

Appendix 5.14-B

Report on Horns-Rev VHF
Radio and Marine Radar

REPORT



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Cape Wind Associates
Report on Horns Rev. VHF Radio and Marine Radar.

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1. Introduction

This study presents the result of an investigation that was done by Elsam Engineering of Fredericia Denmark into the impact of marine VHF radio and marine radar at the Horns Rev offshore wind farm. Elsam Engineering is a Danish engineering firm that has provided various engineering services to Horns Rev and other offshore wind farms. This report presents Elsam Engineering's observations and practical experience from existing offshore wind farms as they pertain to the following two issues:

- VHF radio, Confirmation that the wind turbines do not produce VHF radio interference such as reflections or phase changes, with respect to marine use frequencies, in areas around or in the proposed wind farm. Include methodology and data in the conclusions.
- Marine Radar, Confirmation that the wind turbines would not produce radar reflections, blind spots or return signature shadow caused by blades.

2. Horns Rev

2.1 Description of Horns Rev

As illustrated in Figure 1, Horns Rev is located in the North Sea off the Danish coast just north west of Esbjerg. This area is a "real" offshore site with a harsh wind and wave climate, the latter because of current and shallow water. The wind farm comprises 80 turbines and an interconnection to shore (transformer substation and a cable leading to the main high-voltage grid). The turbines are placed 560 m apart at water depths between 6.5 and 13.5 m. Shortest distance North-East towards shore (Blaavands Huk) is approx 12 km. Distance from South-East to Esbjerg 38 km

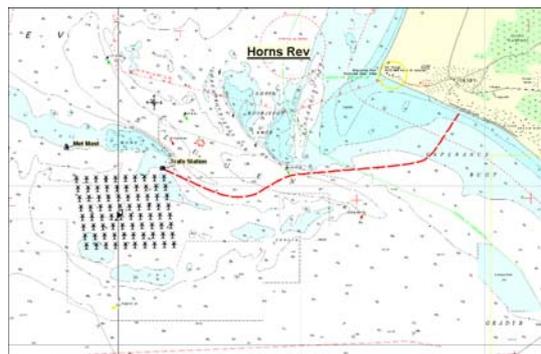


Figure 1. Layout of the Horns Rev Wind Farm

Wind speed measured at a height of 62 m has been assessed to be 9.7 m/s. In the early spring of 2002 foundation works started and soon after turbine erection and cable laying were launched.

2.2 Description of the Horns Rev wind turbine

The chosen wind turbine is a Vestas V80-2.0 MW. The rotor diameter is 80 m and the generator capacity is 2 MW. The hub height is 70 m above sea surface, ie the wing tip reaches 110 m. The wind turbine has a larger number of rpm than a standard wind turbine and is furthermore equipped with a platform on the cabin roof for lowering of engineers from a helicopter. Figure 2 illustrates the turbine.

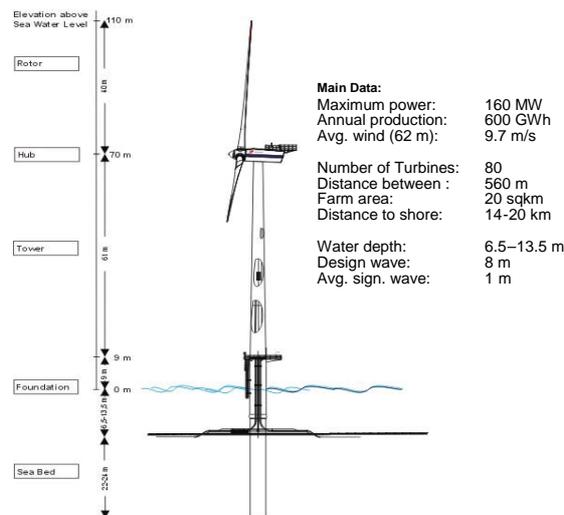


Figure 2. The Horns Rev turbine, sketch and main data

2.3 Description of traffic control

During the construction phase and until commissioning of the wind farm the project had its own traffic coordination. The purpose of the traffic coordination was to coordinate all project-related traffic at sea between the port of Esbjerg and Horns Rev and on site at Horns Rev. This was done by reporting by Nokia 9210 Communicator and SMS/e-mails.

The traffic of individuals was recorded to contribute to a safe and controlled personnel transfer to and from Horns Rev at all times. And to ensure that working ships, platforms, hotel ships, passenger ships, etc. could be positioned in a safe and suitable manner, their planned positions were coordinated by analyzing the contractors' activity plans for Horns Rev.

The traffic coordination was equipped with:

- Mobile phone, Nokia 9210 Communicator (European GSM).
- Cable phone.
- VHF Sailor RT2048, 25Watt. Project channel - frequency 155,2750 MHz.
- VHF Sailor RT2048, 25Watt. Normal VHF frequency band.

- Antenna Sailor A151.

The ships/vessels where equipped with:

- Mobile phone Nokia 9210 Communicator. (A)
- VHF Sailor RT2048, 25Watt. Project channel - frequency 155,2750 MHz. (B)
- Antenna Sailor A151. (C)
- VHF radio (own). Normal VHF frequency.
- Own radar.

A, B and C were handed out to all involved boats from the site management.

For selection of equipment, there has been assistance from market role players in decision of equipment. It has been decided to use the same equipment in future operations.



The SAILOR RT2048 simplex/semi duplex VHF radiotelephone is a part of the Compact 2000 programme introduced by S.P. Radio A/S, Denmark - Europe's leading manufacturer of maritime radio communication equipment (www.sailor.dk).

The SAILOR VHF is a conveniently small set, built to a high standard both mechanically and electronically. The small compact cabinet has room for transmitter, receiver as well as a large 6 W loudspeaker.

The set is equipped with an audio amplifier capable of delivering an additional 6W into an external loudspeaker. The RT2048 operates with a continuous output power of 25W on all possible channels. Furthermore, the SAILOR RT2048 is equipped with all 54 international VHF channels plus a choice of either 10 private channels and full scanning facilities, or 40 private channels. Dual watch and quick channel 16 are standard, with selcall as an option.

2.4 Vessel Descriptions

During the construction phase, between 20 and 40 ships of all kinds and different sizes were used. From fast rescue boats, barges, multi cats, tugs, jack-ups, boats for laying of scour protection, cable laying vessels, turbine erection and hotel ships etc.

The largest vessels were jack-ups and hotel ships.



Jack-up, largest size



Erection of Turbines & Hotel ship, largest size
(Ocean Hanne & Andy)



Crew transport, typical size



Crew transport, typical size



Crew transport, smallest size



Crew transport, smallest size



3. Effect analysis

3.1 Construction phase

The majority of traffic on Horns Rev was during the construction phase. During the construction phase many different tasks were ongoing:

- Laying of scour protection
- Erection of monopiles
- Erection of turbine
- Cable laying
- Transport of crew and materials
- Assisting boats (tugs, multicat, Zodiacs etc.)
- Other

In the beginning the transport was structured because of the natural progress of the project. When scour protection was laid out, the erection of monopiles could take place. Because of different activities this did not follow a structured way of movements of ships/vessels.

As turbines were erected, they were evaluated as obstacles for natural movements of the ships and also interference with communication.

During the construction phase no difficulties with VHF communication were observed:

- Between the ships at Horns Rev
- From Horns Rev to traffic coordination in Esbjerg
- From Horns Rev to Esbjerg Harbour
- Horns Rev to Coast Guard / Rescue Centre
- No problems with turbines in the area.

Shadows on the radar (onboard vessels) have only been observed on small boats when they were alongside hotel ships or jack-ups (double picture). No shadow from turbine blades etc were observed. When the boats were in the middle of the park they could count 80 turbines and the 12 buoys marking the working area; otherwise nothing.

Typical radar onboard involved Vessels is Furuno 1830 and Furuno FR801D (www.furuno.dk), 24 mile radar.

3.2 Finalization phase

Towards the end of the project, there has only been crew transport and material transport. There have been a lot of movements inside the park of small/medium vessels.

Same equipment, same reporting procedure etc. was used as during the construction phase. No problems with VHF communication or Radar have been observed or reported.

The only problem observed with VHF equipment was when handheld equipment was used with internal antenna inside the wind turbine tower. This problem was resolved when an external antenna was mounted on top of the turbine and cable-connected to the handheld VHF radio. Inside the wind turbine nacelle (fibre glass enclosed) there were no problems using the VHF radio.

This handheld equipment was used to communicate between the workers at the turbines, the vessels in the wind park and the control centre on-shore.

4. Conclusion

Due to our experience from the Horns Rev project, -and experience from masters of vessels on Horns Rev we can conclude, that the erection and operation of turbines do not have any significant effect on VHF communication or shadows on radars from rotating turbine blades on the actual project.

A number of vessels have been in the area with different equipment (VHF / Radar) and they have not observed any problems either.

We can recommend using first class equipment and first class assistance from suppliers to chose the right permanent or temporary equipment. Having said that, we cannot guarantee that the same result could not have been achieved with cheaper and simpler equipment and techniques.