Testing of towing and installation of Reinertsen self-installing concept

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Agenda

Concept

- Simplified physical experiment (1:80)
- Physical scale model experiment (1:30)
- Conclusions
- Further work



Installation







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Self-installing concept

Transport with barges



Lowering and ballasting with jacks



40% cheaper installation



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- Hydrodynamic behaviour known for each component separately
- Geometry correctly scaled for submerged components
- Foundation draft
- With and without sponson installed
- MCLab, 39m x 6.45m x 1.5m

















BARGE HEAVE FORCES



Compared with WAMIT numerical model



Foundation draft 14.82m 0.4m foundation oscillation amplitude



BARGE PITCH MOMENT

Foundation draft 14.82m 2 degrees foundation oscillation amplitude



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- Fixed 1.3m water depth
 - Full scale 39m
- Wave
- Wind static force



Relative position	Relative wave heading		
	D0	D45	D90
TRANSPORT	\checkmark	\checkmark	not planned
INST1	\checkmark	×	×
INST2	\checkmark	×	×
INST3	\checkmark	×	×
INST4	\checkmark	\checkmark	\checkmark











WIND TURBINE HEAVE



BARGE HEAVE

Nacelle acceleration	Transport	Installation
Forward direction	$0.9 \text{ G} (9.1 \text{ m/s}^2)$	0.5 G (4.7 m/s²)
Beam direction	$0.8~G~(7.6~m/s^2)$	0.4 G (3.7 m/s²)
Vertical direction	$0.1 \ \mathrm{G} \ (0.9 \ \mathrm{m/s^2})$	0.1 G (0.4 m/s²)

- Transport < 1G
- Installation <=0.5G



Conclusions

- Hydrodynamic parameters dependent on:
 - Foundation draft position
 - Foundation oscillation period
- SIMO model and physical model scale experiment:
 - Overall agreed well
 - Deviations
 - Different hydrodynamic parameters
 - Adjusted damping
 - Wires pretension and mooring line forces
- Accelerations within acceptable range (<1G)
 - Weather window could be less restrictive for installation



Further work

- Post-processing physical experiments
- Optimization numerical models
- Full scale



Thank you for your attention!



