Input paper: [[1]](#footnote-1) ENG18-3.2.2.4

Input paper for the following Committee(s): check as appropriate Purpose of paper:

**□** ARM X ENG **□** PAP X Input

**□** DTEC **□** VTS **□** Information

Agenda item [[2]](#footnote-2) n.n

Technical Domain / Task Number 2 …………………………………

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RIPTIDE PHASE II

# Summary

The main purpose of this input paper is to inform the ENG committee members about the status of RIPTIDE Phase 2 project with core activities focused on building a resilient PNT concept demonstrator in the Black Sea involving key technologies such as AIS/VDES and R-Mode.

The work presented in this paper has been performed in the ESA NAVISP Element 3 programme.

# Background

The RIPTIDE Phase 2 project targets the second phase in the development of a resilient PNT solution dedicated to the particularities of the Black Sea and Danube Lower Basin region.

Specific objectives:

* Review and consolidate the requirements for the resilient solution
* Propose an architecture for the solution, define and consolidate the system design
* Perform an iterative assessment of the alignment and implications to the regulatory and standardization aspects, as well as identify the alignment to the current operational environment
* Implement the Monitor and Protect components of the system
* Perform laboratory and field testing in Black Sea environment to assess the solution performance
* Evaluate the technology readiness and update the operational roadmap
* Transversal evaluation of the RIPTIDE solution applicability in other domains
* Awareness raising process amongst national stakeholders and planning of the future steps

# Description of activities

The RIPTIDE Phase 2 project targets the continuation of the development of a resilient PNT solution dedicated to the particularities of the Black Sea and Danube Lower Basin region through a concept demonstrator in the Black Sea.

The main goal of the project is to demonstrate an improved approach of resilient PNT, based on an integrated solution, tackling both monitoring as well as protection against jamming and spoofing.

The starting point of this activity was the input coming from the previous phase of RIPTIDE.

The next step was the consolidation of the system architecture. The design at both ground part as well as at receiver side, together with the interfaces between different components or subsystems have been detailed. The demonstrator takes advantage of both the Monitor and Protect features proposed in the first phase of RIPTIDE [1] and it has an architecture based around three technological pillars:

* Spectrum Monitoring – represents the monitor feature and aims to detect interference events and broadcast interference alerts to the user.
* Additional Ranging Signals – part of the protect feature and based on a regional land-based radio navigation system, such as VDES R-Mode. For this phase of the project, three VDES R-Mode transmitter stations will be deployed in lighthouses locations in the area of Constanta, Romania. The R-Mode stations are using manufacturer VDES R-Mode boxes and are available to the project through the in-kind support of WSV.
* Trusted NM distribution – represents the second part of the protect feature and consists of a system capable to distribute trusted GNSS Navigation Messages using the maritime VHF infrastructure.

Currently the project is in the development and implementation stage where effort is put on implementing and integrating the modules of the concept demonstrator.

To ensure successful implementation, the following step is dedicated to verification and testing of the solution in both laboratory and in maritime environment with transmitter equipment deployed in lighthouses and receiving equipment mounted on a research vessel. For this purpose, several different scenarios have been defined, targeting to assess the achievable performance and resilience levels of the concept demonstrator.

In the last task of the development chain the applicability of the technology will be evaluated and the alignment and fulfilment of the requirements will be checked. This step will enable the identification of any incompliances or new features to be considered for the next phase of the project and will update the technological roadmap for the operational development.

# References

1. Mistrapau F., Clopot R. M., Circu C. V., Olteanu V. G., Stefanescu I. B., Bivolaru M., Dumitrache L., Popov P., "Resilient PNT for the Black Sea and Danube Region", Proceedings of the 36th International Technical Meeting of the Satellite Division of The Institute of Navigation (ION GNSS+ 2023), Sep 13, 2023

# Action requested of the Committee

The Committee is requested to:

1. Be aware of RIPTIDE Phase II activities focused on resilient PNT and involving key aspects of AIS/VDES and R-mode in the Black Sea.
2. Provide feedback on the proposed approach in view of a potential future standardization perspective.
3. Contact the authors if there is interest in this topic.
4. Provide a presentation slot within ENG18.

1. Input document number, to be assigned by the Committee Secretary [↑](#footnote-ref-1)
2. Leave open if uncertain [↑](#footnote-ref-2)