navisp INDUSTRY DAYS 07 – 08 NOV 2023

NAVIGATON INNOVATION SUPPORT PROGRAMME navisp esa

SESSION 3: ALTERNATIVE PNT

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Expert, RAN Automation and Positioning
Ericsson

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Positioning Programme Lead
UK National Position, Navigation and Timing Office

Lukasz Bonenbergr
Scientific Officer
European Commision

Michael Hoppe
Senior Engineer
German Federal Waterways and Shipping Administration

Sven-Ingve Rasmussen
Project Leader Innovation and Space Technology
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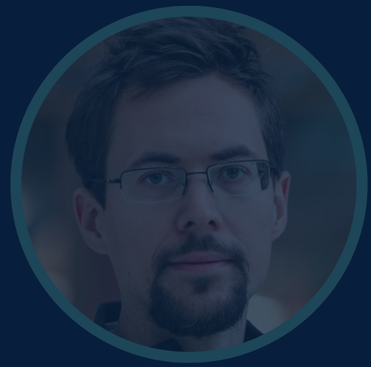

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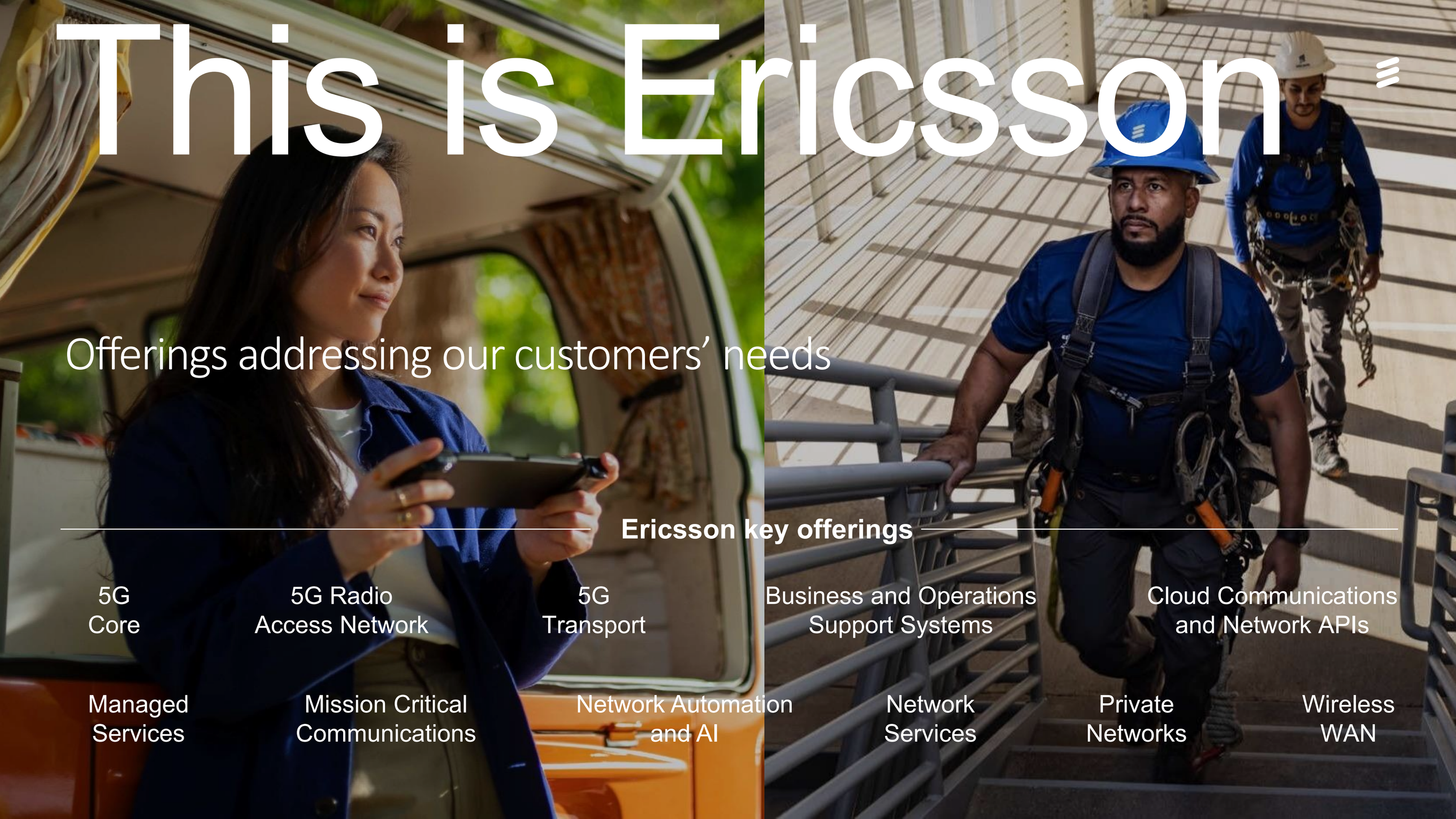
This is Ericsson



Offerings addressing our customers' needs

Ericsson key offerings

- 5G Core
- 5G Radio Access Network
- 5G Transport
- Business and Operations Support Systems
- Cloud Communications and Network APIs
- Managed Services
- Mission Critical Communications
- Network Automation and AI
- Network Services
- Private Networks
- Wireless WAN

5G, the biggest innovation platform ever

Use cases in

Platform values

5G digital infrastructure

Imagine Possible

ericsson.com/future-technologies

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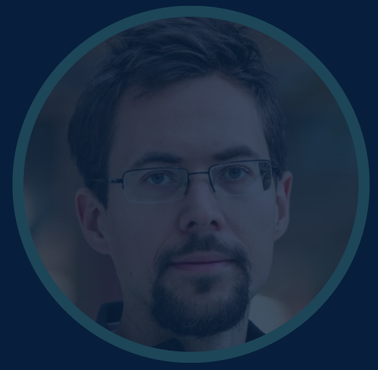

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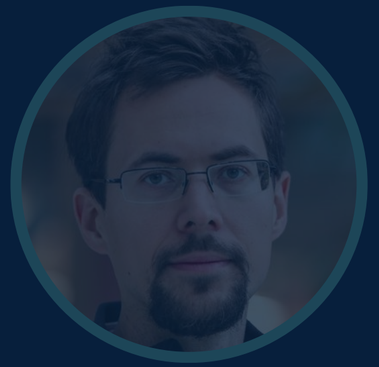

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R-Mode as Alternative (Terrestrial) Radionavigation system for maritime Users

ESA NAVISP Industry Days 2023, ESA-ESTEC centre, Noordwijk aan Zee, NL

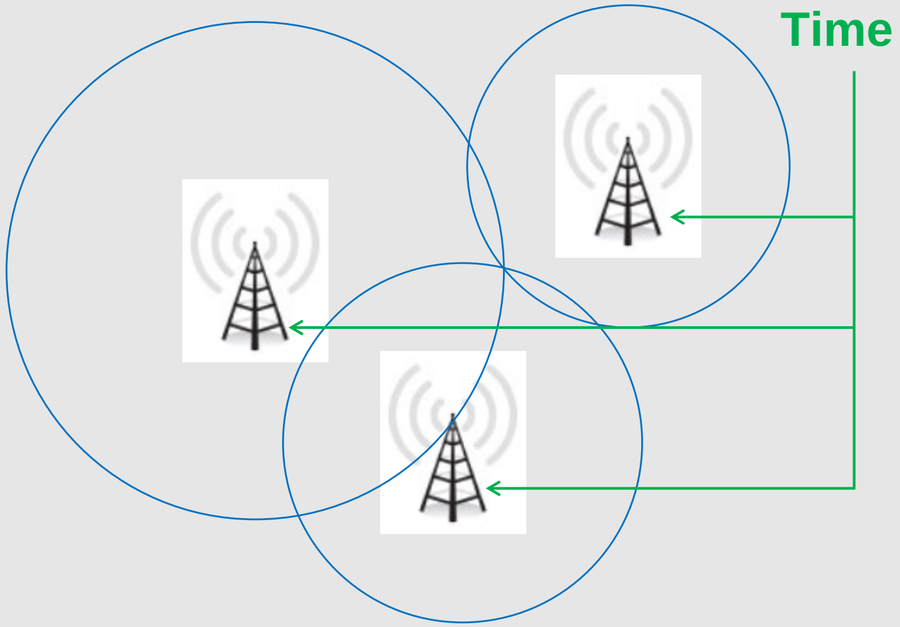
Michael Hoppe

Federal Waterways and Shipping Agency

Directorate General Shipping

Section National and International Standards Traffic Technologies

BRIEF DESCRIPTION OF R-MODE



R-Mode signal sources

- Medium Frequency (MF) using maritime radio beacons
- VDES using VHF transmissions

How R-Mode works

R-Mode is a positioning system that

- transmits timely synchronised ranging signals
- using the communication channel of existing maritime radio infrastructure
- use trilateration to determine position

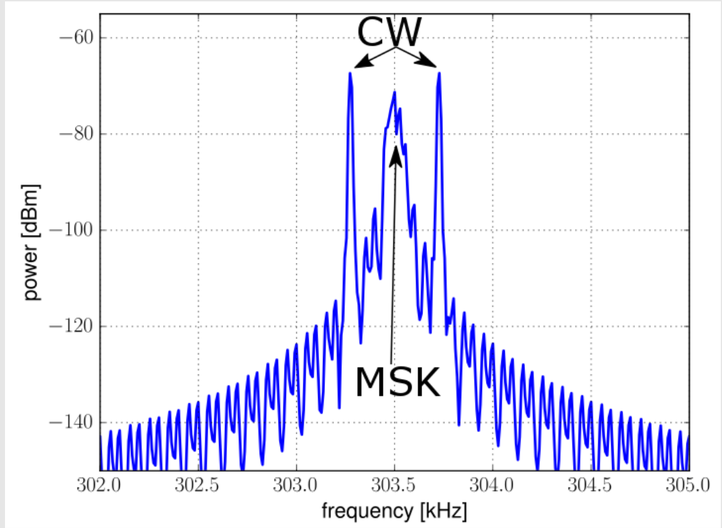
History

- 2008 – Initial ideas of R-Mode concept
- 2015 - R-Mode feasibility studies in ACCSEAS
- Further studies in Germany, Great Britain, China, Korea
- 2017-2021 R-Mode Baltic projects

BRIEF DESCRIPTION OF R-MODE

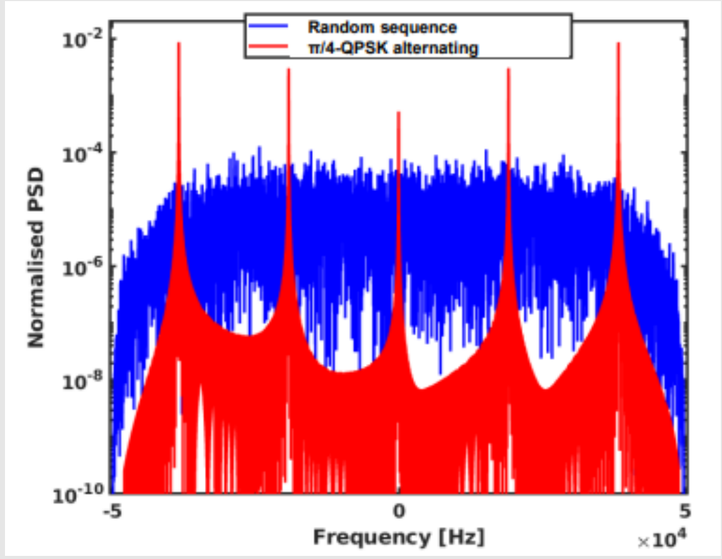
MF R-Mode

- Adding two CW signals
- Signals are added in the nulls of the MSK signal
- Reception of DGNSS service is not disturbed
- Coexistence of DGNSS and R-Mode is enabled

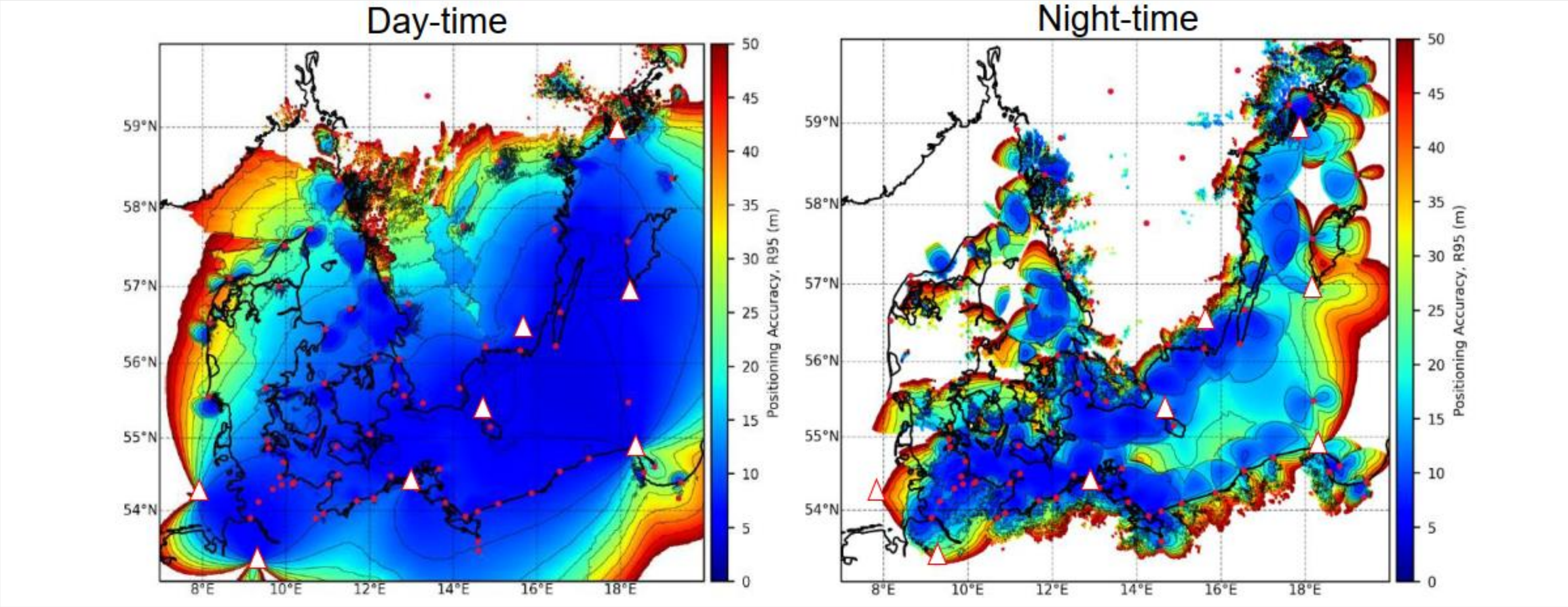


VDES R-Mode

- Use of the AIS channel not possible (Channel load)
- VDES offers 100kHz data channel
- Use of gold and alternating sequences
- Time of arrival obtained from correlation of transmitted sequence



MF + VDES R-MODE TEST BED POSITIONING ACCURACY PREDICTION (95%) – STUDY CONDUCTED BY GRAD



△ MF R-Mode sites

● Existing AIS sites; In simulation there are transferred into VDES R-Mode sites

Michael Hoppe

Generaldirektion Wasserstraßen und Schifffahrt

Dez S33
Nationale und internationale Standards und Normen der Verkehrstechnik

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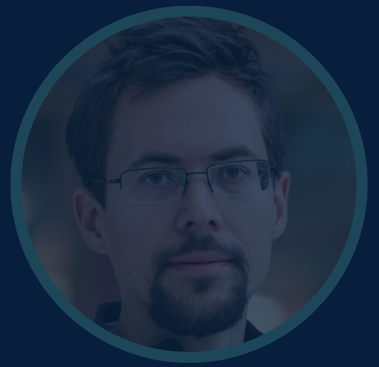

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Introduction – Sven-Ingve Rasmussen, MSc

- Master of Science In Electronics from University of Glasgow.
- 1997 – 2009 EIDEL AS
  - Hardware Designer 1997 – 2002, Project leader 2002 – 2004, R&D Leader 2004 – 2009
  - Invented the concept of “Remote Crypto Distribution System, RCDS” which is today one of EIDEL AS key defense products
- 2009 – 2020 Honeywell Life Safety
  - R&D Manager Nordics
- 2020 – Space Norway AS
  - Project Leader Innovation and Space Technology

- **Space Norway:**
  - Space Norway is 100% owned by the Norwegian Ministry of Trade, Industry and Fisheries and represents a key part of the Norwegian Government’s activities and assets in the space sector.
  - Several important and critical functions depend on information from satellites. Space Norway’s task is to manage and further develop strategic and security-critical space infrastructure safeguarding basic national functions.

ESA NAVISP ICING – Independent Critical Navigation

NAVISP Industry Days 7th -8th November 2023

Sven.Ingve.Rasmussen@Spacenorway.no

SPACE NORWAY

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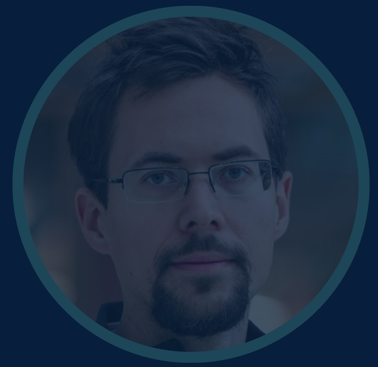

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Florin Mistrapau

Coordinator of Consultancy and Advanced Navigation Solutions Division in GMV Romania

Part of Navigation User Segment & PRS Business Unit of GMV

Main Interests:

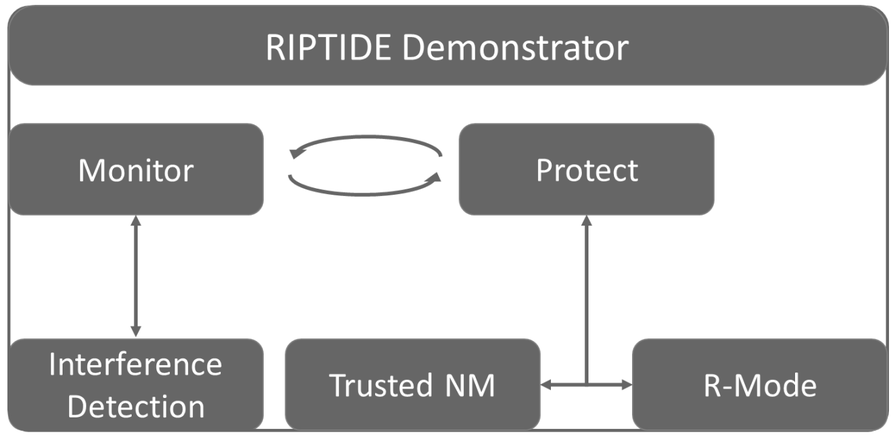
Resilient PNT

Alternative PNT

GNSS interference, jamming, spoofing

Main NAVISP project: RIPTIDE PHASE 2 - Resilient PNT for the Black Sea and Danube Region: Demonstrator

This project targets the second phase in the development of a resilient PNT solution dedicated to the particularities of the Black Sea and Lower Danube Basin region. Main goal is to build a demonstrator following the Monitor & Protect approach defined in the study phase of RIPTIDE.



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EC Joint Research Centre

JRC provides independent, evidence based knowledge and science support to EU policies.

The **A-PNT** Test Campaign

Timing Performance	Time Generation [days]	MTIE [ns]	Time Transfer Fibre [ns]	Time Transfer Networks [ns]	Time Transfer OTA Outdoors [ns]	Time Transfer OTA Indoors [ns]
OPNT BV	N.A.	N.A.	0.057	N.A.	< 200 (±100)	N.A.
7 Solutions SL	80	280	0.089	N.A.	N.A.	N.A.
SCPTime	1	< 1000	N.A.	35	N.A.	N.A.
GMV AD SAU	100	57	1	500	N.A.	N.A.
Satelles Inc	110	364	N.A.	N.A.	145	< 340
Locata Corp	1	< 1000	0.4 (4.9)	0.4 (6.1)	0.7 (6.1)	0.2 (5.2)
NextNav LLC	11.6	40	N.A.	N.A.	N.A.	< 39

Summary of the time performance at 99.7 percentile

2D Positioning Performance	Static Outdoors [m]	Static Indoor [m]	Kinematic Outdoors [m]	Kinematic Indoors [m]
Satelles Inc	17.0	15.0	N.A.	N.A.
Locata Corp	< 0.01	< 0.01	< 0.02	< 0.02
NextNav LLC	9.0	14.0	11.0	N.A.

Summary of the position performance at 95 percentile

Presented results should not be treated as a **qualitative assessment** of the tested technologies. More details available at *https://joint-research-centre.ec.europa.eu/scientific-activities-z/alternative-pnt_en*

Towards the **EU PNT** vision