Name of organization Istanbul Technical University (ITU) Faculty of Naval Architecture and Ocean Engineering	**Year of information updating** 2025
Year established 1773 (ITU) - 2021 (ITUKAT)	**Year of joining the ITTC** 1972
Istanbul Teknik Üniversitesi Ayazağa Kampüsü İTÜKAT Binası – Maslak – İstanbul - Türkiye	**Status in the ITTC** Member
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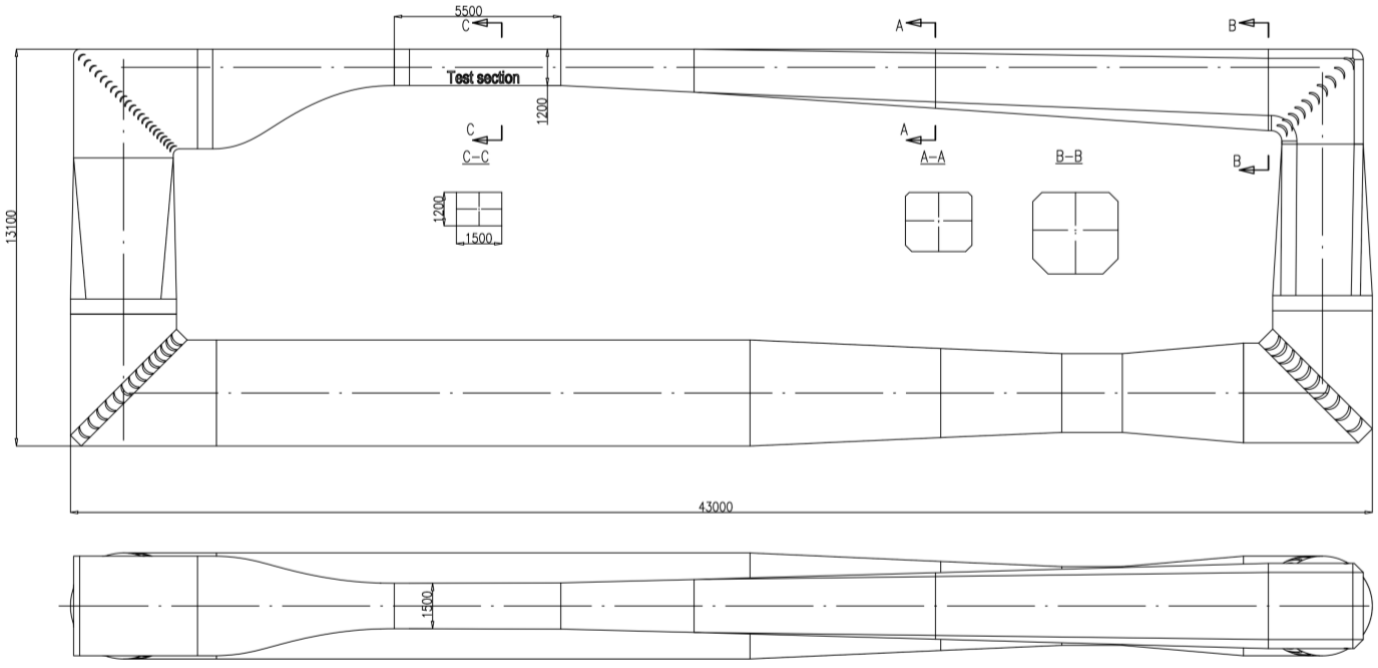
Type of facility (experimental and/or computational) Experimental and computational	**Year constructed/upgraded** 2021
Name of facility ITUKAT (Istanbul Technical University Cavitation Tunnel)	**Location** (if different from the above address)

Main characteristics (dimensions of tank/basin/test section; for simulators: full mission, part task or desktop; for non-experimental services: Numerical services provided)

ITU Cavitation Tunnel Laboratory covers a floor area of 1000 m² with a building height of 21.7 meters. It is a closed-circuit water tunnel that can be pressurised or depressurised for proper cavitation observation. The test section is 5.5 m long, 1.5 m wide and 1.2 m high. Maximum flow speed is 16.5 m/s, which can be increased to 20 m/s using a dedicated insert. The flow is driven by a 1 MW electric motor and supported by automatically operated valves and sensors providing easy access to tunnel data.

Numerical capabilities include RANS-based commercial solvers, enabling a broad range of hydrodynamic and cavitation-related applications, supported when necessary by inviscid flow evaluations.

Drawings of facility



Detailed characteristics (carriages, wave/current/wind generators, instrumentations, etc. or for numerical services: CFD codes and overall principles (RANS, Potential Flow etc.) and computational resources

- Pressurised/depressurised test section enabling controlled cavitation observations and high-speed flow testing
- Advanced flow-measurement and visualisation systems, including PIV, LDA, high-speed camera systems, and professional digital imaging equipment for detailed cavitation, flow-structure observation
- Underwater noise-measurement capability using a spectrum analyser and dual-hydrophone setup for propeller and hydrodynamic noise studies
- Force and moment measurement systems, including 3-component and 4-component load cells for submersible objects and model-scale hydrodynamic components
- Dedicated dynamometers, including open-water, self-propulsion, and counter-rotation dynamometer systems for detailed propeller and propulsion-performance characterisation
- Overhead crane system for safe handling and installation of large models and equipment
- Mechanical workshop and preparation area for model mounting, instrumentation, and component adjustment
- Control room equipped with data-acquisition systems and real-time monitoring capability
- Dedicated areas for sensor calibration and equipment setup
- The facility provides CFD capabilities using RANS-based commercial solvers, supporting a broad spectrum of hydrodynamic and cavitation-related numerical applications and complemented, when appropriate, by inviscid flow evaluations. These computations are carried out on an in-house 176-core cluster system connected via InfiniBand network, with additional high-performance computing resources accessed through National Center for High Performance Computing (UHeM) of ITU when higher capacity is required.

Applications (Tests performed / numerical services provided)

The activities of the laboratory are mainly focused on determining the flow characteristics of any given underwater or surface marine vehicle within a controlled environment. The data provided from the laboratory can be used to develop experimental and computational methods which are widely used in fluid dynamics applications.

- Propeller cavitation and performance characteristics
- Underwater acoustics
- Ship hull optimization
- Design and implementation of custom hydrodynamic measurement systems, including capabilities for specialised force and load measurements in advanced applications
- High-speed underwater vehicles and cavitating/supercavitating bodies
- Surface-modification and flow-control research, including dimpled plates for drag-reduction and boundary-layer manipulation
- Propeller and ship wake characteristics
- Boundary layer characteristics
- Broad range of numerical hydrodynamic analyses using RANS-based CFD solvers

Published description (Publications on this facility)

Özsayan, S., Köksal, Ç. S., Usta, O., Çelik, C., Yilmaz, N., & Korkut (2021). E. An Experimental and Numerical Investigation of the Cavitation Effects on Propeller Performance and Erosion on DTMB-5415 Propeller.

Özsayan, S., Koksal, C. S., Ünal, U. O., & Korkut, E. (2023). Effects Of The Gate Rudder System (GRS) on the Experimental Cavitation Observations and Noise Measurements. In 7th International Conference on Advanced Model Measurement Technology for The Maritime Industry, Istanbul Turkey.

Özsayan, S., Aydin, Ç., Koksal, Ç.S., Ünal, U.O., Korkut, E., 2023. Effects of the gate rudder system (GRS) on the experimental cavitation observations and noise measurements. In: 7th International Conference on Advanced Model Measurement Technology for the Maritime Industry. Istanbul, Türkiye.

Özsayan, S., Aydın, Ç., Köksal, Ç.S., Ünal, U.O., Korkut, E., 2024. Assessment of the gate rudder system on the cavitation and underwater radiated noise characteristics of a containership. Ocean Engineering 313, 119391. https://doi.org/10.1016/j.oceaneng.2024.119391.

Çelik, F., Usta, O., Öksüz, S., Delikan, M., Kara, E., Özsayan, S., & Ünal, U. O. (2025). Experimental investigation of leading-edge tubercle and surface corrugation effects on cavitation and noise in partially cavitating twisted hydrofoils. Ocean Engineering, 324, 120646. https://doi.org/10.1016/j.oceaneng.2025.120646

Çetinkaya, A., & Oral Ünal, U. (2025). An experimental investigation into the resistance characteristics of dimpled plates at high Reynolds numbers. Brodogradnja, 76(3), 1-22. https://doi.org/10.21278/brod76302

Erbaş Öz, B., Özsayan, S., Delikan, M., Kara, E., Çetinkaya, A., Aydın, Ç., Köksal, Ç.S., Ünal, U.O., Korkut, E., Gören, Ö. (2025). "A New State-of-the-Art Cavitation Tunnel – ITUKAT", 20th International Congress of the International Maritime Association of the Mediterranean – IMAM 2025, Sep 28- Oct 03, Crete, Greece.