

TOWING TANK FACILITIES: SIGNIFICANCE IN THE LOCAL INDUSTRY

18Th May 2022

Presented by Dr. Kurt Mizzi



VENTuRE National Networking Event Wednesday, 18 May 2022 Admiral Hall, Fort St Angelo, Birgu Waterfront





TOWING TANK FACILITIES

Tools for solving hydrodynamic problems within a controlled and defined environment.

These facilities allow key stakeholders to test and predict the performance of ships and offshore structures under different weather conditions before the construction phase.

Such information supports engineers and naval architects to optimise vessel performance and consult ship owners to carry out educated decisions to help prevent mistakes and avoid unforeseen costs by the ship owner.

Hydrodynamics is complex. Predictions via:

- Approximations with the use of empirical formulae.
- More accurate predictions with MODEL (Hydrodynamic) Tests.

Hydrodynamic facilities can either be EXPERIMENTAL or VIRTUAL.



VENTuRE National Networking Event Wednesday, 18 May 2022 Admiral Hall, Fort St Angelo, Birgu Waterfront



MODEL TESTS

These tests are generally carried out to measure the following for ships, submarines and offshore structures:

- Powering/Full Scale
- Manoeuvring
- Seakeeping

Such facilities are generally used to:

- Predict the performance of a new hull design
- Predict the performance of a technology retrofit
- Determine the vessel's limits and capabilities
- Solve troubleshooting problems

Model Tests:

- Resistance Tests
- Self-Propulsion Tests
- Open Water Propeller Tests
- Seakeeping tests
- Maneuvering Test



(Kelvin Hydrodynamics Lab, University of Strathclyde)

Methodology, analyses and extrapolation procedures are guided by ITTC Recommended Procedures



VENTuRE National Networking Event Wednesday, 18 May 2022 Admiral Hall, Fort St Angelo, Birgu Waterfront







TOWING TANK FACILITIES

Towing Tank



(SINTEF OCEAN)



VENTuRE National Networking Event Wednesday, 18 May 2022 Admiral Hall, Fort St Angelo, Birgu Waterfront





OTHER EXPERIMENTAL FACILITIES

Cavitation Tunnel





(Mitsubishi Heavy Industries Machinery Systems Ltd.)

(Krylov State Research Centre)



VENTuRE National Networking Event Wednesday, 18 May 2022 Admiral Hall, Fort St Angelo, Birgu Waterfront





OTHER EXPERIMENTAL FACILITIES

Manoeuvring and Seakeeping Basin



(Maneuvering and seakeeping basin (MASK) facility at the Naval Surface Warfare Center (NSWC) Carderock Division)



VENTuRE National Networking Event Wednesday, 18 May 2022 Admiral Hall, Fort St Angelo, Birgu Waterfront





OTHER EXPERIMENTAL FACILITIES

Ice Tank





(Ice Tank Facility -National Research Council, Canada)



VENTuRE National Networking Event Wednesday, 18 May 2022 Admiral Hall, Fort St Angelo, Birgu Waterfront





TOWING TANK FACILITIES

Numerical Modelling





VENTuRE National Networking Event Wednesday, 18 May 2022 Admiral Hall, Fort St Angelo, Birgu Waterfront





TOWING TANK COSTS

Experimental vs CFD

Experimental Towing Tank Testing is expensive. Why? :

- Expensive Machinery
- High Maintenance
- Time Consuming
- High Overhead Costs
- High Operational Costs
- Ship model construction costs.

Computational fluid dynamics (CFD) is a cheaper alternative. CFD has many advantages:

- Quicker
- Cheaper
- Less manpower required
- Overhead costs are not cheap but cheaper than a towing tank.
- Possibility to test variations (hull lines or ESD configurations etc).

Currently, CFD does not replace experimental tank testing. Why?



VENTuRE National Networking Event Wednesday, 18 May 2022 Admiral Hall, Fort St Angelo, Birgu Waterfront





ITTC STANDARDISATION

International Towing Tank Conference (ITTC)

"The International Towing Tank Conference is a voluntary association of worldwide organizations that have the responsibility for the prediction of the hydrodynamic performance of ships and marine installations based on the results of physical and numerical experiments." - <u>https://www.ittc.info/</u>

Purpose:

To encourage progress in full-scale prediction methods through experimental testing and numerical modeling techniques and supporting towing tank consultants for giving advice and information regarding full-scale performance to designers, builders and operators of ships.

Aims:

- To accelerate research in ship hydrodynamics and to enhance full-scale predictions,
- To recommend procedures for model experiments,
- To recommend methods to validate the accuracy of such full-scale predictions and measurements (V&V procedures),
- To formulate collective policy on matters of common interest,
- To provide a bases for the exchange of information on such related matters.







ITTC TOWING TANKS

- SINTEF Ocean, towing tank, ocean basin, cavitation tunnel in Trondheim, Norway
- David Taylor Model Basin and the Davidson Laboratory in the United States
- FORCE Technology in Lyngby, Denmark
- SSPA, in Gothenburg, Sweden
- Maritime Research Institute Netherlands (MARIN) in Wageningen, the Netherlands
- CNR-INSEAN in Rome, Italy
- o SVA Potsdam in Potsdam, Germany
- HSVA in Hamburg, Germany
- National Maritime Research Institute (NMRI)in Tokyo, Japan
- VTT (Finland)



VENTuRE National Networking Event Wednesday, 18 May 2022 Admiral Hall, Fort St Angelo, Birgu Waterfront





TOWING TANKS FOR LEARNING

A towing tank on a university campus will increase the opportunity for students to better understand hydrodynamics as well as gain experience in the environment of tank testing.

- To be able to put to practice, the theory that they have learnt,
- Carry out any practical work/assignments,
- Utilise facilities for dissertations and projects,
- Allow lecturers to better explain Tow Testing procedures and power prediction methods,
- Readily train students for potential careers in towing tank facilities & laboratories.



⁽University of Strathclyde)



VENTuRE National Networking Event Wednesday, 18 May 2022 Admiral Hall, Fort St Angelo, Birgu Waterfront





TOWING TANKS FOR RESEARCH

These facilities can be used for research purposes to improve the hydrodynamic performance of ships and therefore open doors for innovation, optimisation and analyses of hull lines and energy efficient technologies.

- PhD. Students
- Research Activities
- Consultation (To Industry)
- Research Projects







VENTuRE National Networking Event Wednesday, 18 May 2022 Admiral Hall, Fort St Angelo, Birgu Waterfront





TOWING TANKS FOR INDUSTRY

Towing tank facilities and towing tanks tests are used to determine the power requirement to achieve the **contract speed**

that is agreed between the shipyard and ship owner/representatives.

- Power Predictions (ITTC Procedures)
- Seakeeping Performance in Waves
- Consultation, Analyses and Investigation
- Sea Trial Reports (Extrapolations & Draught (Load) Corrections)
- Hire to External Companies



(Force Technology – Deep Water Towing Tank)



VENTuRE National Networking Event Wednesday, 18 May 2022 Admiral Hall, Fort St Angelo, Birgu Waterfront





TOWING TANKS FOR NEW BUILDS

- Final Analyses/Predictions
 - Best Design Candidate
- Powering Performance
 - Contract Speed
 - Power requirements
- Seakeeping Performance
- Manoeuvring Performance
- EEDI Implications

 $EEDI = \frac{CO_2 \ Emissions}{Transport \ Work} = \frac{Power \ x \ SFC \ x \ FC}{DWT \ x \ Vref}$





VENTuRE National Networking Event Wednesday, 18 May 2022 Admiral Hall, Fort St Angelo, Birgu Waterfront





TOWING TANKS FOR RETROFITTING

- Energy & Power Savings
- Manoeuvring Improvements
- Seakeeping Improvements
- EEXI Implications





VENTuRE National Networking Event Wednesday, 18 May 2022 Admiral Hall, Fort St Angelo, Birgu Waterfront





TOWING TANKS

LONG TERM LOCAL IMPACTS

- Enhanced hydrodynamic expertise
- Enhanced research capabilities Further knowledge base
- New Services
- New stream of revenue
- Strengthening the local maritime sector
- Impacting the overall Economy
- Added value to local designers and ship builders
- Operation of tow tanks require specialist personnel





VENTuRE National Networking Event Wednesday, 18 May 2022 Admiral Hall, Fort St Angelo, Birgu Waterfront





TOWING TANKS *INTERNATIONAL RECOGNITION*

- Increased research collaboration opportunities with international partners Networking.
- Power predictions procedures catered for international ship owners & naval architects
- Produce graduates with Towing Tank experience.
- Enhanced Innovation Potential
- Global Recognition



VENTuRE National Networking Event Wednesday, 18 May 2022 Admiral Hall, Fort St Angelo, Birgu Waterfront





THE END



VENTuRE National Networking Event Wednesday, 18 May 2022 Admiral Hall, Fort St Angelo, Birgu Waterfront

