

USNA Hydromechanics Laboratory
Facility Details
Revised 20 April 2012

380 foot Towing Tank

CARRIAGE:

- 1) High speed – 15' x 34' aluminum box truss; 11,000 lbs; $V_{max}=30$ fps
- 2) Low speed – 19' x 34' alum. deep-web box truss; 21,000 lbs;
 $V_{max}=25$ fps

DRIVE SYSTEM:

Shore mounted motors pulling pre-tensioned wire rope cable loops;
(2) 200 hp motors with 400% overload capability = 1,600 total hp

FEATURES:

Planar motion mechanism; peak-to-peak motions: 4' sway, 60 deg yaw
Open water propeller boat with 15 hp drive motor; designed for 8" dia prop
Various struts for submarine testing
Twin rigging modules for side-by-side testing in waves

WAVEMAKING:

Dual flap, dry back, servo hydraulic control wavemaker
Regular, irregular and transient waves; frequency range 0.3 to 1.4 Hz

BEACH:

60' long with slope of 1-to-3; consists of 8 layers of 2" square section bars stacked perpendicular

INSTRUMENTATION:

16 bit PC data acquisition systems on carriage with digital wireless data transmission network, fiber optic trailing cable for video transmission, dynamometers for measurement of multiple axis forces on surface and submerged vehicles, propeller thrust and torque dynamometers, full range of sensors for measurement of force, displacement, angle, angular rate, acceleration, pressure, wave elevation; acoustic Doppler velocimeters, 3-D video motion analysis system

TESTS PERFORMED:

Resistance, self-propulsion, seakeeping, open water propeller tests, planar motion maneuvering tests, ocean wave studies, tests on moored and free floating ocean structures, capsize and dynamic stability, dynamic positioning, flow visualization, hydrodynamic force measurements on towed bodies including flat plates, foils, submarines, torpedoes, divers, rowing shells, sailboats

120 foot Towing Tank

CARRIAGE:

Unmanned with overhead rail and side rail; 5' x 4' wide aluminum platform;
V_{max}=13 fps

DRIVE SYSTEM:

Shore mounted motor pulling pre-tensioned wire rope cable loop; 7 hp motor

FEATURES:

Removable cross-tank wall panel
Oscillator for measuring added mass in heave and sway
Alternate gravity tow system
Sailboat resistance/side force/yaw moment dynamometer

WAVEMAKING:

Dual flap, dry back, servo hydraulic control wavemaker
Regular, irregular and transient waves; frequency range 0.4 to 1.6 Hz

BEACH:

16' long with slope of 1-to-3; 14 layers of 0.5" square section bars stacked perpendicular

INSTRUMENTATION:

On board instrumentation amplifiers, 16 bit PC data acquisition systems on shore, trailing wire data and video transmission, dynamometers for measurement of multiple axis forces on surface and submerged vehicles, full range of sensors for measurement of force, displacement, angle, angular rate, acceleration, pressure, wave elevation; acoustic Doppler velocimeter, 3-D video motion analysis system

TESTS PERFORMED:

Resistance, seakeeping, ocean wave studies, tests on moored and free floating ocean structures, capsize and dynamic stability, flow visualization, hydrodynamic force measurements on towed bodies including flat plates, foils, submarines, torpedoes, divers, sailboats

Coastal Engineering Tank

Main Tank

FEATURES:

Depth variable from 0 to 24 inches

Computer controlled tide system with 4" peak-to-peak tide range

Removable 16' x 24" wide channel with variable beach slope

Overhead moveable bridge

WAVEMAKING:

Single face, dry back, piston type servo hydraulic control wavemaker

Regular and irregular waves; frequency range 0.4 to 2.0 Hz

BEACH:

Vertical stainless steel sheets with varying porosity

Sediment Tank

FEATURES:

Depth variable from 8 to 24 inches

Transparent wall and windows for beach observations

WAVEMAKING:

Vertical wedge, servo electric ball screw drive wavemaker

Regular and irregular waves; frequency range 0.6 to 2.0 Hz

BEACH:

Fine sand; slope variable from 1:1 to 1: 8

INSTRUMENTATION:

16 bit PC data acquisition systems, wave elevation sensors (acoustic, resistance and capacitance), full range of sensors for measurement of force, displacement, angle, angular rate, acceleration, pressure; automated beach profile measurement system, sediment grading sieve and shaker system, water quality instrumentation (dissolved oxygen, temperature, salinity, turbidity). Current measurement: acoustic Doppler velocimeter (2-D), AWAC (waves and current profiler).

TESTS PERFORMED:

Breakwater/reef wave attenuation measurements, wave diffraction studies, harbor wave studies, harbor tidal scouring evaluation, beach erosion measurements, force measurement on moored ships and marine structures; lab and field studies.

Variable Pressure Water Channel

FACILITY TYPE:

Closed loop water channel set up in vertical plane with free surface, variable pressure test section; $V_{max}=25$ fps

DRIVE SYSTEM:

4-blade axial flow impeller driven by 75 hp motor with digital control

FEATURES:

Vacuum pump – 10 hp liquid ring pump; can maintain 2.7 psia in facility

Active skimmer located before test section; variable speed 15 hp pump

Model propeller dynamometer/drive system with 15 hp motor

INSTRUMENTATION:

16 bit PC data acquisition systems, propeller thrust and torque dynamometers, full range of sensors for measurement of force, displacement, angle, pressure; pitot tube velocity measurement, acoustic Doppler velocimeters, 3-component Laser Doppler velocimeter, stereo particle image velocimeter, computer controlled traverse mechanisms

TESTS PERFORMED:

Hydrodynamic force and cavitation measurements on propellers, foils, cylinders, various appendages, towed bodies; boundary layer velocity profiles, detailed velocity distribution in flow over bodies

Low Turbulence Water Tunnel

FACILITY TYPE:

Closed loop water tunnel set up in vertical plane with variable roof geometry for adjusting the streamwise pressure gradient

DRIVE SYSTEM:

Twin 10 hp centrifugal pumps with digital motor control

FEATURES:

- Interchangeable bottom tunnel walls
- Variable pressure gradient over 8' long test section
- Water cooling system for maintaining constant water viscosity
- Flexible pipes used to isolate motor vibration from test section
- Built-in traverse system for precise LDV measurements

INSTRUMENTATION:

16 bit PC data acquisition systems, full range of sensors for measurement of force, displacement, angle, pressure; pitot tube velocity measurement, acoustic Doppler velocimeters, 3-axis Laser Doppler velocimeter, stereo particle image velocimeter, computer controlled traverse mechanisms

TESTS PERFORMED:

Detailed velocity measurements in boundary layers over surfaces with different roughness. Fundamental studies of wall-bounded turbulent flow. Studies of flow around wall-mounted obstacles and bluff body wakes.