

NauticBlue



**Launching the future of Maritime education: Simulation
Engineering & Maritime Informatics**

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From Dynamic Fidelity to Full Immersion

- VR technology:
- ✓ Remote learning potential
- ✓ Ease of deployment
- ✓ Flexibility across platforms
- Modern simulators combine:
- ✓ High-fidelity ship physics
- ✓ Immersive VR and desktop modes
- ✓ Online access for training anywhere in the world



Virtual Reality III

Maritime Simulation

✓ Advantages of VR:

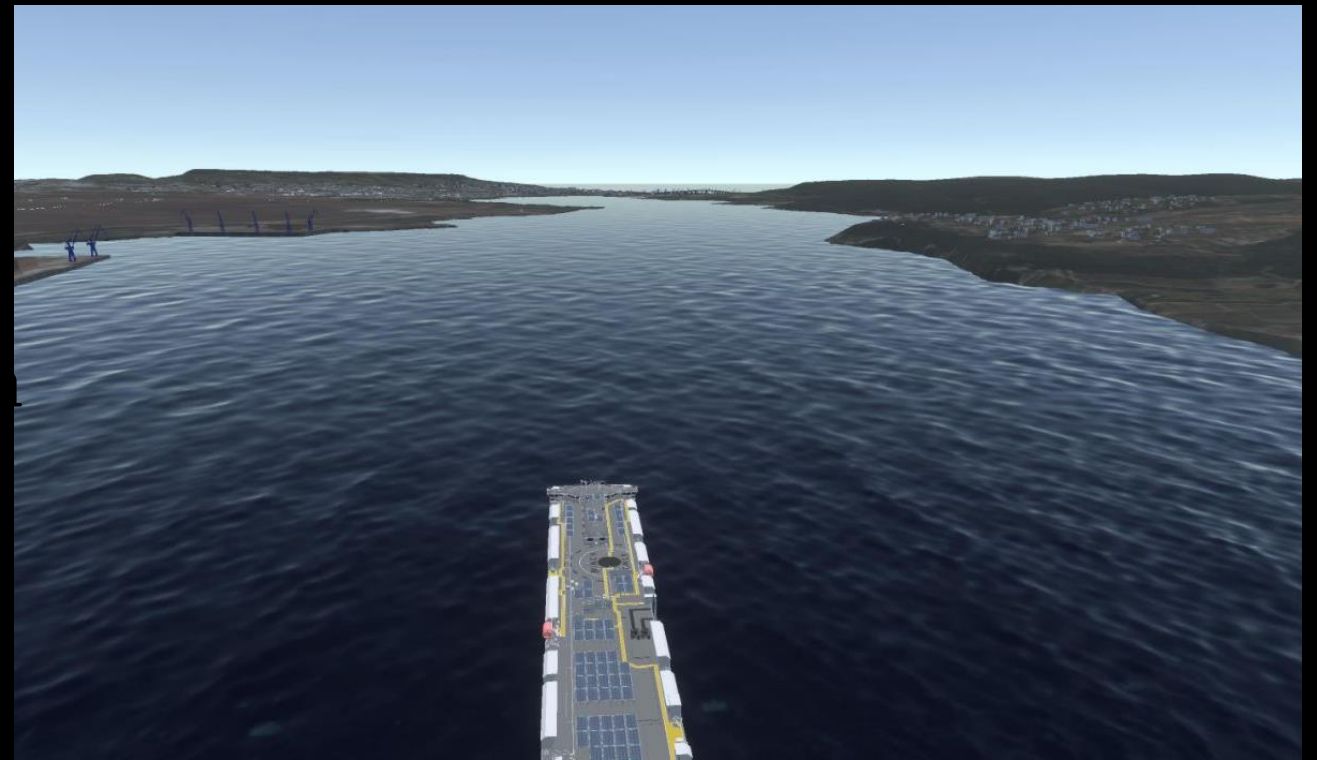
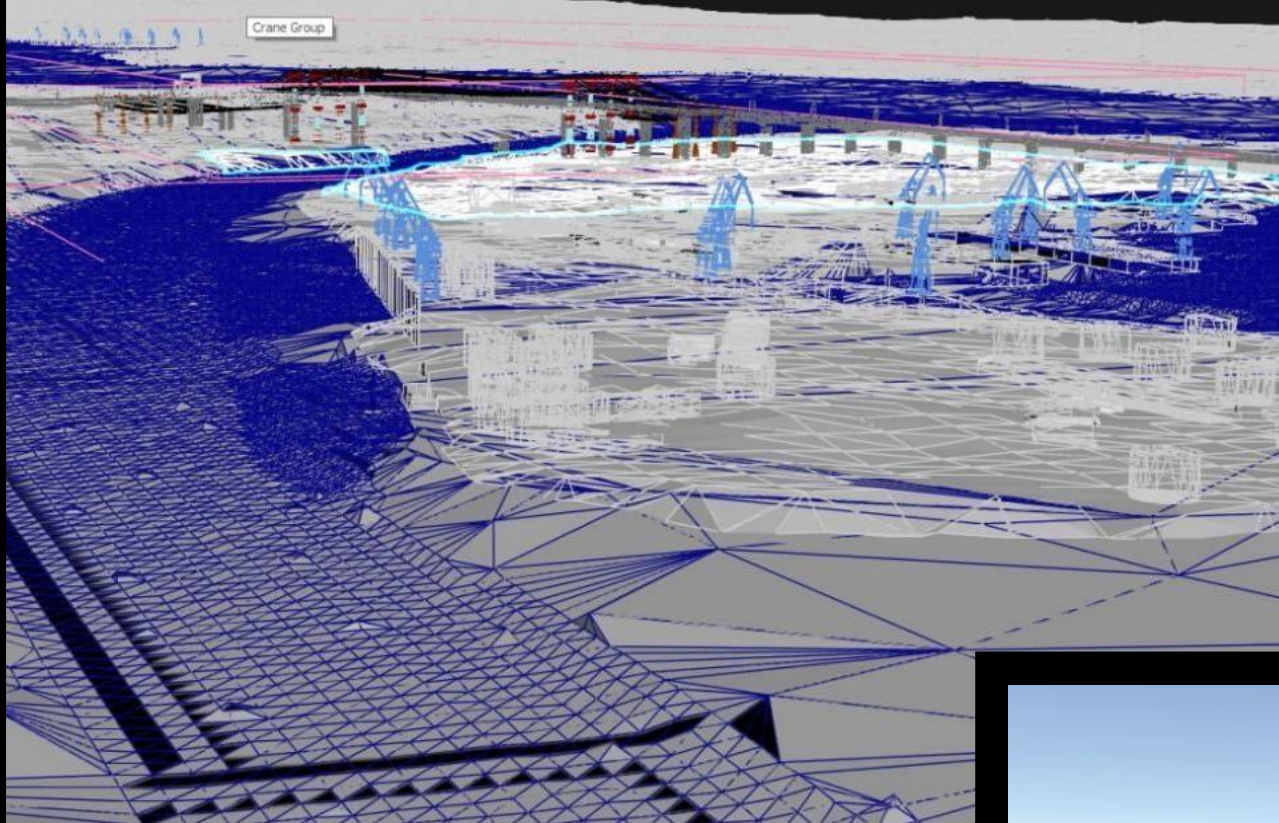
- Full immersion in realistic maritime environments
- Enhanced situational awareness and spatial orientation
- Effective training for emergency situations
- Portable & scalable - ideal for remote or onboard training
- Compatible with cloud-based instructor stations and assessment systems

⚠ Limitations of VR:

- Less precise interaction with complex control panels and instruments
- Possible motion sickness for some users
Hardware requirements and maintenance
- Not always suitable for long-duration sessions or precise operations (e.g., ECDIS use)

✂ **Best Practice: Hybrid Setup VR + Desktop + Real Bridge Hardware**

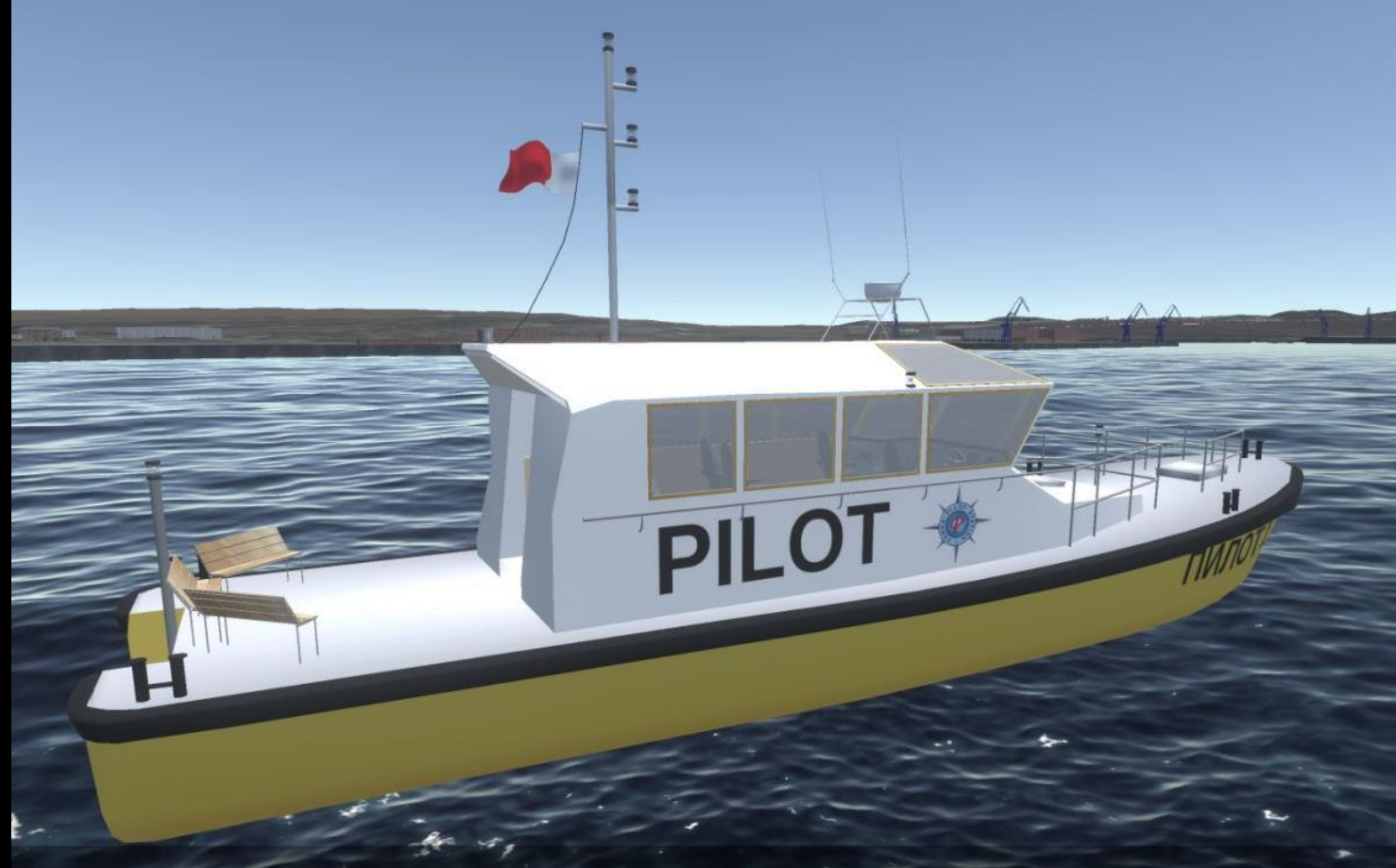




GIS and the Ocean

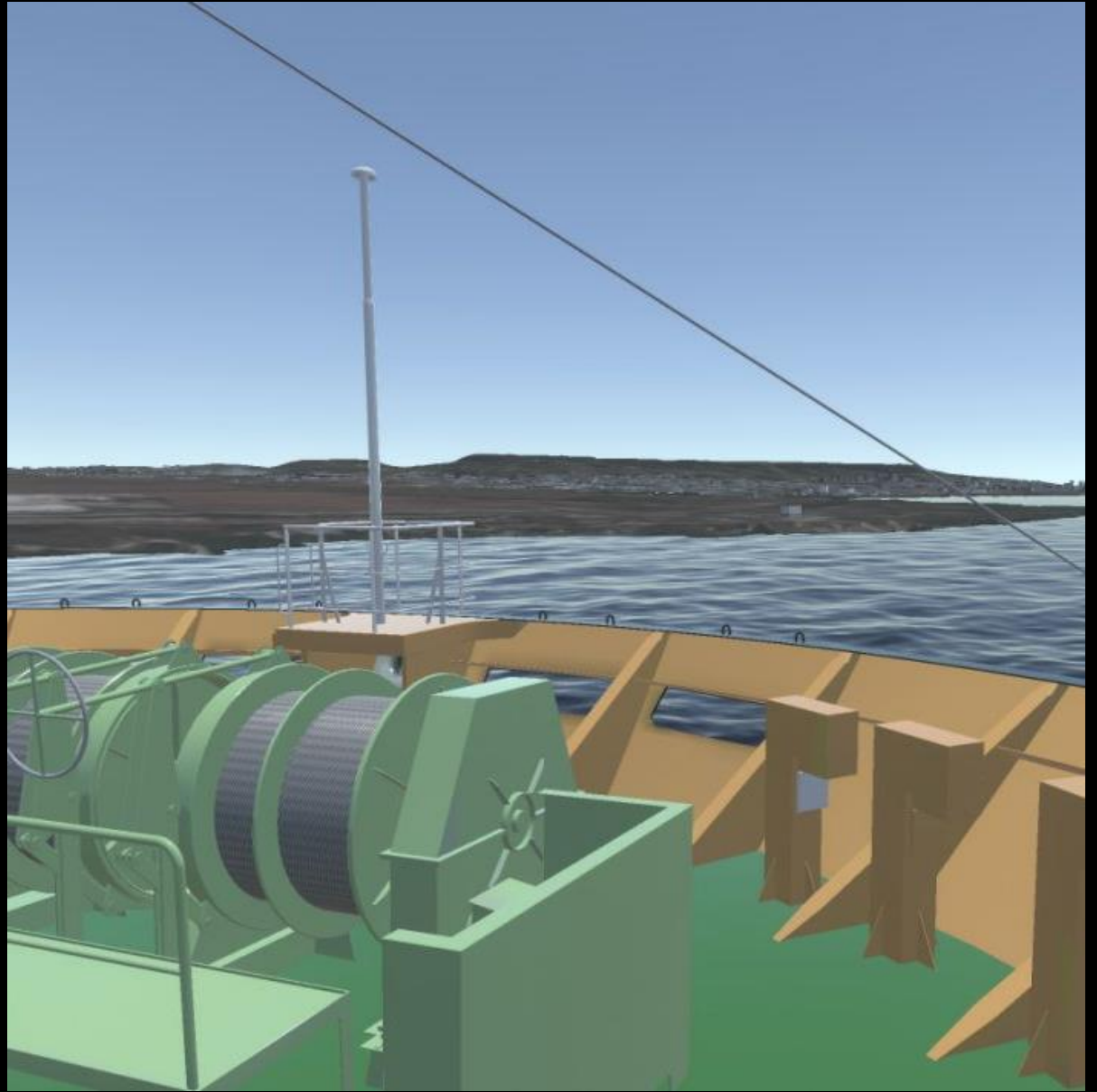
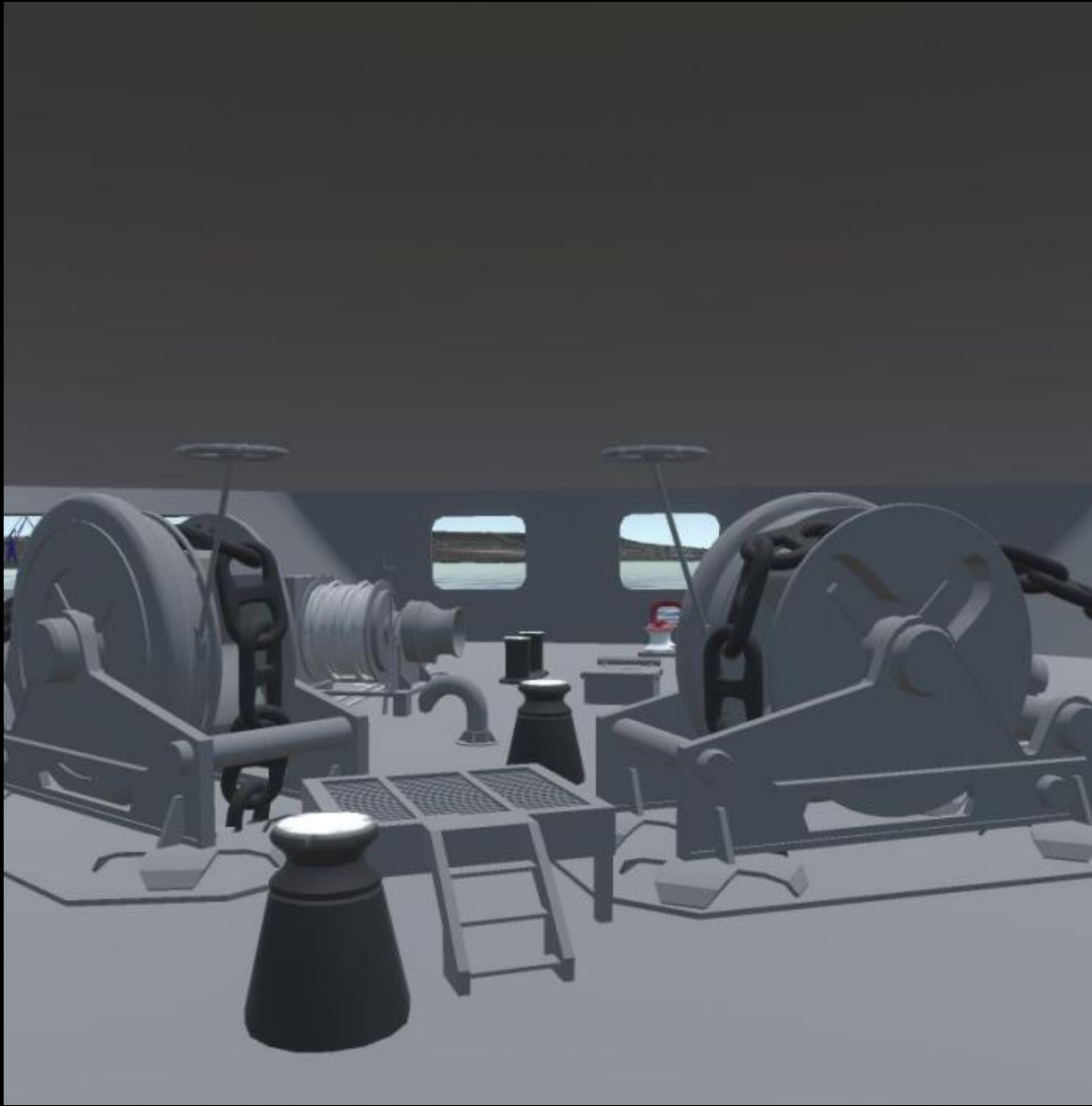
Marlow Blue Simulator

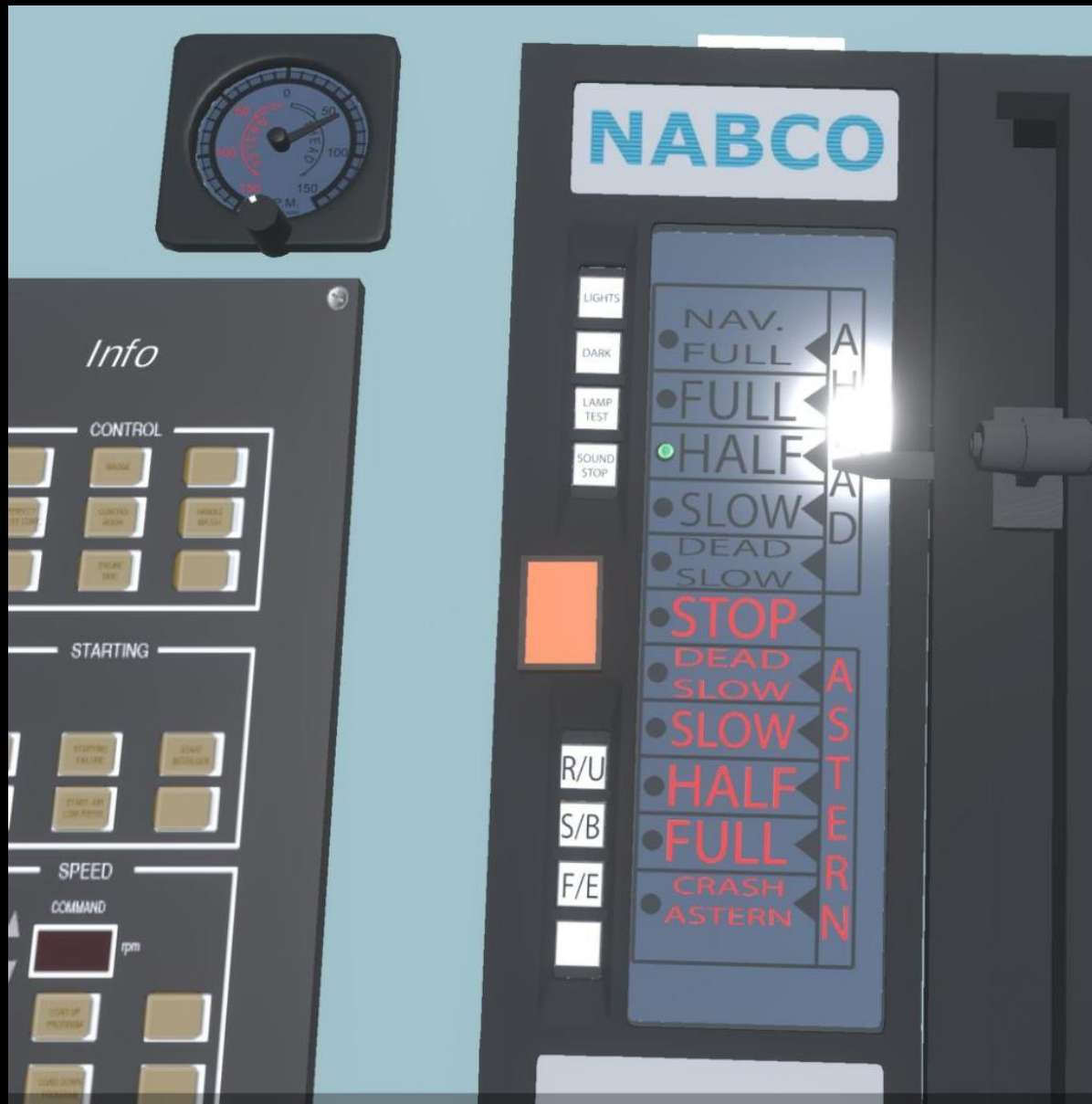
- Specialized VR and Desktop-Based Simulator for Master-Pilot Exchange Training with Emphasis on Operational and Cognitive Skill Development

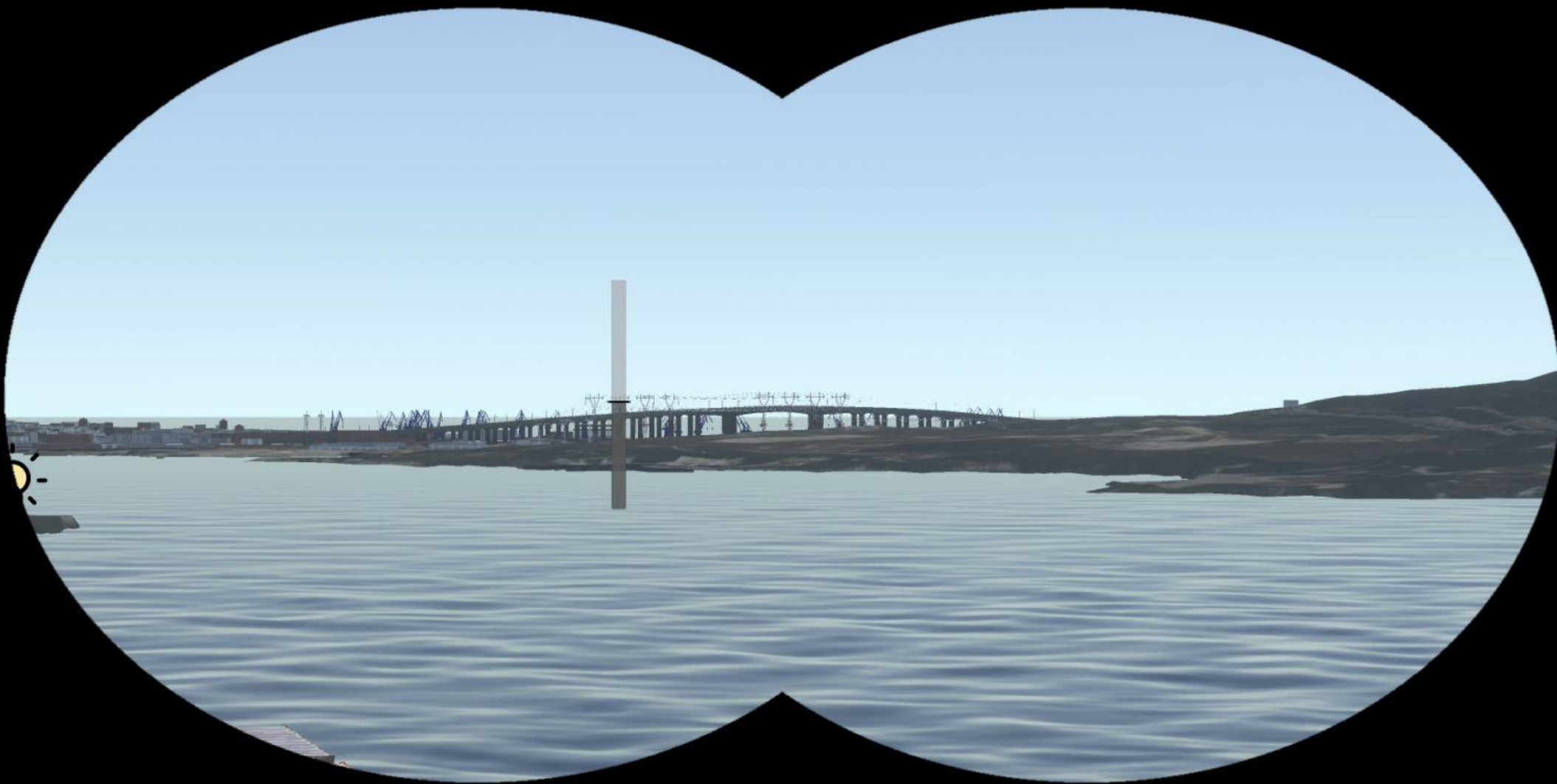


MARLOW NAVIGATION











□ Advanced Modeling in Maritime Simulation

Dynamic Models • CFD • PINNs • Data-Driven Models (DDM)

Dynamic Simulation

$$\begin{aligned} & \mathbf{M} \dot{\mathbf{v}} + \mathbf{C}(\mathbf{v})\mathbf{v} + \mathbf{D}(\mathbf{v})\mathbf{v} + \mathbf{g}(\boldsymbol{\eta}) = \mathbf{F}(\boldsymbol{\eta}, \mathbf{v}) \\ & \mathbf{M} \begin{bmatrix} \dot{u} \\ \dot{v} \\ \dot{w} \\ \dot{p} \\ \dot{q} \\ \dot{r} \end{bmatrix} + \mathbf{C} \begin{bmatrix} u \\ v \\ w \\ p \\ q \\ r \end{bmatrix} \begin{bmatrix} u \\ v \\ w \\ p \\ q \\ r \end{bmatrix} + \mathbf{D} \begin{bmatrix} u \\ v \\ w \\ p \\ q \\ r \end{bmatrix} \begin{bmatrix} u \\ v \\ w \\ p \\ q \\ r \end{bmatrix} + \mathbf{g} \begin{bmatrix} \eta_1 \\ \eta_2 \\ \eta_3 \\ \eta_4 \\ \eta_5 \\ \eta_6 \end{bmatrix} = \mathbf{F} \begin{bmatrix} \eta_1 \\ \eta_2 \\ \eta_3 \\ \eta_4 \\ \eta_5 \\ \eta_6 \end{bmatrix} \begin{bmatrix} u \\ v \\ w \\ p \\ q \\ r \end{bmatrix} \end{aligned}$$

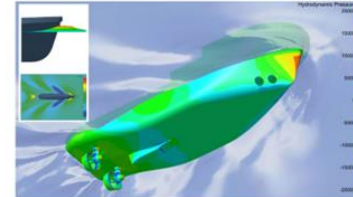


Hydrodynamic Theory

$$\begin{aligned} \frac{\partial v_x}{\partial t} + v_x \frac{\partial v_x}{\partial x} + v_y \frac{\partial v_x}{\partial y} + v_z \frac{\partial v_x}{\partial z} &= -\frac{1}{\rho} \frac{\partial p}{\partial x} + \nu \left(\frac{\partial^2 v_x}{\partial x^2} + \frac{\partial^2 v_x}{\partial y^2} + \frac{\partial^2 v_x}{\partial z^2} \right) + f_x \\ \frac{\partial v_y}{\partial t} + v_x \frac{\partial v_y}{\partial x} + v_y \frac{\partial v_y}{\partial y} + v_z \frac{\partial v_y}{\partial z} &= -\frac{1}{\rho} \frac{\partial p}{\partial y} + \nu \left(\frac{\partial^2 v_y}{\partial x^2} + \frac{\partial^2 v_y}{\partial y^2} + \frac{\partial^2 v_y}{\partial z^2} \right) + f_y \\ \frac{\partial v_z}{\partial t} + v_x \frac{\partial v_z}{\partial x} + v_y \frac{\partial v_z}{\partial y} + v_z \frac{\partial v_z}{\partial z} &= -\frac{1}{\rho} \frac{\partial p}{\partial z} + \nu \left(\frac{\partial^2 v_z}{\partial x^2} + \frac{\partial^2 v_z}{\partial y^2} + \frac{\partial^2 v_z}{\partial z^2} \right) + f_z \end{aligned}$$



Computational Fluid Dynamic (CFD)



↻ Dynamic Models (FDM/FEM):

Used to simulate ship motion, control, sea forces and maneuvering. Essential for training in realistic physics environments.

🐼 CFD (Computational Fluid Dynamics):

CFD is used to model flow around hulls, wave resistance, propeller interaction and shallow water effects.

□ PINNs (Physics-Informed Neural Networks):

These are AI models that learn from data but obey physical laws (PDEs).

📈 Data-Driven Modeling (DDM):

Combines sensor data, simulations, and AI to predict ship behavior and support decision

Simulation Engineering and Maritime Informatics

ВВМУ "Н. Й. Вапцаров"

Department: Mechatronics

Simulation Engineering

Qualification Degree: Master of Engineering

The new master's major at the Naval Academy "N. Y. Vaptsarov" is an engineering and computing specialty with a software orientation, which combines three specializations:

Specialization:

• Engineer in the field of marine simulators

Marine Simulators - Graduates will be engineering specialists in the design, creation and maintenance of marine simulators, but will also be able to create advanced, computational engineering, computer applications in all fields.

• Computational Fluid Dynamics Engineer

Computational Fluid Dynamics - graduates will be engineering specialists familiar with the possibilities of numerical analysis and will be able to solve problems in the field of Fluid Mechanics with Ansys Fluent. They will also be able to use other computer programs and tools and solve tasks not only in the Marine Industry.

• Artificial Intelligence Engineer in the Marine Industry

Artificial Intelligence - graduates will be engineering specialists familiar with the basic principles of modern programming, united under the name Artificial Intelligence. They will also be able to create trained models, algorithms and applications.



ВВМУ "Н. Й. Вапцаров"

Department: Mechatronics

Simulation Engineering

Curriculum

1881

First semester and second semester

Compulsory disciplines:

- Methodology of scientific research;
- Fundamentals of programming;
- Computer networks communications;
- Computer 3D modeling;
- Applied Mathematics for Software Professionals;
- Probabilistic and Statistical Methods for Software Professionals;
- Marine machinery and mechanisms, practical solutions;
- Automation, control, filters and sensors;
- Practical and technical hydrodynamics;
- Modern Navigation and Ship Theory;
- Software systems for mathematical modeling;
- Simulation Methods for Engineers;
- Computer Environments and Environmental Simulations.

Elective subjects:

- Applied Mechanics or CAD systems applied mechanics
- Electrical engineering or Applied Electrical Engineering

Optional disciplines

- English
- Sailing
- Swimming or triathlon

Third semester

Specialization: Marine simulators

- Navigation simulators -
- Machine simulators -
- Specialized marine simulators and applications -

Specialization: Computational fluid dynamics

- Turbulence models -
- Multiphase fluid flows -
- FSI fluid-solid interaction -

Specialization: Artificial Intelligence

- Data science -
- Machine learning -
- Deep learning -

Developing a master's thesis



Department: Mechatronics

- ✓ Tailor-made solutions to meet the specific needs of each shipowner or fleet manager
- ✓ Mobile and cost-effective setup, deployable on board, in offices, or in training centers
- ✓ Highly realistic and dynamic simulation, with scientifically validated fidelity
- ✓ Seamless integration of AI, sensors, and human factors assessment
- ✓ Easy installation and cross-platform compatibility
- ✓ Designed for education, professional training, and advanced research

⚓ Future Plans – Saving Lives at Sea and Higher Education

Engine Room Simulator:

Safety and Fire Equipment Simulation:

Mooring and Anchoring Equipment Handling: