

European  
Global Navigation  
Satellite Systems  
Agency

# **CALL FOR INTEREST: EGNOS corrections over IALA Radiobeacons and AIS/VDES**

IALA eNAV16 – 20 April 2015

Prof. Dr. Manuel Lopez Martinez

# Outline

- Value proposition of EGNOS for navigation
- Drivers for adoption of EGNOS applications and services
- EGNOS possibilities to provide a service with integrity information
- Call for interest – Pilot projects
- Way forward



# Value proposition of EGNOS for navigation

- EGNOS can be used as a complement/back up of IALA DGNSS infrastructure in the following phases of navigation
  - Ocean waters (inside the EGNOS coverage area)
  - Coastal waters, harbour entrances and approaches
  - Inland waterways
- The use of EGNOS for navigation in ports is under study
  - Analysis of operational requirements with Harbour Masters, Pilots Associations and Portable Pilot Units manufacturers.



# Drivers for adoption of EGNOS

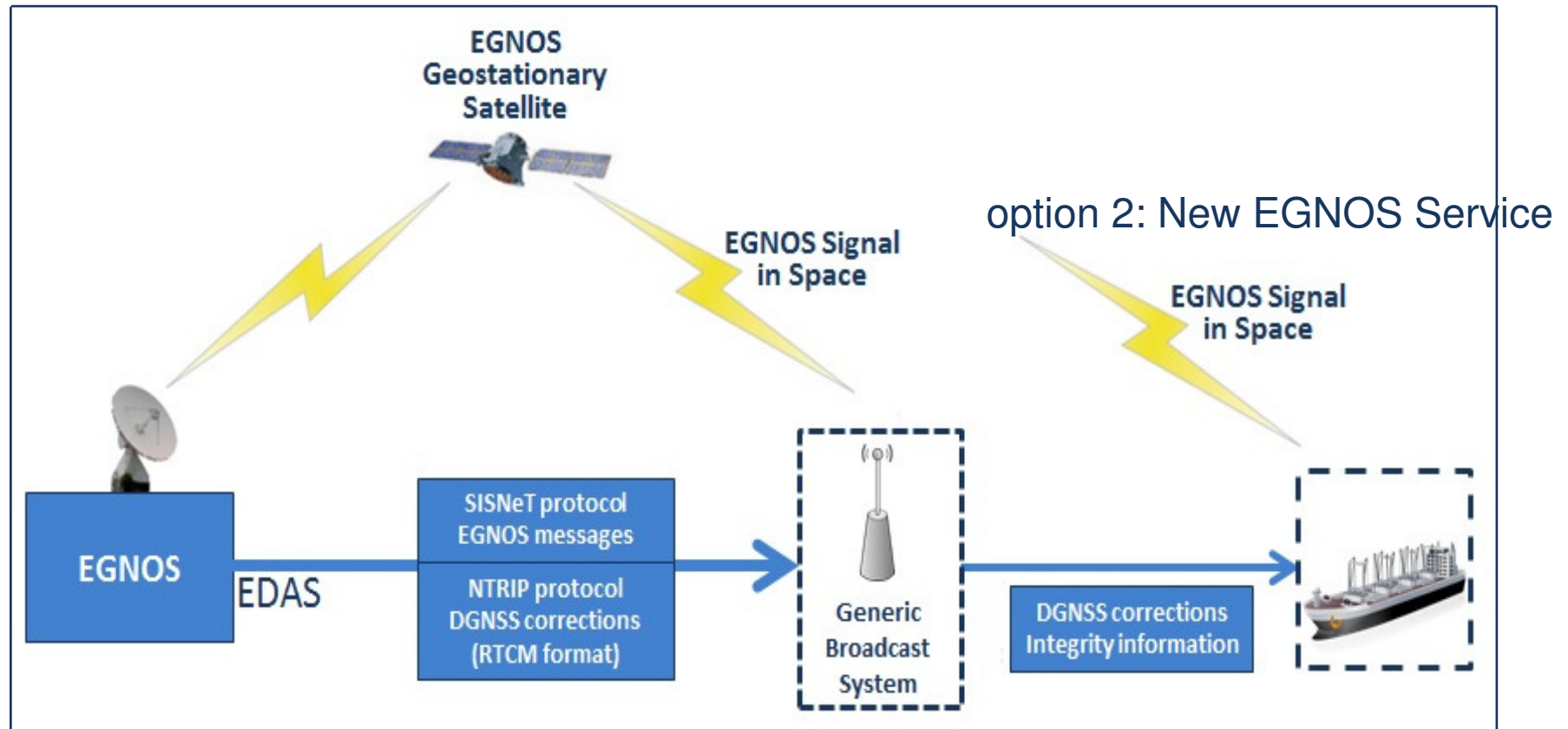
## Need for Pilot Projects

- Performance aspects against user's requirements
  - Coverage area, accuracy, integrity, availability and continuity
- Socio-economical aspects:
  - Cost Benefit Analysis of different applications / services
- Operational information communication
  - Notice to mariners to inform about system status and performance levels
- Standardisation of shipborne receivers (at least 3 years)
  - Multisystem Performance Standards for Shipborne Receivers finalised at IMO NCSR 2.
  - IEC performance requirements and tests specifications needed
  - RTCM standard needed for SBAS (including integrity concepts)
- Regulatory aspects (at least 3 years)
  - Recognition of EGNOS as part of WWRNS – as per IMO Resolution A.1046
  - Liability framework for service provision



# EGNOS possibilities to provide maritime services

Possible architectures:



# EGNOS maritime applications/services providing integrity information

## ➤ Option 1: EGNOS Applications using current shore infrastructure

- EGNOS over IALA beacons
- EGNOS over AIS/VDES stations

### Two sources of corrections:

- EDAS: it can be used when no Geo satellites are visible (Arctic circle, shadowed inland waterways)
  - Sisnet Protocol in RTCA Format. Need to change to RTCM format
  - NTRIP protocol in RTCM Format.
- SIS: it can be used if internet connection is not reliable
  - RTCA Format

## ➤ Option 2: New EGNOS maritime services requiring new Shipborne Receivers receiving SIS (RTCA Format)

- Service 1 providing system level integrity – IMO res. A.1046
- Service 2 providing users' rx level integrity (IMO res. A.915 and revisions)



# Application 1: EGNOS over IALA beacons

- Broadcast of EGNOS corrections through DGNSS beacons according to the message content and format defined in RTCM v2.3.
- Advantages:
  - There is no impact on the final users (i.e. no need to replace their GNSS receivers), since the corrections would be broadcast according to the same signal characteristics, data content and format currently used for DGNSS
  - AtoN providers could take advantage and use either EDAS or EGNOS SIS as a back-up to their DGNSS stations or for recapitalization of the infrastructure (Specific CBA needed)
  - Similar performance to current IALA beacons. Possible local integrity check.
  - An IALA guideline or recommendation would be needed for common implementation (No need to modify/create other standards – IMO, RTCM, IEC)
  - Fast implementation



# Application 2: EGNOS over AIS/VDES stations

- Pilot phase: Broadcast of EGNOS corrections from AIS base station to all AIS mobile units (transponders) within its coverage area.
- Evolution: Implementation in the new channels for applications in VDES (AIS extension)

## ➤ Advantages:

- Similar to application 1
- It represents a complement and back up to IALA DGNSS infrastructure

## ➤ Points under study:

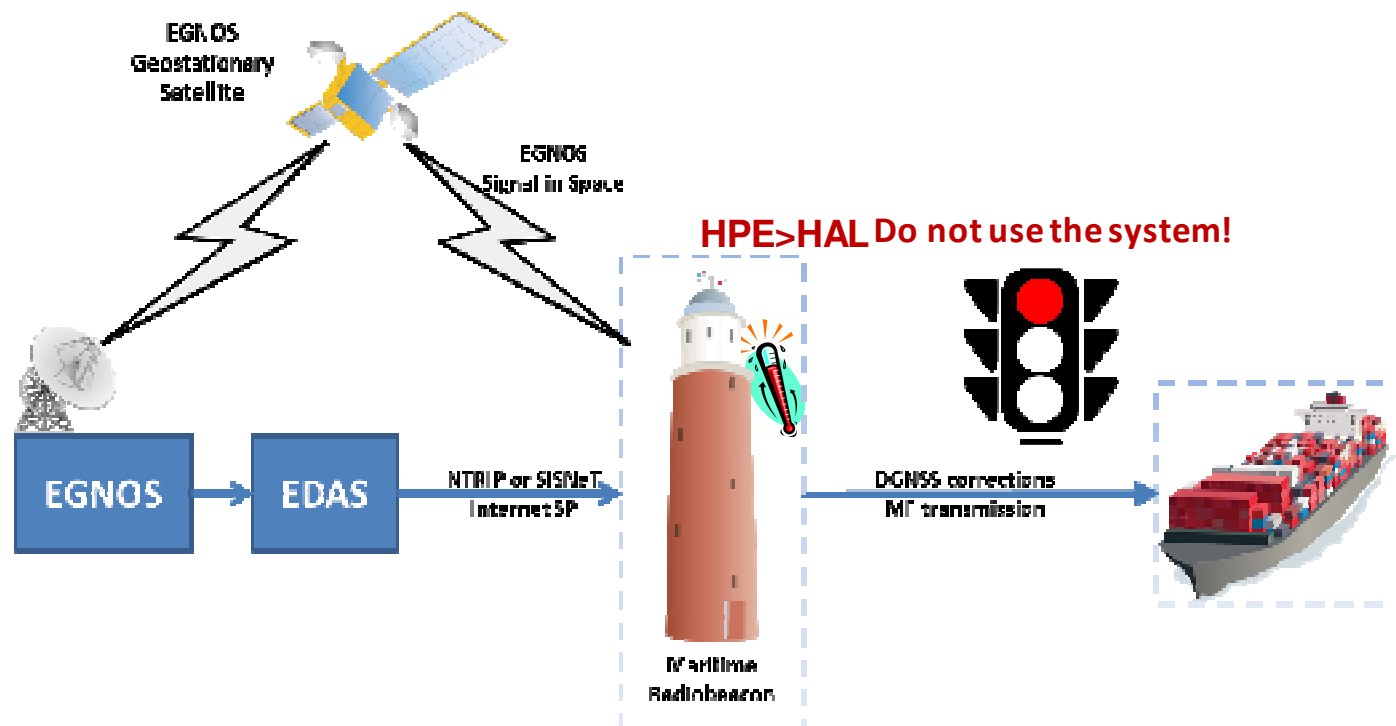
- Analysis of bandwidth required to avoid saturating the channels
- Communication between AIS/VDES transponder and the ECDIS to use this differential corrections or the corrected position in case IALA DGPS corrections are not available



# Call for interest: EGNOS over IALA beacons

Dissemination of EGNOS data via other means different from GEO satellites

- **Pilot Project** for dissemination of EGNOS data via IALA beacons with interested Maritime/River Authorities => compare performance of service using EDAS (e.g. SISNeT, Ntrip) and Signal-in-Space



# Call for interest: EGNOS over IALA beacons

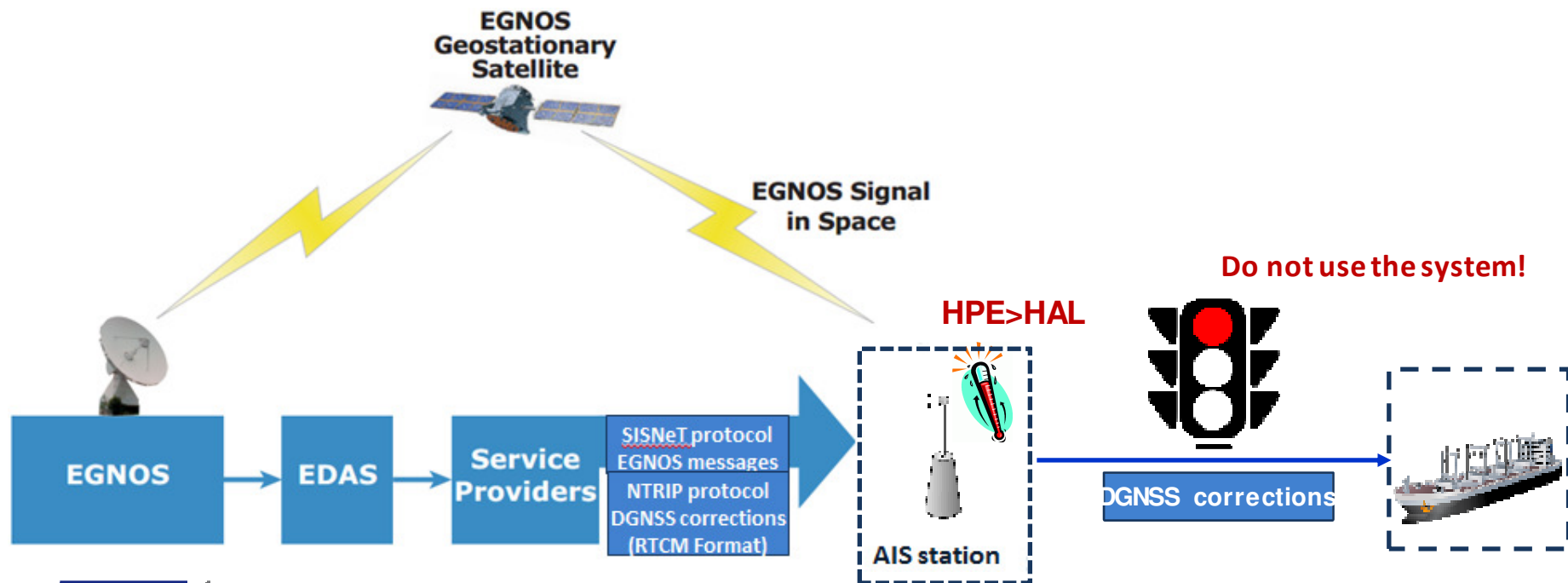
Dissemination of EGNOS data via other means different from GEO satellites

- *Pilot Project for dissemination of EGNOS data via IALA beacons with interested Maritime/River Authorities => compare performance of service using EDAS (e.g. SISNeT, Ntrip) and Signal-in-Space*
- **Cost-Benefit Analysis** for Maritime Authorities/End Users to show the benefits from the perspective of ship owners and to show how maritime authorities could take benefit of SBAS

*Note: EDAS via IALA beacons is foreseen to be used primarily for areas where EGNOS Geo Satellites are not visible.*



## Dissemination of EGNOS data via other means different from GEO satellites



# Call for interest 2: EGNOS over AIS/VDES

Dissemination of EGNOS data via other means different from GEO satellites

- *Pilot Project for dissemination of EGNOS data via AIS with interested Maritime Authorities/End Users => compare performance of service using EDAS (e.g. SISNeT, Ntrip) and Signal-in-Space via AIS*
- *Cost-Benefit Analysis for Maritime Authorities/End Users to show the benefits from the perspective of ship owners and to show how maritime authorities could take benefit of SBAS*
- **Support definition of VDES** at IALA in such a way that it can be used as a means of dissemination for EGNOS data.

*Note: EDAS via AIS/VDES is foreseen to be used primarily for areas where EGNOS Geo Satellites are not visible.*



# Way forward

- ✓ Maritime and Inland Waterways Authorities interested in collaborating in such pilots project by offering a DGNSS station or a AIS station for the tests are requested to send an email to [market@gsa.europa.eu](mailto:market@gsa.europa.eu) before **15 May 2015**



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Global Navigation  
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# THANK YOU !

Fiammetta.Diani@gsa.europa.eu

Manuel.LopezMartinez@gsa.europa.eu

Market Development

Nathalie.Ricard@gsa.europa.eu

EGNOS Exploitation Service Engineering



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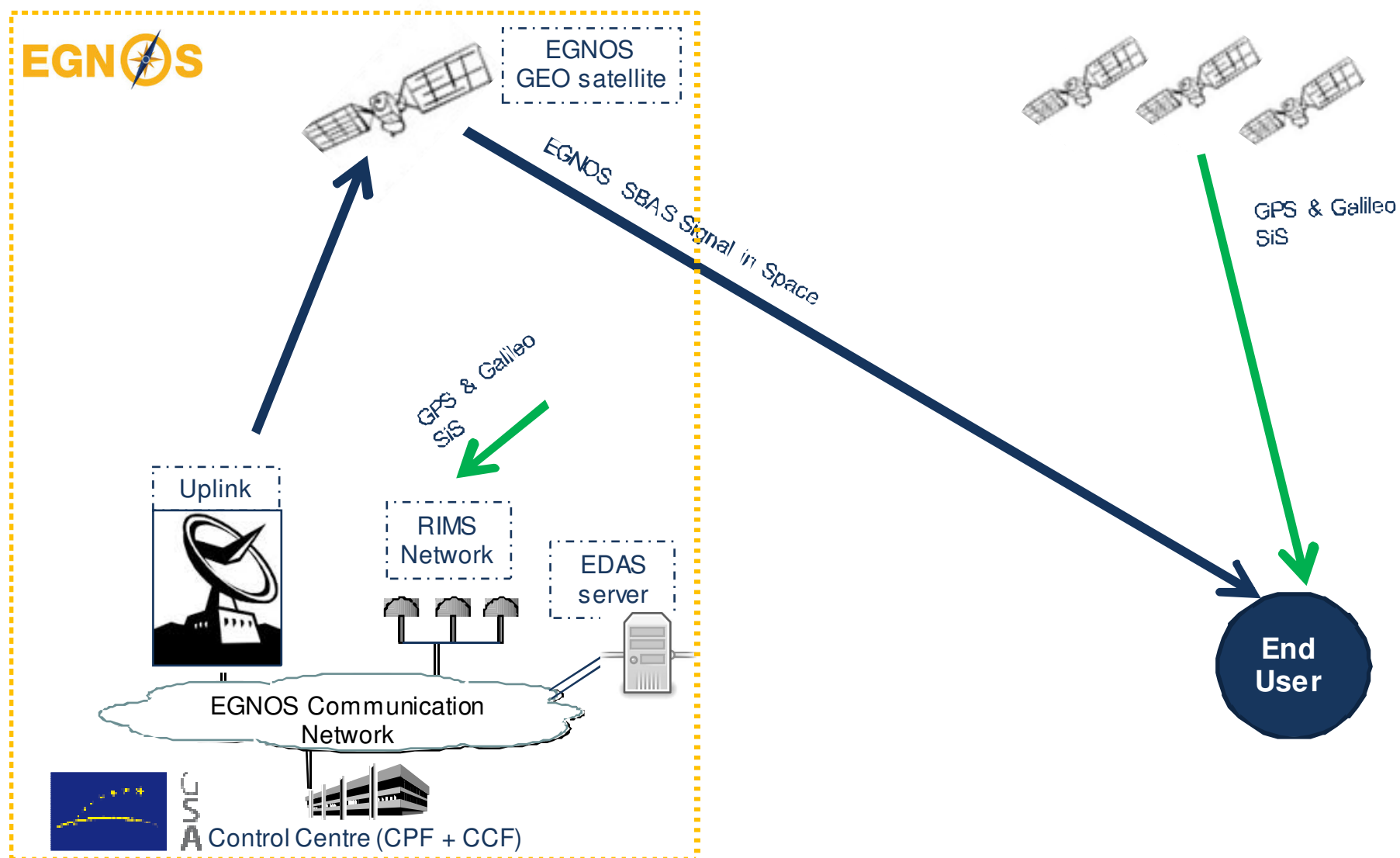
# BACK-UP SLIDES

[Fiammetta.Diani@gsa.europa.eu](mailto:Fiammetta.Diani@gsa.europa.eu)

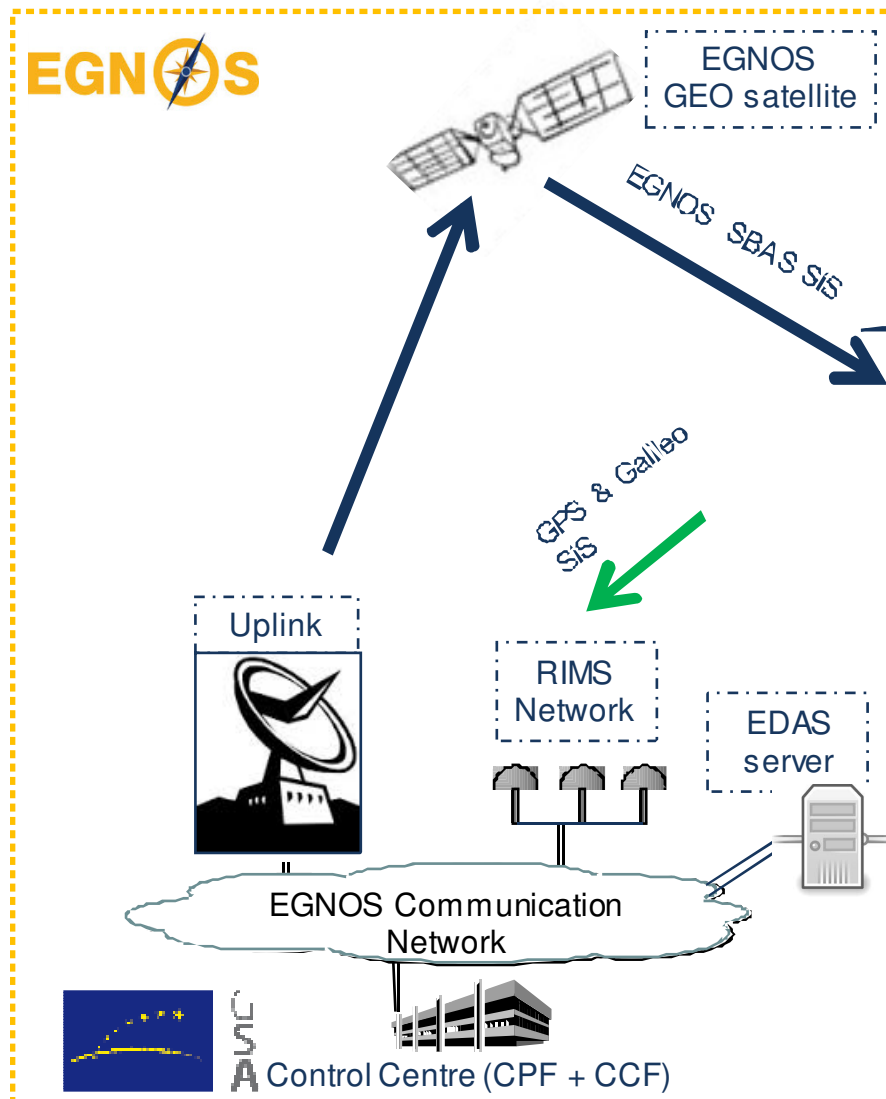
[Manuel.LopezMartinez@gsa.europa.eu](mailto:Manuel.LopezMartinez@gsa.europa.eu)

Market Development

# The way EGNOS SoL works (1/3)



# The way EGNOS SoL works (2/3)



GPS corrections are calculated and provided in the EGNOS signal for

- GPS satellite clock and ephemeris
- Ionosphere/troposphere errors

EGNOS detects any anomaly in GPS and in the EGNOS system itself and warns users within the Time To Alert (TTA) if an error exceeds the threshold (i.e. so-called 'alert limit')

**EGNOS does this detection by calculating the user residual error for users on given geographical grid points and checking that it is less than the specification (i.e. system internal check in the control centre); if not, EGNOS raises an alarm to users in the signal-in-space ("do not use")**

# The way EGNOS SoL works (3/3)

**Additional corrections are calculated on the user side to consider**

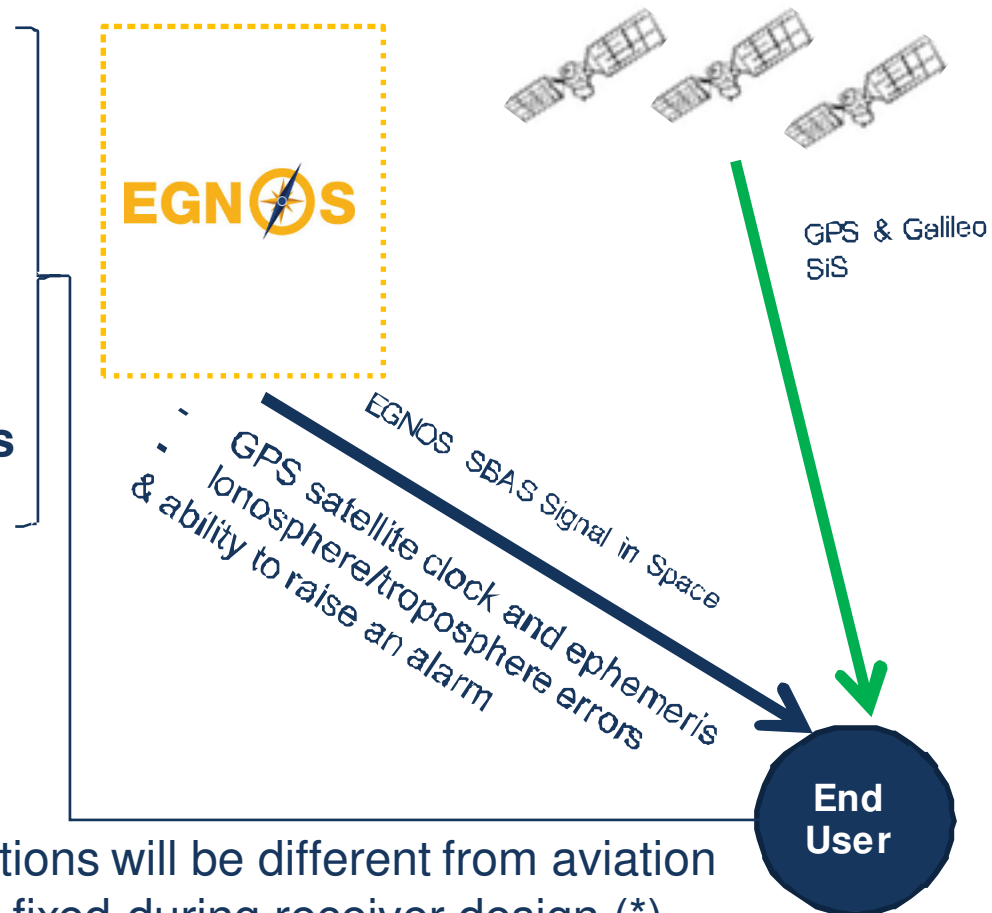
- Multipath
- Receiver thermal/tracking noise
- Shadowing
- Local interference

**and used on top of the corrections received from the EGNOS signal**

=> Bound of the residual error that users can expect (i.e. user-level integrity)

**These corrections all depend on a**

**user location+environment:** corrections will be different from aviation for a maritime user; models used are fixed during receiver design (\*)



(\*) This is standardised for the EGNOS SoL but up to the receiver manufacturer for EGNOS OS.

# Outline

- The way EGNOS works for a safety service
- EGNOS capabilities today
- Maritime Service Development
- Open points / way forward

# EGNOS capabilities today

EGNOS provides three services:

- **Safety Service**, designed for aviation;
- **Open Service (OS)**: today there is no unique standard describing the use of EGNOS messages for OS receivers, this service can only be used for non safety-critical purposes, it is provided without service guarantee or liability;
- **EGNOS Data Access Service (EDAS)** for access to data via the internet

Each service is provided within its respective **service area, defined in the Service Definition Document (SDD)**.

EGNOS Services are intended to be **provided for a minimum period of 20 years**, as from its first declaration date, with **6 years advance notice in case of significant changes** in the Services provided.

The infrastructure is owned by the European Commission who also finances the operations, maintenance and evolutions of the system & services. Each service is provided **free of end user charges**.



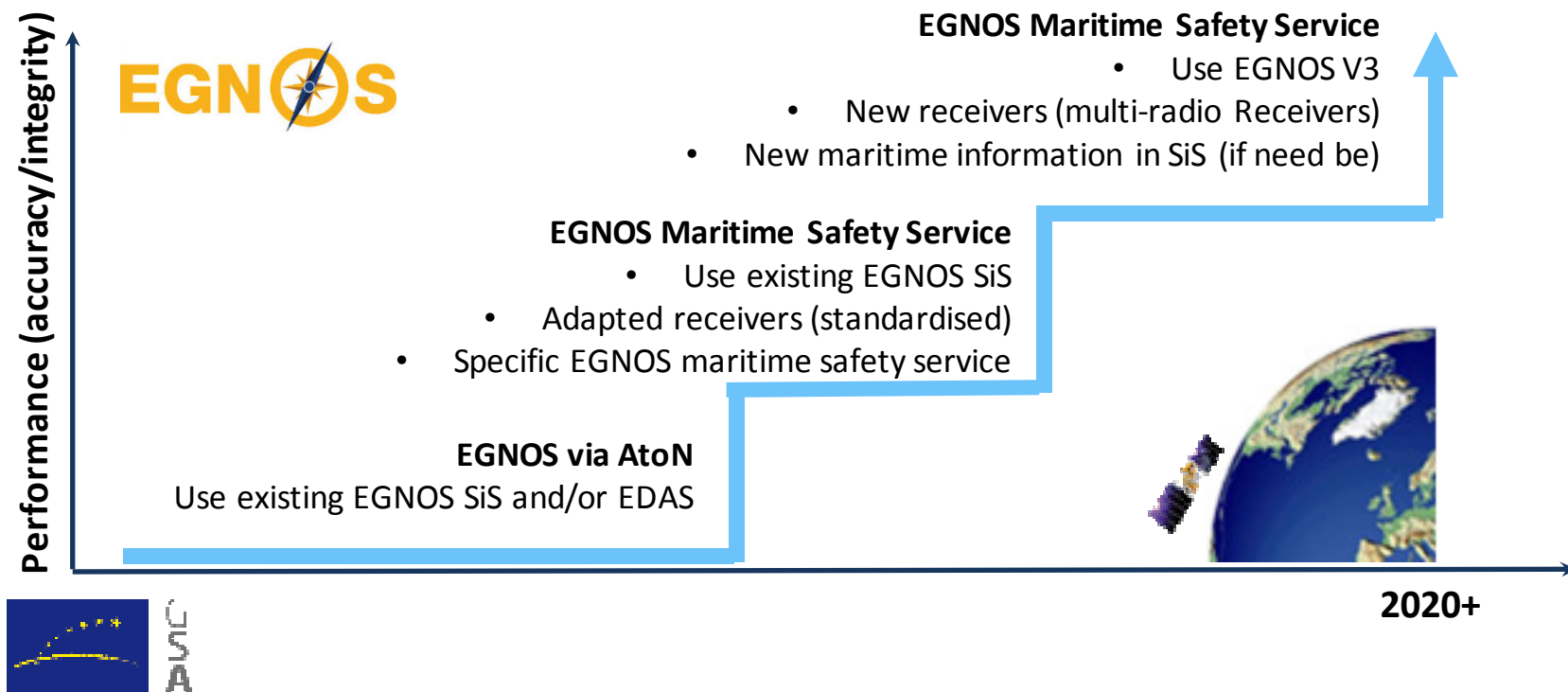
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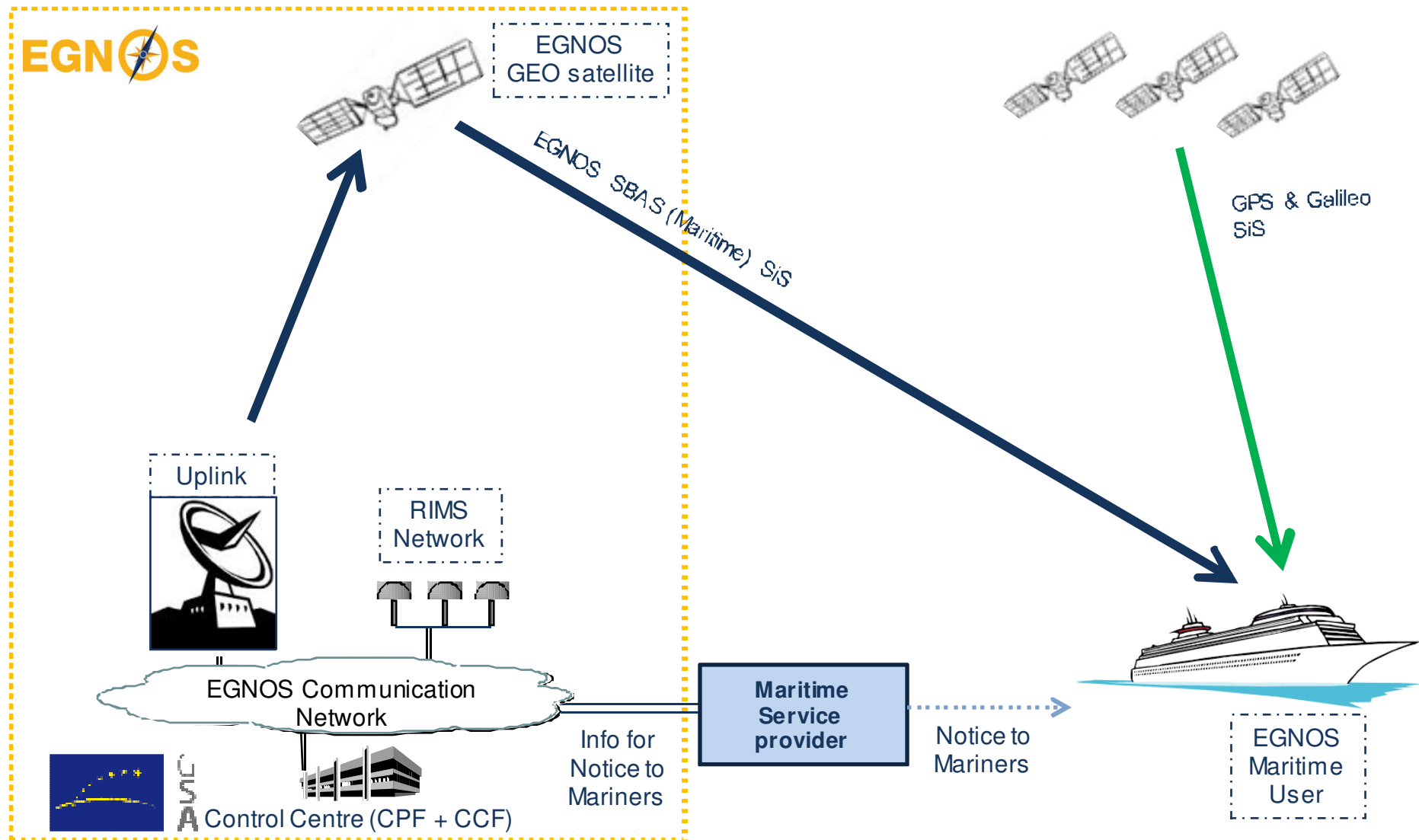
# Maritime Service: incremental steps

3 steps for EGNOS use:

1. Use of EGNOS corrections via existing AtoN
2. Adapt receivers to use EGNOS SiS directly i.e. maritime safety service
3. Maritime safety message in SiS (if need be) and multi-radio receiver



# Maritime service delivery to end user: with EGNOS SiS



# Maritime service delivery to end user with EGNOS SiS

## Two possibilities for the Signal-in-Space:

1. **Use the EGNOS Signal-in-Space as is** (i.e. no specific maritime message) and upgrade of receivers:
  - upgrades of existing Open Service receivers
    - Follow guidelines to ensure homogenous characteristics of manufacturers' existing products
    - Increase performance by adding system-level integrity & alarm mechanism (+ user-level integrity if need be)
  - in the future, new multi-radio receivers (cf IMO NCSR on-going work)
2. **Create a specific 'maritime message' in the EGNOS SiS**; this will need change of the EGNOS system infrastructure itself and new/upgrade of user receivers



# Maritime service delivery to end user with EGNOS SiS

- Open questions:

## At user receiver level

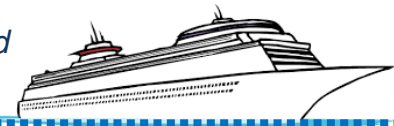
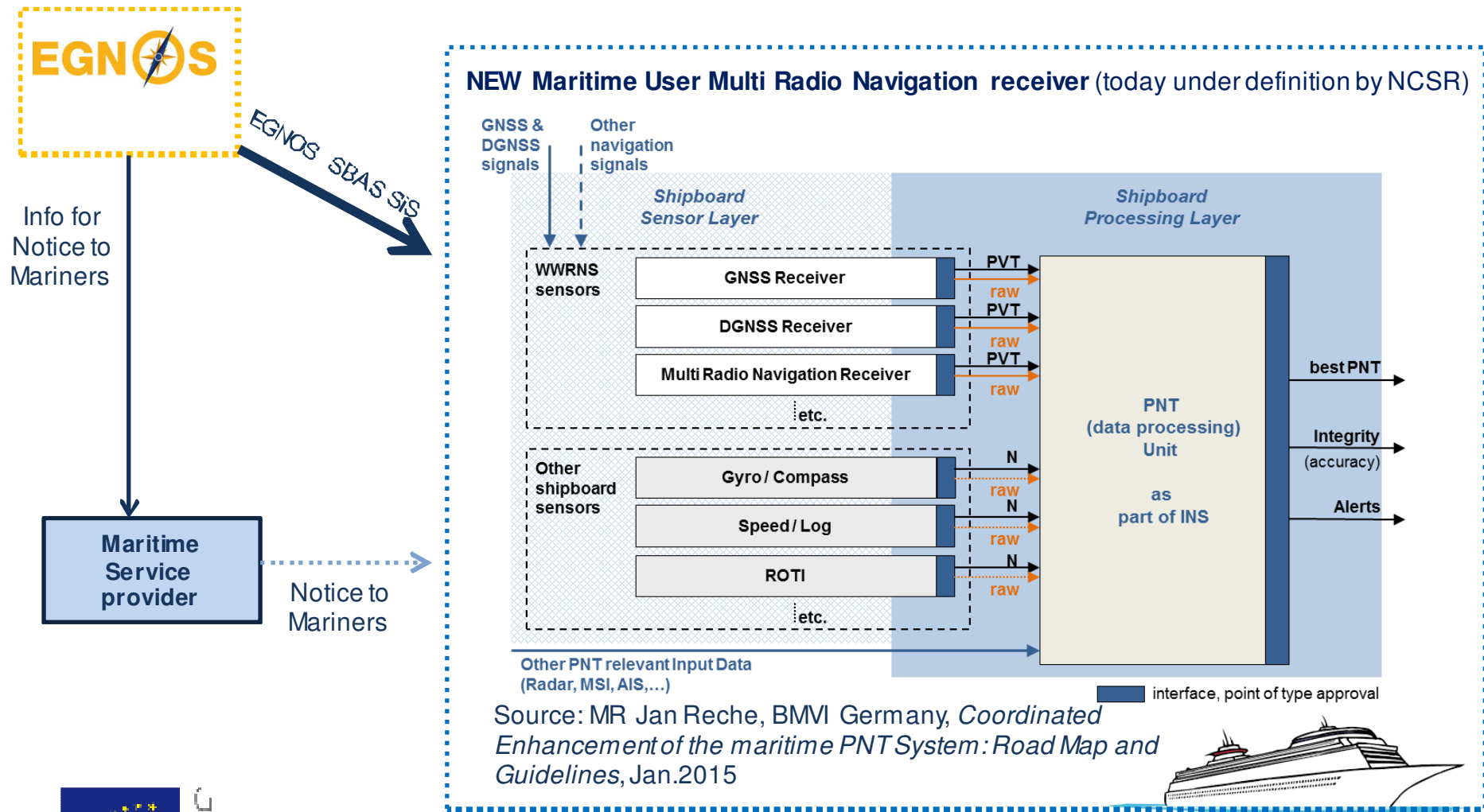
- ❖ There is no standard for OS receivers today so no homogeneity: **under what conditions would users accept to equip and/or retrofit to get the added value of integrity information?**
- ❖ How long will it take for the multi-radio receiver to become a certified product? (Wheelmark?)

## At EGNOS system level

- ❖ Do we need to ensure coverage beyond the footprint of the EGNOS GEO satellite (Arctic)? If so, how? (i.e. how is the additional infrastructure financed?)
- ❖ Developing a **maritime message** sent within the SiS would require to modify the EGNOS system itself and likely require adjusting the SBAS standards (ICD, SARPs) to make sure other users are not impacted => **this is complex and therefore is a long-term approach (ie. EGNOS V3)**



# Maritime service delivery to end user: future multi-radio receivers



# Steps to introduce a maritime service

Because EGNOS is operational and used for safety services, any modification of the EGNOS system follows a **strict process of upgrade called 'release'**, with sequential steps until technical Qualification. Qualification depends on the process required to be followed by users.

=> **What qualification process for a maritime safety service?**

Certification of (parts of) the EGNOS system or of the Service Provider might be required (TBD). For aviation there is no certification of the system but a certification of the EGNOS service provider instead; it is based on declarations of suitability for use of system constituents which are provided by manufacturers of equipment.

=> **What is the certification process for a maritime safety service?**

The process leads to the **Service Declaration**, with the associated SDD document. The duration of the steps depends on the complexity of the upgrade.



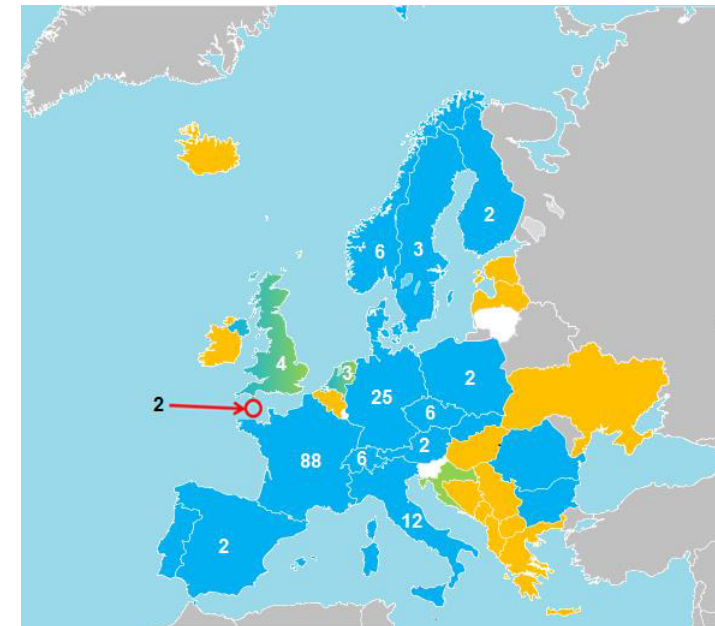
# EGNOS Service provision for aviation

## Concept of EWA

An **EGNOS Working Agreement (EWA)** is signed between the EGNOS Service Provider (ESSP) and the Air Navigation Service Provider implementing EGNOS based operations (e.g. landing procedure). This EWA is **the legal commitment** between ESSP and the ANSP.

Each National Supervisory Authority (NSA) requires this EWA before approving EGNOS-based procedures.

ESSP then provides **services** to Service Providers who signed the EWA, **such as data recording, Notices to Airmen** (i.e. planned unavailability), etc. and **involves them in decision-making**



USA

=> What link between ESSP & maritime authorities/service providers?

# Outline

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# Way forward: GSA activities

## 1. Service provision

- Understand needs of users & Maritime Authorities (esp. liability scheme and roadmap for introduction of new services + AtoN lifecycle)
- Understand the **qualification & certification processes** for maritime safety

## 2. Technical aspects at system level & receiver level

- **Mission study** to understand long-term user needs then define the integrity concept, trade-off possible system architecture & performance, consider hybridation of technologies
- Encourage test of the concepts (**pilot projects** with maritime authorities/users)

## 3. Standardisation (esp. receivers)

- Follow work of IALA, IMO NCSR, IMO MSC, RTCM and IEC
- Understand users needs and determine under what condition standards for receivers would be beneficial
- **Understand the timeline** to make realistic assumptions for a system release



# Topics for next meeting(s)

1. Define the qualification process for a maritime safety service
2. Define the certification process for a maritime safety service and/or service provider, incl. scope of an EGNOS Working Agreement

**Objective:** Determine a realistic roadmap for adoption of new services integrating all pre-requisites for a safety service (standardisation of receivers, certification, regulatory, etc.)

## Proposed dates for next meeting(s)

- End of June, possibly at the GSA in Prague, date TBD by EMRF Chairman
- October of EMRF meeting during ENAV Committee or during IAIN conference

