Webinar about R-Mode for the Baltic Sea Region (BSR)

R-Mode perspectives for the Baltic Sea Region

Stefan Gewies
German Aerospace Center

20 January 2022

Baltic Sea is “made” for R-Mode

MF R-Mode: Realistic range 300 km

Source: Google

VDES R-Mode: Good range 40 km
(range depends strongly on the antenna height)

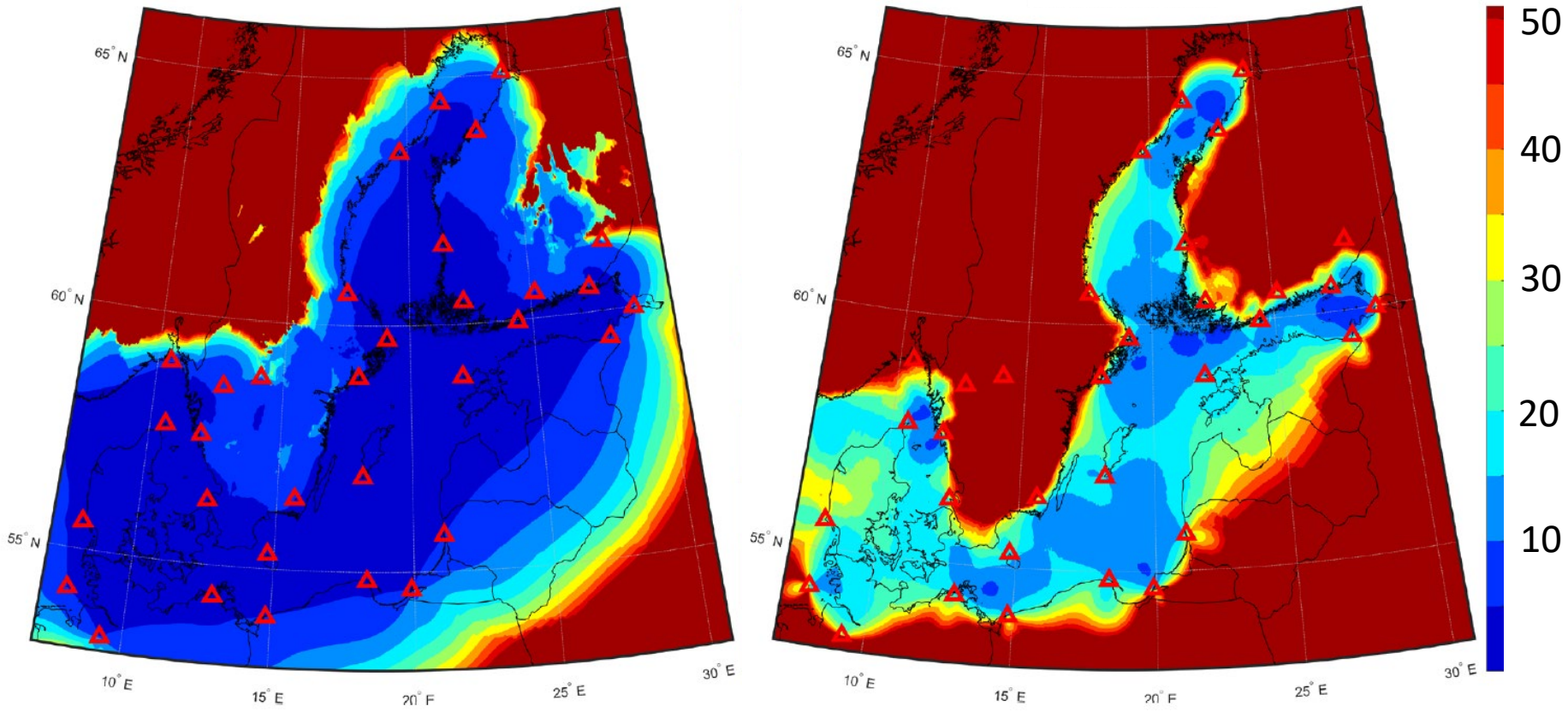
Source: Google

Baltic Sea Region is well prepared for R-Mode

MF R-Mode: Estimated position accuracy for the Baltic [1]

Day-time hours, 95% accuracy [m]

Night-time hours, 95% accuracy [m]

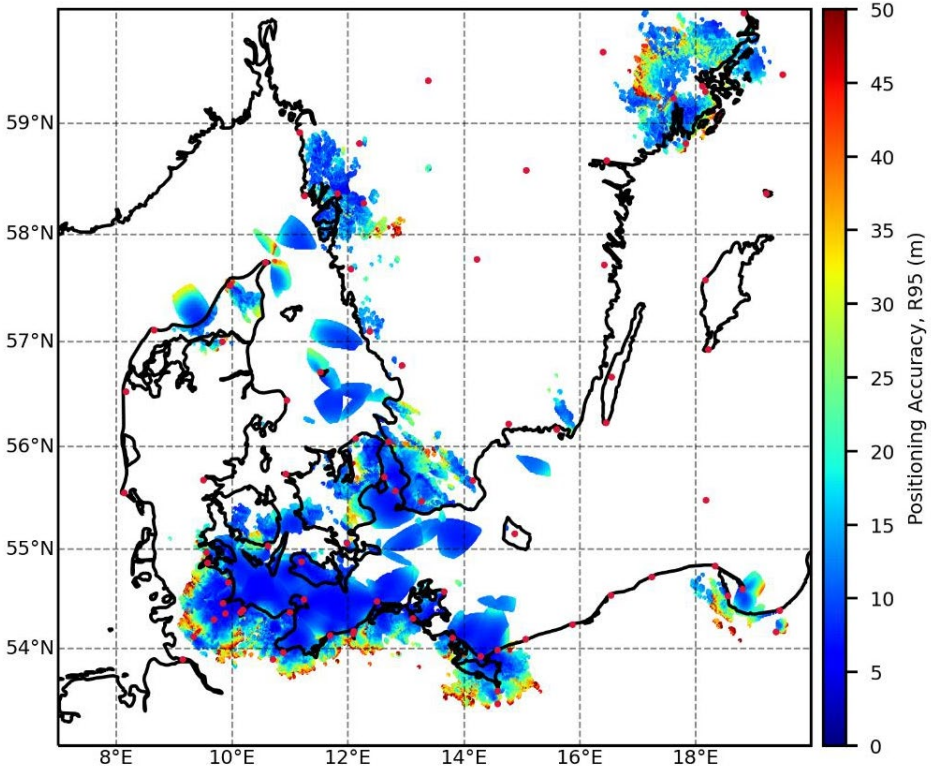


[1] MF R-Mode coverage prediction and accuracy estimation, GRAD, RPT-07-CH-19, March 2019.

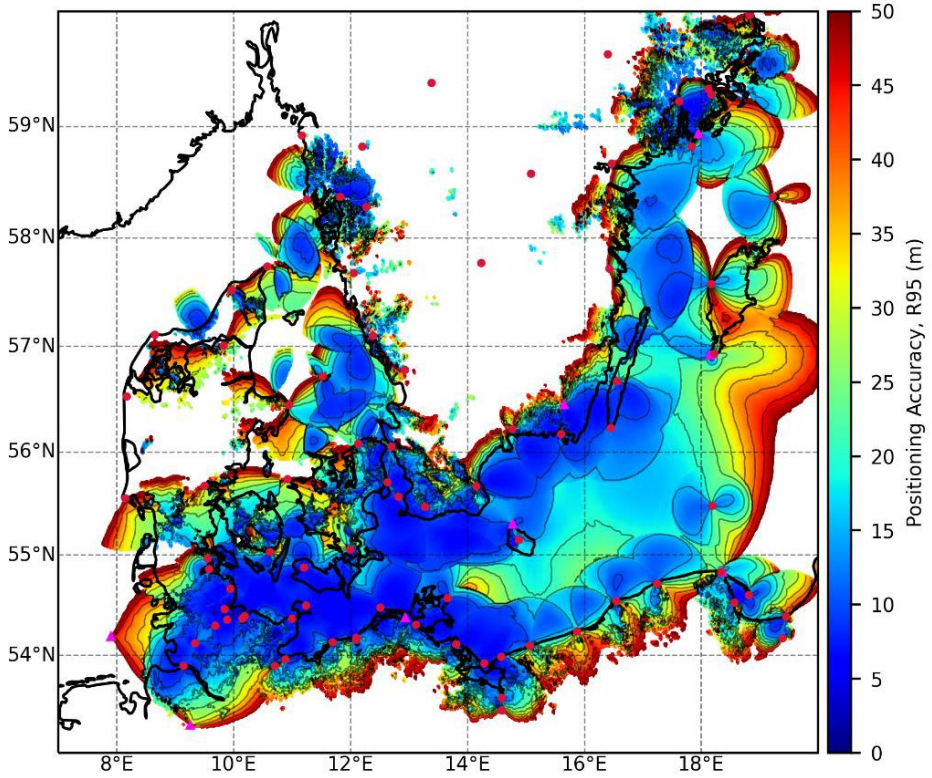
Baltic Sea Region is well prepared for R-Mode

VHF+MF: Estimated position accuracy for southern Baltic [1]

VHF R-Mode, 95% accuracy

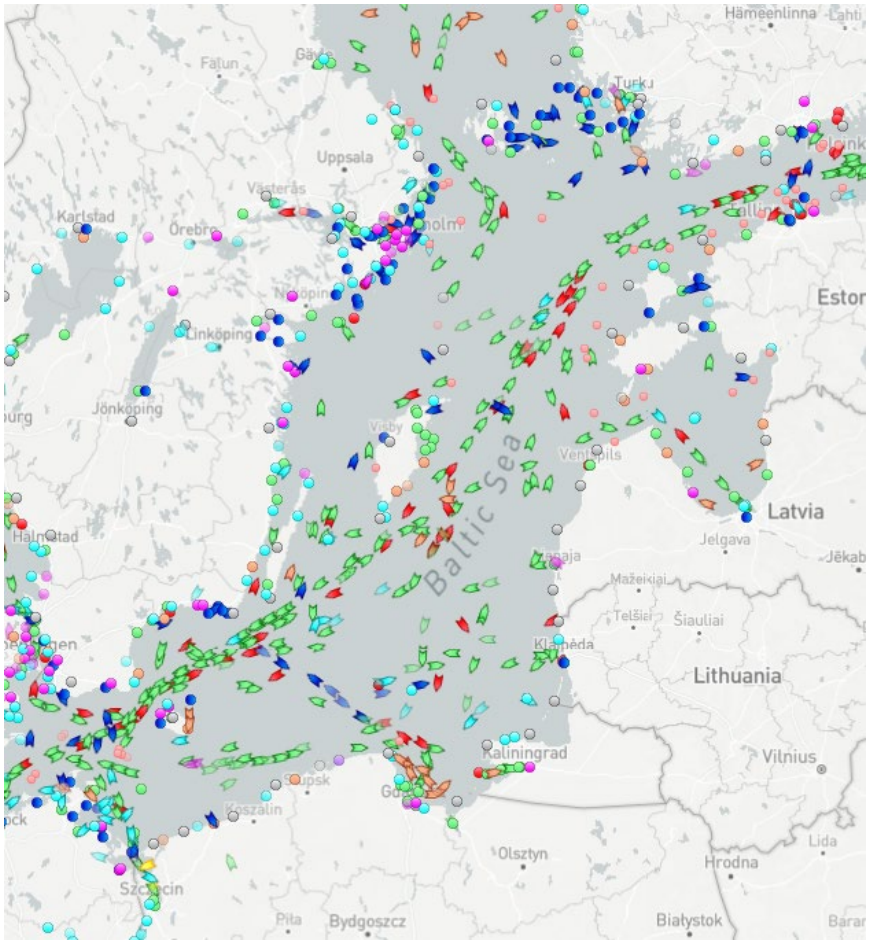


Night-time MF + VHF, 95% accuracy



[1] MF/VDES R-Mode Coverage Prediction and Accuracy Estimation, GRAD, RPT-39-JSa-20, December 2020.

AIS and radio beacons cover most important areas

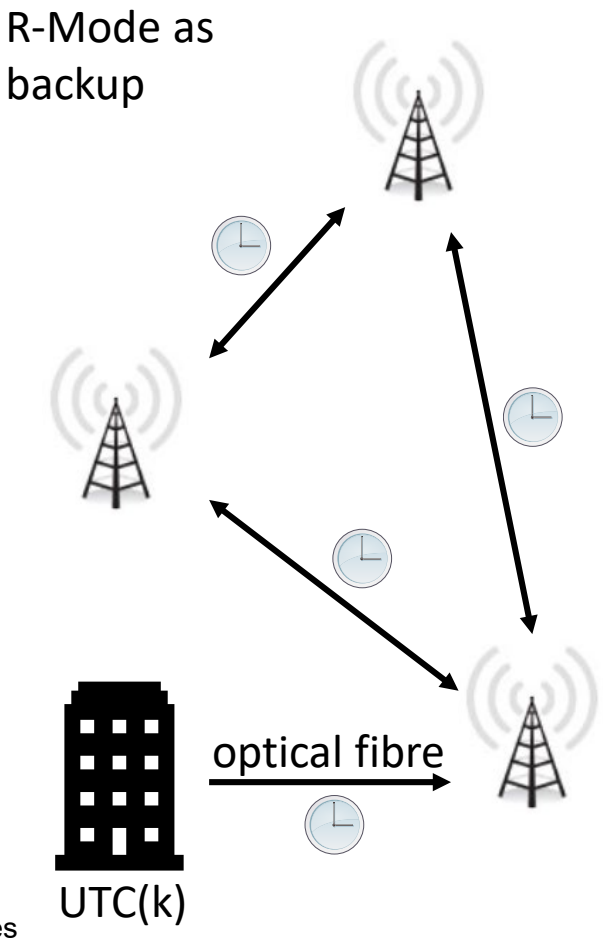


Source: MarineTraffic

- Sensitive areas are covered usually very well with both systems
  - Coastal areas
  - Port approaches
  - Ports
- World-wide study for radio beacons and ships with Class A AIS
  - 40 % of all ships operate in areas with at least 3 visible radio beacons

R-Mode can be a PNT backup system for GNSS

- At the moment implemented as contingency system [1] in the Baltic Sea
  - GNSS used for synchronization
- GNSS independent synchronizations is possible
  - UTC(k) – fibre-optical cable
  - Transmitter sites – R-Mode signal
  - Supporting concepts developed in R-Mode Baltic projects
- Option: R-Mode station network can define it's own time
- Resistant against GNSS threads

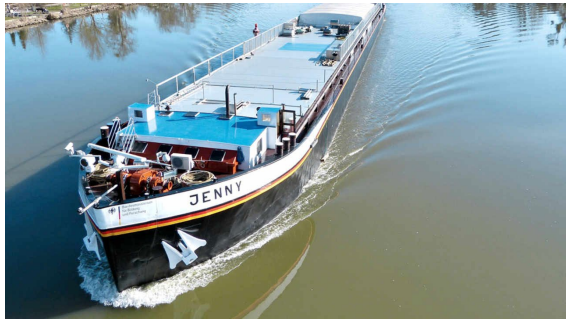


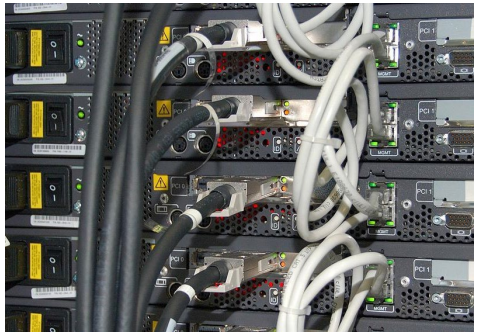
[1] IALA Recommendation R-129 On GNSS Vulnerability and Mitigation Measures

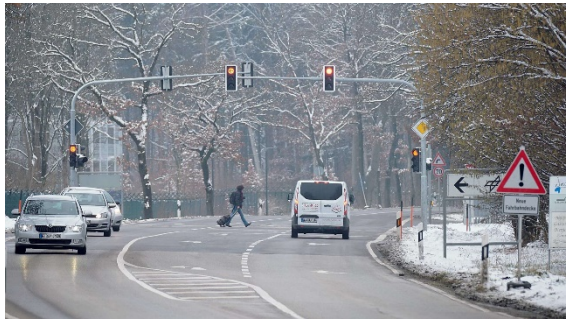
R-Mode could support positioning and timing for non-maritime users

- Signals are available on land

- R-Mode can support with PNT
  - Other transport modes
  - Port applications (cargo handling)
  - Critical infrastructure (Timing)
  - Agriculture





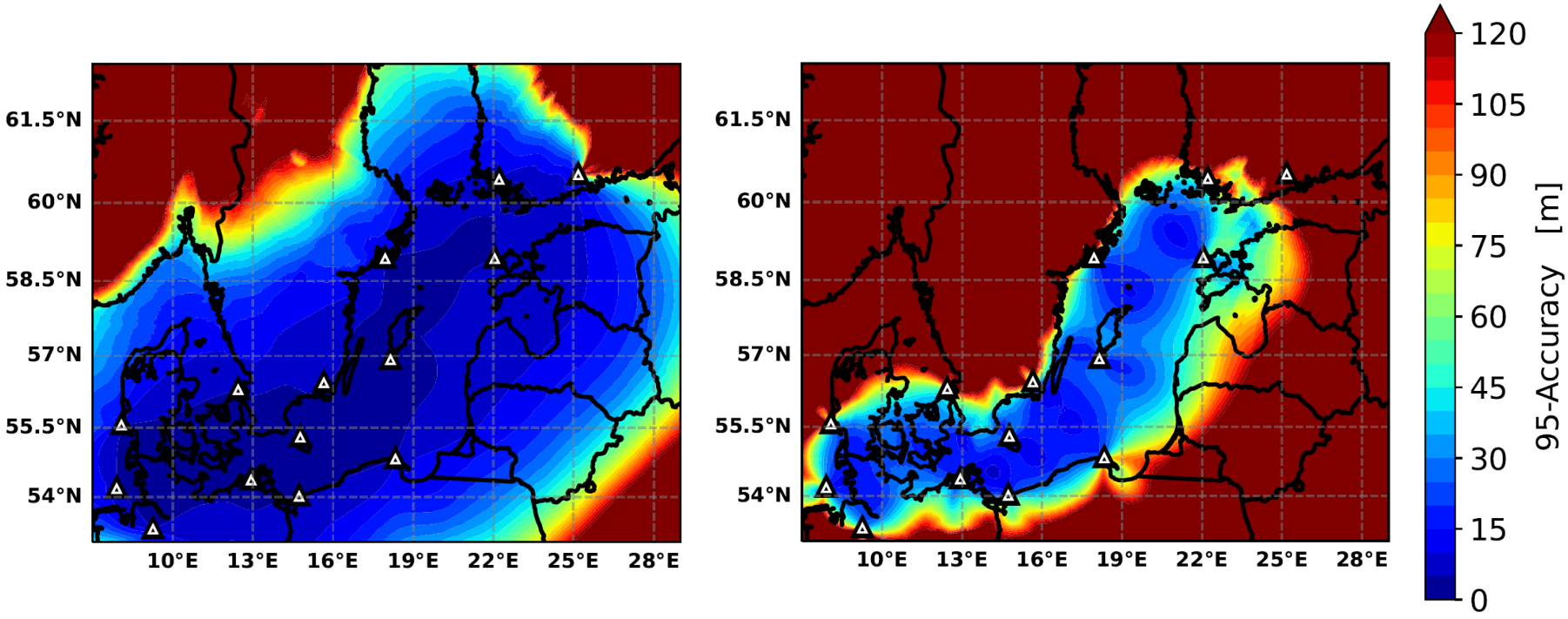


Extend MF R-Mode testbed by additional transmitters

Adding 6 transmitters; assumptions presented before

Day-time hours, 95% accuracy [m]

Night-time hours, 95% accuracy [m]



- R-Mode can support ships from Gulf of Finland to Kiel Canal

VDES R-Mode

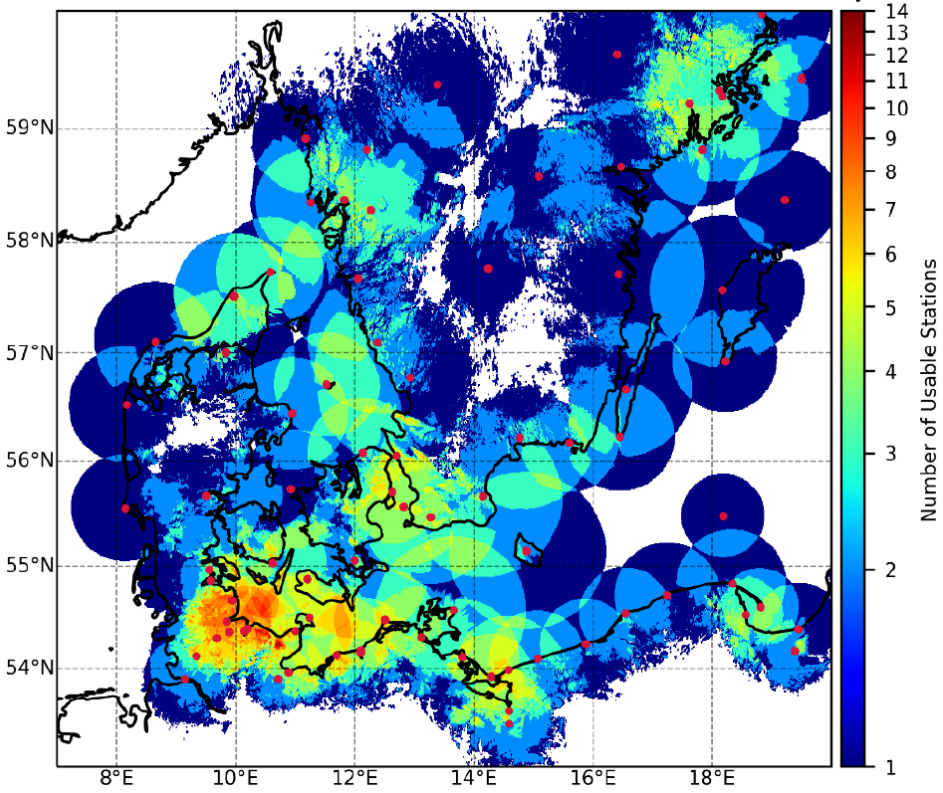
- VDES will replace AIS
- Chance to update to R-Mode

- Kongsberg's new VDES base station offers R-Mode as an experimental option

- Effort for additional VDES base stations is low

- Most likely several regions with sufficient high density of base stations for initial setup of operational R-Mode in the Baltic Sea Region

Southern Baltic: Number of available VDES/AIS



Source: MF/VDES R-Mode Coverage Prediction and Accuracy Estimation, GRAD, RPT-39-JSa-20, December 2020.

R-Mode is an international system

- GNSS: limited number of involved organizations

- R-Mode is a system of systems
- R-Mode can be set up as local/regional system
  - Harbour area
  - Coastline of a state
- R-Mode can support the entire Baltic Sea
  - Connect local/regional R-Mode systems
  - Requires harmonization of local/regional R-Mode systems and services

- Important tasks for the future
  - Setup a framework to work together in BSR
  - Standardized R-Mode shore service and onboard equipment

Summary

- National maritime administrations and authorities own MF and VHF communication infrastructure that has the potential to provide R-Mode service to support coastal navigation with a backup system for GNSS.
- Concepts exist to make R-Mode independent from GNSS.
- R-Mode principle allows to extend the network step by step.
- Coordination is necessary to provide high quality R-Mode service in areas with overlapping system from different countries.

We have to work together that the entire Baltic Sea Region benefits from it.

Contact

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

Project partner