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**□** ARM **□** ENG **□** PAP **□** Input

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

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Korea’s Research and Development Project on Integrated Terrestrial-Satellite VDES System Compliant with International Standards

# 1 SUMMARY

This document introduces Korea's research and development project on an integrated terrestrial-satellite VDES system that is compliant with international standards. This project is sponsored by the Ministry of Oceans and Fisheries of Korea and managed and evaluated by KIMST(the Korea Institute of Marine Science and Technology Promotion) from April 2023 to December 2026.

KRISO(Korea Research Institute of Ships & Ocean Engineering) is in charge of the overall project. A total of eight institutions, including four public research institutes, three private corporations, and a university participate in the project in order to develop VDES technology and infrastructure that comply with the latest international standards(the project part 1). The project also aims to develop VDES-based maritime services and demonstration systems(the project part 2) over the next four years.

The main output of the R&D project can be applied to ship VDES installation and VDE-TER coastal infrastructure construction that is defined/shall be defined by the revision of SOLAS. In addition, it is expected to contribute to expanding the use of VDES-based maritime services and acquiring certified testing technology for commercial VDES equipment.

## 1.1 Purpose of the document

The purpose of this document is to introduce ‘The Research and Development of Integrated Terrestrial-Satellite VDES System’ promoted by Korea and to ask for the participation of interested experts to listen to various opinions from IALA and the International Maritime Society.

**1.2 Related documents**

[1] IALA GUIDELINE G.1117 – VHF DATA EXCHANGE SYSTEM (VDES) OVERVIEW

[2] ITU-R M.1371–5 Maritime Technical characteristics for an automatic identification system using time division multiple access in the VHF maritime mobile frequency band (AIS)

[3] ITU-R M.2092-1 Technical characteristics for a VHF data exchange system in the VHF maritime mobile band (VDES)

**2 BACKGROUND**

Since the release of "Technical Details and Guidelines for VDES Implementation" at the IALA e-Nav Committee in April 2014, various research has been conducted as VDES’s role in promoting the safety of navigation has become clearer. Accordingly, ITU Recommendation M.2092-1 (2022.02), Technical characteristics for a VHF data exchange system in the VHF maritime mobile band and IALA Guideline G.1117 VDES Overview Edition 3.0(2022.12), were revised.

At the 10th NCSR meeting on May 2023, it was agreed that the work to amend SOLAS to reflect that VDES can replace AIS should be prioritized. It was also agreed that the inclusion of VDES as a new GMDSS compartment needs to be discussed continuously and thoroughly. The revision of SOLAS and related working documents are expected to be finalized at the 11th NCSR meeting(June 2024, provisional).

Thus in order to prepare for the infrastructure replacement and reestablishment that will follow the revision of SOLAS, the government of the Republic of Korea decided to invest in the development of domestic VDE-TER and VDE-SAT equipment and operation technologies necessary for the application of maritime services through VDES.

# 3 brief introduction of the project

# 3.1 Part 1 of the VDES R&D PROJECT

The main objectives of part one(1) of the VDES R&D project, the development of VDES communication technology and infrastructure, are as follows.

3.1.1 Development of FPGA-based AIS/ASM/VDE modem

This part of the research includes the block design of the following representative physical layers related to AIS, ASM, VDE-TER, and VDE-SAT communication technologies in a single FPGA chipset:

1. MAC block interface for TDMA multiple access
2. GMSK, π/4-QPSK, BPSK/CDMA, 8-PSK, 16-QAM encoder/decoder and internal register
3. Data packet framer and timing controller
4. NRZI encoder/decoder, 2 Channel RSC-based turbo encoder/decoder, scrambler/de-scrambler
5. LPF and interpolator for transmitter output of spectrum mask shaping
6. AGC circuit and RSSI measuring circuit through AFE part control of RF block
7. Symbol(bit) timing recovery for phase control of ADC sampling clock
8. Frequency offset estimator for phase offset rejection and frequency of received signal

This part of the research will be carried out sequentially from AIS/ASM/VDE-TER communication technology to VDE-SAT communication technology by the first half of 2025. Then, in the second half of 2025, performance verification compliant with the IEC standards will be conducted.

3.1.2 Development of shipborne/shore station equipment

This project plans to develop shipborne/shore station equipment compliant with the latest ITU recommendations and IALA guidelines. Aiming beyond simple VDES-based communication verification technology, all functions of the link layer, the network layer, and the transmission layer will provided to enable two-way communication between ship and ship, ship and shore, and ship and satellite. This part is performed concurrently with the design of the physical layer block. In 2026, a testbed demonstration of the results of the research will be conducted off the coast of Korea and overseas countries.

3.1.3 Development of integrated operation platform for terrestrial control system based on big data

The research develops two subsystems that constitute one terrestrial control system. One is a bigdata data-based VHF data link integrity monitoring and mitigation system, and the other is a resource management and coordination system between VDE-TER shore stations. The systems will be developed to comply with the latest IALA guidelines and to be compatible with the existing AIS vessel monitoring systems. Even after the project is completed in 2026, The algorithm correction for the integrity monitoring will be continuously made based on the data accumulated until the revision of SOLAS takes effect.

# 3.2 PART 2 OF THE VDES R&D PROJECT

The main objectives of part two of the VDES R&D project, the development of VDES-based maritime services and a verification system are as follows.

3.2.1 Development of VDES-based maritime services

The project plans to study digital information services that can be provided with the data transmission capability of VDES among IMO’s maritime services (MS1~16) and develop a system to operate the maritime services. Additional research on how to operate in conjunction with various other communication systems for data transmission in an environment where VDES service is not possible shall also be conducted:

1. LTE-M, established and operated by the Ministry of Oceans and Fisheries(ROK) for vessel safety by the shore
2. ATSC 3.0 standard-based UHD terrestrial broadcasting network, for disaster broadcast etc.

The project shall provide scenarios and data-transmission protocols for operating maritime services. It will be used as test service data necessary for the testbed demonstration of part one of the VDES R&D project. The services will be developed by specifying the parameters that can be used in real sites, by expanding the scenarios in the IALA G1117. The developed services will be open to the public through open API. This is expected to have a positive effect on expanding the use of VDES-based maritime services.

3.2.2 Development of VDES systems performance verification simulator

The project plans to develop a simulator for performance verification of VDES shipborne/shore station equipment and an integrated operation platform for terrestrial control systems. The simulator verifies the accuracy of the RF performance characteristics of the physical layer of the VDES equipment, the automatic detection function for the link layer, the network layer, and the transmission layer, as well as the integrity analysis algorithm and available resource analysis algorithm of the VDL integrity monitoring system within the integrated operation platform. This will contribute to the universalization of accredited verification technology for commercial VDES equipment.

**4 REFERENCES**

1. IMO MSC.1/Circ.1610 INITIAL DESCRIPTIONS OF MARITIME SERVICES IN THE CONTEXT OF E-NAVIGATION
2. E-NAV 31th Extraordinary meeting Input Document – Working Draft of Guideline on VDES VDL integrity monitoring
3. E-NAV 31th Extraordinary meeting Input Document - EM1-5.1.3.4 Proposals on VDES communication resource coordination

**5 ACTION REQUESTED OF THE COMMITTEE**

The Committee is requested to:

1. recognize the main objectives of Korea’s VDES research and development project.
2. consider participation in the expert group for Korea’s VDES research and development project.

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