USER CONSULTATION PLATFORM 2020

MINUTES OF MEETING OF THE MARITIME AND OCEAN MONITORING PANEL

Meeting Date	01.12.2020	**Time**	14:00-17:30
Meeting Called By	GSA	**Location**	Online event
Minutes Taken By	Thiago Tavares (VVA)	**Next Meeting Date**	UCP 2022
Attendees	**Philipp Scheidemann (GSA), Panel moderator** **Thiago Tavares (VVA), Panel coordinator** **User Community Representatives** Johan Gahnström (CompetenSEA), **Panel Users' Chair** **Full list of attendees presented in Annex 1.**		
Distribution (in addition to attendees)	UCP Plenary, GSA, Public		

Agenda Items	Presenter
14:00 – 14:10 Welcome and introduction	Philipp Scheidemann (GSA)
14:10 – 14:40 Introduction and Update on Maritime and IWW user needs and requirements for E-GNSS	
- Update on maritime user needs	Johan Gahnström (CompetenSEA)
- Update on inland waterways user needs	Gergely Mező (RSOE)
14:40 – 14:50 Introduction on Copernicus Services for Maritime, Inland and Ocean Monitoring: (Marine Copernicus and Land Monitoring service for inland waterways levels)	Fabienne Jacq (European Commission)
14:50 – 15:20 GNSS services for Maritime: EGNOS Maritime Service, Galileo OS Authentication (OS-NMA) and High Accuracy Service (HAS)	
- EGNOS Maritime Services	Silvia Porfili (GSA)
- Galileo OS Authentication (OS-NMA)	Jean-Pierre Barboux (GSA)
- High Accuracy Services (HAS)	Francisco Javier de Blas (GSA)
15:20 – 15:30 Break	
15:30 – 17:00 Discussion on GNSS requirements and synergies with Copernicus per applications	
- Ocean Monitoring for Navigation:	Johannes Hüffmeier (RISE) - PrepareShips project
- Maritime Surveillance Operations/Fishing Control:	Ismael Alcalá (ArXiTEC) and Ángela Cortina (ARVI) - Blue Box Porbeagle project
- Coastal Navigation:	Per Erik Kvam (Kongsberg) - MAREC project Marcos López Cabeceira (GMV) - ASGARD project
- Navigation in Inland Waterways	Michael Hoppe (WSV)
- Navigation in Ports:	Per Erik Kvam (Kongsberg) - H2H project Alexandru Pandele and Antonia Croitoru (RoInSpace) - MARGOT project
- Unmanned Vessels (MASS)	Ørnulf Jan Rødseth (SINTEF Ocean)
17:00 – 17:10 Research and Innovation Priorities for Maritime and Inland Waterways Operations	Antoine Borg (GSA)
17:10 – 17:30 Conclusion and Final Q&A	Philipp Scheidemann (GSA)

Summary

The Maritime and Ocean Monitoring panel of the third User Consultation Platform (UCP) took place on 1st December 2020 as an online event. The panel gathered 132 participants with comprehensive coverage in terms of value chain.

There is a clear trend to the development of new assistance functions and first steps towards automated vessels. This is valid not only for **maritime and inland waterways but also for Maritime surveillance and fisheries control**. GNSS is the central sensor to provide position velocity and time for navigation and new applications require high accuracy position, high integrity and resilience to jamming and spoofing (security) – not only related to GNSS but also to consider redundancy in navigation systems.

For **Maritime user requirements**, the only update that is of any substance is the addition of the requirement of resilience of PNT solutions. This comes from new guidance from both IMO and IALA. The most important update for the maritime sectors is on IALA sources, this comes with the fact that IALA now is and international recognised organisation and can now issue standards. IALA therefore have issued standards, one that is of importance to the PNT solutions, that in general points at their older publications already in the sources list.

For **Inland waterways**, **new requirements were identified**. **Horizontal positioning accuracy** is required to be **less than 5 m with detection on errors > 3 σ within 30 seconds integrity** (iECDIS navigation mode) while **some applications**, such as mooring assistance, **require 10 cm horizontal positioning accuracy** (H2H and LAESSI projects). The LAESSI project has also identified additional new requirements for IWW applications in relation to smaller **time to alert (less than 6 s)** and **integrity risk (less than 10^{-5} within a period between 2 minutes to 1 hour depending on application).**

The panel also explored the **synergies between EGNSS and Copernicus**. Copernicus already have well established services for maritime, inland and ocean monitoring. New EGNSS services have high potential to benefit the sector and there are important potential synergies with Copernicus that should be fully exploited.

For **fisheries control**, Copernicus is widely used but a precise verified location would be essential for monitoring of vessels and use in legal disputes. Galileo (at meter level) and OS-NMA authentication would be very important to ensure undisputable position.

For **autonomous vessels**, High Accuracy Service (HAS) for high accuracy, EGNOS Maritime Service for integrity, Galileo Authentication (OS-NMA) for security and when integrated to Copernicus Marine Monitoring services could also benefit from the optimisation of routing.

New applications for **inland shipping** (such as **bridge collision warning, automatic guidance and mooring assistance**) will ask for improved performance requirements for PNT data provision, for example high horizontal position accuracy (<30 cm) and high integrity.

Minutes of Meeting

Selection of the users' chairperson
Johan Gahnström (CompetenSEA) was selected as chairperson.

General discussion notes
This section presents the overview of the general discussion notes and presentations.

Updates on maritime user needs, Johan Gahnström (CompetenSEA)
Mr Gahnström presented the updates in relation to the maritime user needs and its sources. The only update that is of any substance is the addition of the requirement of resilience of PNT solutions. This comes from new guidance from both IMO and IALA. When it comes to sources, the most important update is linked to IALA. This comes with the fact that IALA now is and international recognised organisation and can now issue standards. IALA as a consequence have issued standards, one that is of importance to the PNT solutions (Standard S1030). Important additions are that both IMO and IALA have added guidance on resilience of PNT solutions.

Updates on inland waterways user needs, Gergely Mező (RSOE)
Mr Mező presented the new requirements identified for inland waterways. Horizontal positioning accuracy is required to be less than 5 m with detection on errors > 3 σ within 30 seconds integrity (iECDIS navigation mode). Some other applications have more stringent requirements:

- Less than 30 cm (automatic guidance)
- Less than 20 cm (bridge collision warning, conning display)
- Less than 10 cm (mooring assistance)

The LAESSI project has also identified additional new requirements for IWW applications:

- time to alarm smaller than 6 s (IWW applications)
- integrity risk smaller than 10-5 per 2 minutes (bridge collision warning)
- integrity risk smaller than 10-5 per 10 minutes (mooring assistance)
- integrity risk smaller than 10-5 per 1 hour (conning display)

Copernicus contribution to maritime, inland and ocean monitoring sessions, Fabienne Jacq (European Commission)
Fabienne Jacq presented the different activities that Copernicus is capable of performing in the maritime domain (i.e. climate change, marine monitoring, security, emergency management) and the most relevant services linked to them. Regarding the requirements, within Copernicus the user requirements are all collected in centralised databases that the users can interact with and that are being shared with the wider public.

EGNOS Maritime Services, Silvia Porfili (GSA)
Silvia Porfili presented that an EGNOS Maritime Service should be implemented in incremental steps. The first step is the use of EGNOS corrections via existing AtoN (existing EGNOS SiS and/or EDAS). In the second step, EGNOS Maritime Service, it is necessary to adapted receivers to use EGNOS SiS directly (standardised via International Electrotechnical Commission (IEC)). The EGNOS maritime service needs to be defined in the Service Definition Document (SDD). The third step refers to the implementation of an EGNOS Maritime Safety Service (EGNOS V3), where a maritime safety message is delivered in SiS (if needed be) and received by new multi-system shipborne radionavigation receivers (MSR). EGNOS DFMC will enhance the performance of the service and provide service guarantee at SiS level.

Open Service Navigation Message Authentication (OS-NMA), Jean-Pierre Barboux (GSA)

Jean-Pierre Barboux presented the OS-NMA, a data authentication function aimed at reducing the GNSS vulnerabilities by detecting jamming and spoofing events. Mr Barboux explained that authentication works based on transmission of cryptographic material in previously reserved fields on the I/NAV message on the E1B signal component and that only OS-NMA ready receivers can decode these fields and authenticate the Galileo navigation data. The OS-NMA roadmap was presented and it was highlighted that public testing will take place in 2021. Interested entities can contact the GSA to receive more detailed information on how to get involved.

Galileo High Accuracy Service (HAS), Francisco Javier de Blas (GSA)
Francisco Javier de Blas presented the Galileo High Accuracy Service and its main characteristics both for Service Level 1 (Global coverage) and Service Level 2 (European Coverage Area). It was highlighted that the main target of HAS are emerging applications such as autonomous vehicles, drones or robotics, and other applications where 20cm positional accuracy is sufficient. The initial service capability is expected to be achieved in the course of 2021.

Ocean Monitoring for Navigation, PrePaRe Ships project, Johannes Hüffmeier (RISE)
The speaker presented the PrePaRe Ships project which aims at developing a robust and accurate navigation solution based on the features of Galileo signals in combination with other in-ship sensors. The project identified that the position and attitude determination system shall have the following accuracies:

- RTK accuracy (1 sigma):
  - horizontal accuracy of 3 cm
  - vertical accuracy of 6 cm
- PPP positioning accuracy (1 sigma):
  - horizontal accuracy of 30 cm
  - vertical accuracy of 60 cm
- Attitude accuracy:
  - heading accuracy of 0.5 degrees/baseline length
  - Pitch/ roll angle accuracy of 1.0 degrees/baseline length

For Copernicus, the following requirements have been identified:

- Requirements for Continuous, Real Time Operational Application
  - Spatial Resolution: At least 0.25° x 0.25° for wind and 0.083° x 0.083° for other data
  - Time Resolution: At least every 10-30 min for wind and current
  - Updating frequency: At least every hour
  - Spatial coverage: Global coverage, to be able to reach a global market
  - Data parameters: Wind speed and direction, possibly even surface currents and waves
- Requirements for Testing and Validation
  - Spatial Resolution: At least 0.25° x 0.25° for wind and 0.083° x 0.083° for other data
  - Time Resolution: At least every 10-30 min for wind and current
  - Updating frequency: At least every hour
  - Spatial coverage: Coverage of at least Northern Europe
  - Data parameters: Wind speed and direction, possibly even surface currents and waves

Maritime Surveillance Operations / Fisheries Control, Blue Box Porbeagle project, Ismael Alcalá (ArXiTEC) and Ángela Cortina (ArVi)

The speakers presented the Blue Box project, which aims at using Galileo for monitoring of the vessels position, course and speed of fishing vessels to better control the fishing activity. To Prototype and Build a close-to-market trusted multi-constellation dual-frequency VMS (Blue Box Porbeagle VMS shipborne equipment) as a cost-effective solution for replacement for current receivers. Accuracy is not one of the main drivers for Fisheries Control, but VMS shipborne receivers for fishing fleets will be disruptively enhanced with Galileo due to its increased accuracy at meter-level. Galileo must be the instrument to overcome these VMS vulnerabilities as the unique Satellite System providing civil navigation authentication (also relevant to provide precise verified location for emergencies and legal disputes).

Coastal Navigation, MAREC project, Per Erik Kvam (Kongsberg)

Per Erik Kvan presented the MAREC project. The main objectives of the project was to develop and test a maritime GNSS receiver based SBAS guidelines and to ensure early availability of SBAS receiver ready for type approval. In the MAREC project KONGSBERG has studied the implementation of SBAS in commercial maritime navigation receivers under SOLAS regulations and the key points regarding maritime navigation with SBAS are presented below:

- the existing SBAS SIS should be used
- protection level is optional
- quality estimates is mandatory, for example position error ellipses and 95% accuracy
- RAIM will be required also when applying SBAS corrections
- it will be the responsibility of the equipment manufacturer to find suitable algorithms
- compliance assessment with regard to performance standards is done by test.

Coastal Navigation, ASGARD project, Marcos López Cabeceira (GMV)

Marcos Cabeceira presented the ASGARD project. The project consists of the design, integration and V&V of a shipborne Dual-frequency Multi-constellation Galileo OS enabled including OS-NMA authentication and IEC GNSS approval. The project also has the objective to type approve the Galileo receiver following IEC standard 61108-3 and implement the algorithms to use the OS-NMA to support Resilient-PNT in maritime navigation, following GSA specifications.

PNT requirements for inland shipping, Michael Hoppe (German Federal Waterways and Shipping Administration)

Mr Hoppe started the presentation by highlighting that GNSS is the central sensor to provide velocity and time for navigation in inland waterways and that the main applications are currently Inland-ECDIS and Inland-AIS. AIS mobile (includes type approved GPS-board), radar and rate of turn indicator are mandatory equipment. No carriage requirements exist for EPFD onboard inland vessels and no firm requirements exists for a Heading device. Current position accuracy requirements for Inland ECFIS and Navigation are below 5 m. For Inland AIS, the position accuracy requirements range from 1 m for lock/bridge operation to 15-100 m for Medium-term ahead. There is a clear trend to the development of new assistance functions and first steps towards automated shipping. New driver assistance systems (applications) are rising with much more stringent PNT requirements, including improved performance requirements for PNT data provision and high accuracy positioning.

Navigation in Ports, Hull-to-Hull project, Per Erik Kvam (Kongsberg)

Per Erik Kvan presented the project Hull-to-Hull. The overall objective is to address the need of the maritime community to safely navigate in close proximity of other vessels and objects.

The H2H consortium performed testing of autonomous mooring and navigation with vessels with a variety of PNT sensors, and identified the following requirements:

- 3D model with known accuracy
- GNSS with high accuracy, authentication and high integrity. The required performance is highly dependent on the operation that is taking place. Typically, RTK or PPP accuracy is suitable. Reference data either from the other vessel or form the satellite service (SBAS or Galileo High Accuracy Service). Dual frequency, multi-constellation and data from other vessels can be used. Ability to calculate integrity risk (ARAIM like service)
- Alternative means under bridges and other structures e.g. inertial systems
- Vessel to vessel safe and secure communications
- Standardized exchange between the vessels

Navigation in Ports, MARGOT project, Antonia Croitoru (Romanian InSpace Engineering)
Antonia Croitoru presented the MARGOT project, of which main objectives were to determine over-bounding multipath and interference error models for the maritime environment, determine mitigation methodologies for multipath and interference and determine L-band channel models for the maritime environment. The project included data collection campaigns with vessels of different types (inland and maritime) and lengths (32m – 82m) operating in different environments (inland waterways, costal navigation and port navigation). After a presentation of the project, the speaker presented the following recommendations regarding multipath for maritime:

- Navigation phases can be grouped into the open navigation and port navigation
- Ships should be classified based on the amount of cluttering around the GNSS antenna. A mapping of the masking surfaces should be considered.
- The ICAO multipath model used in aviation is not suitable for maritime and fluvial navigation.
- Fluvial navigation should be divided into open fluvial navigation (wide navigation lanes, no bridges) and port fluvial navigation (high buildings on both shores, bridges).
- A minimum 20° elevation mask is recommended.
- Multipath models should be built based on measurements recorded in calm weather.
- The requirements on positioning accuracy should depend also on ship movement.
- At least 100 s smoothing is recommended.
- Additional integrity methods should be used at receiver level.

Unmanned vessels (MASS), Ørnulf Jan Rødseth (SINTEF Ocean)
Mr Rødseth focused his presentation on the introduction of autonomous vessels and confirmed the GNSS requirements previously mentioned by other speakers: accuracy, availability, authentication and integrity. He also mentioned that the development of unmanned vessels includes technologies such as VDES and AIS communications, IoT emergency communication, AIS tracking, Earth Observation and Data driven navigation.

Galileo Authentication, Antoine Borg (GSA)

Antoine Borg presented the three Galileo Authentication services, named Open Service Authentication (OSNMA), Commercial Authentication Services (CAS) and Public Regulated services (PRS). He also presented more in-depth the PRS and the trustable applications in Maritime (e.g. border protection or harbour infrastructure)

Answers to specific questions:

Three questions were created through polls to the UCP attendees and the results are presented below:

Poll 1: Which Copernicus services are you already using or planning to use in the future? *(Responses=40)*

- Climate change – 23%
- Marine monitoring – 35%
- Security – 15%
- Emergency management – 0%
- None – 20%
- Don't know / no opinion – 8%

Poll 2: Which of the new GNSS services are you expecting to provide more benefits to maritime, inland waterways and ocean monitoring applications? *(Responses=39)*

- EGNOS Maritime Services – 36%
- Galileo OS Authentication (OS-NMA) – 26%
- High Accuracy Services (HAS) – 36%
- None – 3%
- Don't know / no opinion – 0%

Poll 3: How do you see the synergies between Copernicus and EGNSS services to maritime, inland waterways and ocean monitoring applications? *(Responses=18)*

- Very high – 11%
- High – 33%
- Medium – 33%
- Low – 0%
- None – 0%
- Don't know / no opinion – 22%

Additional questions have been raised by the attendees and are presented below:

Q1. What are the plans for publication of future IALA standards publications? Is there any subject in particular that you can mention?

- Answer: The base standards will not differ drastically from the documents that have been published so far, but there is a plan to include some manuals and guidance in the upcoming publications.

Q2. What are the requirements for the mixed areas of navigation?

- Answer: In a lock or during manoeuvres, the requirement is between 0.5-1m maximum. This requirement is less stringent in the open navigation areas.

Q3. Please explain how are the alerts managed by the IWW applications? What happens after the system alert that the service is not available is processed by the solution and potentially presented to the mariner?

- Answer: In general, presently in IWW applications the GNSS quality of service is indicated (DGNSS available or not) but there is no special alert to GNSS problems. The special GNSS-based applications like 'bridge collision warning' of course provide direct alerts to the users.

Q4. Are new requirements for IWW in line with IMO resolution A.915(22)?

- Answer: Yes, the new (stricter) requirements were shown in the presentation.

Q5. For inland waterways, is there an integrity concept selected? Where can we find references?

- Answer: I am not aware if integrity concept has been selected. Sources of the new requirements will be available in the updated user requirement document to be published by the GSA.

Q6. Is there a service of Copernicus providing bathymetry data of rivers? In case yes, which is the accuracy, the update rate per day and the size of the monitored cell?

- Answer: Copernicus services do not provide bathymetry from rivers. It has water levels, water extent and river runoffs but not the bottom.

Q7. What is the process for collecting user requirements for Copernicus Services?

- Answer: In Copernicus, there is a central user requirements process and all the requirements are collected and made available to users and regularly updated

Q8. Which are the intended phases to be available for the OS-NMA receivers testing?

- Answer: First there is a development phase and in parallel there will be projects aiming at developing and testing of the use of the receivers. The GSA will shortly issue an OS-NMA information note that will include guidelines for the testing of the receivers that want to use OS-NMA. After this, there will be an active testing phase.

Q9. What is the GSA's approach to encourage the roll-out of the receivers?

- Answer: We can talk about different approaches: now we are promoting the development of different equipment (e.g. through fundamental elements). With respect to Galileo, the requirements are ready and now we are working on the development of new receivers that can also include new features allowed by Galileo.

Conclusions

The third edition of the Maritime and Ocean Monitoring UCP session is successfully closed by the GSA. Key results of this working session were highlighted during the plenary UCP session on December 7th, 2020 by Johan Gahnström (CompetenSEA).

Other Notes & Information
With the contribution of:

Annexes & Attachments
Annex1_UCP_ListAttendees_Maritime

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