



BEST PRACTICE

3 Dimensional Modelling and Simulation Animation as part of the installation process for Wind Farm Cabling

Although 3-Dimensional Modelling and Simulation Animation are commonplace in many areas such as Media, Entertainment, and Industrial Product Design, Global Marine Systems has found several useful applications for its own work with cable installation for Wind Farms.

When working with unique project equipment, new processes, severe locations and with a Multi-National Group of people a 3- Dimensional image or animation is often the most effective way to explain a cable installation scenario, deck layout or other related process and procedure.

The use of these tools can improve project quality, save significant planning time and money as well as help to ensure complex procedures are completed correctly and thoroughly the first time. The process of creating the 3-Dimensional image or animation allows the actual effectiveness of the proposed engineering solution to a particular problem to be tested long before it is put into practice on-site. If a picture is worth a thousand words, than a 3D picture is worth a million words!

The use of 3-Dimensional Images and Simulation Animation:

- Improves project planning and preparation.
- Decrease the possibility of error on the job site.
- Increase the effectiveness of communications between clients and project teams.
- Increase the efficiency of overall installation process.
- Overcome language barriers common on multi-national projects.
- Improve over all project quality and delivery.

3-Dimensional Modelling

Global Marine Systems has successfully used 3-Dimensional Modelling as part of the jointing design process for project equipment design for the following projects:

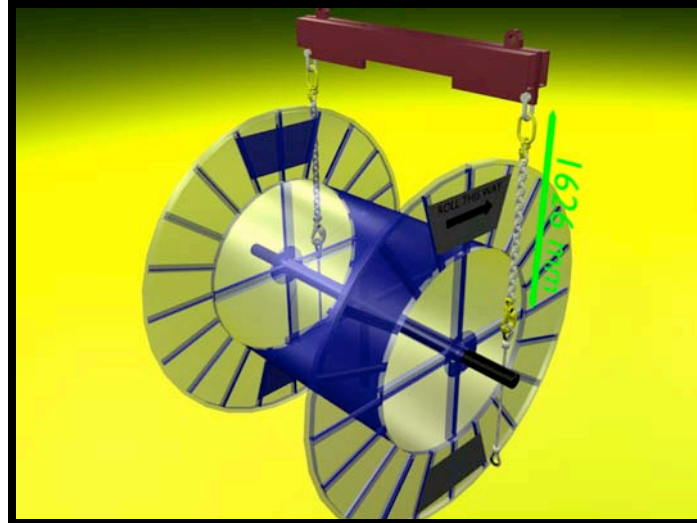
- Beatrice - Oil platform pulling frame including winch.
- Estlink - Cable run highway and chute for CS Sovereign.
- Horns Rev 2 - Drum storage frame, cable recovery drum motor and brake and container platforms.



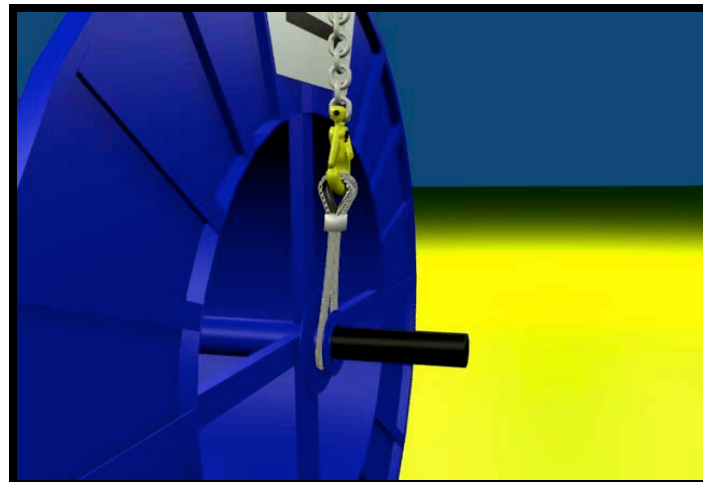
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Example 1



Cable loading in Esbjerg



Cable drum lift rig after connection to the drum

As per the above images of the cable drum lift rig, before connection, transparency has been used to help the user clearly and quickly understand the overall concept and function of the equipment.

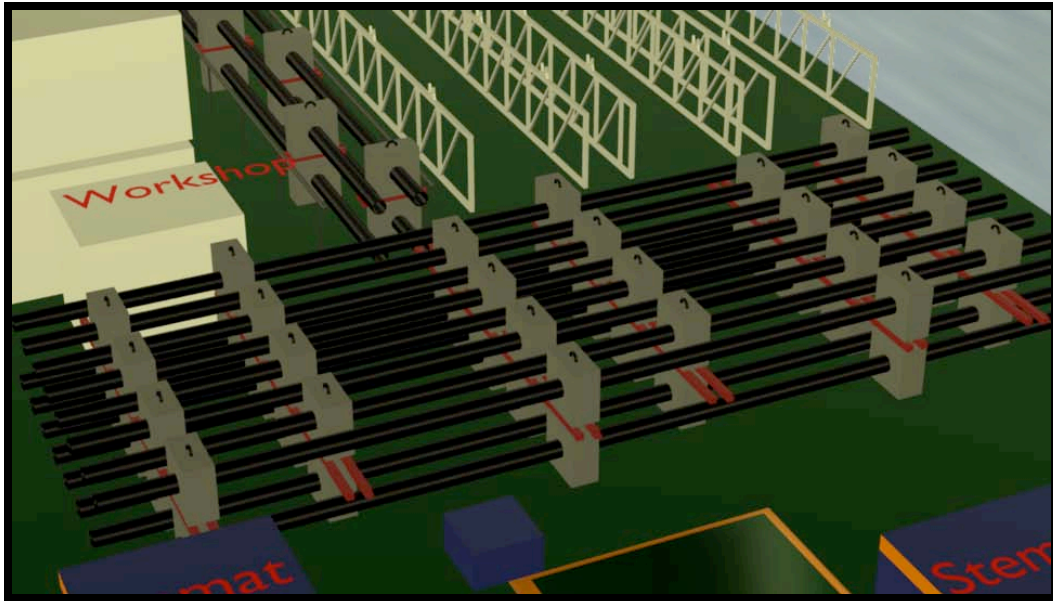
In this way we are able to bridge the translation barrier due to the multiple languages of individuals, project staff and crew, and the briefing of the stevedores for cable loading is much more effective.



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Example 2



Loading of J-flex tubes for a Wind Farm project

The above image has been taken from the loading plan for the Horns Rev 2 flexible tubes installation works using the Pontra Maris. Traditionally, this would be done with a 2-Dimensional diagram including explanations written in English.

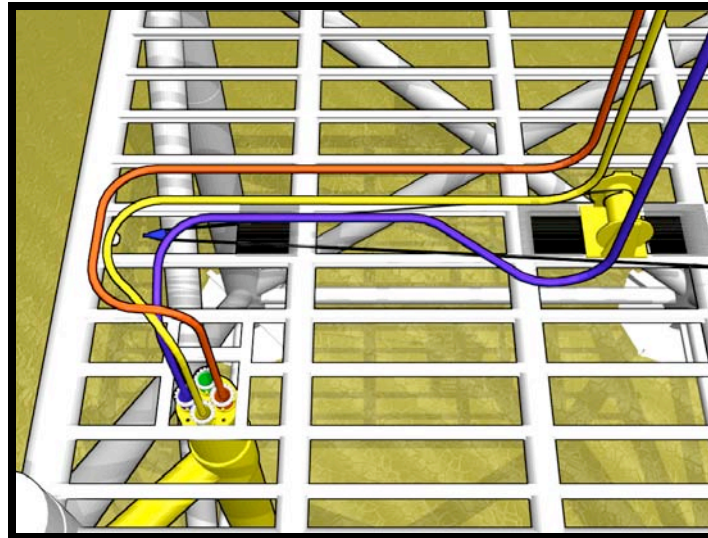
Now with the 3-Dimensional modelling, the diagrams become largely self explanatory allowing for translation barriers to be easily overcome (English, Danish, Filipino).

Example 3



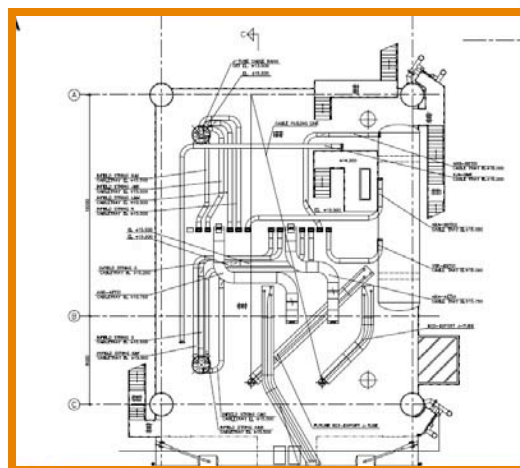
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Cabling for an offshore transformer platform

In the above image please note the cable run on the exit to the J-Tube towards the switch-room for the Horns Rev 2 transformer platform. By the use of colour the complications of the cable run from the top of the J-Tube to the Switch-Room are more easily understood. The use of this type of image significantly decrease the possibility of error and it is easier to understand than a commonly used 2-D image.



Typical 2-Dimensional Image

Through the process of drawing it out in 3-Dimensions, the cable over pull length above the J-Tube exit can be analysed prior to the site visit, when the theoretical value can be cross checked with the real situation.

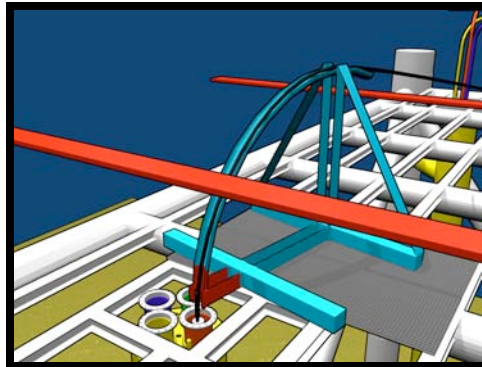


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This allows planning of cable installation into the J-Tube to be carried out in advance of the operation itself, in this way factors such as:

- Is there enough space near the J-Tube to accommodate the cable necessary?
- Is there enough cable supplied as part of the customer order?
- Calculating cable pull in tensions.
- How much headroom is available and what possible conflicts are there with the equipment needed to pull in? (See below).



In the above example, it becomes clear that using a 2.5m radius quadrant will conflict with the light strips (red rectangles). Meaning that a 2m quadrant will have to be used which is best to know in the early stages, before the team begin installation at the project location.



In the photo above, you see the cellar deck area of a HR2 Transformer platform. Low deck height is apparent and would have been a problem for equipment installation. Through the use of 3-Dimensional modeling it was already anticipated and prepared for in the early stages before actual arrival.



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Simulation Animation

Just like 3-Dimensional images, 3-Dimensional simulation animations can be used to test engineering solutions long before they are installed on a project.

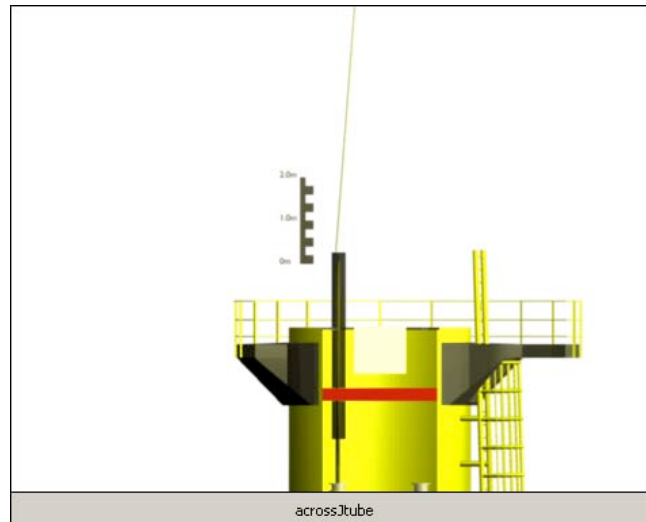
Problem:

What is the likely effect of barge movement on the proposed cable pull in method?

Answer:

Create an animation of the likely action applied to the cable pulling line by applying movements to the cable installation barge such as rolling and heave.

Please view the attached Animations for the J-Tube and Crane Movement [HERE](#)



Early on in the planning of a Wind Farm Project, these animations were used as the basis to change the pull in methodology due to concerns about the amount of movement seen. In the event the new pull in method proved equally problematic and when the crane based method was used as a fall back all the issues demonstrated in part by the animation came to light.

The use of 3-Dimensional Diagrams and Simulation Animations can significantly improve the quality of the project planning process, resulting in a much more cost effective, timely and efficient Wind Farm cable installation process.

The benefits of this practice are clear:

- Find Engineering design problems earlier and plan for these or design them out by changing and testing the solution.



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- 3-Dimensional Modeling and Simulation are far cheaper than reality if it proves that initial ideas are flawed. Once it is discovered that a solution will not work either due to dynamics or space issues, it is far easier to amend ashore than it is offshore when the vessel is already on-hire and the customer is waiting.
- Discover problems early from completely unexpected quarters. A simple thing such as conflict between a tank loading arm and part of the structure of the barge or ship during its rotation, can have dire effects to the efficiency of a vessel mobilisation leading to extensive cost overruns.
- When working with Multi-National customers and crews a picture or animation explains far better than a verbal explanation.