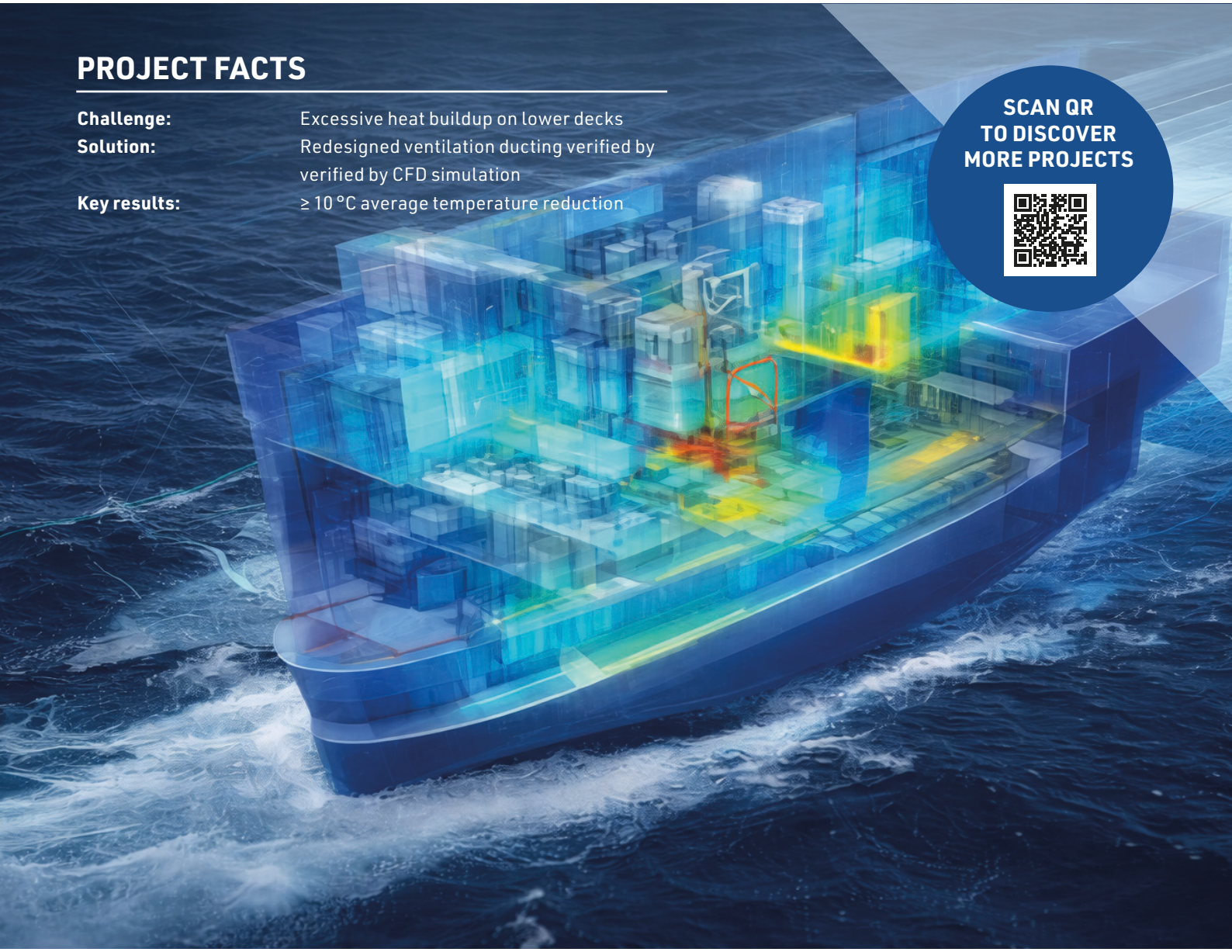
CUSTOMER SUCCESS STORY

ENHACING HVAC PERFORMANCE THROUGH CFD SIMULATION

How to evaluate and optimize the airflow and temperature field inside a ship's generator and engine rooms using CFD simulation.



PROJECT FACTS

Challenge:	Excessive heat buildup on lower decks
Solution:	Redesigned ventilation ducting verified by verified by CFD simulation
Key results:	≥ 10 °C average temperature reduction

SCAN QR TO DISCOVER MORE PROJECTS

NOVENCO
Marine & Offshore

novenco@novencogroup.com
+ 45 70 12 42 22
www.novenco-marine.com

THE PROJECT INTO DETAIL

OBJECTIVE: ASSESSING HVAC PERFORMANCE

A Computational Fluid Dynamics (CFD) study was performed on behalf of Novenco Marine & Offshore

- **assess the performance of the ventilation system within a multi-deck ship environment.**
- **identify hot zones and modify airflow distribution so that more cooling air is delivered to these regions.**

Using Ansys Fluent, the SimTec team modeled complex heat dissipation from engines and gensets and simulated airflow from supply ducts under realistic operating conditions.

CHALLENGES: INSUFFICIENT COOLING AIRFLOW

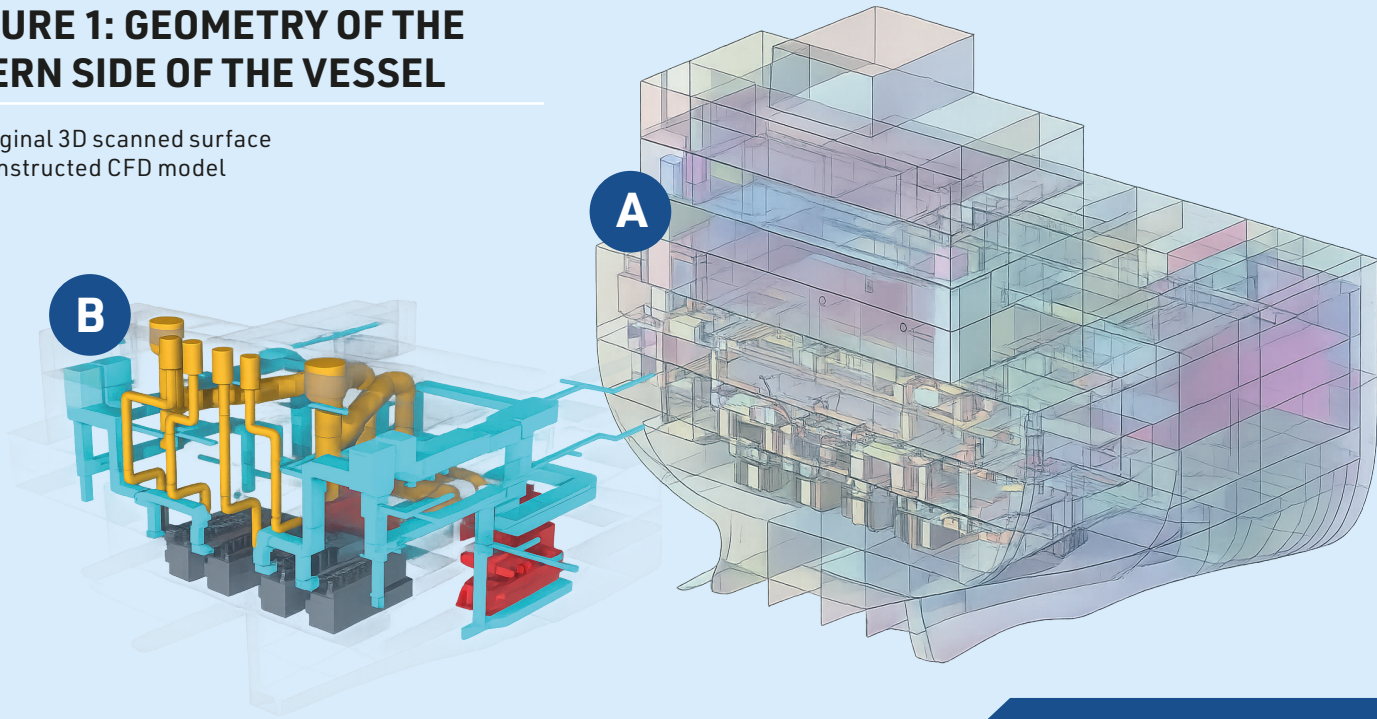
Novenco Marine & Offshore's main concern was the excessive heat buildup observed in the main engine and generator rooms - especially on the lowest decks - caused by insufficient cooling airflow.

To reduce the temperature, Novenco Marine & Offshore redirected ventilation ducts from the 3rd and 4th decks downwards to deliver more cooling air to the lower levels. SimTec used CFD simulation to verify the effectiveness of this revised ducting layout.

Accurate modeling of the thermal environment in enclosed spaces requires realistic modeling of heat transfer through conduction, convection, and radiation, as well as the distribution of turbulent and buoyant airflow across multiple ventilation branches. The task was further complicated by the lack of 3D CAD data, which made it necessary to reconstruct the multi-deck geometry using available 3D scans and 2D drawings.

FIGURE 1: GEOMETRY OF THE STERN SIDE OF THE VESSEL

A: Original 3D scanned surface
B: Constructed CFD model



SOLUTION: REBUILDING AIR VOLUME GEOMETRY

1 **GEOMETRY RECONSTRUCTION**

SimTec rebuilt the air volume geometry of the rooms under investigation, along with adjacent spaces in Ansys SpaceClaim using 3D scans and 2D drawings to produce simplified representations of key components.

2 **MESHING STRATEGY**

A high-quality poly-hexcore mesh was generated to resolve the geometric model composed of a large number of spaces, whereas near-wall flow effects were treated by four mesh inflation layers attached to all walls.

3 **CFD MODEL**

The CFD model accounted for buoyant flow, employed temperature-dependent air properties, detailed heat transfer models, and realistic thermal boundary conditions.

4 **OPERATING DATA**

Air supply flow rates and temperatures were defined based on operating data.

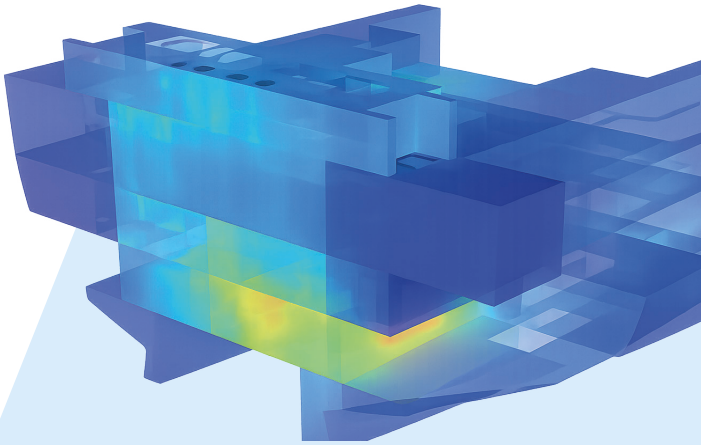
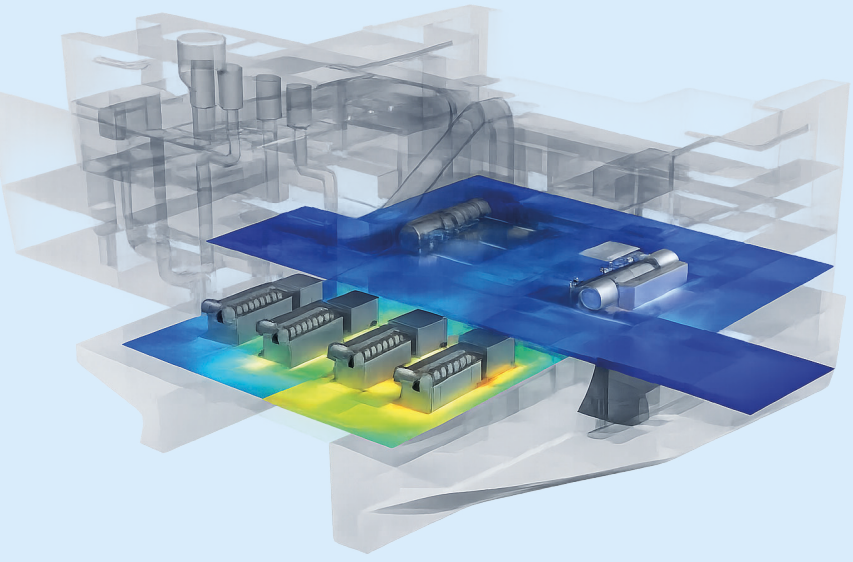


FIGURE 2

Temperature field at vessel internal and external walls for the proposed solution for the proposed solution by Novenco Marine & Offshore.

FIGURE 3

Temperature field at a horizontal plane through the engine and genset rooms for the proposed solution by Novenco Marine & Offshore



10°C

REDUCTION

in average room temperature achieved through CFD-varified ducting reddesign.

CONCLUSION: A SIGNIFICANT IMPROVEMENT

The results of Novenco Marine & Offshore's proposed solution showed that the engine rooms maintained acceptable temperatures, while the generator rooms exhibited higher values.

CFD simulations confirmed that the redesigned ducting, performed by Novenco Marine & Offshore, reduced average temperatures by at least 10 °C in all rooms, bringing a significant improvement compared to the previous ducting layout.

This CFD project assessed how increasing cooling supply airflow can lower the temperature in enclosed environments with significant heat dissipation from machinery.

The insights provided by CFD simulations support and guide efforts to enhance HVAC system performance in demanding marine environments.

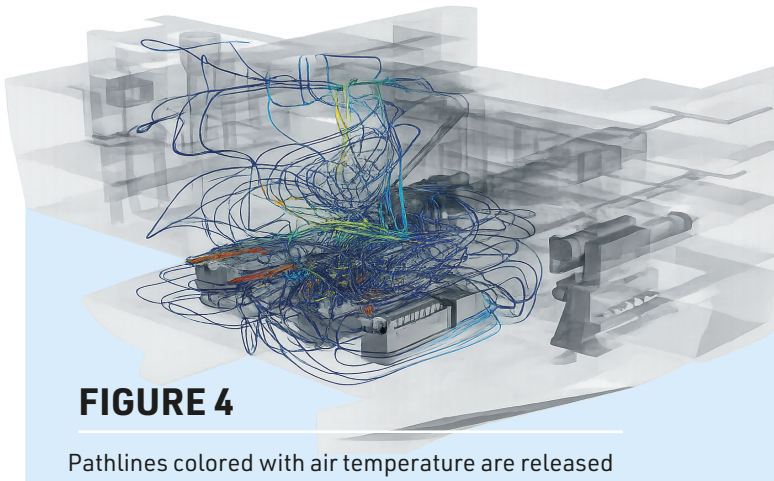


FIGURE 4

Pathlines colored with air temperature are released from selected supply diffusers to provide insight on the spatial effect of specific HVAC components.

KEY RESULTS

TEMPERATURE REDUCTION

IMPROVED ENVIRONMENT

VERIFIED DUCT REDESIGN

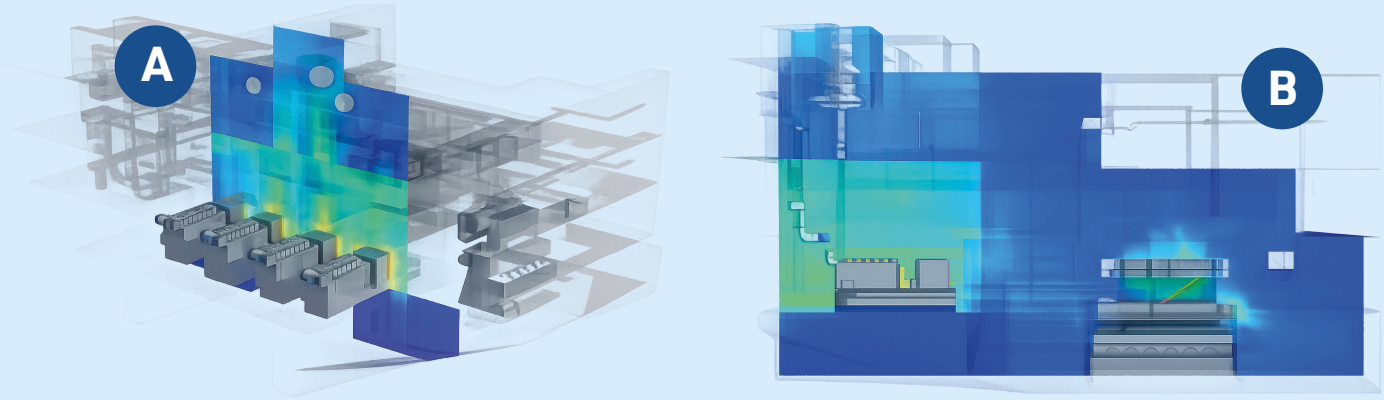


FIGURE 5

Temperature field at two vertical planes through the engine (A) and genset rooms (B) for the proposed solution by Novenco Marine & Offshore.