Report on the EGNOS MRD by the EC/GSA
- EGNOS: v3 Maritime Requirements -

EMRF meeting. Paris, 16th October 2013

European Commission

European GNSS Agency

GALILEO EGNOS

Navigation solutions powered by Europe

Agenda

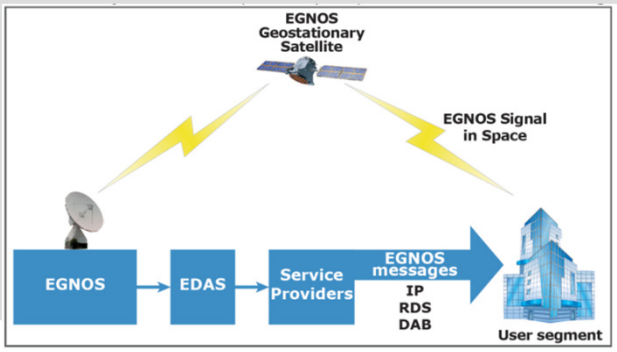
Navigation solutions powered by Europe

- Overview of EGNOS
- MRD open issues:
  - Coverage
  - Multifrequency / Multiconstellation capability of EGNOS v3
  - Integrity algorithms / RAIM as back-up
  - Review of standards and specifications
- Summary
- Questions

Navigation solutions powered by Europe

EGNOS is currently available

- EGNOS is a providing augmentation to GPS L_1
  - IMO requirements fulfilled for general navigation except in ports
- EDAS services (not for SoL):
  - Transmission of EGNOS messages via internet protocol, Radio Data System (RDS), and Digital Audio Broadcast (DAB).
  - Transmission of EGNOS data using RTCM SC 104 standard.



Navigation solutions powered by Europe

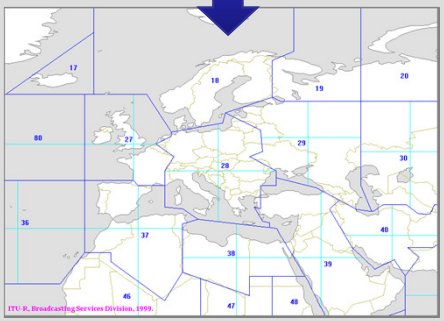
Improved coverage benefiting the maritime domain:

★ **MRD: EGNOS *shall* support navigation in harbour entrances, harbour approaches and coastal waters applications over the territorial waters of Europe and ENP***

Need EGNOS coverage extension to higher latitudes (75º) ?

★ **New route from Norway to Russia**

Coverage using ITU-R CIRAF zones?



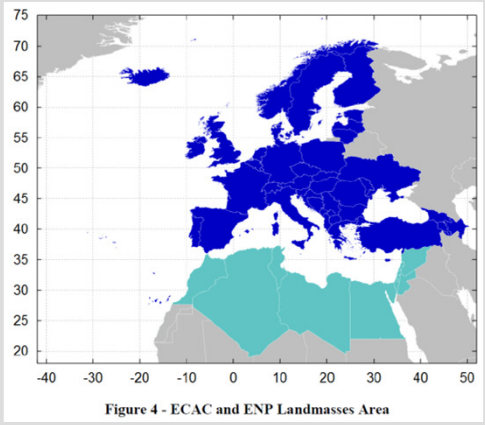


Figure 4 - ECAC and ENP Landmasses Area

* European Neighbouring Policy

Navigation solutions powered by Europe

Multifrequency / Multiconstellation capability of EGNOS v3

★ **Current specifications drafted for EGNOS augmenting Galileo and GPS (L_1 / L_5), cover those applications that require less than 10m Horizontal Navigation System Error (HNSE).**

					Service Coverage	Accuracy					Integrity				Continuity Risk	Availability
						HNSE	VNSE	Vertical NSE – fault-free conditions	Vertical NSE – system failure conditions	Velocity	HAL	VAL	TTA	Integrity Risk		
SoL Maritime	M	GPS L1-L5	DF	Navigation in harbour entrances, harbour approaches and coastal waters.	National waters of Europe and ENP	10 m	NA	NA	NA	20 cm/s	25 m	NA	10 s	10^{-5}/3 hour	$3x10^{-4}$/15 min	99.8%
		GPS+GALILEO	GG	Navigation in harbour entrances, harbour approaches and coastal waters.	National waters of Europe and ENP	10 m	NA	NA	NA	20 cm/s	25 m	NA	10 s	10^{-5}/3 hour	$3x10^{-4}$/15 min	99.8%

Multifrequency / Multiconstellation capability of EGNOS v3

- ★ It is being investigated if EGNOS v3 augmenting Galileo and GPS (L_1/L_5) will be able to support applications down to 1m HNSE.

- ★ MRD: ESA simulations has achieved accuracies of 0.91 - 1.42 m HNSE

Is it possible to admit an intermediate level of performance for certain applications? (e.g. 3 m HNSE)

Navigation solutions powered by Europe

Integrity algorithms

- **Computation of the Horizontal Protection Level (HPL), using RTCA standards[1] may result in a too stringent requirement**
  - **MRD: Ask industry to tailor aviation integrity algorithms to meet maritime requirements.**

Would the maritime community like to validate the new integrity algorithm and parameters knowing the overall integrity target?

[1]Based on the RTCA "Minimum operational performance standards for Global Positioning System/Wide Area Augmentation System Airborne Equipment"

Navigation solutions powered by Europe

RAIM as a back up for EGNOS PL

RAIM: Receiver autonomous integrity monitoring

- ★ Using RAIM with SBAS is part of the MOPS standard for some operations in aviation (NPA).
- ★ MRD: RAIM and advanced RAIM could be considered as a back-up to monitor integrity. But the RAIM algorithm would require adaptation.

Would EMRF like to use RAIM as a back up for EGNOS to monitor integrity?

Navigation solutions powered by Europe

Current standardisation requirements

- ★ **No IEC publication regarding EGNOS receiver performance standards.**
- ★ **No IMO resolution for the adoption of performance standard of EGNOS receivers.**

MRD: Until a maritime standard is available, the maritime Safety of Life dual frequency and dual constellation performances will be defined assuming an aviation receiver (HPL).

Would EMRF support the elaboration of a MOPS for maritime?

Navigation solutions powered by Europe

In Summary, 6 questions:

- ✓ EGNOS coverage extension to **higher latitudes** (75º) ?
- ✓ Coverage using **ITU-R CIRAF zones**?
- ✓ Intermediate **level of performance** for certain applications? (3 m)
- ✓ Validate new **integrity algorithm** and parameters?
- ✓ **RAIM as a back up** for EGNOS to monitor integrity?
- ✓ Would EMRF support the elaboration of a **MOPS for maritime**?

Manuel Lopez Martinez (GSA)

EMRF meeting. Paris, 16th October 2013

European Commission

European GNSS Agency

GALILEO EGNOS

Navigation solutions powered by Europe