

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, capsizing 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;  
Vmax=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.