPL = 40 m
  - VNSE below 10 m (FF case 1E-7)
  - VNSE below 15 m (Faulty case 1E-5)

Not monitored directly at airborne level but controlled today by procedure publication.

Different SBAS service areas for different airport needs:



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DFMC SBAS: APD coding (FAS DB)

APD value	Definition	SBAS avionics mode compatible for use
0	DFMC SBAS or L1 SBAS service	L1 SBAS mode or DFMC SBAS mode
1	DFMC SBAS service augmenting one or more constellations (L1 SBAS not supported)	DFMC SBAS mode using at least 1 augmented constellation from SBAS
2	DFMC SBAS service augmenting at least two constellations (L1 SBAS not supported)	DFMC SBAS mode using at least 2 augmented constellations from SBAS
3 and 4	Spare	
5	DFMC SBAS service augmenting one or more constellations (L1 SBAS with reduced continuity/availability)	Nominal: DFMC SBAS mode using at least 1 augmented constellation from SBAS Degraded: L1 SBAS mode
6	DFMC SBAS service augmenting at least two constellations (L1 SBAS with reduced continuity/availability)	Nominal: DFMC SBAS mode using at least 2 augmented constellations from SBAS Degraded: L1 SBAS mode
7	Spare	

More information on the receiver behavior for APD>0 in section O.3 of ED-259.

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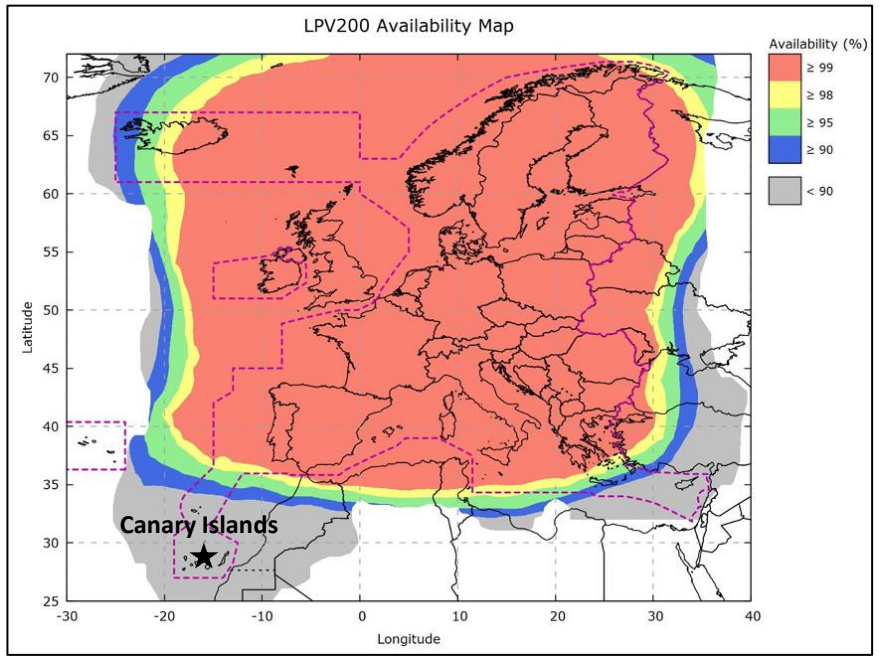
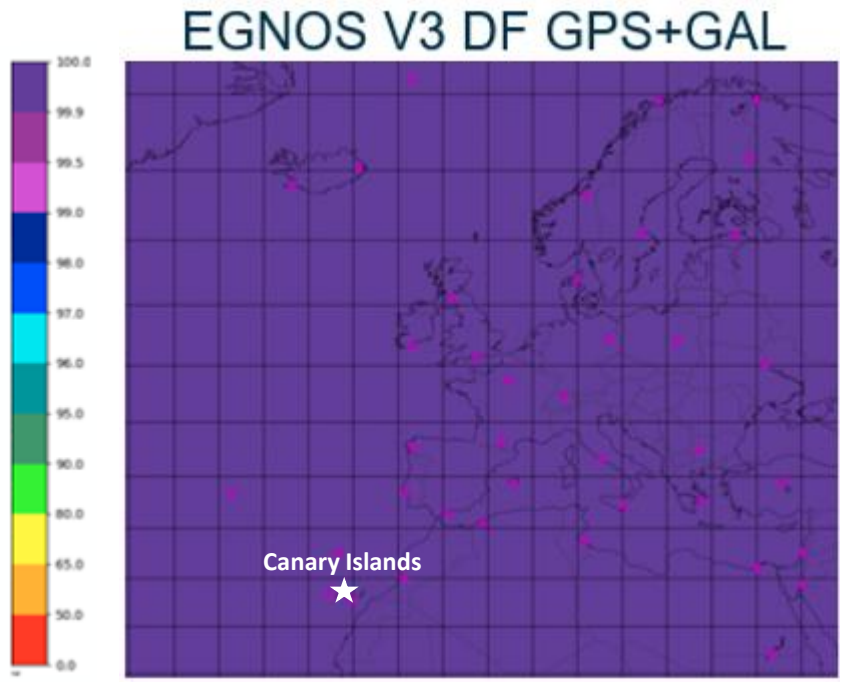
DFMC SBAS: APD coding



Source: EGNOS SoL SDD v3.6



Source: Presentation 2a-EUROCAE WG2/62#68 meeting – 23/10/2023

	Canary Islands
Desired performance	CAT-I
L1 SBAS	Lacks availability
DFMC SBAS	Meets CAT-I
Constellations	1
APD coding	**5**

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DFMC SBAS: Impact on procedure design (FAS DB)

- Procedure designers are required to provide FAS DB information following ICAO Doc 8168 Vol II (PANS-OPS):

Appendix A to Chapter 6

INFORMATION TO BE PROVIDED BY THE PROCEDURE DESIGNER CONCERNING THE SBAS FAS DATA BLOCK

c) *Approach performance designator*. This parameter is not used by SBAS avionics and should be set to "0" for all SBAS procedures including SBAS Cat-I.

DFMC SBAS operational concept and use of APD coding should be added into PANS-OPS.

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DFMC SBAS: Impact on procedure design (Charting)

- Procedure designers are responsible for providing instrument approach charts following ICAO Doc 8168 Vol II (PANS-OPS), Aeronautical Chart Manual and Annex 4.

- Any sensor, system or capability required to fly the procedures shall be depicted in the chart following ICAO documentation.

- Today, there is only one operational scenario: SBAS L1 (APD 0)

- DFMC SBAS brings different combinations of systems/sensors required → Guidance on how this shall be promulgated in the chart will have to be developed.

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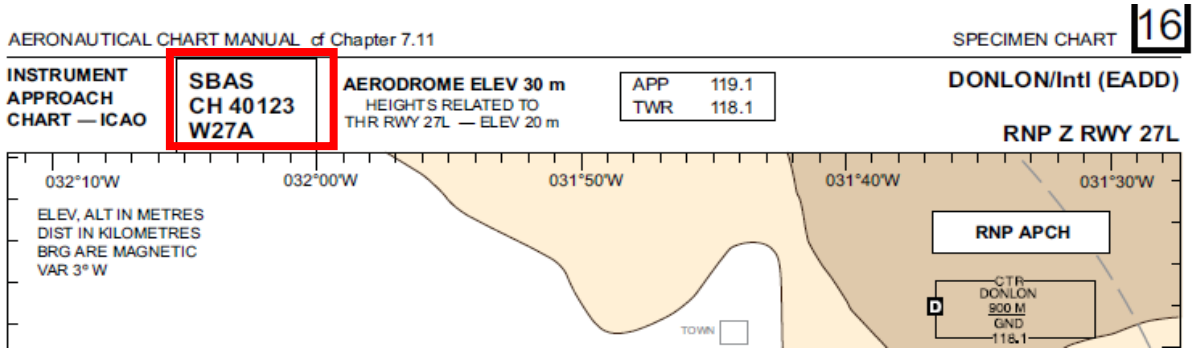
DFMC SBAS: Impact on procedure design (Charting)

Today: LPV approach operation requiring SBAS L1

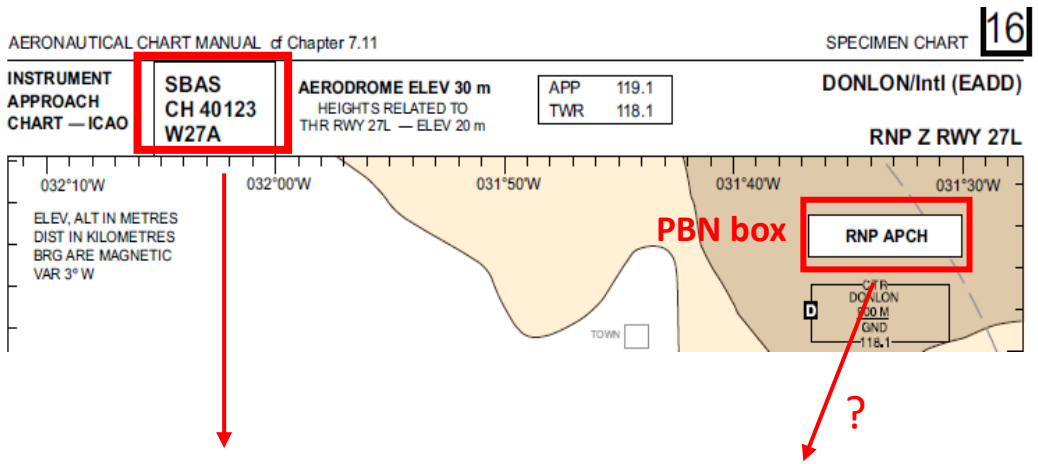
SBAS L1 aircraft
(E) TSO 145-146



Only one SBAS-based approach operation scenario

Tomorrow: LPV approach operation requiring SBAS L5 + GPS/Galileo

DFMC SBAS
GPS/Galileo aircraft



To be addressed in the relevant ICAO panels..

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AVIATION

Thank you!

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