Investigation of Ship Accident Using Ship Handling Simulator

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ABSTRACT
We selected a case of marine accident, in which a ship had sunken after the collision, based on the Marine Accident Investigation Report of Japan Transport Safety Board and conducted virtual experiments to reproduce the accident using a simulator. By using the ship handling simulator, we investigated the detailed cause of the accident from the simulated information of navigation instruments such as radar and from the reproduced view of the bridge of the sunken ship. We also studied the possible way of avoiding the collision in this selected case from the results of the reproduction experiments.

KEY WORDS: marine accidents, accident analysis, ship handling simulator, Japan Transport Safety Board.

INTRODUCTION
When a ship accident occurs on the coast of Japan, the "Japan Transport Safety Board" investigates the cause of the accident and reports the results of the investigation as a "Marine Accident Investigation Report". However, there are cases where the investigation is difficult because the ship sinks or the officers pass away. In those cases, it seems useful to study a reproduction experiment using a ship handling simulator based on the data of the collision accident from the report (Kobayashi, H, et al., 1998) (Nishimura, T., 2014) (Nishizaki, C, et al., 2010) (Yoshimura, K et al., 2012). The purpose of this study is to investigate the detailed causes that led to the collision based on the results of the reproduction experiment and examine the maneuver to avoid the collision.

STUDY PROCEDURE
We will select the research object of marine accidents from the database of "Ship accident investigation report". We will investigate the cause of the accident described in the selected "Marine Accident Investigation Report" (hereinafter Report). We will conduct an experiment to reproduce the accident using a ship handling simulator in accordance with the situation at the time when the marine accident occurred. We analyze the detailed cause of the accident described in Report and study the avoidance method from the data obtained by the reproduction experiment.

SHIP ACCIDENT Targeted FOR THE EXPERIMENT
Selection of ship accident
The conditions of selecting a ship accident is as follow.
(1) A maritime accident that occurred between 2008 and 2018
(2) The type of accident is collision
(3) The gross tonnage is 500 tons or more which is AIS-equipped ship
(4) The type of ship is a cargo ship, passenger ship, and tanker
We searched cases with above four conditions. In addition, we selected the cases that were difficult to investigate such as the case that the ship sank after the collision or the watch officer was passed away. As a result, we selected a case for our study as the "collision between a car carrier CYGNUS ACE and a multipurpose cargo ship ORCHID PIA" (Japan Transport Safety Board, 2011).

Summary of selected vessel accident
The collision accident between the car carrier “CYGNUS ACE” (hereinafter Vessel A) and the multipurpose pure car carrier “ORCHID PIA” (hereinafter Vessel B) is a marine accident where they approached and collided each other across the course at night off the east coast of Oshima, Japan. At that time, the navigator on the side of Vessel A (hereinafter Officer A) confirmed Vessel B approaching with his eyes and the radar. However, it is reported that Officer A was unable to judge the movement of Vessel B appropriately. In addition, Officer A did not perform an appropriate collision avoidance operation. Officer A was not acquired proficiency in handling of ARPA. As a result, Officer A assumed that Vessel B would pass ahead in spite of the fact that Vessel B was actually passing the stern of Vessel A. Officer A gradually began to turn Vessel A to the left when the second ARPA alarm was sounded. One minute before the collision, Officer A judged the danger of collision