Name of organization CNR-INM National Research Council of Italy Institute of Marine Engineering	**Year of information updating** 2021
Year established 1927 (INSEAN) 1962 (new site in via di Vallerano) 2018 INSEAN changed to INM	**Year of joining the ITTC** 1933
Address Via di Vallerano 139, 00128, Rome (Italy)	**Status in the ITTC** AC member
Contact details (phone, fax, e-mail) Phone +39 06 50299 222 Fax +39 06 507 0619 Email segreteria.inm@cnr.it PEC protocollo.inm@pec.cnr.it	**Website** http://www.inm.cnr.it/labs/circulating-water-channel/

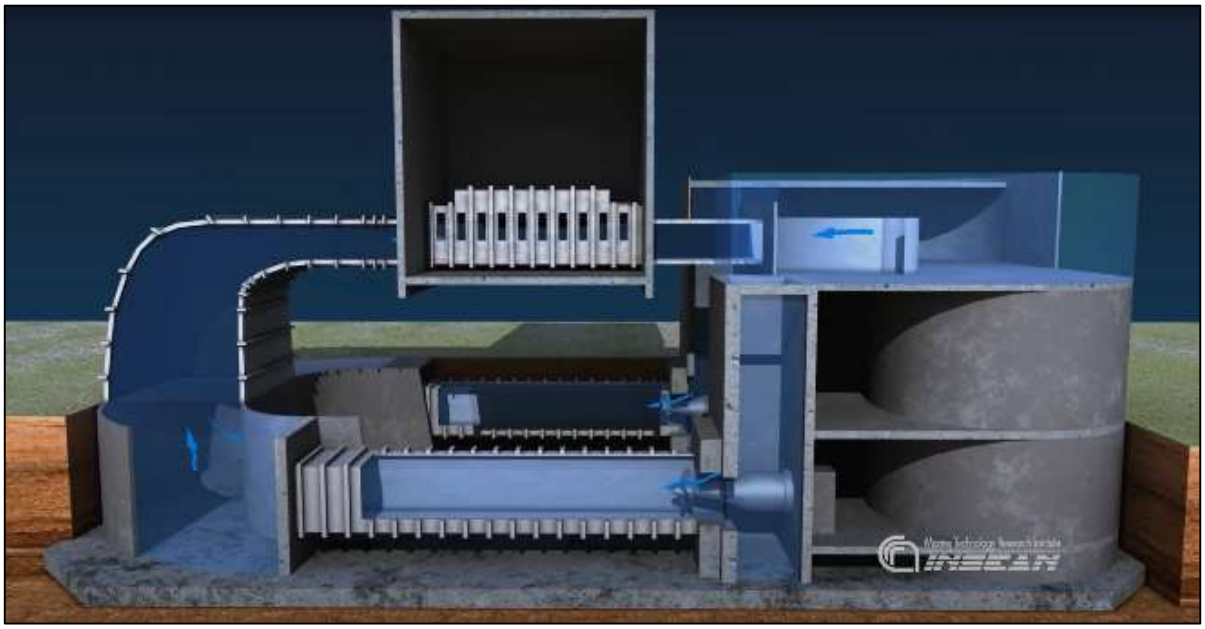
Type of facility Free surface circulating water channel	**Year constructed/upgraded** 1978
Name of facility **Large Cavitation Channel (LCC)**	**Location** (if different from the above address)

Main characteristics (dimensions of tank/basin/test section; for simulators: full mission, part task or desk top)

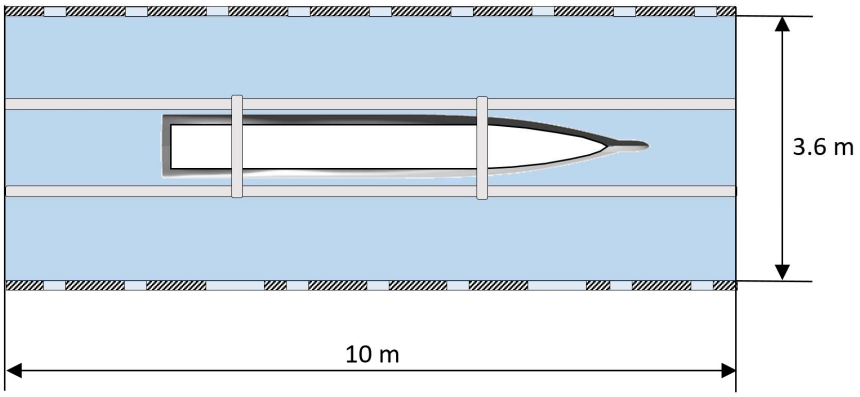
- Test section: 10 m (L) × 3.6 m (W) × 2.25 m (water depth).
- Pressure range in the test section: from 30 mbar to atm
- Maximum water speed: 5.3 m/s
- Turbulence levels in the test section: 3-4%
- Mean velocity uniformity: < 2% (axial component), < 4% (cross components)
- Test section designed to provide flexibility of operation settings:
  - Cavitation channel: test section closed to simulate depressurized free surface flows.
  - Water flume: test section roof open to simulate free-surface flows at ambient pressure.
  - Water tunnel: test section closed and filled to maximize volume at ambient pressure.

Drawings of facility

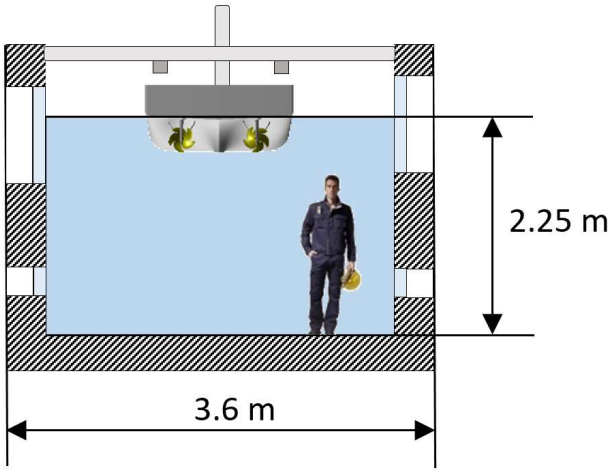
- **Overview**



- **Top-view plan (test section)**



- **Cross-section-view plan (test section)**



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

Ancillary systems:

- water flow driven by dual 4-bladed axial impellers with delivered power of up to 435 kW.
- Test section depressurization by n. 2 axial pumps (25kW, 939 m^3/h) and n.1 surpressor (18.5 kW).
- Crane (12 ton, 15m x 8m excursion)

Instrumentation:

- Velocimetry measurements and observations:
  - Laser Doppler velocimetry system.
  - PIV/SPIV/TomoPIV fully underwater velocimetry systems.
  - Digital stroboscopes.
  - High power illumination systems.
  - High speed cameras.
  - High resolution cameras.
- Acoustic measurements:
  - Hydrophones;
  - Pressure transducers.
  - 40 channel acquisition system.
  - Conditioning amplifiers.
- Fully underwater dynamometer/motor for atmospheric and vacuum tests on propellers/rotors:
  - Maximum Thrust: 1200N.
  - Maximum Torque: 60 Nm.
  - Maximum rotational speed: 4500 rpm.
  - Propeller pitch (range): ±25° (remotely controllable).
  - Propeller yaw (range): ±90° (remotely controllable).
  - Propeller depth (range): 0-400mm from the fin tip (remotely controllable).

- Fins: 325mm (fin 1), 700mm (fin 2), 1075mm (fin 3), 1450mm (fin 4).
- Other equipment: torque meters, wave gauges, etc.

Applications (Tests performed)

- Hydrodynamic tests on profiles, installed and open water propellers.
- Detailed flow measurements by optical techniques.
- Cavitation tests (qualitative and quantitative tests).
- Acoustic tests (acoustic source level measurements, acoustic source diagnostics)
- Propeller/rotor performance tests.
- Propeller induced pressure fluctuation measurements.
- Tidal rotors.
- Tidal rotors interactions.
- Tidal rotor and seabed interaction.
- Seabed foundation loads.

Published description (Publications on this facility)

Ship/propeller hydrodynamics (not exhaustive)

- Felli M., Di Felice F., Lugni C., "Experimental Study of the Flow Field around a Rolling Ship Model ". 25th Symposium on Naval Hydrodynamics, St John's, Canada. Agosto 2004.
- Calcagno G., Di Felice F., Felli M., Pereira F., "A Stereo-PIV investigation of a five blade MAU propeller wake behind Series 60 Cb=0.6 ship model in a large free surface tunnel". Journal of Marine Technology, Vol.39, n.2, 2005.
- Felli M., Di Felice F., "Propeller wake analysis in not uniform inflow by LDV phase sampling techniques", Journal of Marine Science and Technology, Vol. 10, n.4, pp. 159-172, 2005.
- Muscari R., Felli M., Di Mascio A., "Analysis of the flow past a fully appended hull with propellers by computational and experimental fluid dynamics". Journal of Fluid Engineering. 133(6), 2011.
- Pecoraro A., Di Felice F., Felli M., Salvatore F., Viviani M., "An improved wake description by higher order velocity statistical moments for single screw vessel", Ocean Engineering, Volume 108, pp 181–190, 2015.
- Wang, L., Martin, J.E., Felli, M., Carrica, P.M., Experiments and CFD for the propeller wake of a generic submarine operating near the surface, Ocean Engineering, 2020, 206, 107304

Ship/propeller hydro-acoustics (not exhaustive)

- Felli M., Falchi M., Dubbioso G., "Experimental approaches for the diagnostics of hydroacoustic problems in naval propulsion". Ocean Engineering 106, 1-19, 2015.
- Felli M., Grizzi S., Falchi M., "A novel approach for the isolation of the sound and pseudo-sound contributions from near-field pressure fluctuation measurements: analysis of the hydroacoustic and hydrodynamic perturbation in a propeller-rudder system". Experiments in fluids, 55-1, 1651, 2014
- Tani, G., Viviani, M., Felli, M., Lafaber, F.H., Lloyd, T, Atlar, M., Hallander, J., Sakamoto, N., Noise measurements of a cavitating propeller in different facilities: Results of the round robin test programme, Ocean Engineering, 2020, 213, 107599

Marine renewable energy systems (not exhaustive)

- Gaurier, B.; Germain, G.; Facq, J. V.; Johnstone, C.M.; Grant, A.D.; Day, A.H.; Nixon, E.; Di Felice, F.; Costanzo, M.; Tidal energy "Round Robin" tests comparisons between towing tank and circulating tank results; 2015; International Journal of Marine Energy; ISSN: 2214-1669; Vol.12, pp. 87-109; Elsevier, doi:10.1016/j.ijome.2015.05.005
- Morandi, B.; Di Felice, F.; Costanzo, M.; Romano, G.P.; Dhomé, D.; Allo, J.C.; Experimental investigation of the near wake of a horizontal axis tidal current turbine; 2016; International Journal of Marine Energy; ISSN: 2214-1669; Vol.14, pp. 229-247; Elsevier; doi:10.1016/j.ijome.2016.02.004
- Del Frate, C.; Di Felice, F.; Alves Pereira, F.; Romano, G.P.; Dhomé, D.; Allo, J.C.; Experimental Investigation of the turbulent flow behind a horizontal axis tidal turbine; Progress in renewable Energies Offshore, Proceeding of RENEW 2016 2nd International Conference on Renewable Energies Offshore, Lisbon Portugal; 24-26 October 2016, ISBN:978-1-138-62627