The Actual Situation of Bridge-to-Bridge Communication in Tokyo Bay

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1. Introduction
It has become much easier to identify vessels nearby since the requirement that vessels be equipped with AIS. Communication using VHF has increased. However, attitudes toward the use of VHF in collision avoidance vary significantly, particularly between the United States and the United Kingdom. For some, bridge-to-bridge VHF communications are an indispensable adjunct to navigation and collision avoidance. To others, such communications are a source of distraction and confusion and therefore have little or no place in collision avoidance under the current rules.

The purpose of our study was to propose an effective use of VHF in collision avoidance. We researched VHF communication and AIS data between vessels in Tokyo Bay, which is one of the densest areas of sea traffic anywhere in the world. As a result of this study, we were able to grasp actual bridge-to-bridge communication using VHF in Tokyo Bay.

2. The role of VHF communication in collision avoidance
VHF is a useful tool to communicate with other ships. However, there are no rules which provide for VHF exchanges in collision avoidance, despite COLREGs, which regulate the use of RADAR. Wakita[10] discussed opinions on the use of VHF as a means of communication in collision avoidance in their paper. Those opinions are as follows:
(1) Harding states that officers should make good use of VHF to determine avoiding action;
(2) Stitt states that officers should not use VHF to agree on avoiding action, because these actions shall be determined only with COLREGs; and
(3) Cockcroft showed the divergence in the use of VHF in collision avoidance, then suggested that VHF should not be used to agree on avoiding action which might not comply with COLREGs.

However, it is often hard to take avoiding action following general rules as overtaking, head-on and crossing situation in busy waters. Therefore, it can be effective to make an agreement on avoiding actions on VHF when a close-quarters situation is developing in the vicinity of an entrance to a traffic route. It also could be effective to use VHF for avoiding the occurrence of risk of a collision. Seto[20] talks about the relation between VHF communication and marine traffic in Ise Bay, which is located in central Japan. The substance of his commentary analysis is as follows:

(1) The collision risk in a developing situation in the case when a VHF call is made is higher than the case in which one is not; and
(2) OOW deal with the risk of collision by using VHF when they consider these risks are higher than usual.

There are differing attitudes to the use of VHF in collision avoidance. However, VHF is actually used as an available means of collision avoidance in the present navigation. Therefore, an effective use of VHF need to be developed.

3. Research of VHF communication in Tokyo Bay
We researched conversations on VHF and navigational situation of each communication. The research point is Futsu-Misaki, which is located in the central of Tokyo Bay. As a result of our research, we were able to grasp the timing of VHF communication, the change of the distance between vessels and the point where VHF calls were made in Tokyo Bay. We observed forty-one conversations, then analyzed the vessel type, the sea area and the detail of each conversation.

4. Actual bridge-to-bridge communication
4.1 Vessel type
Fifty percent of ships called are tugboats and boats escorting huge vessels. These communications are to confirm the "destination" and "maneuvering intention" of the ship answering calls or to keep the distance between these two vessels.

4.2 Sea area
There are some differences in conversations on VHF which depend on traffic routes. Simple conversations such as "red to red", "after you" and so on are occur in circumstances which are not restricted by traffic routes. However, in the case where two vessels are about to enter a traffic route, conversations concern the relative positions of the vessels.

4.3 Content of communication
Fig.1 indicates a breakdown of vessel information which is communicated to the answer-ship from the call-ship. Fig.2 also indicates the same one which is communicated from the call-ship to the answer-ship. This information is classified as "destination", "altering course", "speed" or "maneuvering intention". "Destination" information is the most common type information exchanged on VHF. More than half of such exchanges were carried out by tugboats escorting other vessels. These calls are made in order to grasp the "maneuvering intention" of answer-ships.

4.4 Timing of communication
Fig.3 indicates the relationship between the periods from VHF calls to the closest point of approach and the length of the call-ship. On crossing situation, around 70% of vessels communicate with a vessel five to ten minutes before the closest point of approach, regardless of the length of the vessel. Some other VHF calls that were made more than ten minutes or less than five minutes before the closest point of approach are observed as shown below:
(1) Two vessels came out from Yokohama Passage and Tsurumi Passage simultaneously; and
Fig.1 Content of information (Informing)

Fig.2 Content of information (Asking)

(2) Two vessels came out from Nakanose Traffic Route and Kisarazu Passage simultaneously.

In an overtaking situation, the period from a VHF call to the closest point of approach is valuable. The timing of communication does not depend on the length of the vessel.

5. Consideration

There are some situations in which avoiding action following COLREGs cannot be taken in an area of dense traffic as shown in Chapter 2.

There are some cases in which vessels make a VHF call much earlier than other sea areas near Kisarazu Port Offing Light Buoy, as shown in Chapter 4. In this sea area, it is difficult to notify another vessel of one's maneuvering intention by altering course and speed, even when close-quarter situation are seen developing. That is the reason why vessels in this particular confirmed maneuvering intention with each other beforehand.

A communication alert by a call-ship notifying a following vessel (answer-ship) of its speed was also observed. Below is the reason why the call-ship made a call is to confirm its maneuvering intention and to keep a safe distance between the vessels:

(1) Traffic flows of southbound vessels in excess of fifty meters in length merge at the entrance to Nakanose Traffic Route.

(2) There is a speed limit in Uraga Suido Traffic Route and Nakanose Traffic Route. Therefore, southbound vessels navigating Nakanose West Sea Area alter their speed frequently.

Communication between vessels navigating one direction is in order, not only to take avoiding action, but also to call other vessels’ attention to the distance between two vessels and their relative positions.

6. Conclusion

As a result of this study, we were able to grasp actual bridge-to-bridge communication using VHF in Tokyo Bay. The main results of this study are as follows:

(1) "Destination” accounts for the majority of information exchanged. Half of these VHF calls are made by escort boats and tugboats. The purpose of these calls is to grasp the maneuvering intention of the answer-ship;

(2) In area not restricted by traffic routes, agreements for avoiding action using concise phrases such as “red to red” and, “after you”, are often established. These VHF calls are mostly made five to ten minutes before the closest point of approach;

(3) At the entrance to a traffic route, significant alteration of vessel course is restricted. Therefore, VHF calls are made fifteen to twenty minutes before the closest point of approach. That is earlier than the case shown in (2); and

(4) In a traffic route, or in the case two that vessel is navigating in parallel, VHF communications are about the relative positions of the two vessels.

Communication using VHF increase the risk of collision because of misunderstanding or over-reliance, unless it is used properly. However, VHF can be a useful tool for the exchange of information, when used in appropriate circumstances. The establishment of effective use of VHF is the topic for the future research.

References
