Name of organization University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture	**Year of information updating** 2025
Year established 1919	**Year of joining the ITTC** /
Address Ivana Lučića 5, 10000 Zagreb, Croatia	**Status in the ITTC** /
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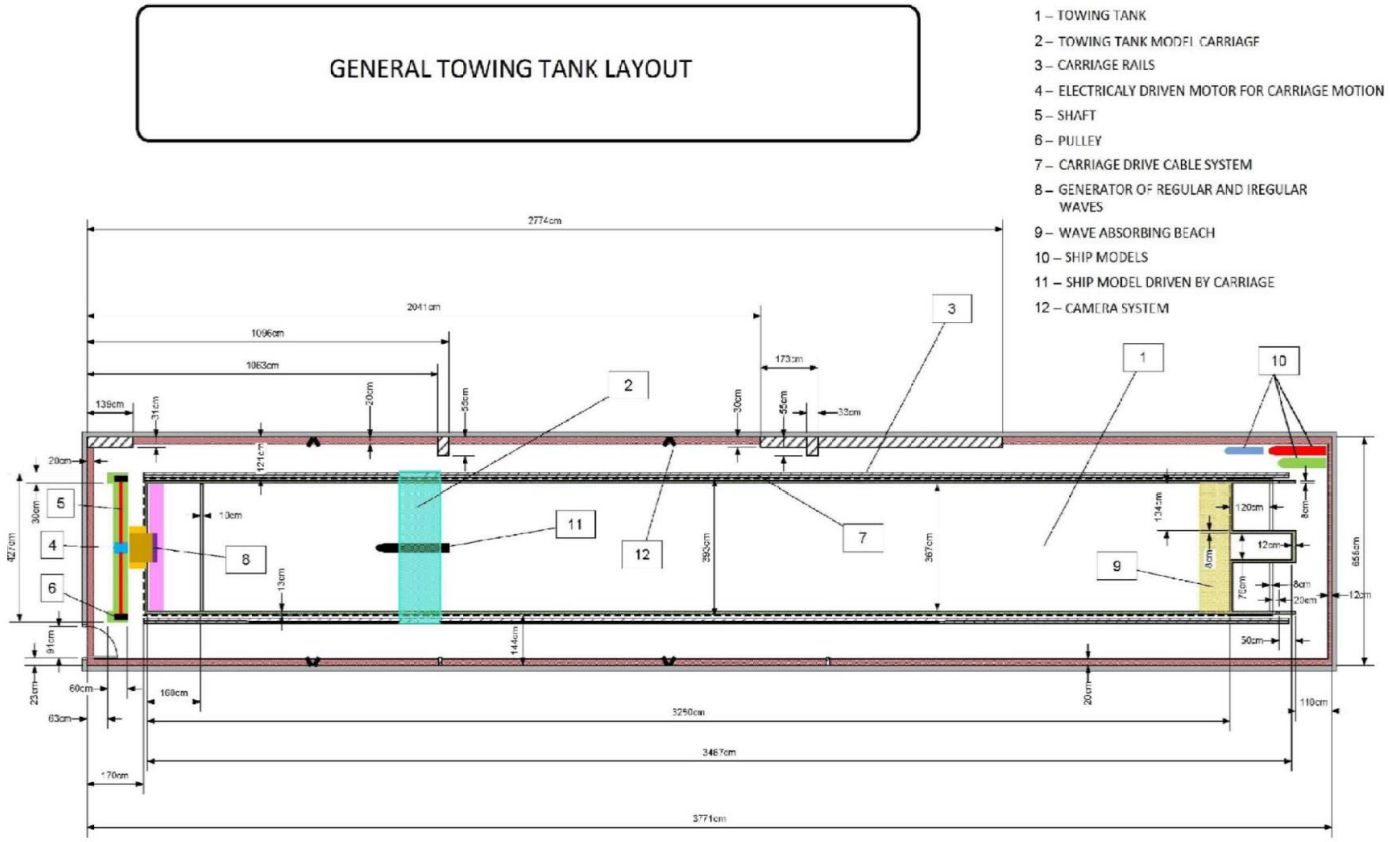
Type of facility Towing tank	**Year constructed/upgraded** 2022
Name of facility Laboratory for computational and experimental ship hydrodynamics (LAMINAR)	**Location** (if different from the above address)

Main characteristics

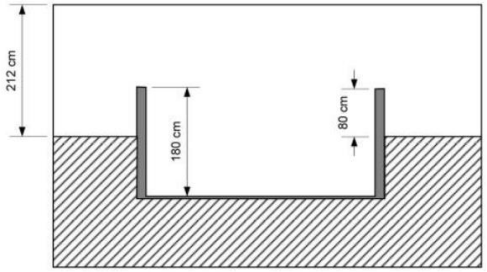
The towing tank has dimensions of 32.8 m in length, 3.6 m in width, and 1.5 m in depth, extending to a total length of 34.6 m with the inclusion of a wave-absorbing beach. The carriage can achieve a maximum speed of 5 m/s, while the wave generator is capable of producing regular and irregular waves with heights of up to 200 mm.
Equipped with a non-contact optical measurement system, the towing tank enables simultaneous measurement of all six degrees of freedom. An advanced inertial balance system is employed to determine the vertical position of the center of gravity and the moments of inertia about the *x* and *y* axes of ship models during seakeeping tests.

Drawings of facility

Top-view plan



Cross-section-view plan



Detailed characteristics (carriages, wave/current/wind generators, instrumentations, etc.)

Model carriage

Width	< 3920 mm (max. dock width)
Weight	< 1500N
Height	< 1.15 m
Carriage structure	Lightweight frame structure
Material	aluminum alloy or carbon fibers
Structure rigidity	deformation of the structure in the longitudinal and vertical direction during the test should not exceed 0.1 mm compared to initial condition
Model length span	0.5 m ÷ 1.5 m
Position of the model symmetry centerline	tank symmetry centerline ± 10 mm
Calm condition velocity range	0.5 m/s ÷ 5 m/s
Maximum velocity	5 m/s
Measurement period at 5 m/s	min. 10 m
Velocity error at measurement conditions	< 0.1% of the measurement speed or < 0.5 mm/s
Acceleration	up to 2.5 m/s2
Breaking	up to 2.5 m/s2
Position error in motion direction	< 1 cm
Rail length	35 m
Rail installation	rail girders (with regulators of horizontal and vertical position) installed on the steel belt on the tank on each 800 mm (width 100 mm)
Error of the rail position	vertical ± 0.1 mm horizontal ± 0.1 mm
Rail material	stainless steel or aluminum alloy
Safety breaking system	mechanical
Compatibility with measuring instruments	carriage must ensure acceptance and conditions required by measuring instruments listed in the section Measuring instruments

Power drive of the model carriage

Nominal voltage	230 / 3x400 V
Power	14 kW
Frequency	50 Hz

Measuring instruments for models tests:

Measurements on towed model

Measurement type	Model resistance in the direction of carriage

	motion
Load cell span	400 N (with overload protection)
Load cell resolution	< 0.05 N
Measurement type	Trim angle (longitudinal angle)
Angle span	± 30°
Angle resolution	< 0.05°
Measurement type	Heave measurement (vertical motion)
Measure span	± 150 mm
Measure resolution	0.1 mm
Measurement type	resistance, trim and heave
Temperature effect on zero	0.0025 % / °C
Temperature effect on span	0.0025 % / °C
Compensate temperature range	- 10°C / + 50°C
Combined error	< ± 0.03%
IP protection	IP67

Capacitive wave elevation sensor system, 2 pcs.

Measure span	0 -500 mm
Resolution	< 1 mm
Linearity	0.5 %
Response time	10 ms
Output	0÷20 mA
IP protection	IP67

Pressure sensor

Sensor span	0÷200 mbar
Resolution	0,1 mbar
Temperature drift	< 0.05 mbar/°C
Max non-destructive overpressure	2 bar
Output	0÷20 mA
IP protection	IP68

Inclinometer (accelerometric type)

Angle span	± 40°
Angle resolution	< 0.1°
Error	0.3 %
Maximum frequency response	5 Hz
IP protection	IP67

Wave generator

Wave type	Regular and irregular
Maximum wave height	200 mm (100 mm wave amplitude)
Wave generator type	plunger
Maximum plunger speed	1.3 m/s
Maximum plunger acceleration	12 m/s2
Wave frequency span	0.5 rad/s ÷ 30 rad/s
Wave frequency step	0.001 rad/s
Stroke	0 ÷ 200 mm
Stroke step	0.1 mm
Wave generating time	2 ÷ 1200 s
Wave generating time step	0.01 s
Ramp	1 ÷ 120 s
Ramp step	0.01 s
Range of wave phase shift	0 ÷ 6.3 rad
Range step of wave phase shift	0.001 rad
Tail	0 ÷ 10 s
Tail step	0.1 s

Irregular waves definition	Data file input
Connection with computer interface	USB / Lan

Power drive of the wave generator

Nominal voltage	230 / 3x400 V
Power	20 kW
Frequency	50 Hz

Wave absorbing beach

Beach type	Multilayer perforated parabolic
Reflexing coefficient	< 10 %
Gate for model passage	Manual foldable mechanism

Applications (Tests performed)

PROeco project (https://marservis.hr/en/proeco/) - eco-catamaran partially made of natural, environmentally friendly materials powered by environmentally friendly, solar energy, which represents a significant step forward in the field of research and development on a global scale.
The eco-catamaran, PROeco 60, 19 m long and 7.5 m wide, is designed to carry 100 passengers with two crew members. Powered by an environmentally friendly electric drive, the catamaran is fully equipped with all the necessary equipment, and uses biocomposites in construction, which significantly reduces the impact on the environment.
A key element of the PROeco catamaran is the response to the environmental challenges of modern society, providing smart and environmentally friendly transport solutions. Using materials rarely used in maritime and water transport, eco-catamaran represents a global novelty.
The eco-catamaran project is also aligned with future trends in the shipbuilding sector that require a reduction in the energy consumption of ships and the achievement of high environmental standards. Through continuous investments in the construction of ships aimed at environmental protection, Marservis d.o.o. wants to position itself as one of the leaders in sustainable shipbuilding.

NEREAS project (https://nereasproject.org/en/project/project/) - an interdisciplinary research project in which the use of modern engineering tools brings new scientific insights into the archeology of seafaring. Ships are structures whose behavior due to the action of different loads can be predicted by numerical simulations. However, the application of such tools in maritime archeology is very limited. The NEREAS project seeks to capitalize on the experience of the international team in the effort to focus on a range of research questions, and clearly demonstrate the scientific justification and significance of the application of modern engineering methods in the analysis of marine structures and events of the past. In addition, the influence of interpretation, that is, variations of the reconstruction of the ship, caused by the limited archaeological resources, on the stability and seaworthiness of the ship is analyzed. The NEREAS project enhances the shipwreck simulations, focusing on a specific shipwreck. On the basis of material evidence, it is possible to determine the most plausible scenario that led to the tragic event. The NEREAS project also takes pioneering steps in comparative analysis of the structural details of ship made of wood. Finally, experimental research was conducted in towing tank for the ships Gagliana grossa and Condura Croatica, both of great importance for the Croatian maritime history.

Published description (Publications on this facility)

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