**Input paper: [[1]](#footnote-1)** EM1-5.1.3.4

**Input paper for the following Committee(s):** **Purpose of paper:**

(Select as appropriate)

ARM  ENG  PAP  Input

ENAV VTS  Information

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

**Technical domain/ Task number** 2 …………………………………

**Author(s)/Submitter(s)** China MSA…………………………

Proposals on VDES communication resource coordination

# Abstract

IALA initiated a new task "Develop a Guideline for VDES resource sharing and coordination/cooperation" proposed by Japan in 2021. The objective of the task is to establish international cooperation and resource sharing and management on VDES terrestrial and satellite. It provides a framework of VDES resource sharing and coordination/cooperation for VDES satellites operators, VDES terrestrial operators and VDES users, so as to realize smooth and efficient official or individual VDES communications. Recently, Japan and other countries have carried out relevant research.

Proper coordination of VDES resources is the prerequisite to ensure the communication efficiency of VDES, and reduce the effect of interference and conflicts. Therefore, the potential VDES resource sharing and coordination issues are listed, and the corresponding principal proposals are suggested in this proposal.

## Purpose of the document

It is recommended that the principles and mechanisms of VDES VDL resource coordination proposed in this proposal should be taken into account when drafting the guideline for VDES resource sharing and coordination/cooperation.

## Related documents

1. ITU-R M.2092-1, *Technical characteristics for a VHF data exchange system in the VHF maritime mobile band, February 2022*
2. IALA G1117, *VHF Data Exchange System(VDES) Overview, December 2022*

# Background

According to ITU-R M.2092-1, the air interface resources should be coordinated and shared among VDE-TER stations, VDE-TER and VDE-SAT stations, and VDE-SAT stations. In addition, in order to improve the efficiency of the VDES application and provide the full capacity of VDES service worldwide, a consensus has been reached that the application resource should be shared and coordinated between VDE-TER and VDE-SAT in the VDES community.

# Discussion

## ISSUES to be coordinated

The following issues should be taken into consideration for the resource sharing and coordination between VDE-TER and VDE-SAT.

### resource sharing and coordination among land-based control stations

The VDE-TER resource allocation and sharing may change dynamically. The allocation of physical channels, logical channels, and slots should be coordinated among control stations. The control stations should manage the VDE resource assignments through the bulletin board and announcement signaling channel in the coverage area. The following aspects should be considered:

1. How to coordinate the allocation of the physical channel, logical channel, and slots among control stations to ensure the reliability and efficiency of the transmission;
2. The control station service area (defined in the bulletin board) should be within the stable coverage area of the control station signals, rather than the actual signal transmission range. The signal transmitted by the control station may still cause interference to signal transmission outside the service area. For the mobile station, it is almost impossible to confined its signal in the current control station service area. There might be signal interference on the adjacent service area covered by the mobile station.

### resource coordination and sharing between VDE-TER and VDE-SAT

The allocation of resources provided by the TBB(Terrestrial Bulletin Board) in the service area of the VDE-TER station shall have priority over that provided by the VDE-SAT in the SBB(Satellite Bulletin Board).

Additional considerations should be included:

1. If the satellite uses channels other than A and B, the VDE-SAT and the VDE-TER stations may have frequency conflicts. It is necessary to establish the mechanism that the VDE-SAT should not interfere with the VDE-TER station when transmitting in the non-satellite dedicated channels.
2. When the satellite needs to obtain the target ship position for addressed VDE messages, the possible method that using AIS message received by the satellite to obtain the ship position has low efficiency. It is mainly shown in:
   1. The satellite has limited coverage of AIS targets and a long revisit period. Considering that the ship is also on a voyage, the comprehensiveness and timeliness of obtaining the ship's position are limited.
   2. Because of the long transmission duration on the VDE-SAT channels, and limited isolation between the AIS and VDE antennas on the satellite, the satellite's ability to receive AIS messages is severely weakened.
   3. The satellite needs to process the received AIS messages in real time and maintain a global Ship Home Location Register (SHLR) on the satellite. It will take considerable VDE-SAT resources.

Considering the above factors, the ship position information obtained by a single satellite or a single VDES constellation cannot meet the transmission requirements of VDE-SAT downlink addressed message. Therefore, the global ship position information sharing mechanism should be established.

### resource coordination and sharing among vde-sat systems

The air interface resource coordination and sharing among VDE-SAT systems are managed among the satellite service providers. The coordinated resource is announced through the bulletin board.

It should be considered in the following aspects:

1. How to perform VDE-SAT resource coordination for channels and slots within one country's domain;
2. The coordination among satellite systems is related to many elements, such as dynamic coverage area , physical channels, logical channels, and slots. Therefore, it is more complex compared with that of the VDE-TER systems.

## proposals on the resource coordination and sharing of the VDES systems

Given the above issues, some general recommendations are proposed as below on the resource coordination and sharing among VDE-TER stations, VDE-TER and VDE-SAT stations, and VDE-SAT stations.

### general principle

* "Give priority to the land systems": The VDE-SAT service should show respect to the land-based station service to avoid conflicts;
* "Low priority should show respect to the high priority": Low priority services must yield to high priority services;
* "First come, first served": If multiple VDES satellites apply for the same resource, the one who applies first will obtain the allocation;
* "Balanced resource allocation": On the basis of "first come, first served", the resource request needs to be coordinated to guarantee fairness.

### satellite work mode

There are three work modes of satellite communication:

* Received-only mode: VDES satellite in the received-only mode will only receive data without transmitting. All the available channels specified in the ITU-R M.2092-1 can be used.
* Channel limited mode: VDES satellite shall send the satellite bulletin board (SBB) messages in the dedicated frequency band. When there is a need for VDE data transmission, the satellite will send and receive data on the dedicated channel to be separated from the VDE-TER systems in the physical frequency band, in case of any interference between them. The dedicated channel pair is A and B channels given in the table 61 in the annex 5 of the ITU-R M.2092-1, and the channel bandwidth is 50 kHz.
* Full bandwidth mode: The satellite will transmit and receive data in all the available channels specified in the table 61 in the annex 5 of the ITU-R M.2092-1. The available channel pairs are the A, B, C, D, E, and F, and the channel bandwidth can be 50 kHz, 100 kHz and 150 kHz.

It is recommended that VDES satellites work in the received-only mode and channel limited mode over the coastal waters, so as to ensure the overall communication efficiency of VDES system.

### resource coordination and sharing among the land-based control stations

When the default bulletin board is used, the VDL allocation of the land-based control stations should avoid slot conflicts as much as possible;

The land-based control stations should make use of the available channels of VDE-TER as much as possible and reasonably allocate the logical channels to ensure maximum throughput while avoiding conflicts.

The land-based control stations should coordinate resource allocations with each other;

It is recommended to establish the VDL integrity monitoring system to monitor the VDES VDL operation.

### resource coordination and sharing between the vde-sat and vde-ter

The VDE satellite is allowed to receive VDE messages in all areas in the receive-only mode.

The competent authority shall have the right to decide on the work mode of the satellite within its domain and specify geographical area, physical channels, logical channels, and slots that can be used for the satellite VDE transmission according to the actual situations. The dynamic resource requesting and allocation mechanism should be established to help the satellite service providers to use the VDE-SAT resources in their domains.

To facilitate the communication between VDE-SAT and VDE-TER, an automated VDES resource coordination system should be established to undertake such functions as mobility management (MM), resource coordination (RC), service gateway (SGW), and service quality control (QoS). Thus, it will provide information routing, resource allocation, system inter-operation, and quality assurance for communication between satellite and terrestrial system.

### resource coordination and sharing among the vde-sat stations

Satellite service providers carry out the VDE-SAT resource coordination outside the domains of states.

It is recommended that a corresponding coordination mechanism should be established.

# References

1. ITU-R M.2092-1, *Technical characteristics for a VHF data exchange system in the VHF maritime mobile band, February 2022*
2. IALA G1117, *VHF Data Exchange System(VDES) Overview, December 2022*

# Action requested of the Committee

The Committee is requested to:

1. Consider the principles and mechanism of VDES resource sharing and coordination in this proposal.
2. Discuss the subject of automated resource coordination system under the subject of VDES resource sharing.

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