

<b>Name of organization</b> University of Michigan		<b>Year of information updating</b> 2017
<b>Year established</b> 1817		<b>Year of joining the ITTC</b> 1948
<b>Address</b> 1085 South University, Ann Arbor, Michigan 48109, USA		<b>Status in the ITTC</b> Member Advisory Council
<b>Contact details</b> (phone, fax, e-mail) Yin Lu (Julie) Young Email: <a href="mailto:ylyoung@umich.edu">ylyoung@umich.edu</a> Phone: 734-647-0249 Fax: (734) 763-3488		<b>Website</b> <a href="http://mhl.engin.umich.edu/">http://mhl.engin.umich.edu/</a>
<b>Type of facility</b> Towing tank, cavitation tunnel, wind-wave tank, film drop/impact test laboratory, fully developed turbulent flow test laboratory, marine renewable energy laboratory	<b>Year constructed/upgraded</b> 1904/2015	
<b>Name of facility</b> Marine Hydrodynamic Laboratory	<b>Location</b> (if different from the above address) Same as above	
<b>Main characteristics</b> (dimensions of tank/basin/test section; for simulators: full mission, part task or desk top) -see attached slides		
<b>Drawings of facility</b> – no change to dimensions and primary capabilities, but key components have been regularly updated/replaced.		

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

**Applications** (Tests performed)

Resistance and seakeeping tests

Self-propelled tests

Open water propeller tests – wetted and cavitating

Wave-structure interaction tests

Wind-wave interaction tests

Wave-structure interaction tests

Impact/drop tests

Added mass and damping studies.

Skin-friction studies in fully developed turbulent flow

Renewable energy device tests

Air-layer drag reduction tests

Biofilm and drag studies

**Published description** (Publications on this facility)

# Facilities: Physical model basin/tow tank



Carriage drive system type and total power

Four 5kW brushless servo motors using computer control for optimum speed regulation

Tank length

109.7 meters (360.0 feet)

Tank width

6.7 meters (22 feet)

Tank depth (to edge of trough)

3.05 meters (10.0 feet)

Tank depth (to edge of trough)

Carriage type

Manned bridge and unmanned trailer.

Carriage speed

(min. and max.) 0.08 to 6.10 m/s (0.25 to 20.0 ft/s)

Wavemaker type and class

Plunger type capable of generating regular and irregular waves; computer generated for any spectrum.

Wave making parameters

Wave Period – 0.5 to 2.0 seconds  
Wave length – 0.39 to 6.24 meters (1.3 to 20.5 feet)  
Maximum wave height – 0.46 meters (1.5 feet)

Run time cycle

Variable depending on the type of test and size of model (typically 15 minutes without waves and 30 minutes with waves)



# Facilities: Wind-Wave Tank



- Width: 70cm
- Length: 35m
- Depth: 1.2m
- Programmable wavemaker
- Winds to 30m/s
- Optical viewing all 4 sides
- PIV/PTV system
- PLIF system
- Tri- and six-axis forces and moments
- High-speed video



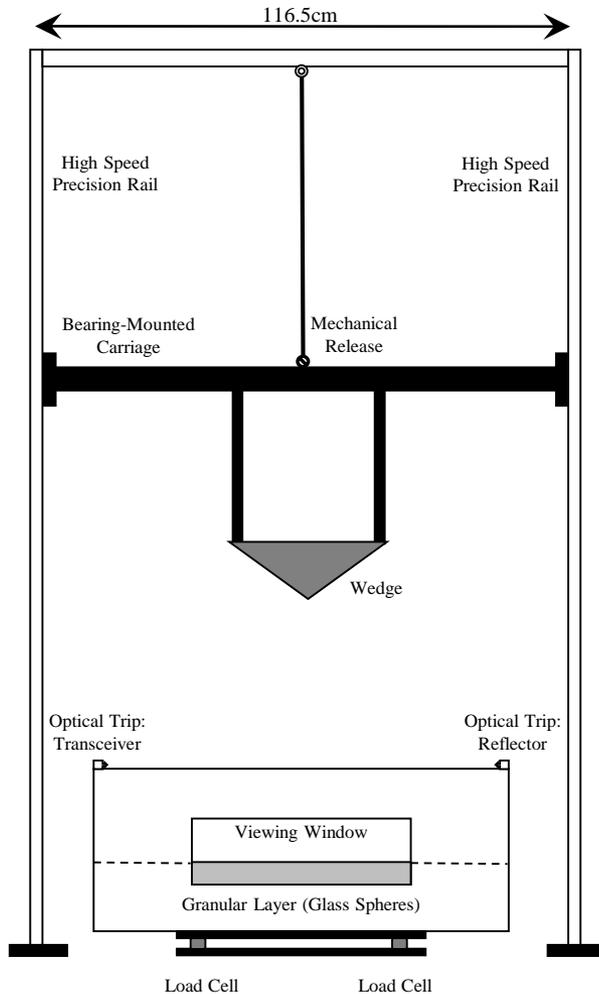
# Facilities: Flow tunnel/ mini-Large Cavitation Channel



- 1/14<sup>th</sup> scale model of the USN Large Cavitation Channel in Memphis, TN
- Speeds to 25 m/s
- Test Section: 21.8cm x 21.8cm
- Pressures to at least 200KPa abs
- Test section access – all sides
- Splitter plates
- De-aeration equipped



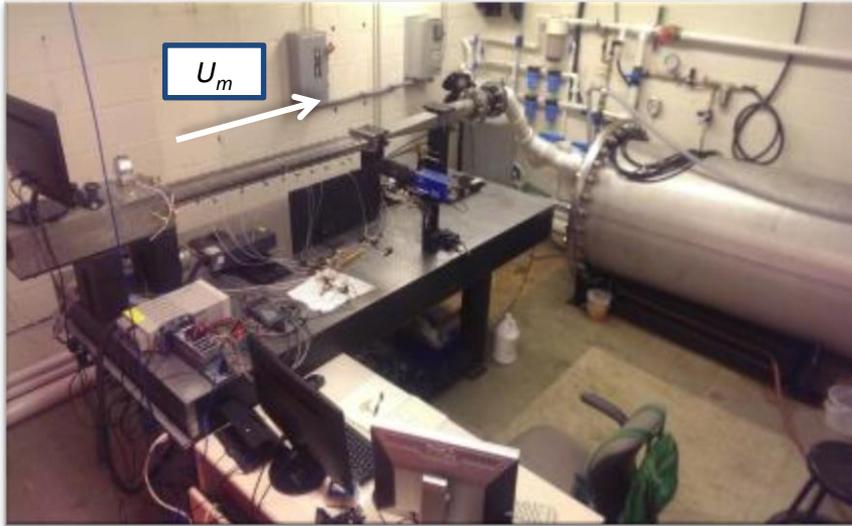
# Facilities: Impact/drop laboratory



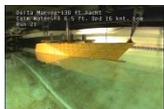
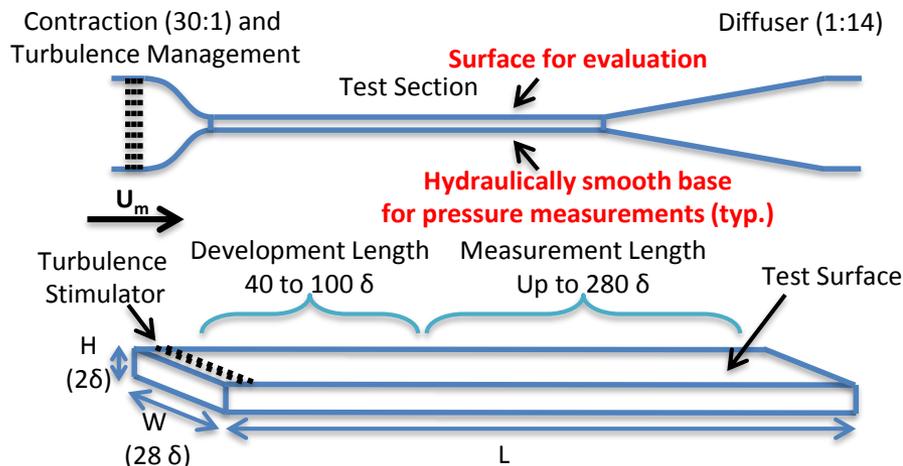
- High-speed rails – 10m/s
- Drop height – 2m
- High-speed imagers to capture impact
- Reservoir for water, glass beads, etc.
- Load cells to 250,000 lb/1.1MN and 30KHz response
- Wedge-entry problems



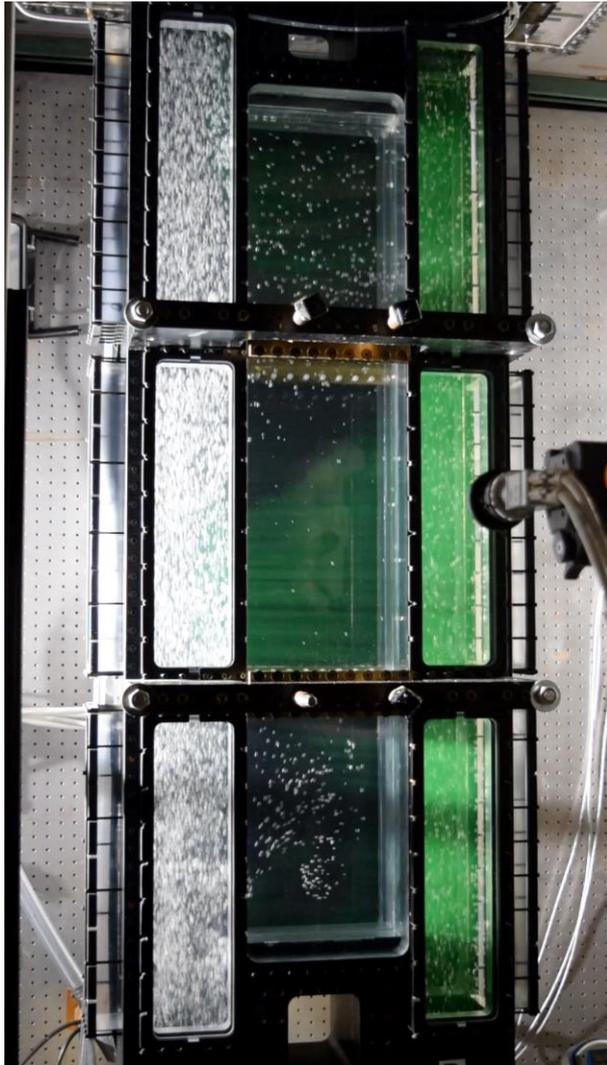
# Facilities: Fully-Developed Turbulent Flow Facility for Skin-Friction Evaluation



- Utilizes streamwise pressure drop and PIV measurements for friction evaluation
- Speeds to 0 to 20 m/s
- Test Section: 1.2 m x 0.1 m x 0.007 m
- Pressures to at least 200KPa abs
- Test section access – all sides
- De-aeration equipped
- All S.S., glass, and PVC construction



# Facilities: Parallel flow mixing loop



- Mixing of two vertical laminar and turbulent single and of two-phase flows
- Independently controlled parallel flow loops connected by a variable height, narrow gap (0 to 50 mm)
- Inlet Reynolds number ( $Re_{Dh}$ ): 40k to 100k
- Test sections: 127 mm x 127 mm
- LDV, Stereo PIV, PLIF

