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| From: ENG8 | ENG8-12.1.25 |
| To: ENAV23 & ARM8 | 18 October 2018 |

LIAISON NOTE

VDES R-Mode Requirements

# Introduction

ENAV forwarded a Liaison Note to ENG (ENG8-11.13) requesting support for the development of system requirements VDES R‑Mode. The ENG Committee would like to express its gratitude for being invited to support this activity and for the summary of discussions held within the ENAV Committee, as that helps all interested parties remain informed.

# Details of paper

For ease of reference, the actions requested of the ENG Committee are listed below:

1. *Note / review the information in the following documents related to VDES R-mode:*
   1. *Reply to “Is R-Mode the VDES Killer Application?” (ENAV22-9.3.6) (ENG8-11.13.1);*
   2. *Results of Discussion on VDES R-mode (ENAV22-9.2.5) (ENG8-11.13.2);*
   3. *VDES R-mode - Development Status Update (ENAV22-9.2.10) (ENG8-11.13.3);*
   4. *R-mode Baltic - Baseline and Priorities, when available.*
2. *Provide input on the system requirements for VDES R-mode to ENAV Committee as soon as possible, ideally by the end of October 2018. In particular, requirements on the VDES R-mode waveform; transmission jitter and synchronisation accuracy; and expected transmission duty cycle.*
3. *Consider the possibility of holding a joint ENG PNT WG – ENAV Comms WG inter-sessional meeting / workshop to progress work on VDES R-mode.*

Item 1a, (document ENG8-11.13.1) contained a number of additional questions, which again are copied here for ease of reference:

1. *What are the expected requirements in available a) data rate, b) access bandwidth, c) packet size and data structure and d) at which update rate for the communication?*
2. *There were concerns raised as the VDE channels are currently allocated by ITU Radio Regulations as mobile service and not for radionavigation service*
3. *What are the requirements on the slot transmission accuracy / transmission timing jitter of the clock at the base station and what will be the overall impact on the jitter between the different clocks?*
4. *In case of spoofing at the base station what is the impact?*
5. *In case of spoofing at the mobile station what is the impact on the vessel? Currently VDE assumes it uses the location and timing information is provided by GPS (through the AIS receiver).*

In response, the ENG committee is able to provide the following comments and support (numbered to match the points above):

1a (i) The ENG Committee does not feel suitably educated on the specifics of VDES to be able to answer these questions, but is willing to support the ENAV Committee where it can (see item 3).

1a (ii) The ENG Committee does not feel suitably educated on the specific implications of the ITU designations in order to understand the implications of VDE channels not being designated as a Radionavigation service. It would appear that seeking Radionavigation designation is appropriate if the channel is being used in that manner and the ENG Committee offers its support in enabling this action, should that be required.

1a (iii) The ENG Committee feel that the permitted slot transmission accuracy/jitter will be a function of the target performance the system is being designed to achieve and the implementation method used to add a ranging function to VDES. It feels that it may be pertinent to define a use case from which to design the system requirements. The ENG Committee provides a suggested approach below.

1a (iv) The ENG Committee is not familiar with the design of an AIS/VDES base station. However, given the assumption that the base station remains static, one may expect spoofing of a GNSS signal at the base station would affect the timing control of the system (if static, spoofing the position should not cause any problems). If GNSS timing is affected, this could potentially affect the AIS/VDES transmissions in terms of synchronising bit transitions or data outputted. Without more knowledge of the system design, it is not possible to elaborate, however the ENG Committee suggests that any new equipment should be designed to test for, and alert the user, if cyber-attack (including jamming or spoofing) is detected. The inclusion of a local clock (e.g. Rubidium) may help mitigate for certain outages, but the level of holdover would need to be carefully considered.

Spoofing that reports the presence of a new base station could potentially affect the system performance and unless there is some form of authentication, would inevitably affect the user position.

The ENG Committee would like to offer its support to investigate this further and believes that it may be easier to address once a particular R-Mode approach is agreed (in terms of how the timing information is provided).

1a (v) The ENG Committee is not familiar with the design of a VDE shipborne receiver. An AIS receiver uses GNSS to report the vessel’s position and GNSS time for message timing. If a VDE receiver operates in a similar manner, then jamming or spoofing has the potential to affect its ability to calculate a range and bearing to any received lat/lon information or, in the case of spoofing, potentially report them erroneously. The ENG Committee recommends that such new receivers are designed to consider cyber-attacks (including jamming and spoofing) so that such events can be detected and the mariner informed, if the impact can’t be mitigated. When considering the provision of R-Mode, it is anticipated that the internal clock, along with timing/range information provided by the R-Mode capability would enable the receiver to calculate its position during periods of GNSS outage.

The ENG Committee would like to offer its support to investigate this further and believes that it may be easier to address once a particular R-Mode approach is agreed (in terms of how the timing information is provided), and receiver standards start to be developed.

1b & 1c The ENG Committee noted these documents and are grateful for the summary of discussions.

1d The ENG Committee noted that the R-Mode Baseline & Priorities report is not yet published and will review it when available.

2 The ENG Committee feel that the waveform, transmission accuracy, jitter and duty cycle will be a function of the target performance the system is being designed to achieve, and the overall R-Mode design adopted. It feels that it may be pertinent to define a use case from which to design the system requirements. The ENG Committee provides a suggested approach below.

3 The ENG Committee supports the idea of working closely on this important development. The ENG Committee has a work item within its current task plan to arrange an R-Mode workshop. This is currently being defined and the ENG Committee strongly welcomes the participation of ENAV and ARM members interested in developing this topic.

The workshop is currently being scoped to take place during 2019, although a date and specific location has not yet been agreed. The workshop is being considered as an opportunity to form agreements on the way forward and it is clear that work to develop ideas and proposals is needed to ensure the topics are suitably mature to enable decisions to be made. The ENG Committee will circulate the workshop plan as soon as it is available. It is anticipated that the all interested parties will need to work closely on this topic before and after the workshop and joint intersessional discussions, whether face‑to‑face or via email/teleconference will be required in order to support system development.

In order to progress the development of VDES requirements, the ENG Committee suggests that a use case is developed. Such a use case needs to be beneficial and realistic. Therefore, the ENG Committee invite ARM to:

* Review the performance requirements for a backup system as provided in IALA R-129 to ensure they remain valid.
* Identify a particular use case/scenario that could then be used to help define R-Mode system requirements.
* Consider whether R-Mode performance is considered as a redundant, backup or contingency system for the use case/scenario selected (as that may help drive design considerations).

# Action requested

The ENAV committee is requested to:

1. Note the content of this liaison note and consider it within its work on this topic.
2. Provide comments on the workshop content, once the workshop planning document is circulated.

The ARM committee is requested to:

1. Note the discussions captured in this liaison note and that of ENG08-11.13.
2. Review the backup requirements provided in the annex of R-129 to ensure they remain valid.
3. Consider a suitable use case/scenario where R-Mode VDES can be used, and to identify whether it should be considered a redundant, backup or contingency system, as defined in R-129.
4. Provide its thoughts back to both the ENAV and ENG Committees.