

An Experimental Study on the Temperature Reduction of Exhaust Gas at a Snorkeling of Submarine

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Abstract : Conventional submarines obtain propulsive force by using an electric propulsion system consisting of a diesel generator, battery, motor, and propeller. In the underwater, the submarine uses the electric power stored in the battery. After that, when a certain amount of electric power is consumed, the submarine floats near the sea water surface and recharges the electric power by using the diesel generator. The voyage carried out while charging the power is called a snorkel, and the high-temperature exhaust gas from the diesel generator forms a heat distribution on the sea water surface. The heat distribution is detected by weapon system equipped with thermo-detector and that is the main cause of reducing the survivability of the submarine. In this paper, an experimental study was carried out to establish optimal operating conditions of a submarine for reduction of infrared signature radiated from the sea water surface. For this, a hot gas generating system and a round acrylic water tank with adjustable water level were made. The control variables of the experiment were set as the mass flow rate, the temperature difference between the water and the hot gas in the water tank, and the water level difference between the air outlet and the water surface. The experimental instrumentation used a thermocouple of T-type to measure the released air temperature on the surface of the water, and a thermography system to measure the thermal energy distribution on the water surface. As a result of the experiment study, we analyzed the correlation between the final released temperature of the exhaust pipe exit in a submarine and the depth of the snorkel, and presented reasonable operating conditions for the infrared signature reduction of submarine.

Keywords : experiment study, flow rate, infrared signature, snorkeling, thermography

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