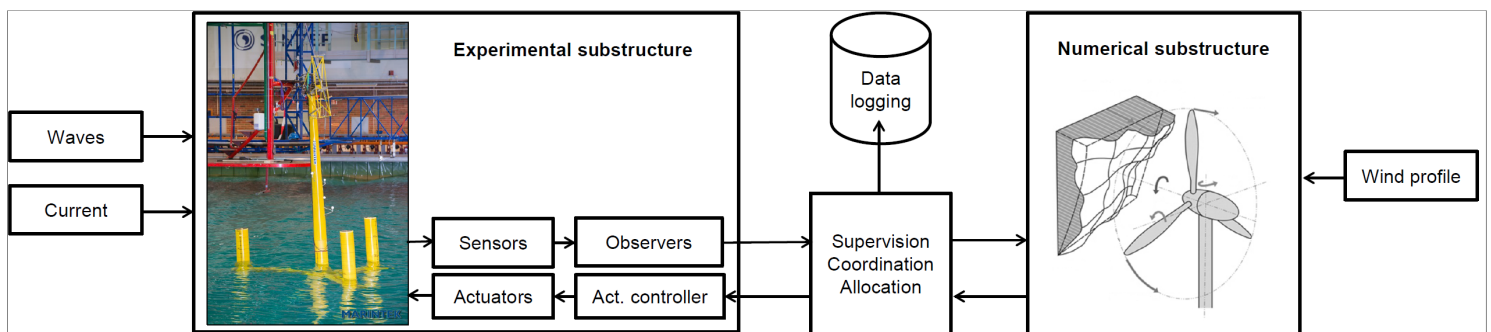


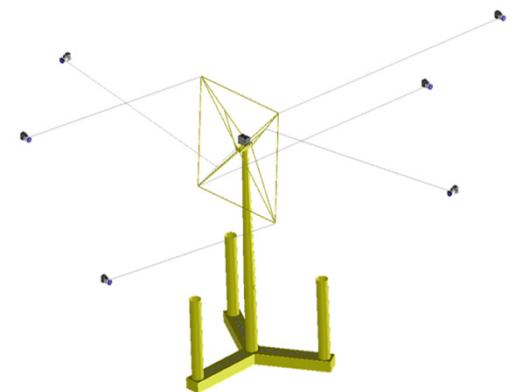
# ReaTHM™ Testing of Offshore Wind Turbines

## Innovation description

- Real-time hybrid model testing of offshore wind turbines (abbreviated **ReaTHM™ testing**) has been developed in a joint effort between MARINTEK and NTNU.
- The **principle** of ReaTHM testing is the following (see Figure below):
  - The OWT-substructure is located in an ocean basin, and exposed to (physical) waves and current.
  - Wind loads on the turbine are simulated (using NREL's AeroDyn), and applied, in real-time, on the substructure via a set of actuators. The resulting motions of the turbine are fed back into the numerical model.



- This approach **enables**
  - solving the issue of **Froude-Reynolds** scaling incompatibility in model testing of FOWT,
  - studying complex hydrodynamic processes with an accurate and **deterministic** coupling with aerodynamics,
  - including correct both thrust and **non-thrust wind loads**, which are of importance for some FOWT designs,
  - investigating **fault situations** such as FOWT dynamics under emergency shutdown, or seized blade (new).



## Impact

- This testing method allows for improved de-risking and optimization of novel concepts. Through **reduced uncertainties and reduced over-conservatism**, this has a direct positive influence on the cost of energy.

## Further development

- This method has been used to perform the model test of the NOWITECH semi in MARINTEK's Ocean Basin in 2015.
- It will now be developed further and used in the **LIFES50+** (<http://lifes50plus.eu>) and **HYBRID KPN** projects.
- MARINTEK's goal is to offer **commercial testing** based on this technology in 2017.

## References

- [1] Thomas Sauder, Valentin Chabaud, Maxime Thys, Erin E. Bachynski, Lars Ove Sæther (2016). "Real-time hybrid model testing of a braceless semi-submersible wind turbine: Part I: The hybrid approach". In 35<sup>th</sup> International Conference on Ocean, Offshore and Arctic Engineering, no. OMAE2016-54435.
- [2] Erin E. Bachynski, Valentin Chabaud, Thomas Sauder (2015) "Real-time hybrid model testing of floating wind turbines: sensitivity to limited actuation". Energy Procedia. vol. 80.
- [3] Valentin Chabaud, Sverre Steen, Roger Skjetne (2013). Real-Time Hybrid Testing for Marine Structures: Challenges and Strategies. In 32nd International Conference on Ocean, Offshore and Arctic Engineering.