Galileo Authentication Supporting Fishing Control Operations

Prof. Dr. Manuel Lopez

Senior Technology Officer,

Market Downstream and Innovation Department

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. **A new feature of authentication for the navigation message provided via Signal-in-Space will be available in 2024 (OS-NMA, 2024).**

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 available since 2016 and Return link service 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 and also via internet. Horizontal Accuracy 20 cm. Operational since January 2023.

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)
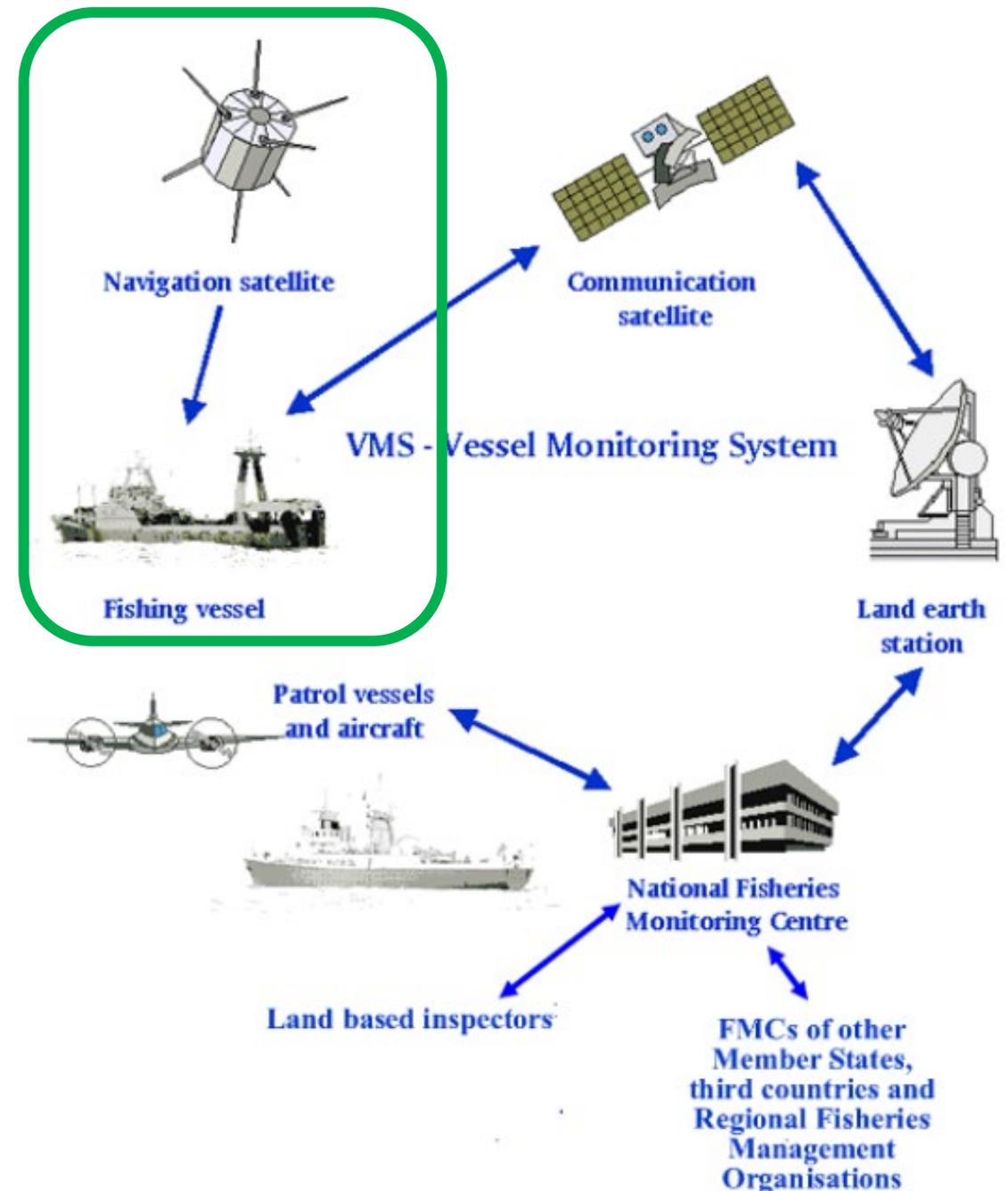
Galileo Navigation Message Authentication (OS-NMA)

- Galileo OS-NMA is a new public and free of charge service that:
  - will **authenticate the Galileo data** using the navigation message
  - will allow to **detect certain spoofing attacks**
  - will be **free of charge** to Galileo Users
- This mechanism provides users with an additional security layer so that to be reassured about the authenticity of the information received from Galileo satellites.
- Initial OS-NMA Signal-in-Space transmission in test mode started in 2021. Service provision is expected to start in Q1 2024.
- In the receiver, it takes 2.5 minutes for the initialization process and the first authentication. After that, next authentications takes around 1 minute.
- OS-NMA infonote, ICD and Guidelines for manufacturers available at https://www.gsc-europa.eu/electronic-library/programme-reference-documents#OSNMA

GALILEO OPEN SERVICE NAVIGATION MESSAGE AUTHENTICATION (OSNMA)

INFO NOTE

Use Case 1: Fishing Vessels

- Resilience of the VMS.
  - **Jamming** interference → already detected and reported to FMCs as signal lost.
  - **Spoofing** is a new cybersecurity vulnerability difficult to detect.

- Main driver for the use of **Galileo** is its new service providing **authentication** of the transmitted information. The **bluebox** will know if the data collected to compute the position is genuine and will mark the message sent via the communication satellite as position authenticated.

Navigation satellite

Communication satellite

VMS - Vessel Monitoring System

Fishing vessel

Land earth station

Patrol vessels and aircraft

National Fisheries Monitoring Centre

Land based inspectors

FMCs of other Member States, third countries and Regional Fisheries Management Organisations

New Authenticated Receivers are needed

Blue Box Porbeagle Summary

Contract: GSA/GRANT/02/2019

Title: Shipborne double frequency multi-constellation receiver (E1/E5a) (https://blueporbeagle.eu)

Start: 01 of January 2021

End: 30 of September 2023

Manufacturer: ArXiTEC Critical Systems (www.arxitec.com). Digital Hardware design SME specialized in the development of projects that require high functional safety, reliability and security

Blue Box Porbeagle project Goals are:

1. ArXiTEC to Prototype and Build a close-to-market Trusted dual-frequency multi-constellation receiver (GAL, GPS, GLO, BEI) **VMS shipborne equipment**.

2. The prototypes have been tested for demonstration during fishery activities, in partnership with **Cooperative of Fishing Vessels' owners of the** Port of Vigo **(ARVI)**, to validate the performance achieved during the real operation of vessels from European fishery fleets.

5

Dynamic tests in Fishing Vessel with VMS and Galileo Authentication

Dynamic tests in Fishing Vessel with VMS and Galileo Authentication

Grand Sole fishing grounds

Galileo Availability during Fishing Campaign	
UTC Start:	2023/11/21 17:14:52
UTC End:	2023/11/29 19:02:30
Number of Messages Sent:	195
Number of Messages Received:	195
Unauthenticated PVT > 5 mins:	0
Max Number of Galileo Satellites:	11
Average Galileo Satellites:	09
Min Galileo Satellites:	07

# Authentication System-in-Package

- An affordable and small authentication System-in-Package (SiP) for any Application requiring trusted position, velocity or time.

- Specially designed for integration on Maritime and RPAS applications.

- Main Features (Beta units)
  - Size: 30x30mm
  - Weight: < 10 g
  - GNSS: E1b and Galileo OSNMA Authentication
  - Processor: 667MHz ARM Processor to run other customer applications
    - Memory: 512MB

Use Case 2:
Patrol aircraft/Drones

- Aircraft computes its position using data from navigation satellites.

- Galileo Authentication can be used to include in images taken from the aircraft/drone a proof that the timing and location of the image has been computed with genuine information from Galileo.

- EFCA/EMSA confirmed interest in this use case in EUSPA AB workshop on Drones in December 2022, delivering a joint EU Strategy on Space for Drones.
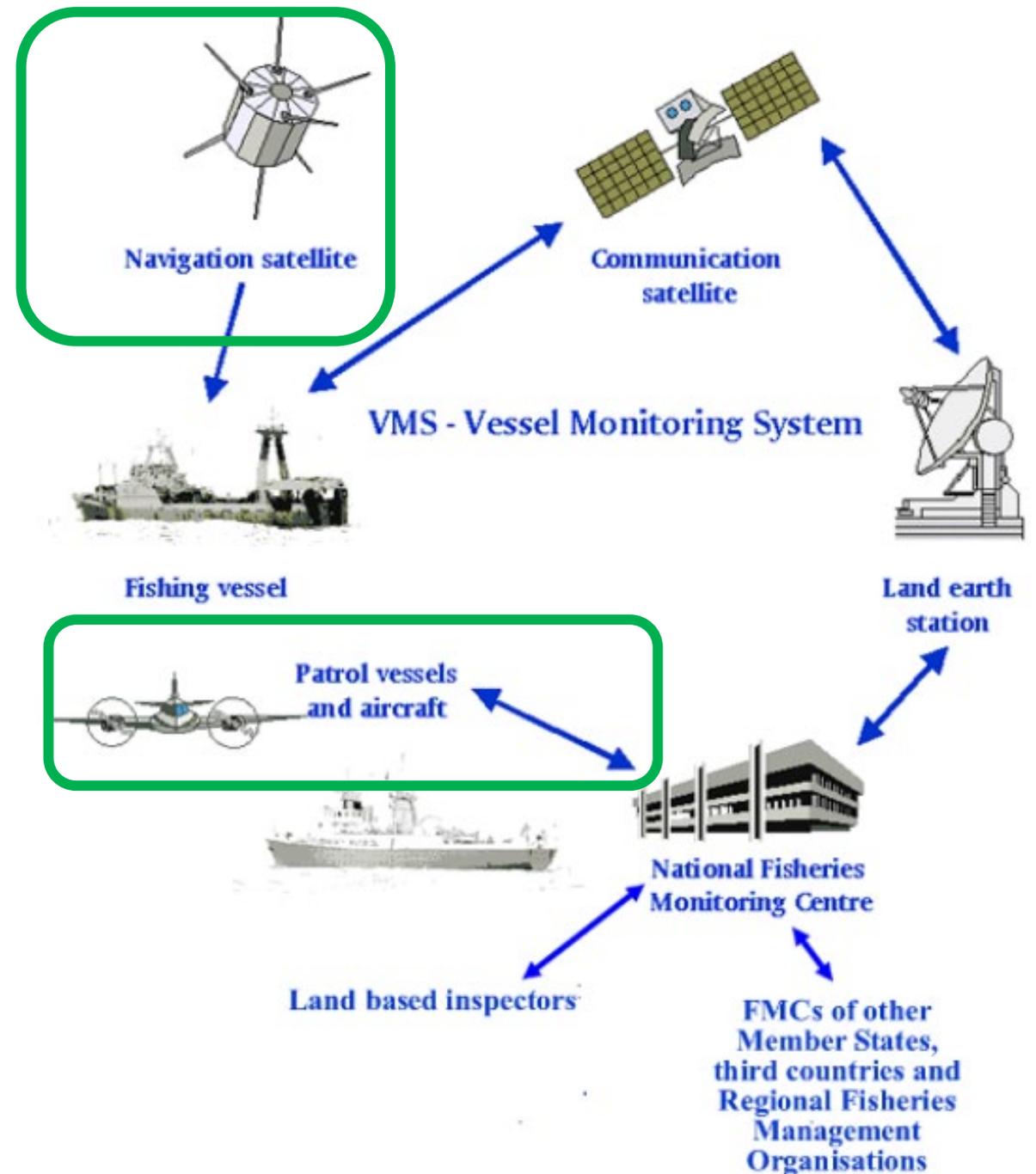
H2020 Projects: PASSport and Certiflight– Developing solutions with position and time authentication for drones operations

- **Goal:** To engineer and qualify a solution extending the situational awareness based on aerial fixed/rotary wing **drones to improve security and safety in defined areas.**

- **Galileo OS-NMA will be used to authenticate the position of the drone and to time/position stamp the images**

- This will globally demonstrate the possibility to use RPAS data to establish some legal records (staying in forbidden areas, dangerous comportments, illegal fishing, etc)

Source: Horizon Certiflight Project

https://h2020-passport.eu/
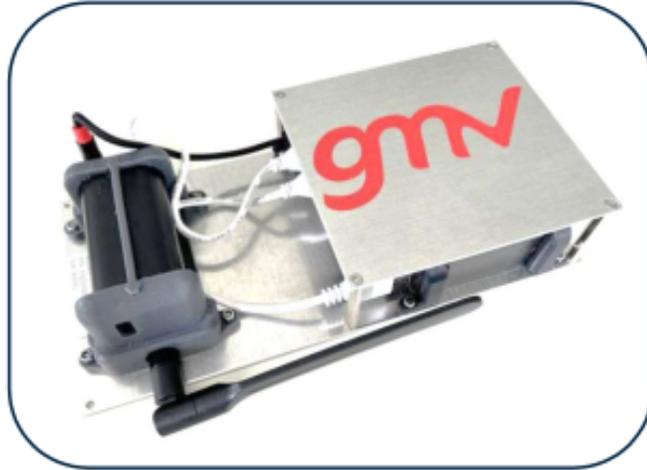
https://certiflight.info/

Passport Project: Authentication results

Authentication with OSNMA

Protection Levels with IBPL

Multifrequency: L1/E1 + L5/E5a

Multiconstellation: GPS + GAL

Laboratory & Static Tests
Until 06/2023

Dynamic tests: Embarked in vessel
Homecoming Homeport Hamburg 06/2023

Dynamic tests: UAS integration
Valencia 06/2023
Napoli 07/2023

Dynamic tests: On-board UAS
Valencia - 10/2023

PASSPORT

28

Passport Project: Authentication results

https://h2020-passport.eu/wp-content/uploads/2024/01/Valencia.pdf

Main results: Valencia

- First drone on-board testing in harbour conditions.

- Goal: performance assessment replicating real life operations

  - 13 manual flights on-board a Skyjib X4 Ti-QR.

  - Open-sky environment.

Passport Project: Authentication results

https://h2020-passport.eu/wp-content/uploads/2024/01/Valencia.pdf
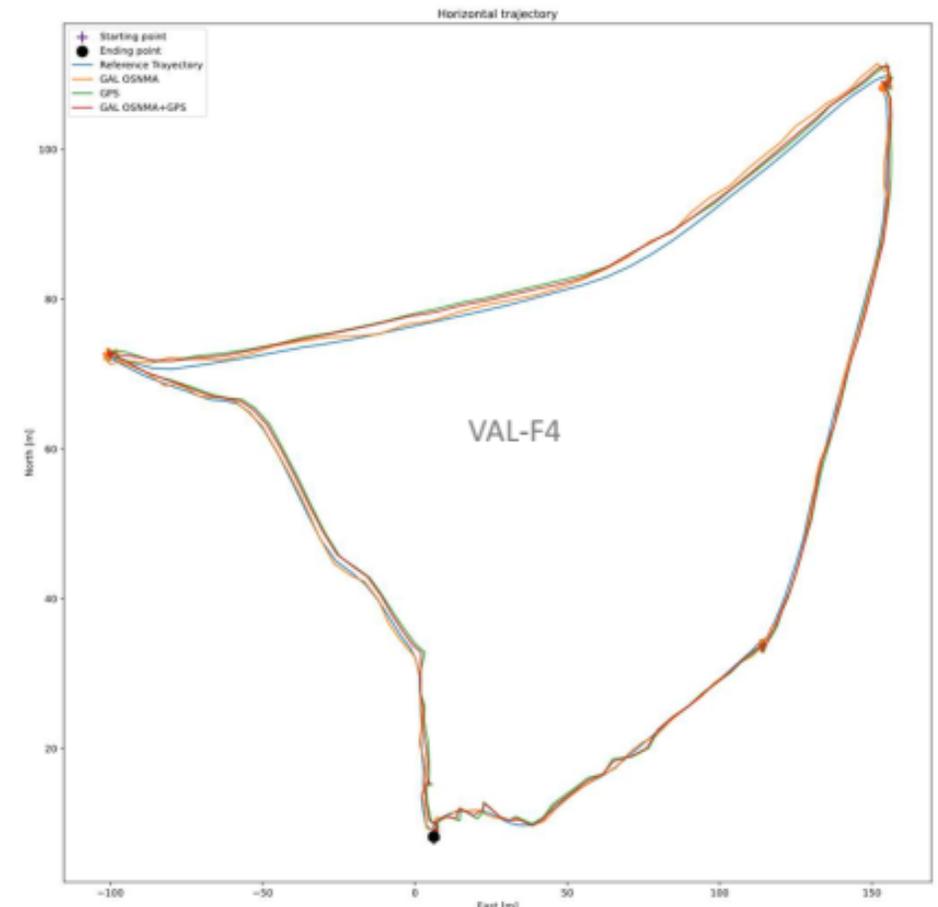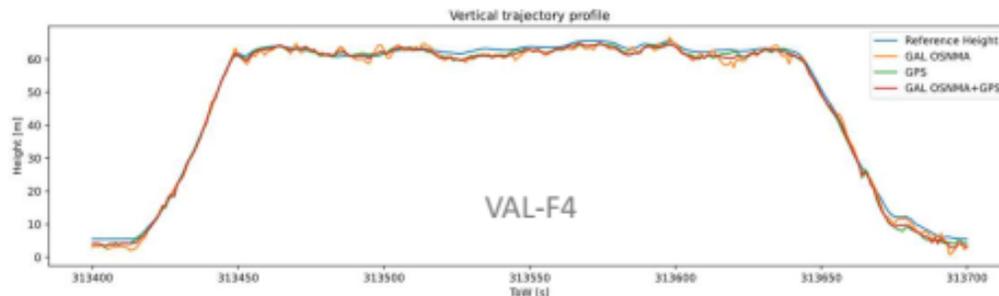
OSNMA Assessment

Recording ID	Recording duration [min]	TTFA [s]	MTBA [s]	Number of authentications	ASA [%]	AER
VAL-R1	15.70	120	62.03	714	100	0
VAL-R2	48.54	100	56.08	2348	100	0
VAL-R3	34.17	122	76.80	1520	100	0
VAL-R4	4.20	142	61.91	110	100	0
VAL-R5	2.91	104	57.99	78	100	0
VAL-R6	12.52	126	58.29	290	100	0
VAL-R7	13.04	120	58.18	428	100	0
VAL-R8	8.91	88	65.47	422	100	0
VAL-R9	7.70	106	50.97	234	100	0
VAL-R10	12.00	104	67.02	376	100	0

Average TTFA ~ 2 min

Average MTBA ~ 1 min

Authentications 100% successful

Conclusions

- Use Case 1: VMS Bluebox: Galileo Authentication 100% successful

- Use Case 2: Drone position – Galileo authentication 100% successful

Interested Authorities please contact us to receive further information

Thanks !

You can contact me at

Manuel.Lopezmartinez@euspa.europa.eu

| f EU4Space | in EUSPA | 🐦 @EU4Space | 📷 @space4eu | ▶ EUSPA |

The European Union Agency for the Space Programme is hiring!

Apply today and help shape the future of #EUSpace!