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DESIGN FEATURES OF THE UPCOMING COASTAL AND OCEAN BASIN (COB) IN OSTEND, BELGIUM

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ABSTRACT

The new Coastal and Ocean Basin (COB) at the Greenbridge Science Park in Ostend, Belgium is under design. The laboratory will provide a versatile facility that will make a wide range of testing possible, including the ability to generate waves in combination with currents and wind at a large range of model scales. The facility is part of the Gen4Wave project on offshore renewable energy and coastal engineering in Flanders, Belgium. The COB is funded by the Hercules foundation, the Agency for Innovation by Science and Technology (IWT), the Ministry of Public Works and Mobility, Ghent University (UGent) and University of Leuven (KU Leuven). The basin will be part of a larger building complex that will also host a towing tank from the Maritime Access Division of the Ministry of Mobility and Public Works. This new infrastructure will offer the opportunity to companies and government agencies to develop innovative designs thereby strengthening the position of Flanders in coastal engineering and offshore renewable energy.

The COB will be 30 m long, 30 m wide and will have a variable water depth of up to 1.4 m. A central pit will allow experiments e.g. with mooring lines at a depth in excess of 4 m. The basin will have state-of-the-art generating and absorbing wavemakers and submerged bidirectional propellers that will drive the recirculation current (velocities of up to 0.4 m/s) across the underground current tank. It will be possible to generate wave-current interactions in the same, opposite and oblique directions. The design of the current generation system has been achieved using both numerical and experimental models. Flow velocity fluctuations are expected to be smaller than 10% RMS. For wind generation, a portable device capable of generating speeds up to 15 m/s is foreseen. The basin will be equipped with state-of-the-art instruments for wave, current, wind and topographic measurements.

The COB will allow users to conduct tests for coastal and offshore engineering projects as well as for research. The basin is expected to be operational in 2017. This paper presents an overview of the basin's capabilities, the ongoing work, and some results of the design work.

KEWORDS: physical modelling, coastal engineering, offshore engineering, renewable energy, wave energy

1 INTRODUCTION AND SCOPE

A new Coastal and Ocean Basin (COB) to be built in the municipality of Ostend in Belgium, within the context of the Gen4Wave project, is under design. The COB will come to satisfy the demands from not only the academic sector, but also from private companies developing coastal and offshore technology. The facility will cover a wide range of needs while keeping the lowest possible operating costs, which has led to the adoption of some unique solutions both in the management of the project and in the engineering solutions.

Scientific research in the fields of coastal and offshore engineering, like many other engineering domains, has evolved into a so-called integrated research methodology, combining both numerical modeling and physical scale model testing. In this context the scarcity and limitations of existing testing infrastructure for maritime research and development calls for further investment in this sector. As part of the credentials for the financing of the Gen4Wave project, the interest in the project by both the private sector and the academic sector, had to be demonstrated. This was successfully achieved receiving ample expressions of interest for the commercial use of the facility, ensuring the complete allotment of available testing times for the private sector during the initial phase of operation.

Flanders has a long tradition in coastal engineering supported by the infrastructure of Flanders Hydraulics Research (WL by its acronym in Dutch) in Borgerhout. However, the dimensions of the wave tank of WL (17.5 m ×12.2 m × 0.45 m) are limited and only long-crested waves can be generated so that it is more suitable for coastal engineering applications. Therefore, the proposed COB project complements the existing infrastructure not only for coastal engineering applications but also for offshore as well as wave and tidal energy applications.

The three partners in the COB project, i.e. UGent, KU Leuven and WL, have a longstanding research record in projects involving wave propagation, coastal processes, and coastal structures. Swift access to a large-scale facility with multi-directional wave, currents and wind, will enable breakthrough experimental research in the field of coastal engineering.

In the field of renewable energies further understanding of an optimal wave energy converter (WEC) farm layout for realistic 3D wave-current fields will be pursued. This comprises the production of a data set to validate numerical models of wave energy converters, including mooring effects. In the same area experimental research towards numerical model validation of wave slamming on complex floating objects, such as (but not limited to) WECs, is planned.

Fundamental questions still remain on the impact loading of structures due to combined waves and currents, and the consequent structural response. Examples of this are the prediction of wave overtopping at harbour quay walls and the interaction of overtopping flows with storm surge walls, the prediction of damage at scour protections for monopile wind turbines and the impact of vegetation on the bottom erosion parameters in combined wave-current conditions. These research questions will be tackled in the COB, amongst others, and will allow coastal and offshore engineering research in Flanders on a high international level. To this end, swift access to a large-scale facility with multi-directional wave and current generation is indispensable.

Finally, the COB will enable further studies of the role of wave-current and wave-wave interactions on the excitation of freak waves. This research line has been seriously hampered by the scarcity of 3D wave basins capable of generating high quality flows for wave-current interaction studies.

2 BACKGROUND

As the project has gathered interest from both industry and academia, it received financial support from different organizations. UGent together with KU Leuven obtained financial support for the wave-current generation system from the Hercules Foundation in the amount of approximately 2.3 million Euros. UGent and KU Leuven provide complementary funds in the frame of this funding. The Hercules Foundation is a structural funding instrument for investment in scale infrastructure for fundamental and strategic research in scientific disciplines.

The Gen4Wave project has made available the resources to acquire additional relevant equipment to have the COB fully operational. The Gen4Wave project is financed by the Agency for Innovation by Science and Technology (IWT), which is providing approximately 3 million Euros for the initial investments, and 2 million Euros for the operational phase.

The building and main infrastructure will be provided by the Maritime Access Division of the Flemish Ministry of Mobility and Public Works. This includes the housing and the concrete wave tank structure.

2.1 Gen4Wave Project

The COB is part of the Gen4Wave action plan resulting from an initiative of the Flemish government that supports the innovative manufacturing industry in the field of renewables. The plan has been developed by Agoria Renewable Energy Club (AREC) and UGent upon request of Generaties, a working group positioning Flanders in the field of renewable energy production, and came to existence thanks to the consortium UGent (coordinator), KU Leuven and Flanders Hydraulics Research (WL). The Gen4Wave project is defined by three pillars:

- **Gen4Wave Coastal and Ocean Basin (COB)**: The first pillar is the infrastructure that will allow users to perform model tests of coastal structures. The infrastructure is versatile and has been designed keeping in mind various applications: wave and tidal energy converters, offshore wind turbines under the influence of waves, currents and wind loads, offshore engineering structures, coastal engineering structures, wave / flow-vegetation interactions, and even basic research in physical phenomena.
- **Gen4Wave R&D Projects**: The second pillar is the support of innovation projects in line with the Gen4Wave R&D Roadmap .
- **Gen4Wave Energy Platform**: The third pillar is a platform for dialogue, bringing together the academic institutions and the industry, namely the Gen4Wave Energy Platform. This platform works as a dynamic breeding ground for new projects.

The huge demand for physical model testing has led to a shortage of available capacity in Europe. In preparation for the COB proposal, we further conducted an exhaustive study of the existing infrastructure in Europe. The first step was to see how COB positions itself against other testing facilities in Europe in terms of dimensions and capabilities. In that respect, the Unique Selling Propositions (USPs) of the COB are:

1. COB-dimensions allow a wide range of applications at various scales at an acceptable cost.
2. Ability to accurately reproduce (combined) loads from waves, current and wind.
3. Powerful machinery able to generate significant flow loads.
4. High directionality, with currents and waves interacting at random directions relative to each other.

A unique opportunity to create a research synergy was found between the COB and the new towing tank of the WL in Ostend, both infrastructures sharing the same location in Ostend.

2.2 Synergy with towing tank

Part of the expansion of the activities of the WL is the building of a new towing tank. By having both initiatives take place in the same location, a physical modelling cluster will result, reinforcing both initiatives. This cluster will allow for synergy in aspects such as the sharing of expertise, resources and administration of the infrastructure.

The infrastructure is illustrated in Figure 1. The red section is the COB, and the blue section is the towing tank by the Hydraulics Laboratory. The figure on the left shows the location of the COB at the Green Bridge Science Park as well as the location of the park near Ostend.

2.3 Consortium

The consortium is composed by Ghent University, the Catholic University of Leuven and Flanders Hydraulics Research. From Ghent University the following research groups participate: (1) Coastal Engineering research group, (2) Maritime Technology Division and (3) the research group of Mechanics of Materials and Structures. The Catholic University of Leuven participates with the Hydraulics Laboratory. These groups will contribute with their specific expertise in the upcoming academic projects in the COB: coastal and offshore structures engineering, composite materials, slamming and deformation, wave and tidal energy, maritime technology, wave-current and wave-wave interaction and sediment mechanics.

The organization of the consortium is stated in a consortium agreement, defining the contributions of each partner and the joint activities to be pursued. This involves also a management committee to exploit the COB on a daily basis.

3 DESIGN BASIS

In this section the specific elements that are part of the Gen4Wave Coastal & Ocean Basin (COB) are reviewed in the context of the COB targeted functionality. This comprises the basin facilities (section 3.1), the infrastructure to generate loads (waves, currents and wind) and water levels, see sections 3.2 to 3.6, and the instrumentation and data acquisition (section 3.7 and 3.8).

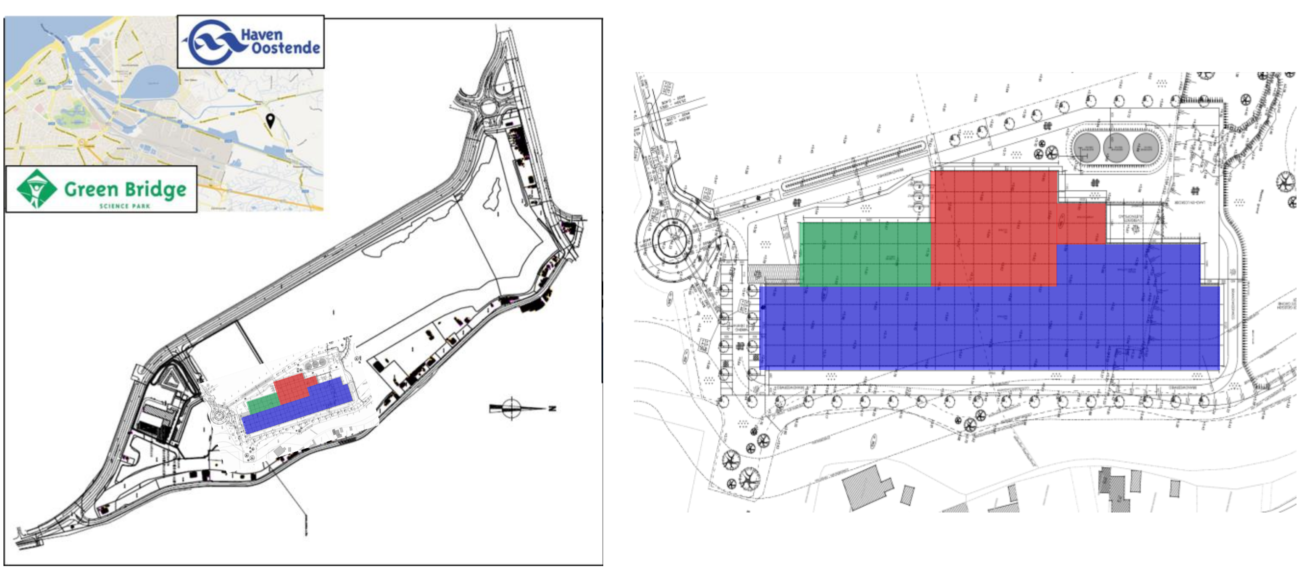

Figure 1. Location of the upcoming research cluster near the port of the Ostend (red: COB Gen4Wave, blue: towing tank operated by Flanders Hydraulics Research, green: shared office space).

3.1 Location

The COB will be located at the Green Bridge Science Park close to the port of Ostend (Figure 1). The Science Park covers about eighteen hectares and provides the necessary space and services for the planned wave basin as well as for the development of future industrial activities. The science park also houses the eponymous incubator Green Bridge. This can be used by start-up companies that are associated to the wave basin to develop commercial activities thus having the opportunity to grow. The proximity to the port of Ostend is an advantage as the site is a strong renewable energy hub.

3.2 Basin facilities

The COB lab (52 m × 42 m) will host the basin (30 m × 30 m) and several autonomous systems that allow to achieve its whole capability (Figure 2). The main systems are the wave and current system, the wind generator and the water transfer system which are connected to the data acquisition system (DAQ) to be able to rapidly set up testing scenarios and to collect the main testing parameters. There are also other systems that are needed to efficiently operate the COB, most notably the bridge crane, the carriage (or access bridge), the forklift and the wheel loader. These devices will be described in the following.

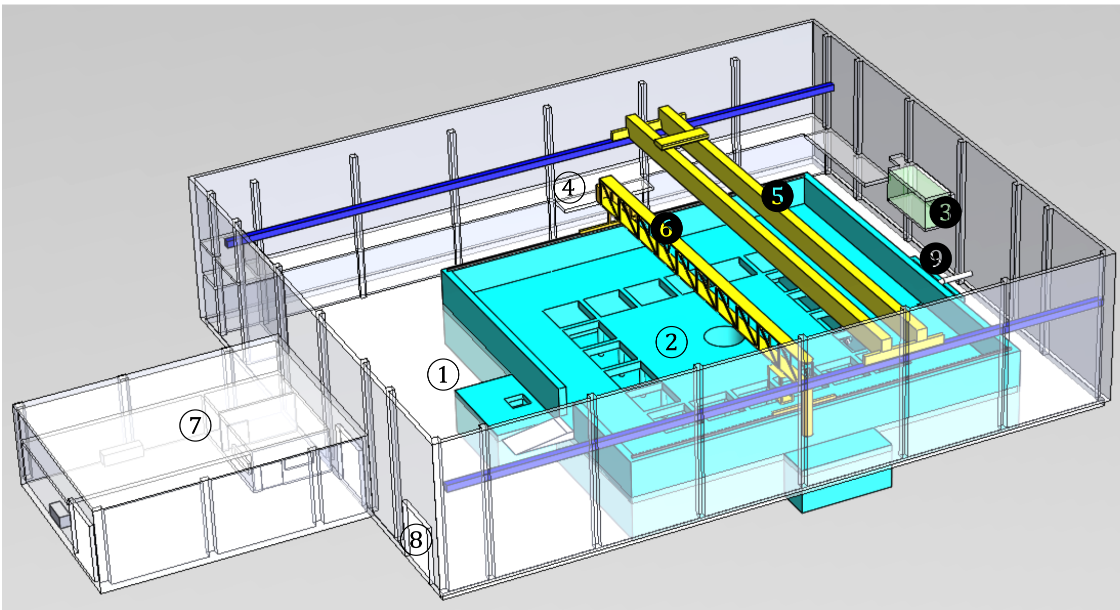

Figure 2. Overview of the COB facility: 1) COB lab, 2) COB, 3) Main operation location, 4) Secondary operation location, 5) Bridge crane, 6) Carriage (access bridge), 7) Workshop, 8) External access, and 9) Water transfer system.

An overhead crane with a suitable capacity (10tons) will be available to displace heavy items in and out of the wave tank (i.e. scaled models, structures, equipment, wind generator, etc.). The crane will cover the entire area of the COB lab. It will be possible to access the wave basin with an electric forklift or a wheel loader making the model construction process as simple as practically possible. The operation of the basin will be possible from two control locations.

Furthermore, the COB will be equipped with an access bridge. This is a mobile structure which allows the users to reach every location or instrument in the basin without having to go inside the water. These "dry" conditions facilitate the work of the experimentalists. Also, the measuring bridge provides a close view of the experiments.

Working with models and operating such infrastructure also requires a technical working space where things can be assembled, processed, manipulated and repaired. For this purpose there is a workshop area immediately next to the COB lab. Furthermore, a range of materials will be stored for the construction of models (stones in a variety of sizes, model blocks, guiding walls, etc.). The synergy with the towing tank will allow co-operation in specialized tasks.

3.3 Wavemaker

The wavemaker is the most important mechanical system in the COB. The wavemaker will be purchased through an international tender and therefore a lot of care has been taken to produce the right specifications. The first analysis towards the determination of these specifications involved the analysis of typical modelling scenarios. Based on these results extra margins in some of the parameters were defined to allow for further flexibility or capability.

The COB wavemaker will ideally cover two sides of the basin, forming a corner. This setup allows for a larger range of oblique wave angles. Also, as the current can be reversed in direction, any relative angle between the current and the waves can be achieved.

The COB will be able to cover test conditions from coastal to near offshore. In Table 1 some examples of existing coastal wave basins are shown. The wave height in these basins is often limited by the available water depth and this is often related to the horizontal dimensions of the basin for most of the 3D coastal models. On the other hand, too large coastal models would increase the construction and operation costs of these models. The COB will therefore allow coastal models in up to 1.1 m water depth and a maximum depth-limited wave height of 0.55 m (regular waves).

Table 1. Selected examples[1)] of existing coastal wave basins.

Name	Dimensions (length x width x water depth) (m)	Maximum wave height (m)
Portaferry (Ireland)	18 x 16 x 0.65	0.55
DHI (shallow basin, Denmark)	25 x 35 x 0.8	est. 0.4
Aalborg basin 1 (Denmark)	15.7 x 8.5 x 0.75	0.2
Aalborg basin 2 (Denmark)	12 x 17.8 x 1	est. 0.5
Delta basin (Deltares, Netherlands)	50 x 50 x 1	0.45
Pacific basin (Deltares, Netherlands)	22.5 x 30 x 1	0.4
Atlantic basin (Deltares, Netherlands)	75 x 8.7 x 1	0.45
Tsunami wave basin (Oregon, USA)	48.8 x 26.5 x 1.37	0.75 (in practice 0.7)
Coastal basin (Plymouth, UK)	15.5 x 10 x 0.5	0.3
HR Wallingford (UK)	27 x 55 x 0.8	0.25

[1)] The list of coastal wave basins world-wide has been limited to a number of key facilities

In a similar way the COB will offer additional offshore modelling capability. Offshore tests often cover a very wide range of conditions (see e.g. the selected offshore test basins in Table 2). In the case of the COB the most relevant offshore application will be the tests of wave energy converters and therefore a compromise water depth of 1.4 m was adopted adding a central pit in excess of 4 m depth for mooring applications.

Table 2. Selected examples[2)] of offshore test basins.

Name	Dimensions (length x width x water depth) (m)	Maximum Wave height (m)
Water circulation basin (Ifremer, France)	18 x 4 x 2.1	0.3
Ocean Wave Basin (Plymouth, UK)	35 x 15.5 x 3	0.4
Flowave TT (UK)	φ 30 x 2 (circular)	0.7
OTRC (USA)	45.7 x 30.5 x 5.8	0.9
Marin (Netherlands)	45 x 36 x 10.2	0.2
HR Wallingford (flume, UK)	75 x 8 x 2	1
MOERI (Korea)	56 x 30 x 4.5	0.8
Oceanide (France)	40 x 16 x 5	0.8

[2)] The list of offshore test basins world-wide is a lot longer but the overview has been kept short and is limited to a number of key facilities

In the case of offshore engineering applications, the wave height will not be limited by the water depth but rather by the model scale and by the simulated sea conditions. A good compromise is achieved by setting a maximum wave height for regular waves to about 0.35 m, which will allow for a comfortable range of model scales.

For a wave basin like the COB, the capability for oblique wave generation is an extremely relevant aspect which will be achieved by a wavemaker composed of relatively narrow paddles. Investigations were performed regarding the largest paddle width that allows for a satisfactory oblique wave quality. In this case the most demanding conditions are for shorter waves when they are produced at a large angle from the wavemaker normal direction (Andersen & Frigaard, 2014). The wave quality is typically specified as a spurious wave content for a certain wave period and angle, but to have a clear cut quality criterion and to later verify the accomplishment of these goals is rather difficult. Therefore a maximum paddle width was determined which is in the range of 0.67 m for the case of a snake-type wavemaker and about 0.5 m for a box-type wavemaker, respectively. These values would allow the COB to produce waves with 1 s periods or longer in any oblique direction with respect to the wavemakers with a satisfactory quality.

3.4 Current generator

One of the unique characteristics of the COB is the capacity of producing combined waves, current and wind. The literature and internet bibliographic search showed that there are not many combined flow and current facilities. Journal publications regarding experiments with combined waves and currents are also scarce (Lorke *et al.*, 2011; Toffoli *et al.*, 2013).

It is important to note that an off-the-shelf solution for the current system does not exist. The design of the system requires a tailor-made solution considering the basin layout and target flow rate. The target current velocity is based on the flow conditions in the Belgian coastal waters, characterised by tidal currents with a typical depth-averaged flow velocity of about 1 m/s. Considering a maximum scaling factor of about 1:8 the flow velocity in the model is reduced to 0.4 m/s. The current generation system should produce a steady current with an almost uniform depth-profile in a uniform water depth of up to 1.4 m, requiring a total flow of approximately 11 m^3/s. A screening of existing laboratory facilities (Table 3) reveals that only few basins are able to generate currents with a velocity exceeding 0.25 m/s in this water depth. However, maximum current speeds depend also on the water depth used for a specific test where a smaller water depth would allow a higher speed.

Table 3. Current systems in existing wave basins.

Type	Name	Dimensions (length x width x water depth) (m)	Flow rate (m^3/s)	Current velocity (m/s)
Coastal	DHI (shallow basin, Denmark)	35 x 25 x 0.8	1.2	
	LNHE Chatou (France)	50 x 30 x 0.8	1.5	
	NRC Canada	47 x 30 x 0.8	1.6	
	HR Wallingford (UK)	27 x 55 x 0.8	1.2	
	Pacific basin (Deltares, Netherlands)	22.5 x 30 x 1	1.8	
	Franzius-Institute (Germany)	25 x 40 x 1	5	0.3
	QU Belfast (UK)	16 x 18 x 1.2		0.25
	Cedex (Madrid, Spain)	34 x 26 x 1.6	0.2	
	COB (Ostend, Belgium)	**30 x 30 x 1.4**	**11.2**	**0.4 (at 1.4 m depth)**
Offshore	DHI (offshore basin, Denmark)	20 x 30 x 3	0.2	
	Ocean Engineering Tank (Japan)	50 x 10 x 5		0.2
	Marin Offshore Basin (Netherlands)	45 x 36 x 10.2		0.5
	MarinTek Trondheim (Norway)	80 x 50 x 10		0.25
	CCOB Cantabria (Spain)	30 x 44 x 3	18	
	Ocean Wave Basin (Plymouth, UK)	35 x 15.5 x 3		0.3 (at 2m depth)
	Flowave TT (UK)	φ 30 x 2 (circular)		0.8

The information on the quality of the flows that can be obtained by the different current system approaches is scarce. Robinson *et al.* (2015) presented experimental model measurements and numerical simulations for the Edinburgh FloWave TT ocean energy research facility (Davey, 2012), stating that a turbulence level of approximately 10% was achieved. Some velocity profiles were also published for the flow systems of Marin basin in the Netherlands (Buchner *et al.*, 1999; Buchner *et al.*, 2008), Marintek in Norway (Stansberg, 2008; Li, 2014), COAST laboratory in Plymouth University, UK (Collins *et al*., 2013) and the Ocean Engineering Tank of Japan (Waseda, 2005; Toffoli *et al.*, 2013). The design of the COB current system is aimed at achieving a higher flow quality than that of existing infrastructure.

Current and wave facilities can be divided into three groups: jet induced flows, pump and pipe systems and flow chambers. The first two systems are more compact but they involve the presence of high velocities in different parts of their systems, resulting in relatively higher power requirements and even current velocity limitations. For the COB we prioritized obtaining the highest flow quality while keeping the lowest operation cost possible. In this context the use of a flow chamber below the level of the wave tank floor, namely a current tank, was chosen.

A scheme of the current system is shown in Figure 3. The current is introduced in the basin through a number of guiding grids flush mounted in the basin floor. Each grid can be replaced by a lid when the current system is not used.

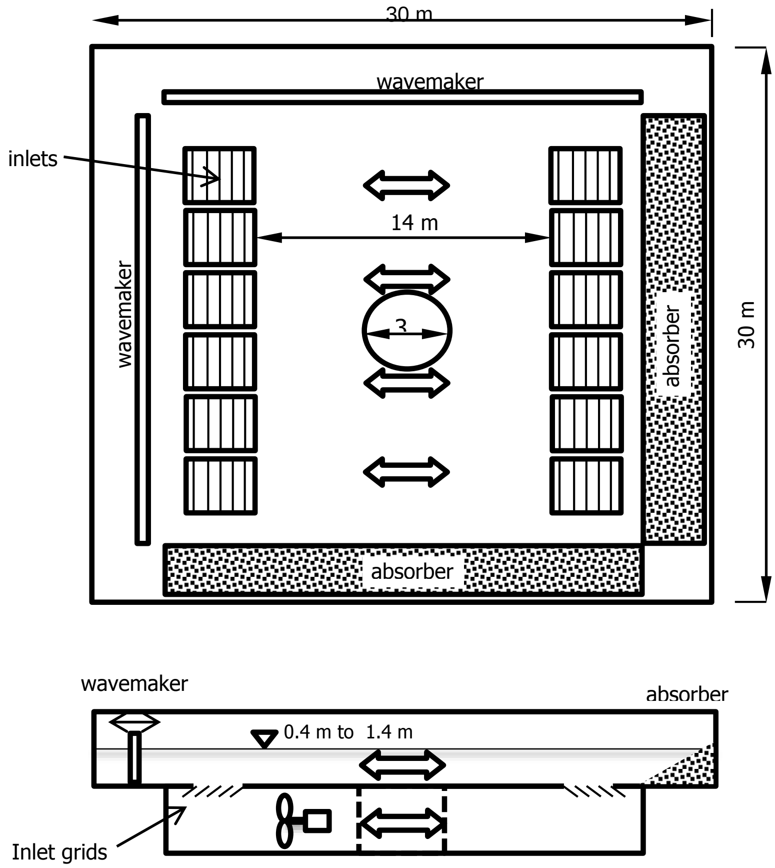

Figure 3. COB schematic including the wavemaker and the current system (top: plan view, bottom: cross section).

The approach taken here to obtain a uniform and steady velocity profile in the wave tank has been to pursue the lowest possible velocities in the current tank and having successive velocity increases as the flow is guided to the wave tank (Idelcik, 1966; Chin and Gerrits, 2001; Hamilton, *et al*., 1996). The last step is the turn of the flow coming from the bottom of the basin to continue horizontally into the test section which was achieved by designing an inlet guiding grid. T

In the design process, CFD tools were used to optimise integrally the design of the whole current system. Later the design was verified in a physical model (1:10 scale). Velocity measurements were carried out by means of a particle image velocimetry system. Figure 4 shows a typical vertical velocity profile obtained from the small wave flume of the Civil Engineering Department at Ghent University. The figure shows a rather uniform distribution of velocities from the still water level to about 2/3 of the water depth (around 8 cm), where the velocity decreases from 0.36 m/s to about 0.32 m/s. Further below, in water depths down to 12 cm the velocity decreases to zero velocities as expected. Further model tests and CFD simulations will be run to optimise the design and to eventually suggest the final geometry of the inlet grids.

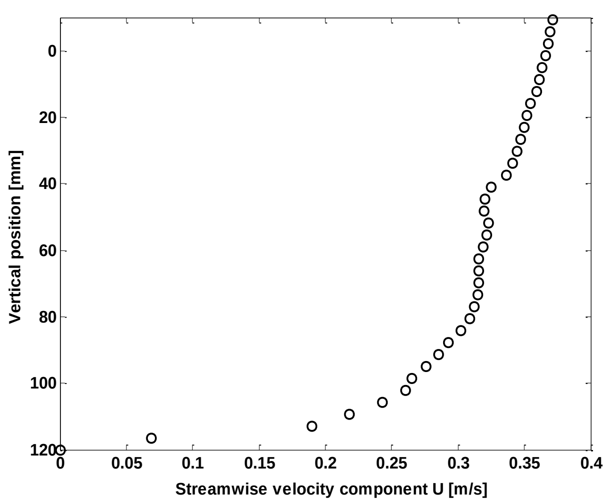

Figure 4. Velocity profile in model current system.

3.5 Wind generator

The purpose of the wind generator is to generate wind loading on models to be tested. At this stage it was decided to have a frontal flow section of 2 m x 2 m with a maximum wind speed of 15 m/s, as this would generate already a significant dynamic pressure load on a floating structure (130 Pa). The overall estimated power at maximum speed is 70 kW. The design approach is similar to the one of Ohana *et al.* (2014), and it consists of a short square duct with an array of fans followed by flow conditioning elements. An exploded view of the planned wind generator is shown in Figure 5. The flow conditioning design consists of a metallic mesh, a honeycomb and a final metallic mesh, with appropriate separations in between to allow space for flow redistribution. This design was based on the wind tunnel design guidelines by Bradshaw and Pankhurst (1964), and Mehta and Bradshaw (1979). The function of the honeycomb panel is to reduce streamwise vorticity while the meshes generate a distributed pressure drop that helps uniform the flow field. In contrast with the design presented by Ohana *et al.* (2014) we decided to have one of the meshes before the honeycomb to ensure the proper performance of this last one. The meshes are going to be made of non-rust metallic wire. The opening area of the meshes is between 55% and 65% of the total area, respectively, and the pitch between wires should not be larger than 4 mm.

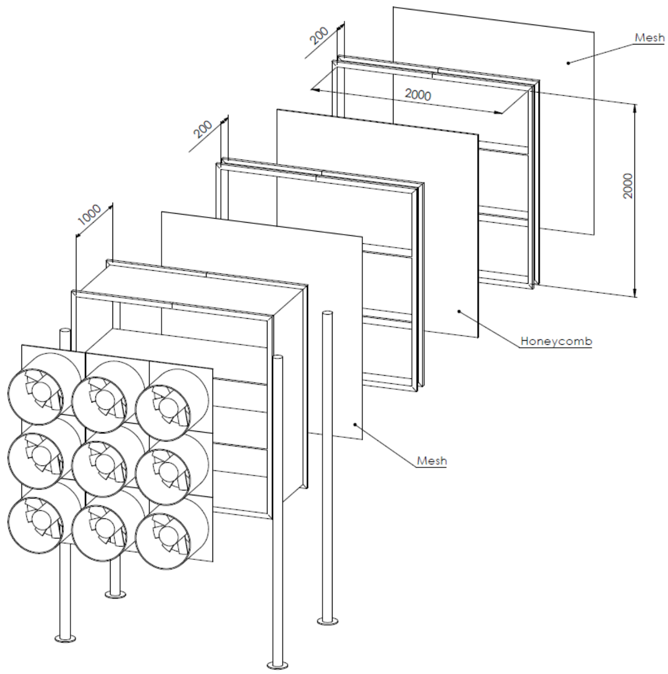

Figure 5. Wind Generator exploded view.

3.6 Water transfer system

The water transfer system is needed to fill and empty the COB, but also to set up the working water level. The design flow rate is 1300 m^3/s that allows to produce a 10 cm change of the water level in approximately 10 minutes and to take the wave basin from a 1.4 m water depth to zero in approximately 1 hour. A water level setting precision of 1 mm has also been specified. There are three water storage facilities planned, the COB itself, the internal water storage, used for rapid water level adjustments, and the external water storage, used to completely empty the COB. A schematic of the water transfer system is shown in Figure 6. The water transfer system will have to deal with important variations in water heads, being able to transfer water from any container to any other, and to control the water level to within 1 mm. These requirements call for a specialized system with a valve manifold, frequency controlled pumps and a control and safety PLC.

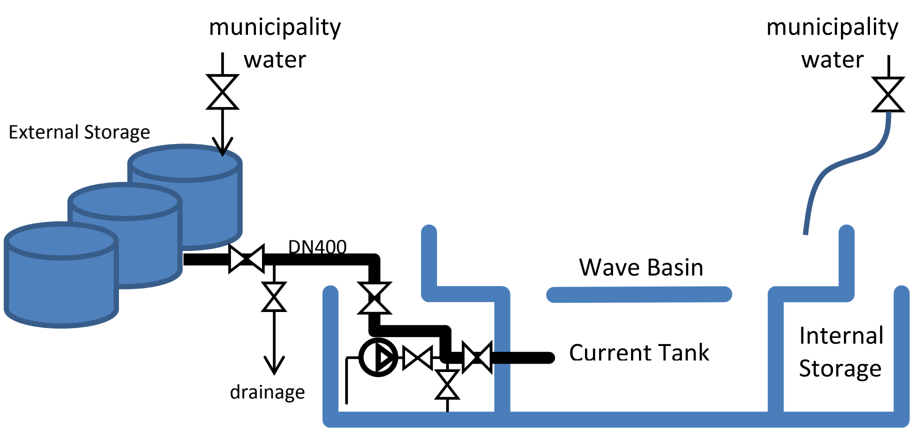

Figure 6. Water transfer system schematic.

3.7 Instrumentation

An important objective of the COB is to provide state-of-the-art testing and be able to interpret the results. The laboratory will have a large inventory of conventional and state-of-the-art instrumentation for measuring the free surface (i.e. capacitive, resistive, ultrasonic wave gauges), velocity (Acoustic Doppler Velocimeter, Acoustic Doppler Profiler, micropropeller velocimeter), pressure, stress (axial load cells), wind (ultrasonic anenometer, cup anemometer, barometer, air temperature sensor), and depth. In addition, a motion capture system and a 3D laser scanner for topographic mapping system are foreseen.

3.8 Data Acquisition System

The Data Acquisition System (DAQ) includes the analogue signal input from the instruments, the communication with the autonomous systems, the display and processing of signals and other information, and the data storage and back-up. The autonomous systems are the water transfer system, the wavemaker, the current system, and the wind generator. Figure 7 illustrates the general concept.

The DAQ will have to cope with different experimental setups. The number of instruments connected to the analogue signal inputs may vary from one test to the next as well as the measurement positions. We therefore adopted a system with three acquisition "boxes" connected to an acquisition server by Ethernet. Each box offers an assortment of signal acquisition modules covering different possible sensors and acquisition speeds. The boxes can be easily repositioned in the COB to reduce analogue signal cabling to a minimum. There will be a total amount of 160 analogue input channels, 24 counter channels and 32 bridge or resistance channels.

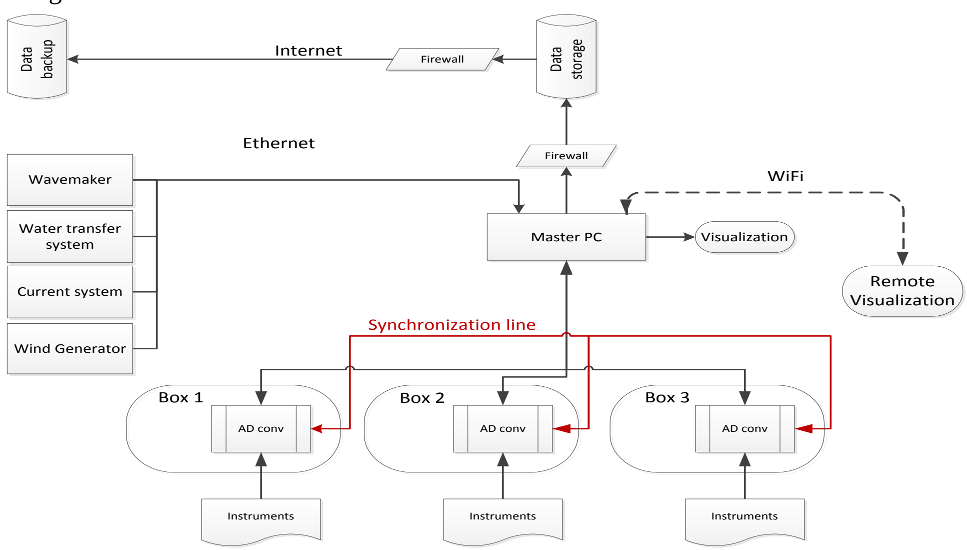

Figure 7. Schematic of the planned data acquisition system in the COB.

There will be two fixed locations where the operation of the DAQ is possible: from the viewing room on the 1st floor and from the cockpit located on the 1st floor corridor, at 90° from the viewing room (see Figure 2, positions 3) and 4), respectively). There will be also a remote, portable interface to be able to monitor the DAQ system from other locations.

4 CONCLUSIONS

There is a significant potential for wave and tidal energy in Europe and there is plenty of work on different wave and tidal energy devices and systems at various stages of development. Yet there is a clear need for a new infrastructure to be able to move from concept to open water (as recognized in various roadmaps at European level). This need for testing infrastructure is also true for projects related to coastal engineering, where updated knowledge on coastal protection schemes and methods, especially under 3D conditions and wave-current interaction, is still needed. The Gen4Wave project was conceived to address these needs, where the Coastal and Ocean Basin (COB) is one of the central pillars of this project. The COB will provide a versatile facility that will make a wide range of testing possible, including the ability to generate waves in combination with currents and wind at various model scales, at any relative angle.

The different aspects of the design of the COB were briefly presented showing the criteria that were applied to each system and the decisions taken. The COB will not only provide state of the art testing conditions, as can be observed by comparing with the technical specifications of other existing facilities, but will also be able to produce unique testing conditions. These include in particular complex scenarios combining currents, waves and wind. The prospective start date of the construction is in late summer 2016 and the basin is expected to be operational in 2017.

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