

PhD THESIS SUMMARY
"CONTRIBUTIONS REGARDING THE OPTIMIZATION OF THE
VENTILATION AND AIR CONDITIONING SYSTEM ONBOARD
SPECIAL SHIPS"

Author: Lieutenant Commander eng. Octavian – Narcis VOLINTIRU,
email: octaviannarcis@gmail.com
Phd supervisor: Professor eng. Anastase PRUIU

The thesis entitled "Contributions regarding the optimization of the ventilation and air conditioning system onboard special ships" and structured on seven chapters, deals with aspects regarding the optimization of the HVAC (heating, ventilation and air conditioning) system of the special ship by the elaboration of calculation and simulation programs.

The calculation includes both theoretical calculation and simulation using the Ansys Fluent program. The object of the study was a special ship of 5000 tonnes, which was taken as a reference for the study of the ventilation system of the machinery space room and the air conditioning system with a power of 300 [kW] operating with type R134A refrigerant.

This work deepens a side of scientific research in the field of ventilation and air conditioning (HVAC) onboard special ships. In order to complete this research in the naval field regarding the design, construction and operation of the microclimate and ventilation system, was used concepts from physics, thermomechanics and mathematics that are related to this part of science.

The first element of the research was the study of the regulations of the ventilation and air conditioning systems onboard the ships, both in terms of classification registers and NATO standards.

This thesis is based on the idea that computer programs that model physical processes can be used for scientific purposes to deepen and research different solutions with direct applications in various fields, and for this thesis in the naval field.

Thus, the flow model of the air in the machinery room ventilation system, where the ventilation flow requirement is quite high, was studied using numerical methods of calculation, using a computer modeling program, and the results were validated by an experiment on scale 1:1 onboard a special ship.

Was also studied the possibility of using the HVAC system to reduce the ship's thermal load, which is defining for the main purpose of the special (military) ship - the fight.

Chilled water plants use seawater as the primary agent and is used for the production of air conditioning on board, the cooling of electronic equipment and for cooling the ship under special operating conditions such as NBC defense (citadel system).

The thesis focused on the possibility of optimizing the functioning of the mechanical types of equipment in the ship machinery room by optimizing the ventilation system and implicitly the positive repercussions of optimizing this installation throughout the entire ship.

The thesis elaborated is important because it studies a way to optimize the air conditioning and ventilation system and obtains an experimental validation of the efficiency of its use for a special ship, which is particularly important, for example, to reduce the ship thermal load in the military operations.

It is also relevant because in the current context when military research is constantly expanding and opens new perspectives on how to research and operate this type of installation, especially important onboard special ships.

The present thesis focuses on five major objectives:

- 1) The current state of the classification societies rules regarding the air conditioning and ventilation systems onboard the special vessels;
- 2) Elaboration of an algorithm for sizing and verifying the ventilation and microclimate systems in special ships;
- 3) The study of the operating parameters for the air conditioning and ventilation system for a special ship;
- 4) Modeling and studying the energy transfer using the Computational Fluid Dynamics (CFD) on the ventilation section of a machinery room;
- 5) Validation of the results by comparison with the results obtained through a 1: 1 scale experiment.

To meet the proposed objectives, the research method approached was both theoretical and experimental. Here was used two numerical calculation programs: one used for sizing and checking the ventilation system and microclimate in the Mathcad program and another used to simulate the heat transfer in Ansys-Fluent and the results obtained were validated by experimental research onboard the ship.