



UNIVERSITY OF
PLYMOUTH

School of Engineering,
Computing & Mathematics

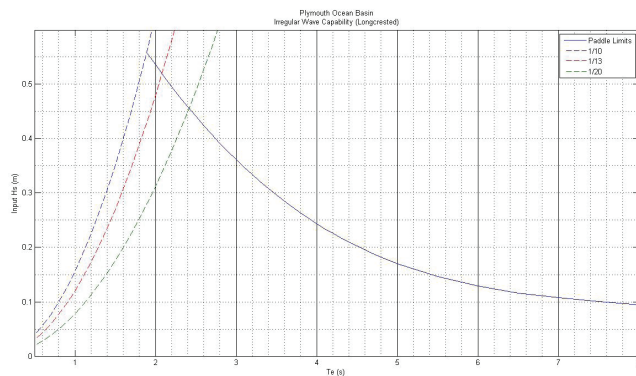
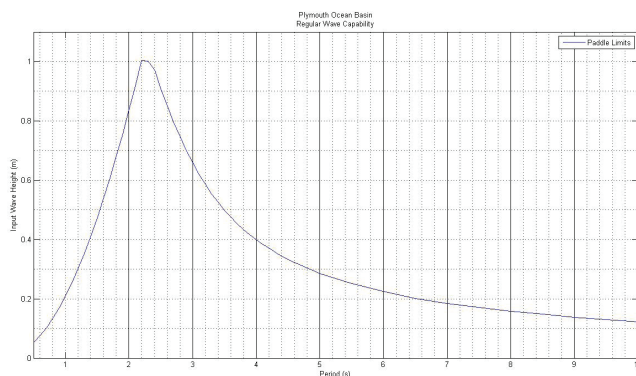


COAST LABORATORY

COASTAL OCEAN & SEDIMENT TRANSPORT

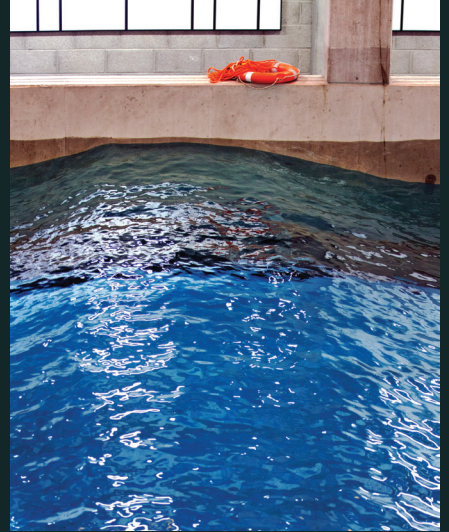
OCEAN BASIN

The Ocean Basin is a unique facility that allows waves and currents to be generated at any relative orientation and can be run at different water depths. This basin can be used to create unidirectional and directional wave fields, regular waves, wave spectra and currents putting it at the forefront of testing for marine renewable energy arrays. Future developments of the facility include the provision of a wind generation facility.



WAVE GENERATION CAPABILITIES

The paddles produce regular waves with an approximate maximum height of 0.9 m at 0.4 Hz and wave height above 0.2 m in a range of 0.166 Hz – 1 Hz. Wave synthesising software allows long-and short-crested spectral sea states to be generated as well as special wave effects. Oblique waves can be generated up to 40° from normal.



TECHNICAL SPECIFICATION

The Ocean Basin is 35 m long by 15.5 m wide with a moveable floor that allows different operating depths of up to 3.0 m.

PADDLES

Waves are generated by 24 individually controlled hinged flap absorbing paddles.

Dry-backed 2.0 m hinge depth.

CURRENTS

The recirculating flow system provides longitudinal currents of up to 0.3 m/s for a 2.0 m water depth.

A multi-pump recirculating hydraulic system provides the transverse current, enabling a mean flow speed of 0.3 m/s at 2.0 m of depth.

FLOOR

Slope of up to 6° along the Basin.

Maximum point load of 500 kg.

1.0 m x 0.5 m grid of M12 threads throughout the central section of the tank providing mooring capabilities.

ABSORBING BEACH

Convex beach to minimise reflected wave energy.





COASTAL BASIN

One of the key features of the COAST lab is its flexibility. The Coastal Basin allows sediment transport and coastal structures to be studied at scale in a controlled environment.

TECHNICAL SPECIFICATION

The Coastal Basin is 15.5 m long by 10.0 m wide with a maximum operating depth of 0.5 m.

PADDLES

20 absorbing piston paddles operating as five modules of four paddles.

Each paddle is 0.5 m wide by 0.5 m.

CURRENTS

Unidirectional flow up to 0.5 m/s via five individually controlled pumps across the basin.

FLOOR AND BEACH

Can simulate a fixed-bed beach and support sediment and cement beach models.

Elemental construction means it can be reconfigured by two people.

All floor attachment points have M12 threads.

SEDIMENT

Crossflow pumps are able to deal with large grain sediment (up to 2.0 mm grain size), the equivalent of very coarse sand.



WAVE GENERATION CAPABILITIES

The paddles will produce regular waves with a peak wave height of 0.32 m. The paddles also function as active wave absorbers to mitigate the reflections in the basin. Wave synthesising software allows long and short-crested spectral sea states to be generated as well as special wave effects.



FLUMES

COAST houses two wave and current flumes. A 35m flume, with sediment capability and a 20m flume, with sediment capability which can also be tilted. The inclusion of current circulation in the facility allows tidal energy to be studied as well as wave energy technology. The novel current circulation technology enables a smooth current to be modelled with minimal disturbance to the wave signal. This enables the controlled study of wave-current interaction and wave-current-device interaction.

WAVE GENERATION CAPABILITIES

Waves up to 0.35 m high can be generated. Regular waves, focussed waves and plunging breakers are all possible. The paddles actively absorb reflected wave energy.

TECHNICAL SPECIFICATION

The Sediment Flume is 35 m with a working section that's 0.6 m wide, and a still water depth of 0.75 m.

The Tilting Flume is 20 m long, with a working section of 0.6 m wide and 0.5 m deep.

PADDLE

The paddles in both flumes exhibit wave energy absorbing capabilities. They can both produce regular wave heights of up to 0.35 m as well as irregular waves.

CURRENT

Reversible flow recirculation of >1.0 m/s including sediment trap.

BEACH

Removable flat beach to simulate fixed-bed beach or to support sediment.

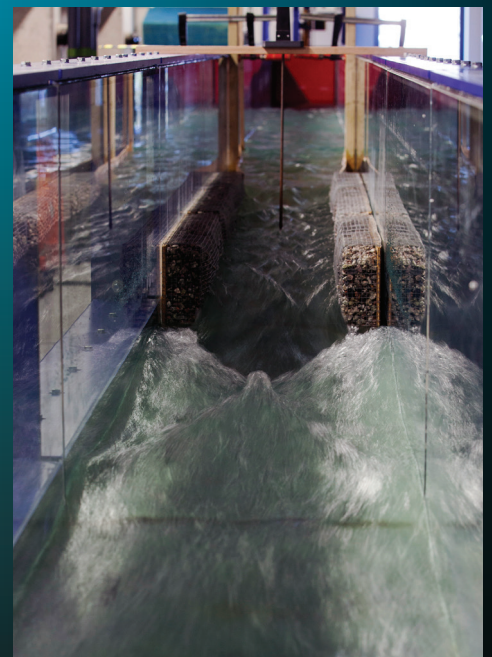
SEDIMENT

Pumps are able to deal with large grain sediment (up to 2 mm grain size); the equivalent of very coarse sand.

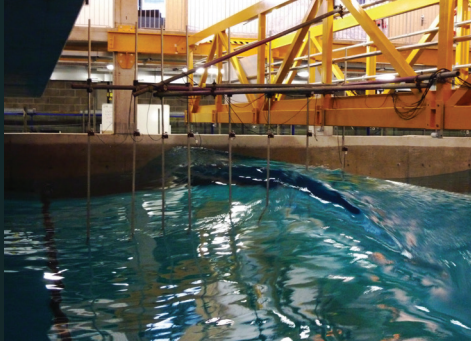
OTHER

Glass sides the full length of the flumes facilitates flow visualisation.

Hoist for lifting models, wet sediment and equipment into flume (maximum 1.0 tonne).



INSTRUMENTATION



COAST lab boasts a large range of instrumentation and data acquisition hardware and software. The equipment is maintained and operated by a dedicated team of engineers.

ADDITIONAL FACILITIES

The University is equipped with metal and wood working facilities that can be used for creating components and models bespoke to your requirements.

TECHNICAL SPECIFICATION

DATA ACQUISITION (DAQ)

A range of National Instruments Compact DAQ hardware paired with custom written LabView software.

The hardware is a modular system consisting of a base unit with expansion modules added to cover specific signal and sampling requirements.

MOTION CAPTURE

Set of 9 Qualysis 6 DoF (degrees of freedom) cameras, one with high speed video capabilities.

Multiple lenses allow accuracy of better than 1.5 mm in most ranges.

Underwater capability.

FLOW MEASUREMENT

Dantec 3D particle image velocimetry (PIV) on a 1 m traverse;

Laser Doppler anemometer;

Valeport impeller flow metering;

40 twin-wire resistance wave probes with lengths up to 1.4 m;

Vectrino Profiler Acoustic Doppler Velocimeters.

SEDIMENT MEASUREMENT

FARO 3D colour laser-scanner;

Aquascap sediment probe.

CAMERAS

High definition video and stills cameras.

Photron Fastcam SA4 High speed camera capable 3600 fps at a resolution 1024x1024 resolution.

NAC HotShot 1280 High speed camera capable of 500 fps at 1024x1024 resolution. Nikon D5200 DSLR.

Underwater cameras, allowing a live view and recording of models underwater.

OTHER SENSORS

Pressure transducers, water-proof load cells, accelerometers, strain gauges, torque meter, pressure measurement, LVDT, hydrophones.



COAST

COASTAL OCEAN & SEDIMENT TRANSPORT

Housed in the new Marine Building at Plymouth University, the Coastal, Ocean And Sediment Transport (COAST) laboratory provides physical model testing with combined waves, currents and wind, offered at appropriate scales for device testing, array testing, environmental modelling and coastal engineering.

This is a flexible facility with the capability to generate short and long-crested waves in combination with currents at any relative direction, sediment dynamics, tidal effects and wind.

The Marine Building is home to a host of dedicated scientific, engineering and technical staff who are experienced at supporting commercial projects, as well as teaching and research work within the COAST research group since 2012.

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