R-Mode Baltic

Project status and results: June 2020

Stefan Gewies, German Aerospace Center (DLR)
EUSBSR PA Safe 22nd Steering Committee Meeting

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Outline

- Project goal
- Status of R-Mode system deployment
- R-Mode VDES measurement results
- COVID-19 pandemic
- R-Mode Baltic 2
- Summary

R-Mode Baltic project goal

The main goal of the project R-Mode Baltic is the development and demonstration of a new maritime backup system for position, navigation and time (PNT) purposes.

- R(anging)-Mode is a terrestrial positioning system that
  - transmits timely synchronised ranging signals
  - using the communication channel of existing maritime radio infrastructure

- Project utilises signals of marine radiobeacons and VDES base stations

Deployment of the R-Mode Baltic testbed

- First phase completed: 5 radiobeacons transmit R-Mode signals
  - 3 German
  - 2 Swedish
- Further 2 planned in Denmark and Poland

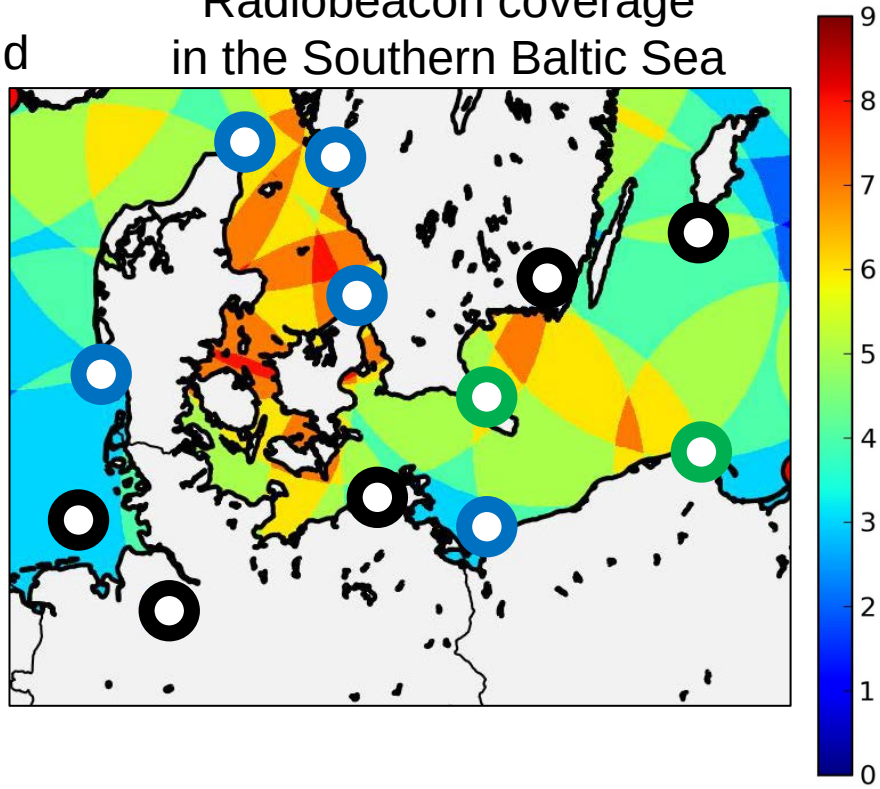
- Procedure radiobeacons upgrade:
  - replace modulator
  - add GPS stabilised rubidium clock

R-Mode radio beacon

Planned R-Mode radio beacon

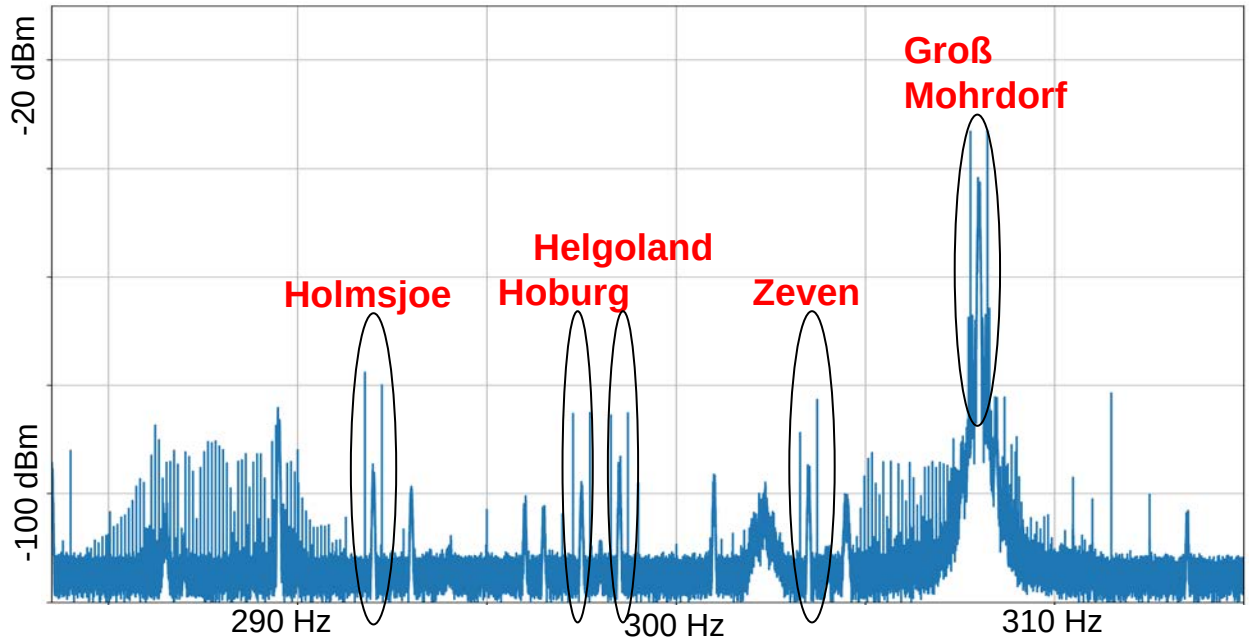
Radio beacon

Radiobeacon coverage
in the Southern Baltic Sea



Deployment of the R-Mode Baltic testbed

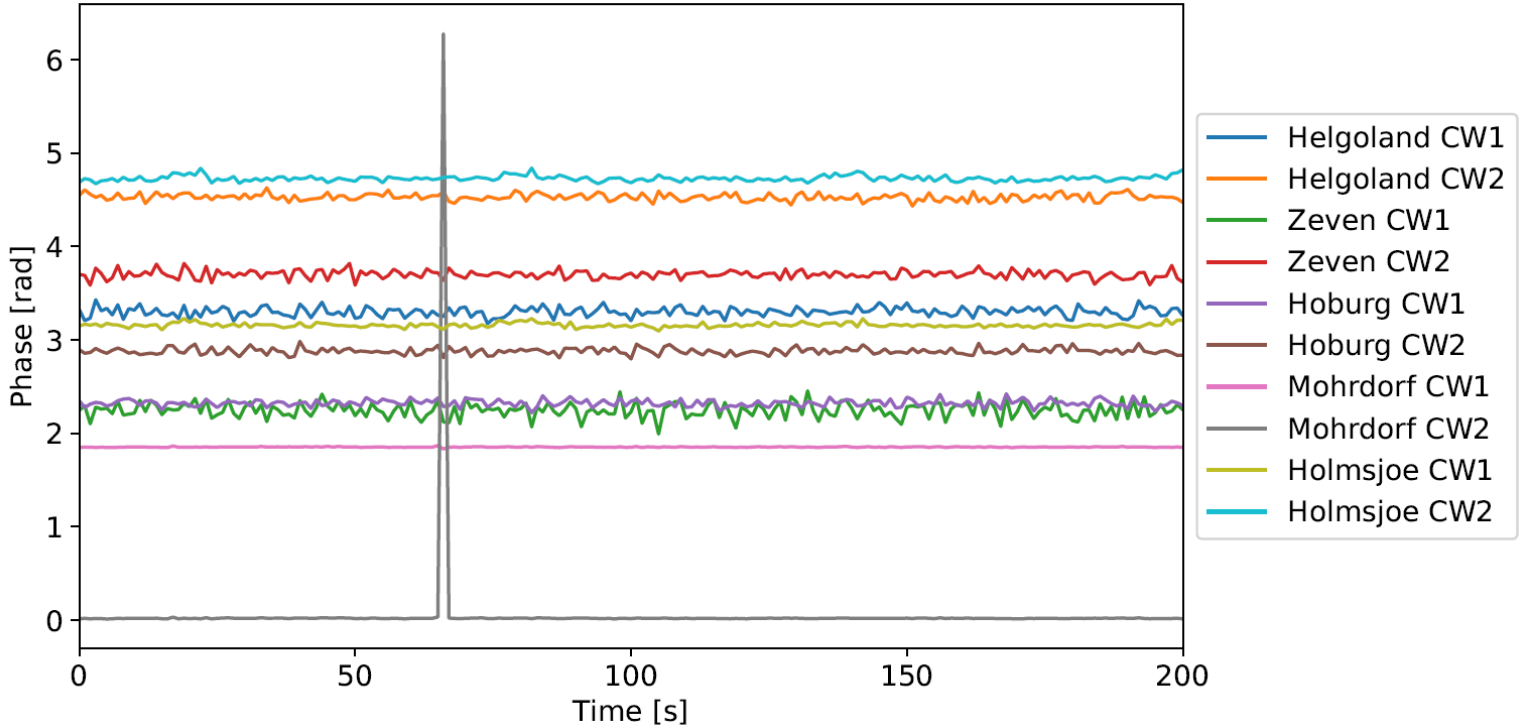
- First measurements in the testbed near Groß Mohrdorf (June 2020)
  - All signals a clearly receivable (farthest station about 400 km)



- For R-Mode upgrade planned Danish and Polish radiobeacons were also visible

Deployment of the R-Mode Baltic testbed

- First time 5 R-Mode stations were received at once



- 3 to 4 signals are necessary for positioning

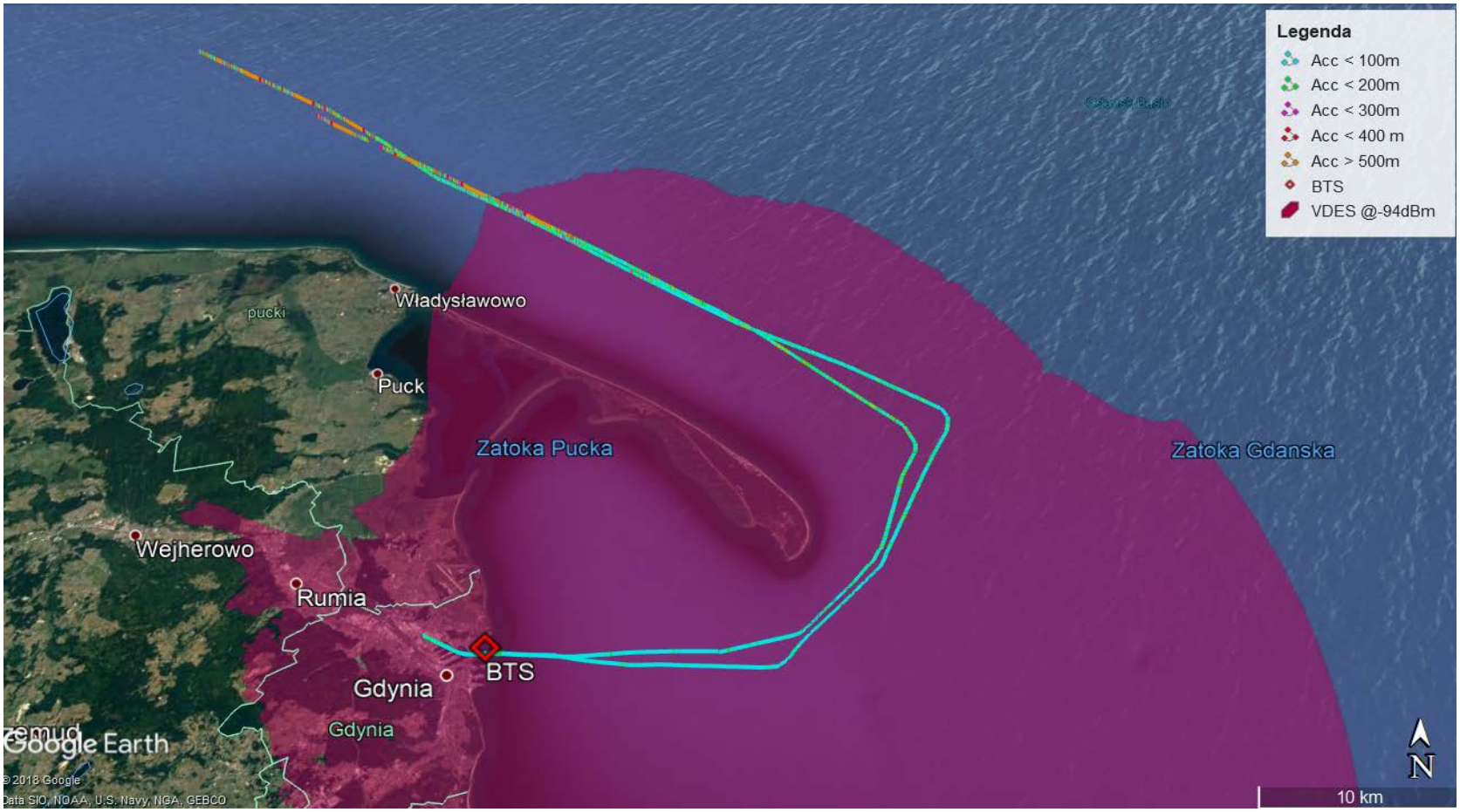
Calibration of the R-Mode Baltic testbed

- Development of procedure for calibration of R-Mode radiobeacons

- Preparation: measurements of receiving antennas with Helmholtz coil
    - Commercial H-field antenna not suitable for R-Mode because not phase stable
    - Simple H-field antennas has to be used

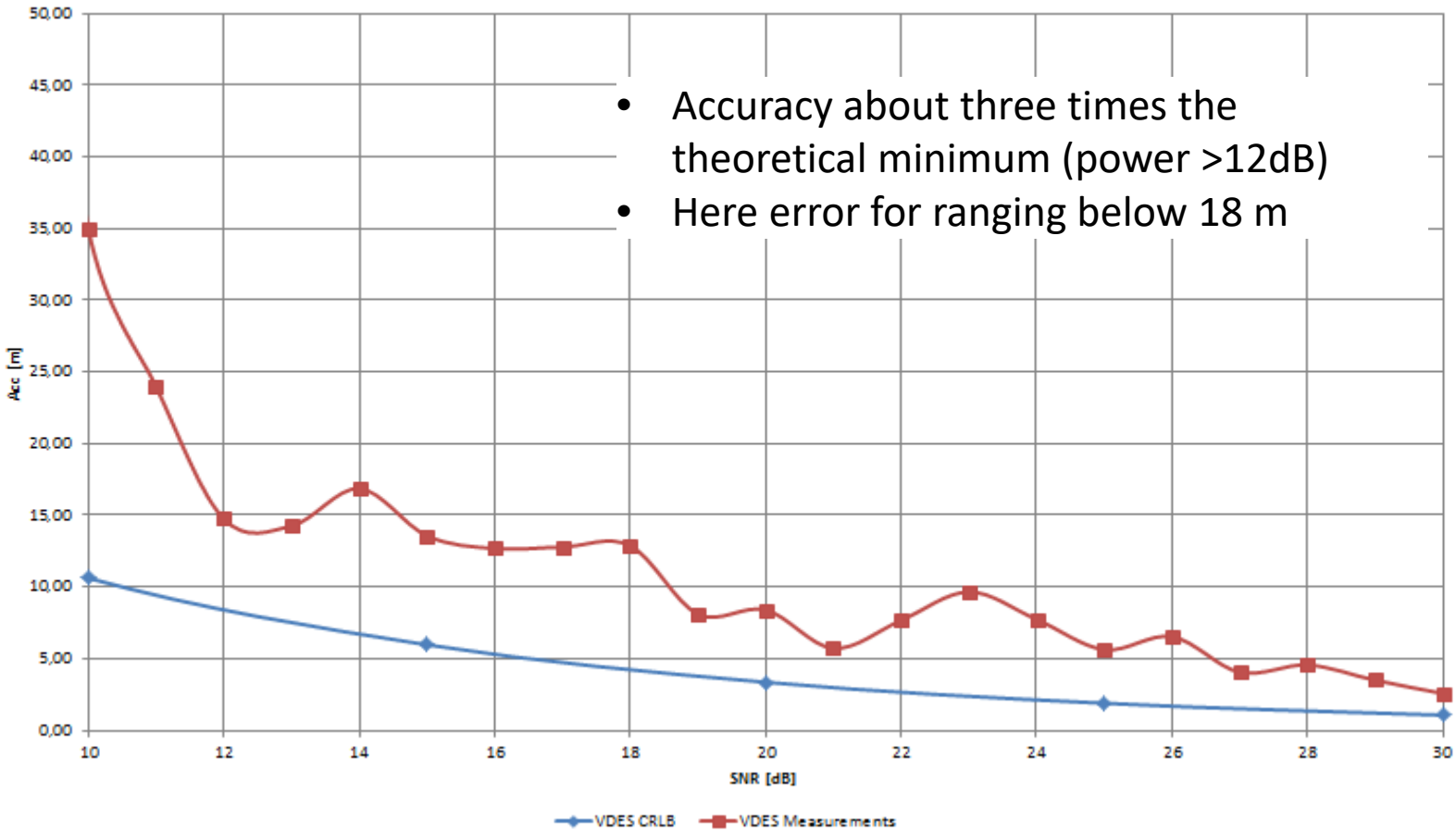
- Calibration will start in summer 2020

R-Mode VDES measurement campaign in port of Gdynia



R-Mode VDES measurement campaign in port of Gdynia

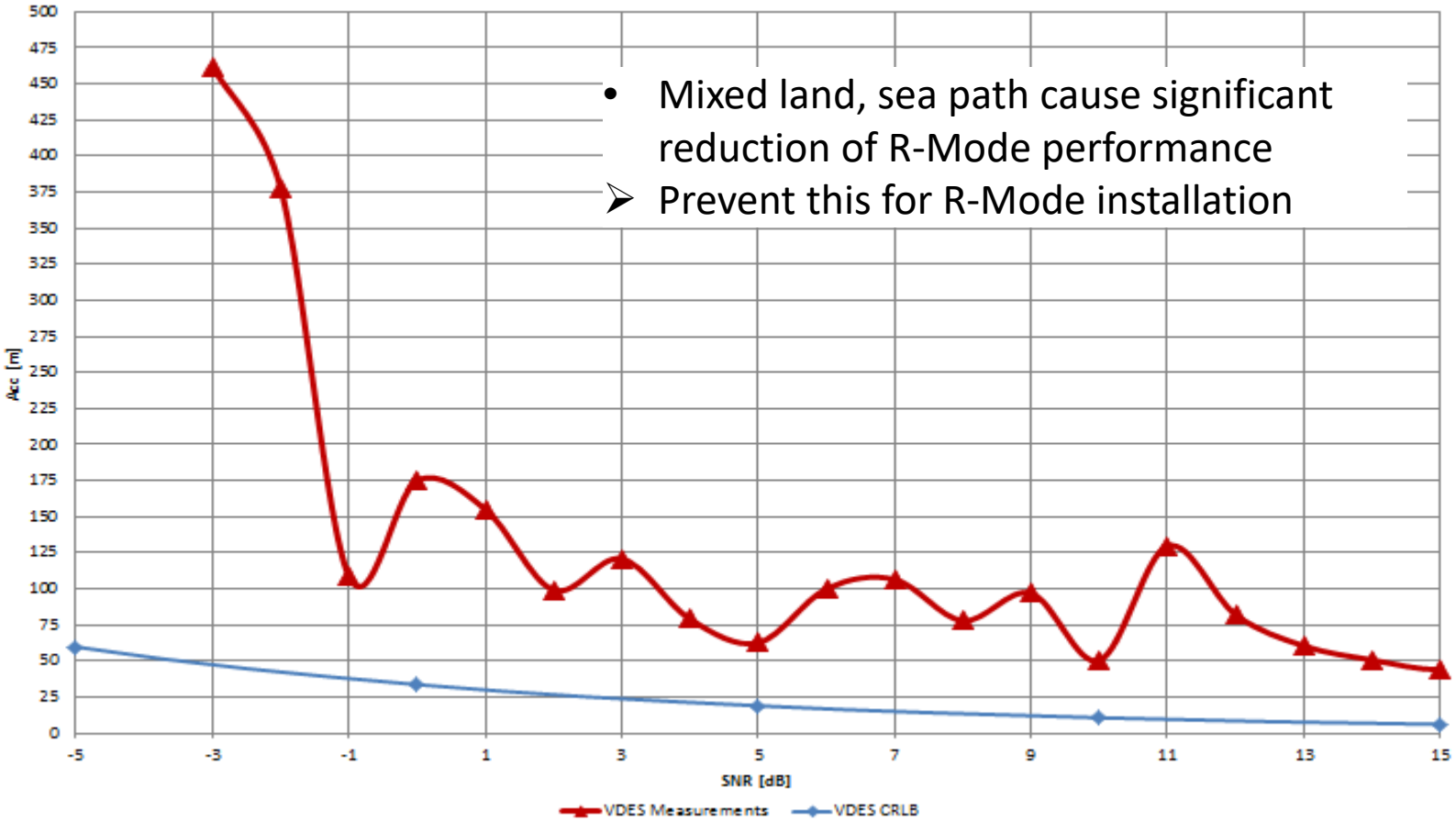
LOS Sea path measurements



- Accuracy about three times the theoretical minimum (power >12dB)
- Here error for ranging below 18 m

R-Mode VDES measurement campaign in port of Gdynia

Mixed (Land + Sea) path measurements



- Mixed land, sea path cause significant reduction of R-Mode performance
- ➢ Prevent this for R-Mode installation

COVID-19 pandemic

- Pandemic hits the project in a final phase

- All planned activities postponed or cancelled
  - Installation of equipment
  - Campaigns
  - Meetings
  - Dissemination activities

- Project lost so far about four months

- Planning of next project activities is difficult due to travel restrictions (national, regional and organisation)

- Interreg BSR MA/JS agreed to a six-month extension

R-Mode Baltic extension: R-Mode Baltic 2

"Ranging Mode Baltic Sea test bed evaluation"

- Long-term evaluation of the R-Mode Baltic testbed
  - Extend the system with additional monitors
  - Implement R-Mode receiver on different vessels
  - Evaluate system performance over nine months

- Testing of new concepts
  - Two-way time transfer using R-Mode signals
  - Real-time calibration of R-Mode transmitters
  - Real-time estimation of propagation delays caused by the ground

- Project was selected for funding at 17th June
- Duration: Most probably April – December 2021

- PA Safe Coordinator provided a letter of support: Thank you!

Summary

- Upgrade of five marine radiobeacons to R-Mode transmitter sites finished
- Signals are available in the Southern Baltic Sea => Calibration necessary

- R-Mode VDES shows good performance in the vicinity of the transmitter under undisturbed conditions => will be considered during site selection

- COVID-19 pandemic cause delay of project activities

- R-Mode Baltic 2 will evaluate R-Mode Baltic testbed, extend functionalities and improve independence from external time sources

Contact

Stefan Gewies
Project Manager
German Aerospace Center (DLR)
Institute of Communications and Navigation
Phone: +49 3981 480187
E-mail: Stefan.Gewies@dlr.de
www.r-mode-baltic.eu

Project partner