Development of a Simulation Environment for Offshore Floating WTGs

OC3 MEETING – ROSKILDE, 13-3-2009

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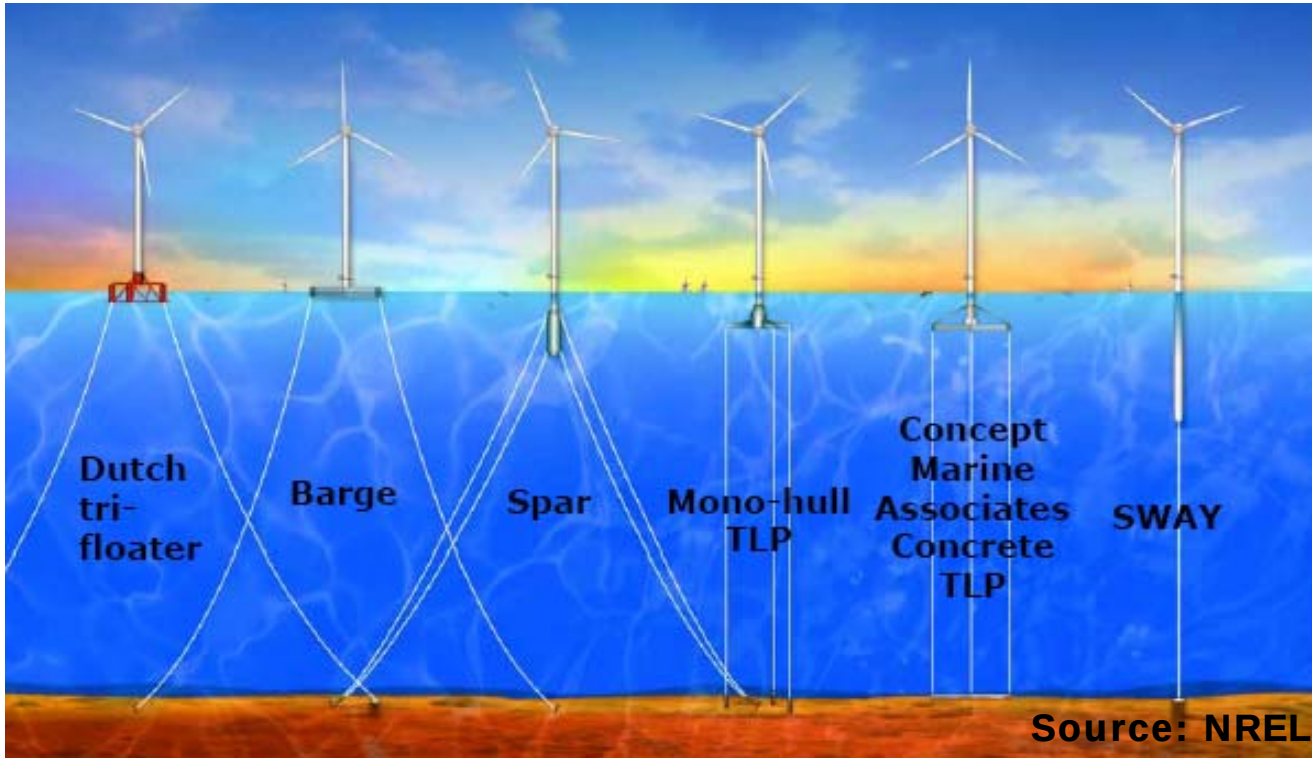
OC3 Meeting

EOLIA

EOLIA: Objective

The objective of the project is investigate, design and test new solutions to install wind turbine in deep waters.



EOLIA Consortium

*The Project is divided in **10 Research Activities (Worpackages)***

We are working with 25 Technological Centers and 7 companies in the consortium.

OC3 Meeting

Offshore Floating WTGs

WP1.- Verification of FAST Simulation Tool

- NREL 5MW three bladed offshore HAWT with monopile substructure (IEAXXIII model) will be simulated
- Load cases based on IEC 61400-3 Ed.1
- Compare results from FAST with other simulation codes

WP2.- Simulation of Offshore Floating WTGs with the FAST-Hydrodyn Code Suite

- Simulation of three different concepts of floating WTG on the basis of the 5MW NREL Baseline WT:
  - Tensioned-leg platform (TLP)
  - Spar-buoy
  - Floating barge or semisub
  - Simulations will be performed using the FAST-Hydrodyn code in comparison with Simo-Riflex

WP3.- Improvement of FAST WTG Simulation Capabilities

- Introduction of torsional D.O.F. in blades and tower
- Implementation in FAST of the Beddoes-Leishmann based code DYSTOOL developed by CENER
- Semi-automated generation of DLCs and batch execution
- Improvement of current User Interfaces focused on postprocessing of wind turbine certification-related load calculations

WP4.- Improvement of Offshore Simulation Capabilities of the FAST-Hydrodyn Code Suite

Two main extensions to the current capabilities of the FAST-Hydrodyn code suite will be addressed. These extension requirements, which were identified and highlighted by J. Jonkman (NREL) in the conclusions of his PhD thesis [1], consist in:

- Asses of model to account for the **dynamics of mooring lines**. Overview of a state-of-the-art commercial hydrodynamics code such as Orcaflex or Simo_Riflex.

- Assess of **2nd order (nonlinear) theory for the wave kinematics and hydrodynamic loads**

- Knowledge of the problems and the limited capabilities of the FAST and Simo-Riflex software to propose future improvements.

WP5.- Development of Advanced, Fine-Tuned Models and Tools

The **purpose** of this Work Package is to validate the models and tools developed in previous Work Packages and to fine-tune them with available experimental data. For this purpose, two different approaches will be used:

- ***Code-to-code comparison:***

Extensions in the models performed in WP4 and WP5 will be compared to original models used in WP2. Depending on the approach pursued in WP4, other state-of-the-art commercial hydrodynamics codes such as Orcaflex or Simo-Riflex may be used to validate the model of the floating substructure.

- ***Code validation with experimental data from tests:***

It will make available different experiments performed in the test basins. The test specimens and test conditions will be simulated with the tools developed in the project.. During the parameter fine-tuning process, special care shall be taken to obtain physically meaningful parameters. It is expected that the resulting fine-tuned code will allow realistic predicitions of the dynamic behaviour of the floating wind turbine in real sea-conditions.

Tentative Time Plan

	2008	2009				2010			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
WP1.- Verification of FAST									
WP2.- Sim. of floating concepts with current FAST									
WP3.- Improvement of aeroelastic FAST capabilities									
.- WP3.1.- Torsional dof									
.- WP3.2.- Integration DYSTOOL									
.- WP3.3.- Semi-automated DLCs									
.- WP3.4.- Improved User Interface									
WP4.- Improvement of hydrodynamic FAST capabilities									
.- WP4.1.- Coupling of mooring lines model									
.- WP4.2.- Development of 2nd order model									
WP5.- Advanced, fine-tuned tool									
WP6.- Conclusions									

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Many thanks for your attention!