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Agenda item 6.3

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

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Proposal on the application of VR technology to VTS simulation training

# Summary

Considering that the IALA VTS Committee may revise G1027 on Simulation in VTS Training in the 2023-2027 working plan. This paper mainly combined with years of training experience of China Maritime Safety Administration to share the idea of applying VR technology to VTS simulation training, in order to obtain better training effect in the future VTS simulation training.

# Purpose of the document

The purpose of this document is to provide ideas for the application of VR technology in VTS simulation training.

# Related documents

VTS52-7.3.5 New Task Plan 2023-2027 (2022-03-14)

IALA Recommendation R0103 (V-103) On Standards for Training and Certification of VTS Personnel

IALA Guideline G1027 on Simulation in VTS training (2005)

# Background

At present, VTS simulation training is mainly based on the relevant content of the IALA G1027. In simulation training, trainees can enhance their capabilities in equipment operation, disposal procedures, and emergency response. However, limited by existing equipment, we found that the trainees did not have a strong sense of experience in some simulated scenarios, such as emergency response scenarios, especially for trainees with no nautical experience. Even if they participate in the training, they are still not very clear about many situations at sea, and they are prone to overwhelmed problems when they encounter emergencies in practical work.

In recent years, with the maturity of VR technology, the mode of virtual training has gradually been widely used in many fields, such as the training of pilots, astronauts, surgeons, firefighters, etc., and has begun to replace some practical training in practice and exert great potential. With the help of VR technology, we can solve and avoid the problems that occur in the simulation training, further improve the training effect and ensure the quality of training.

# Discussion

**3.1 Concept of VR technology**

Virtual reality technology seeks to create a realistic three-dimensional image or environment that participants can perceive as real and allow them to interact to observe and operate the virtual world in realistic ways. VR technology has three important characteristics: immersion, interaction and imagination.

Figure 1 Three characteristics of VR technology（3I）

* 1. **The necessity of VR technology application in VTS simulation training**

The application of VR technology in VTS simulation training is based on the following considerations:

Practical needs to improve training effectiveness. In the daily VTS simulation training, trainees conduct daily training through the on-duty screen of the computer in the training room. The trainees, especially those without sailing qualifications, can hardly match the training content with the complexity of the real situation at sea only through watching VTS screen, which greatly reduces the training effect. VR technology can be used to display the reality of the corresponding scene on the duty screen simultaneously, so that trainees can feel various situations encountered in the actual work of VTS more intuitively, and form natural on-site judgment and disposal intuition.

To realize the practical demand of high cost performance of "input - benefit". At present, only a few VTS have simulation training bases including bridge simulation for VTS simulation training. However, due to the limitations of funds, sites and equipment, simulation training, especially bridge simulation, is difficult to be applied on a large scale. In addition, in order to let the trainees have an intuitive understanding of complex emergency situations, on-site learning will have high training costs or high risks in some scenes which are difficult to reproduce, such as collision, fire and other accidents. The advantages of VR technology can be used to solve the above objective problems. Although VR technology needs to invest a sum of money for equipment procurement, model and design in the former stage, only low-cost maintenance funds is needed in the later stage to achieve better training results.

Respond to the objective in need of remote training. Affected by the COVID-19 pandemic, remote training has become an important way of daily training. But due to the limitations of existing equipment, simulation training is difficult to be carried out under online training scenarios. In addition, trainers and trainees generally considered that remote training is less interactive than physical courses, and it is difficult for students to concentrate, which affects the quality of training negatively.

**3.3 Feasibility of VR technology application in VTS simulation training**

In terms of current technical means, various marine scenes can be easily recorded and stored permanently by unmanned aerial vehicles (UAVs), fisheye cameras and other equipment. 3D modeling technology can also be used to obtain relevant 3D models. The sharing and transmission of the scene are relatively simple. Through the use of VR technology, the recorded real scenes or 3D models can complement the existing training, improve the sense of substitution of trainees and enhance the shock power without affecting the safety of personnel.

Several common situations will work (see below) to carry on the design and production into VR scene. Connecting the signal of training screen into VR equipment and using the data helmets, gloves and other devices to match the situation encountered on the screen with VR scene, which can vary according to the instructions for real-time of the trainees. Trainees can also freely switch the on-duty screen, VR scene or synchronous display according to their own needs.

Some common situations in VTS work (ship related):

VA technology can be applied to the following scenarios:

Conventional scenes: heavy traffic flow, bad weather and sea conditions, ships passing through bridges, abnormal Atons, traffic violation, etc.

Emergency scenarios: collision, grounding, disabled ships, dragging, fire/explosion, sinking, personnel / cargo overboard, etc.

The following takes ship grounding as an example to explain the specific production of VR scene:

Step 1- Design the scene (see Figure 2), including the specific content of the scene, the path of scene switching, the logic of interaction, etc.

Step 2- According to the requirements of the scene design, the UAV, fisheye camera and other equipment are used to shoot, and the panoramic video or panoramic picture is made. For the content that cannot be shot in real time, 3D modeling is needed to obtain relevant materials.

Step 3- Create and output interactive VR scenes.

Step 4- The VR scene will be tested and perfected continuously until the scene is satisfactory.

**Y**

**N**

Information collected by trainees

Are all crewmembers safe？（number, situation etc.）

Is the ship safe？（Stranded parts、draft、cargo etc.）

Meteorological and hydrological situation、sediment？

……

Arrange rescue force/warn other ships/ traffic control…… until the danger is clear

Actions taken by trainees

Proceeding to shallow water

Is the ship taking effective measures?（controlled by trainers）

Cancel the warning

Ship grounding

Warning from VTS trainees

*Figure 2 scene design*

In addition, bridge simulation training can be implemented in a similar way (if necessary). Remote training needs to upload the relevant data to the cloud, and then cooperate with the corresponding equipment, which can be realized by using the existing technology.

**3.4 Considerations for VR technology application in VTS simulation training**

The application of VR technology in VTS simulation training should pay attention to the following points:

VR scene-related shooting and production can be completed by professionals, but the scene design requires in-depth participation of experts engaged in long-term VTS simulation training and detailed discussion with engineers to determine the relevant scheme.

The scenes of VTS simulation training is relatively complex, and the comprehensive training time may be long. Since the effect of VR scene depends on VR equipment, the influence of long-term wearing of VR equipment on trainees should be considered, and the continuous wearing time should not exceed 1 hour as much as possible.

# 4 Action requested of the Committee

The Committee is requested to consider the above proposals in future work.