Input paper: [[1]](#footnote-1) VTS44-3.2.2

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

**□** ARM **□** ENG **□** PAP ☑ Input

**□** ENAV☑ VTS **□** Information

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

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

Author(s) / Submitter(s) …………………………………

Vessel Monitoring and Voice Alerting System for VTS

# Summary

With the development of global shipping economy, traffic congestion has become more serious than ever before in many ports and waterways. The vessel traffic service (VTS) center now is facing challenges on how to monitor the real-time movements of all ships effectively within a large VTS area. Although most of the existing VTS systems could generate warnings automatically, VTS operators are always confused by a great number of unprocessed warnings including some repeated warnings even some false warnings produced by VTS system. Therefore, there is a strong impetus to develop a new system which can calculate and filter the risks of ship navigation and broadcast warnings to ships automatically. This paper presents an effective risk management tool based on automatic identification system (AIS) signals to reduce the risks associated with ship navigation at sea，which named Vessel Monitoring and Voice Alerting System(VMVA System). The methods of classifying and filtering, the text-to-speech technology and VHF automatic control techniques are employed in this system.

## Purpose of the document

What do you expect the Committee to do as a result of the input of the document or is it an information paper?

We except the Committee could develop the Recommendations and Guidelines based on the technology mentioned in this paper.

# Background

With the rapid development of the world trade, maritime transportation has its unique advantages in transp-orting large quantities of goods over long distances. According to International Maritime Organization (IMO), around 90% of world trade is carried by sea [1]. The VTS operators are facing challenging issues on account of continuous growth in vessel number [2]. Although latest VTS equipment could offer navigational warnings to VTS staffs, a considerable portion of them are meaningless. VTS staff has to pick out the useful warnings and carry out most of the things manually to guide the ship’s captain properly.

# Discussion

[Generally](file:///C:\Users\Liyuan%20Xiang\AppData\Local\youdao\DictBeta\Application\7.2.0.0703\resultui\dict\?keyword=generally) [speaking](file:///C:\Users\Liyuan%20Xiang\AppData\Local\youdao\DictBeta\Application\7.2.0.0703\resultui\dict\?keyword=speaking) , collision risk assessment is performed by the value of DCPA and TCPA. In this section, we will mainly introduce how to process the risk information further.

## Classifying and Filtering

### Both the types and sizes of ships can affect the collision risk of encountered ships. For instance, even if DCPA and TCPA between two merchant ships and between two fishing vessels are same, collision probability between fishing vessels is less due to their relative smaller size and better performance. So classing the collision risks is significant to provide effective warnings. Besides, the collision risk of two tugs and the tug and the merchant ship are also classed in lower level.

### The collision risk between two ships will last for some time in general. During this period, the risk is still calculated and analysed, and the existing VTS technology will remind VTS operators repeatedly. Such repeated warnings between two ships should be filtered.

### When a merchant ship enters the fishing area where lots of fishing vessels are operating, there will maybe collision risks between the merchant ship and most of the fishing vessels. The existing VTS systems tend to provide all the warnings of collision risk to VTS operators. In fact, one or two warnings are enough to attract the attention of VTS operator to notice the dangerous situations.

### In some special areas, for example, in the port basins, the distance between a berthing ship and another near-by ship is short, which will be considered as collision risks. By filtering the risks in these areas, false warnings will be avoided.

### The risk of collision between the sailing ship and the anchored ship is lower than that of two sailing ships. It is necessary to filter the risks like this. Setting the low threshold value of DCPA is a good way to reduce the number of warnings.

## Auto-broadcasting

Most of the existing VTS systems display the warnings in the user interface, which can remind VTS operators only. Then the operators control VHF to broadcast the navigational warnings to ships. If the systems could broadcast useful voice warnings to ships automatically, the labour intensity of VTS operators will be reduced. In order to realize this function, the text-to-speech technology and VHF automatic control techniques are utilized.

The text-to-speech technology makes transformation from warning information to speech signals come true. The speech signals can be different languages based on nationality of the ship. The VHF automatic control techniques make sure that the normal VHF communication will not be interrupted. The warning will be broadcasted when the VHF is available only.

## Application

The Vessel Monitoring and Voice Alerting System was completed in Dec 2015 based on the AIS signals and technology mentioned above, and has been successfully running in VTS centre of Tangshan Port. By using the system, the quality of services is greatly improved, the safety of life and navigation at sea are enhanced and the labour intensity of VTS operators is reduced.

## Prospect

To develop a new generation of VTS system, it is necessary to pay attention to collect the information, such as conventional radar, AIS, CCTV, and meteorological information. It is more important to process and analyse the collected data, which provide more valuable information to VTS operators and aid operators to made decisions. The results, such as collision risks of ships, which are calculated by the system should be recognized. The navigational information from the system and from operators should be treated equally. We hope that, in the future, machines’ [intelligent](javascript:;) monitoring of the navigational traffic at sea will play an important role in VTS daily work.

# References

1. P. Kaluza, A. K¨olzsch, M. T. Gastner, and B. Blasius, “The complex network of global cargo ship movements,” Journal of the Royal Society Interface, vol. 7, no. 48, pp. 1093–1103, 2010.
2. Ahmad C. Bukhari a, Inara Tusseyeva a, Byung-Gil lee b, Yong-Gi Kim a, “An intelligent real-time multi-vessel collision risk assessment system from VTS view point based on fuzzy inference system”, Expert Systems with Applications 40 (2013) 1220–123

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