EGNOS and Galileo Maritime Safety Information (MSI) Requirements, Promulgation Scheme and Operational Concept

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ESSP Trust, from space to cockpit, for one clever sky.

IHO WWNWS 30/08-03/09

Galileo is the European GNSS offering a wide range of services

Open Service (OS)

Galileo open and free of charge service set up for positioning and timing services (operational since 2016). It is plan to deliver navigation message authentication (OS-NMA, 2022+).

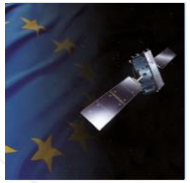
Search and Rescue Service (SAR)

Europe's contribution to COSPAS-SARSAT, an international satellite-based search and rescue distress alert detection system. Forward Link service operational since 2016. Return link service operational since 2020.

High Accuracy Service (HAS)

A service complementing the OS by providing an additional navigation signal and added-value services in a different frequency band. The HAS signal can be encrypted in order to control the access to the Galileo HAS services (HAS, 2022+)

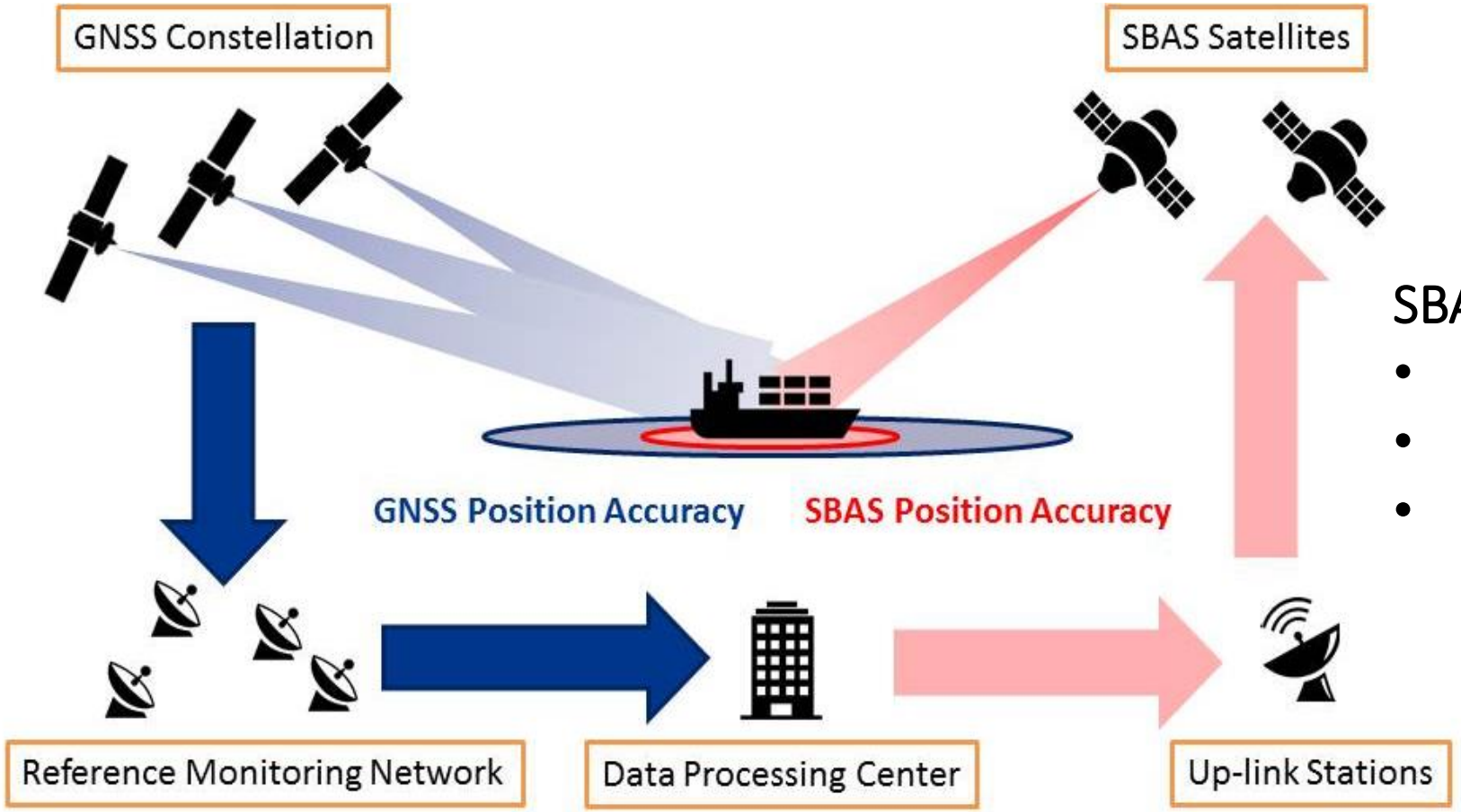
Public Regulated Service (PRS)



Service restricted to government-authorised users, for sensitive applications that require a high level of service continuity

Galileo was recognised by IMO in 2016 as part of the World Wide Radionavigation System, allowing for its use in Merchant Shipping (IMO SN.1/Circ.334)

EGNOS: The European Satellite-Based Augmentation System (SBAS)



SBAS provides:

- Pseudorange corrections
- Satellite & system alerts
- Better accuracy wrt GNSS standalone

User Level : The International Maritime Organisation (IMO) requires in GNSS receivers multiconstellation and augmentation for merchant vessels

IMO Res. MSC 401 (2015): Minimum requirements:

- Track at least 2 constellations of GNSS belonging to World Wide RadioNavigation System (WWRNS), e.g. GPS + Galileo
- Have the capacity to process augmentation signals, e.g. SBAS

RESOLUTION MSC.401(95)
(Adopted on 8 June 2015)
PERFORMANCE STANDARDS FOR MULTI-SYSTEM SHIPBORNE RADIONAVIGATION RECEIVERS

MSC 95/22/Add.2
Annex 17, page 4

3 OPERATIONAL AND FUNCTIONAL REQUIREMENTS (MODULE B)

The equipment should:

3.1 Operate using civil access navigation signals of at least two independent GNSS recognized by the Organization as part of WWRNS, provided in the radionavigation satellite service (space-to-Earth) frequency bands designated in article 5 of the Radio Regulations[5];

3.4 Have the facilities to process augmentation data, in accordance with the appropriate methods[6];

[6] e.g. Recommendation ITU-R M.823, RTCM 10410, or other relevant standards , already existing or still to be developed in particular for Satellite Based Augmentation System (SBAS) adoption.

IMO allows the use of Galileo and EGNOS in Receivers if system operational requirements are met and if there are receiver standards in place.

Service Level : Promulgation of Maritime Safety Information (MSI) is an operational requirement for GNSS as per IMO Res. A.1046 (2011)

- IMO Res. A.1046 establishes the operational requirements for a GNSS to be usable in merchant vessels and then to be a component of the WWRNS.

- Operational requirements defined in Annex of this resolution:
  - MSI promulgates information about malfunction of aids to navigation and therefore is a suitable mechanism to report on outages of GNSS or their augmentation systems.

	Horizontal Accuracy 95%	Signal availability	Service continuity (over 15min)	Position update rate	Integrity warnings[1]	System coverage
Ocean waters	100m	99.8%	-	2s	**MSI as soon as practicable**	Adequate[2]
Harbour entrances, harbour approaches and coastal waters	10m	99.8%	99.97%	2s	10s	Adequate[2]

[1]Generation of integrity warnings in cases of system malfunctions, non-availability or discontinuities.

[2]Taking into account the radio frequency environment, the coverage of the system should be adequate to provide position-fixing throughout this phase of navigation.

EGNOS MSI requirements are approved at Programme Level

EGNOS Maritime service is planned to be operational by 2023 (augmenting GPS only)

→ EGNOS will be the first SBAS providing Maritime Safety Information to maritime users implementing IALA Guidelines 1152 on the SBAS Maritime Service.

- The EGNOS MSI Service is aimed at providing timely information to EGNOS (L1) maritime service users on service outages.
- In line with the Joint IMO/IHO/WMO Manual on Maritime Safety Information and as indicated in the IMO A.1046 operational requirements, the means for providing information on deviations of radionavigation services is the MSI.

Requirement Description
EGNOS **shall** provide the data to support the MSI service in particular: - EGNOS maritime service outages due to planned maintenance activities at least **72 hours** in advance. - EGNOS maritime service outages due to unplanned system events **within 2 hours**. Note: the notifications will be provided using a prediction tool, which will compute the impact of planned (e.g. EGNOS maintenance activities) and unplanned (e.g. GPS and EGNOS satellite status, EGNOS RIMS status) events and if needed, send notifications of potential EGNOS outages to maritime users. Note: EGNOS outages means degradations of the EGNOS service performance impacting the maritime users.
The EGNOS MSI service **shall** be provided on a 24/7 basis.

Galileo shall support navigation of Merchant Vessels

- Galileo was recognised by IMO as part of WWRNS (Circular SN.1/Circ.334 (2016)). However today:
  - (1) Galileo is not yet in full operational capability (FOC).
  - (2) Galileo does not provide warnings of system malfunction.

A new Galileo MSI function would provide valuable information to mariners

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SN.1/Circ.334
20 May 2016

RECOGNITION OF THE GALILEO GLOBAL NAVIGATION SATELLITE SYSTEM AS A COMPONENT OF THE WORLDWIDE RADIONAVIGATION SYSTEM

1 The Maritime Safety Committee, at its ninety-sixth session (11 to 20 May 2016), pursuant to operative paragraph 4 of resolution A.1046(27) on *Worldwide Radionavigation System*, recognized the Galileo Global Navigation Satellite System (Galileo GNSS), proposed by the European Commission, as a component of the Worldwide Radionavigation System.

2 The Committee's decision was based on the recommendation and assessment made by the Sub-Committee on Navigation, Communications and Search and Rescue (NCSR) at its third session (29 February to 4 March 2016). The NCSR Sub-Committee assessed the offer of the European Commission in accordance with the requirements of the annex to resolution A.1046(27). The NCSR Sub-Committee had agreed that Galileo GNSS meets the operational requirements of the appendix to resolution A.1046(27) to assist in the navigation of ships in ocean waters.

3 Administrations should note that, in future, the static and dynamic accuracy of the system is expected to be better than 10 metres with a probability of 95%, with integrity provided by Receiver Autonomous Integrity Monitoring (RAIM) techniques (as per resolution MSC.233(82)), and therefore, once full operational capability is met, it will be suitable for navigation in harbour entrances, harbour approaches and coastal waters.

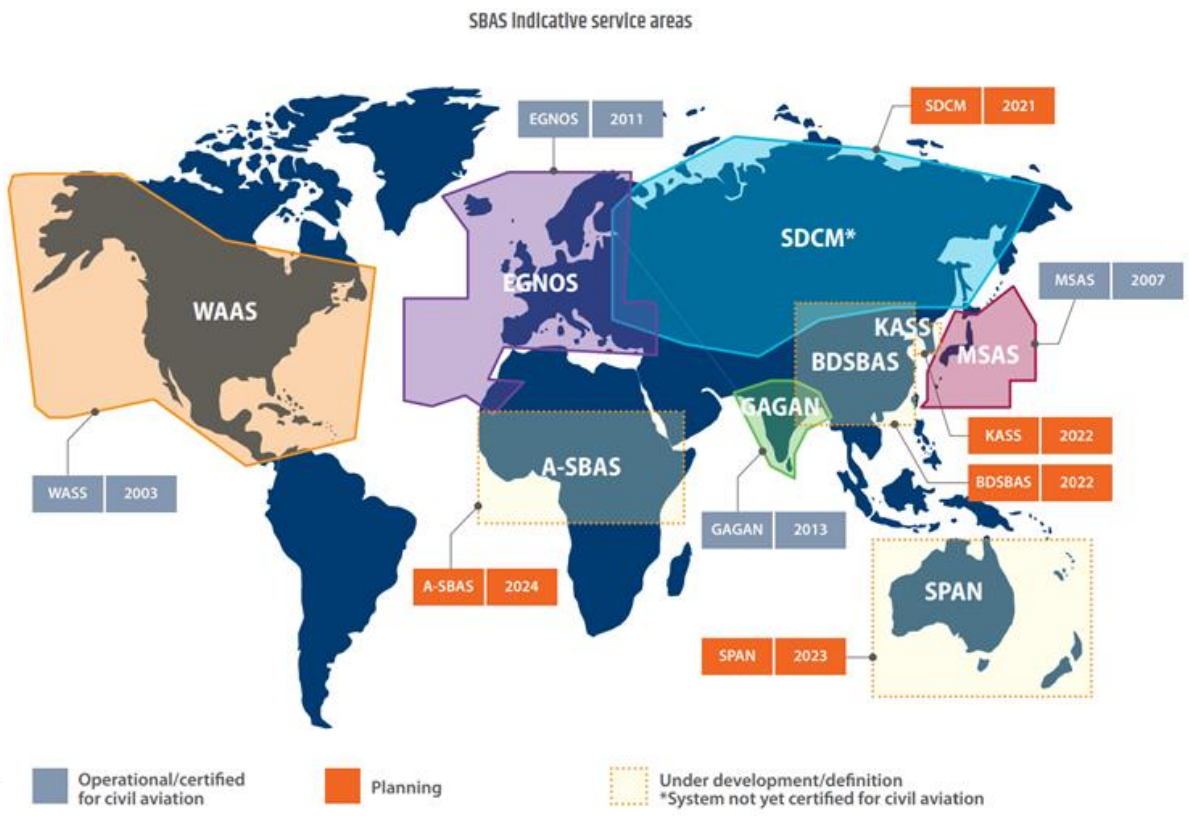
4 Galileo GNSS does not provide instantaneous integrity warnings of system malfunction. It should also be noted that the accuracy and integrity of the system can be greatly enhanced by the use of differential correction techniques using either local or wide area augmentations, or both.

5 Member States are invited to bring this information to the attention of all concerned.

Complementarity of MSI functions

- MSI EGNOS function – will provide information, in Europe, about EGNOS planned and unplanned service outages.

- A new MSI Galileo function – could provide information, worldwide, about Galileo planned and unplanned service outages



User Consultations on requirements for MSI of EGNSS

- EMRF: User requirements identification and definition of operational concept with European Navarea coordinators (I,II,III,XIX) for EGNOS MSI promulgation at European Level (October 2019).

- IALA: Presentation of operational concept at international level with representatives of IMO and IHO for EGNSS MSI promulgation (October 2020).

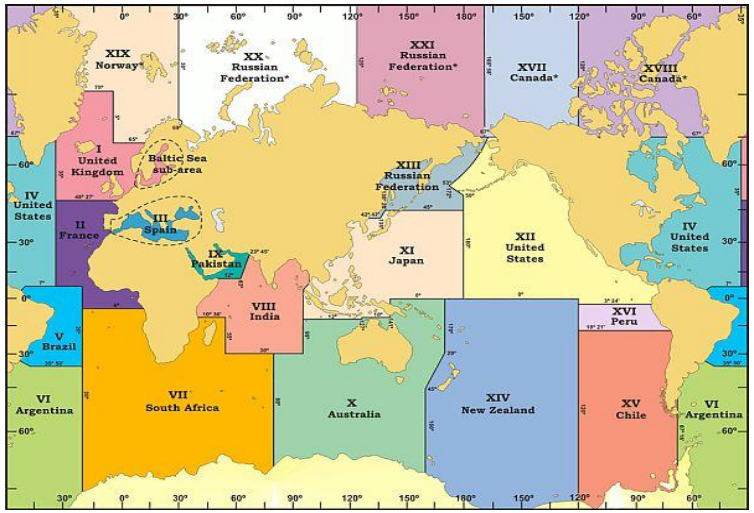
- IHO: Consultation with main IHO WWNWS representatives for consolidation of the MSI operational promulgation concept for EGNSS (September 2021).

Procedures for the provision of MSI

- **NAVAREA warnings:** issued by a NAVAREA coordinator and include information required by ocean-going mariners for safe navigation. They are principally affecting main shipping routes and offshore areas, so they are broadcast via satellite.

- **COASTAL warnings**: issued by a National Coordinator and include information required by all vessels for safe navigation within the given area. They are broadcast using NAVTEX, complemented by radio telephony broadcasts.

- **LOCAL warnings:** issued by a Local Coordinator; for example a port or harbour authority. They include information required for safe navigation within port or inshore waters that passing ocean-going vessels do not require. These warnings are broadcast mainly using VHF and voice communications.



The world's oceans are divided into 21 geographical sea areas, called NAVAREAs (NAVigational AREAs)

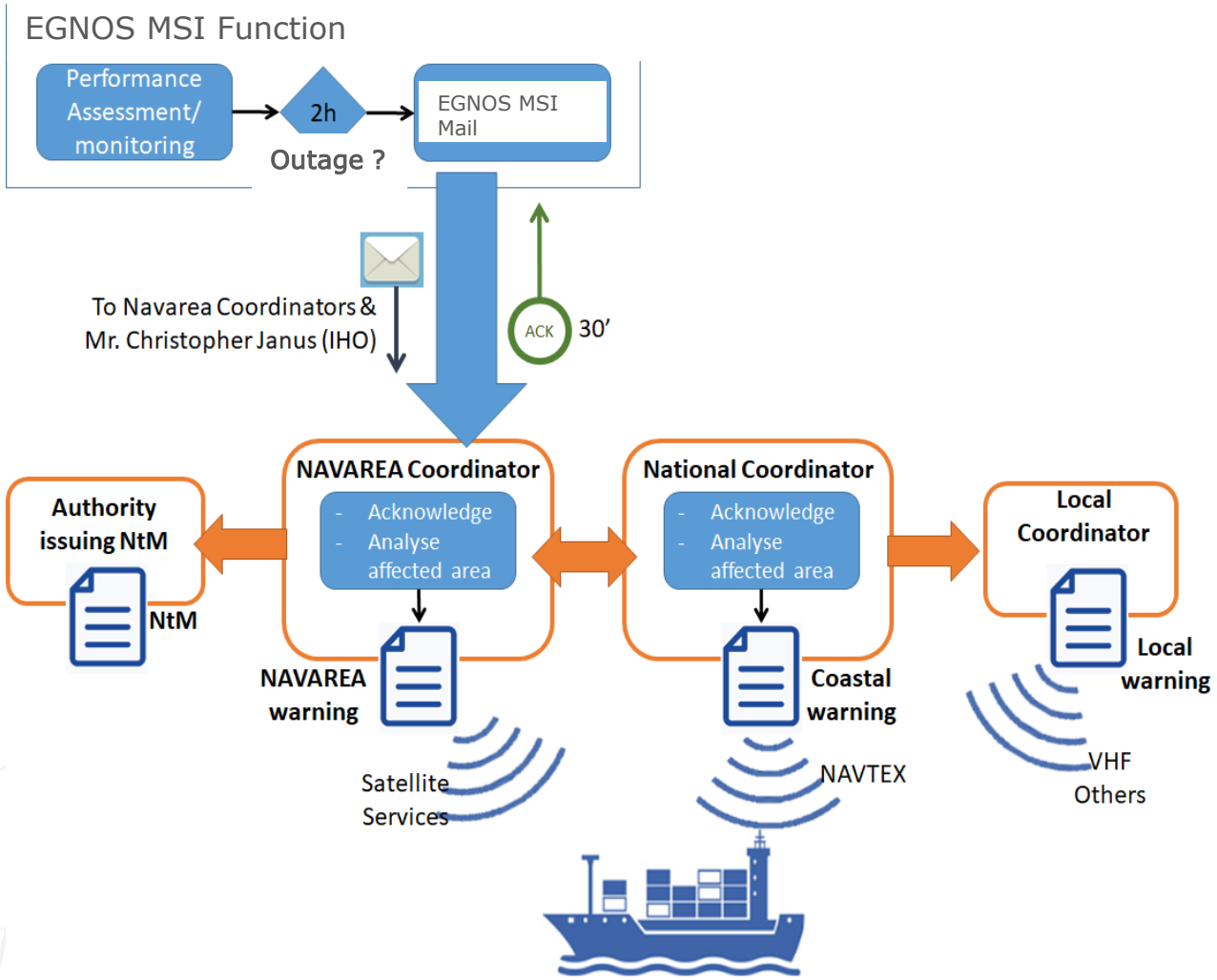
- Navigational warnings should be broadcast as soon as possible or as dictated by the nature and timing of the event.
- Whenever possible, warnings concerning critical scheduled events, should be originated not less than five days in advance.
- In English and using structured messages in standard format, as shown in the MSI Manual

EGNOS Maritime Safety Information (MSI) Function

- The EGNOS MSI Function will monitor EGNOS performance wrt IMO Resolution A.1046 operational requirements and will communicate any **scheduled** event or **unscheduled** outages in the service:
  - **Scheduled** events should be communicated with at least:
    - **72h (EMRF req / EGNOS MRD)**

    before the service is affected
  - **Unscheduled** outages or events shall be notified
    - **within 2h (EMRF req / EGNOS MRD)**

- A standard mail shall be sent to the corresponding NAVAREA Coordinator **(IHO req)**



EGNOS Maritime Safety Information (MSI) Service

- EGNOS MSI Messages (Mails) will be issued in English and shall contain the following fields

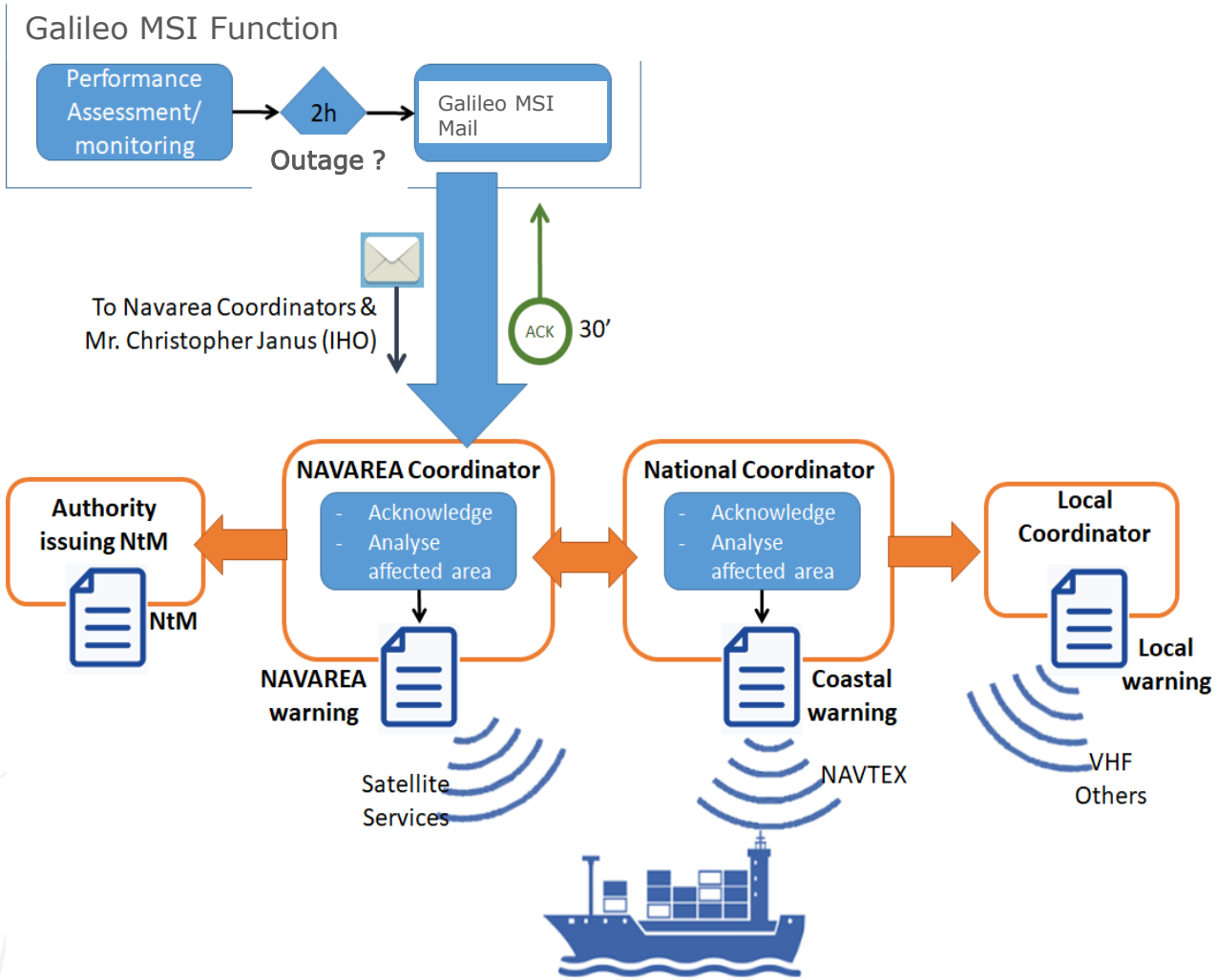
FIELD	CONTENT
Message identifier:	EGNOSMSG XXX/YY (sequential number)
General Area:	EGNOS MARITIME SERVICE
General Subject: the nature of the event	EGNOS NOT AVAILABLE FOR MARITIME NAVIGATION
Geographical Position	Area limits/position in WGS84 in degrees and minutes or degrees, minutes and decimal minutes. Positions listed in a clockwise direction starting from the North West corner. Latitude: DD-MMN or DD-MMS Longitude: DDD-MME or DDD-MMW
Amplifying remarks	Date, time and duration of the event FROM: DDHHMM UTC MoMoMo YY; TO: Unknown or DDHHMM UTC MoMoMo YY Note: the ending time can be included if known. If not known, a recovery message is needed.

- The NAVAREA/Sub-Area should be responsible for the issuing and formatting the final Navigational warnings

Galileo Maritime Safety Information (MSI) Function (under study)

- The **Galileo MSI Function** will monitor the **Galileo** performance wrt IMO Resolution A.1046 operational requirements and will communicate any **scheduled** event or **unscheduled** outages in the service:
  - **Scheduled** events should be communicated with at least:
    - **48h (Galileo Nagus req (TBC))**

    before the service is affected
  - **Unscheduled** outages or events shall be notified
    - **Within 30h (Galileo Nagus req (TBC))**
- A standard mail shall be sent to the corresponding NAVAREA Coordinator **(IHO req)**



Galileo Maritime Safety Information (MSI) Service

- Galileo MSI Messages (Mails) will be issued in English and shall contain the following fields

FIELD	CONTENT
Message identifier:	GALILEOMSG XXX/YY (sequential number)
General Area:	GALILEO MARITIME SERVICE
General Subject: the nature of the event	GALILEO NOT AVAILABLE FOR MARITIME NAVIGATION
Geographical Position	Area limits/position in WGS84 in degrees and minutes or degrees, minutes and decimal minutes. Positions listed in a clockwise direction starting from the North West corner. Latitude: DD-MMN or DD-MMS Longitude: DDD-MME or DDD-MMW
Amplifying remarks	Date, time and duration of the event FROM: DDHHMM UTC MoMoMo YY; TO: Unknown or DDHHMM UTC MoMoMo YY Note: the ending time can be included if known. If not known, a recovery message is needed.

- The NAVAREA/Sub-Area should be responsible for the issuing and formatting the final Navigational warnings

Summary and Request to IHO WWNWS

The committee is requested:

A) To consider the EGNOS/Galileo Maritime Safety Information (MSI) proposal and

B) To support the promulgation of such data to final users according to the proposed operational concept, considering:

1) EUSPA, by means of the service provider, will inform corresponding Navarea Coordinators and the chair of WWNWS of any planned/unplanned service outage following the proposed message format and times.

2) Navarea coordinators will acknowledge the reception of such proposals of Maritime Safety Information and will promulgate the information to mariners following the procedures established in the Joint IMO/IHO/WMO Manual on Maritime Safety Information.

Note: EGNOS Maritime Safety Information function is planned to be operational by mid-2023. Galileo Maritime Safety Information function development is under study.

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