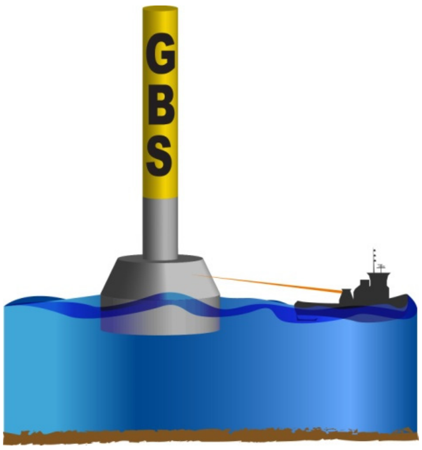
GBS JIP

Optimising workability and reduce cost of GBS installations

Improve engineering methods for transport and installation of GBS for wind turbines

As a result of the Paris convention it is expected that there will be a large increase in offshore wind energy capacity in the next decades. One expected trend is that larger wind turbines will be placed further offshore in relatively larger water depth. For example in the Netherlands the next generation wind turbines may be placed further offshore in water depths of 40 m. The future plans for "IJmuiden far" are an example of this development.



Objective

Based on the developments we propose a new JIP with the following objective:

To improve the engineering methods of transport and installation of gravity based wind turbine foundations. This will lead to more effective and safer operations with better workability and optimised logistics.

For remote areas new concepts are under development which aims for low installation cost and good workability in offshore environments. When wind turbines are larger and need to be installed at relatively larger water depths a GBS construction can be a feasible option. To reduce the overall cost of offshore wind energy we need to optimise the workability of the installation process of such GBS constructions. This requires a better understanding of the towing and installation of such large concrete structures. This includes aspects like towing stability, tug handling, operational logistics, hydrodynamic response in waves and bottom interaction during the placement on the bottom.

At present the installation of GBS structures is carried out for civil engineering (e.g. tunnels and storm barriers) and for oil and gas. These installations are typically done in the summer season. For the large scale at which wind turbine fields will be developed the industry needs better tools to also work in higher seas and still conduct safe operations.

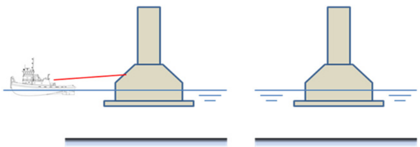
Research questions

In the present project the following research questions will be addressed:

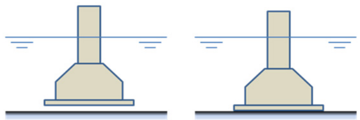
- Which GBS design parameters affect towing resistance and seakeepinng behaviour?
- How can the tug arrangement be optimised for different weather conditions?
- What is the added mass (suction) effect of a GBS close to the bottom?
- What bottom impact loads may be excpected?
- What is the critical phase of the workability of GBS installations?
- How can the workability be improved in higher sea states?
- How can logistics of a wind turbine field installation be optimised?

Previous work

The project partners have a good track record related to simulating and model testing concepts for offshore wind energy. The combined expertise on hydrodynamics, wave systems, soil interaction and logistics will lead to new insights for improved GBS installation procedures.



Transport: Towing resistance VIM response Motions (course stability) Tugs



Installation: Current loads Motions Bottom reaction forces Ballasting Tugs

For more information contact MARIN:
Erik-Jan de Ridder
T + 31 317 49 32 05
E e.d.ridder@marin.nl

Arjen Koop
T + 31 317 49 32 68
E a.koop@marin.nl

Scope of work

It is proposed to carry out a scope of work regarding the Transport and Installation of GBS structures. The proposed scope of work will be made available in a project plan. Project participants are invited to discuss the final scope of work. At present we foresee the following aspects to be included:

Work packages

The following work packages are foreseen:

- WP1: Base case design
- WP2: Transport
- 2.1 Identify existing methods
- 2.2 Towing resistance & course stability
- 2.3 Tug capacity and operational practice
- WP3: Installation
- 3.1 Identify existing methods
- 3.2 Motion response and hydrodynamic loads
- 3.3 Seabed interaction
- 3.4 Operational installation practice
- WP4: Integrated project logistics and cost calculation
- WP5: Recommended design and analysis methodology
- WP6: JIP Management

Project deliverables

The deliverables of this JIP can be used to improve GBS installation procedures. The most important deliverables of this project will be:

- Model test, CFD calculation and full scale measurement reports:
  - Containing the measurement and calculation results, analysed data, time records in ASCII
  - Format, applied calculation grids and discussion and validation of the results
  - Model test of 1 generic GBS designs
  - Report with comparison of time domain results to model test
- "Best practice" reference document:
  - Guidelines and cases study results describing the step-by-step analysis and design approach
- Tools:
  - aNySIM time domain research license
  - aNySIM seabed interaction model to include Added mass effect
  - Integrated project logistics and cost calculation tool

Organisation and schedule

The GBS JIP will be conducted as a 3-year Joint Industry Project in close co-operation with energy companies, operators, yards and marine system suppliers. MARIN will act as JIP manager and sign participation agreements with all members. All participating companies will be represented in the JIP Steering Group with meetings during the Blue JIP week every 6 months. Presentations, reports and other relevant information will be posted on the confidential project website.