Offshore vessel design: often evolution, sometimes revolution

Founded in 1937, KNUD E. HANSEN A/S has both experienced and been at the forefront of many of the dramatic changes in commercial ship design and has made its mark on over 15,000 vessels. We take a look at the company offerings and discover how it became a key provider in today's wind industry.

The marine industry in general, and shipbuilding in particular, tends to be rather conservative businesses and for good reason; the sea can be a dangerous place and proven solutions provide confidence and predictability. However, with advances continually being made across all the technologies that underpin the sector, being too conservative can also block vital innovation.

When developing new projects, KNUD E. HANSEN starts with a blank sheet of paper, considering all the possible solutions. Existing designs and technologies are re-evaluated, but in parallel with that a completely fresh approach is also taken; evaluating new and emerging technologies and assessing their potential in the context of each project.

The company also studies existing systems and techniques to see if they can be applied in new ways. Ultimately, the design

Focus: Pacific Orca

Wind turbine installation offshore

Turbine Installation vessels (TIVs) like the Pacific Orca designed by KNUD E. HANSEN A/S, embody the latest developments and technologies in turbine installation. The vessels have traditional vessel hulls, looking and operating like vessels. They have a large deck area that is used to transport components and used as work space while the vessel carries out the installation.

The vessels have jack-up and DP capabilities, fixed cranes and sometimes a helipad. Self-propelled, they can attain speeds of up to 13 knots, reducing transfer times considerably. In addition, once the vessel is jacked up, it is able to carry out operations in harsher weather conditions. Overall these vessels reduce installation times, create larger weather windows for operations, and reduce transport times.

Jackup legs

Jackup legs on jackup vessels or barges are subject to extreme forces in volatile conditions, especially during the jacking up and jacking down process. A stuck or broken jackup leg can destabilize the entire vessel. As a result, proper design and manufacturing of the jackup legs is vital. Jackup legs can be differentiated based on a number of characteristics, notably by the number of legs, type of legs, method of seafloor stabilization and type of elevating device.

Number of legs

Depending on its size, a jackup typically has four or six legs. A four legged jackup is the most common, but the newer turbine installation vessels (TIVs) are equipped with six legs. According to KNUD E. HANSEN A/S, designer of the new Pacific Osprey and Pacific Orca, more legs increase the cost of the vessel, but provide substantially more stability and allow the vessel to continue operations in harsher weather. As wind farms move further away from shore, TIVs need to be able to work in harsher weather or face a reduced operational window.

teams consider every possibility however innovative or traditional, with the objective of ensuring that the final proposal best fulfils the needs of the customer.

The design work is sometimes preceded by transport studies looking at optimising the type and number of vessels required for installation work.

KNUD E. HANSEN A/S also applies this design ethos to vessel conversions and the design of customised equipment for the transportation, handling and installation of wind turbine components.**Designs on offshore**

The offshore wind sector has grown dramatically in recent years in the number and size of both the turbines themselves and of the collective installations.

The engineering challenges have meanwhile increased greatly in scale and scope, requiring the application of specialist knowledge right across the project process from planning, design and engineering, through to installation and commissioning.

KNUD E. HANSEN A/S has the skills and experience to act as a valuable marine partner at every stage of an offshore wind project, particularly for civil and land based engineering companies with limited offshore experience.

The success of any offshore wind turbine project requires in-depth knowledge of the demanding environmental conditions that the finished installation will encounter, and a detailed understanding of the various

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stages that it must go through in order to be delivered on time and on budget.

The company divides these project phases as follows, and offers specialist staff and resources for each:

- Tender assistance
- Vessel selection, including design and conversion
- Engineering and operations
- Logistics and transport
- Installation
- Demobilisation ■

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Ask the experts

We caught up with the company's Senior Naval Architect, Edwin Pang.

PES: Welcome to PES magazine. Would you like to take this opportunity to explain a little about the company?

Edwin Pang: We are an established Danish company founded in 1937, and we've designed almost every kind of vessel, including the world's first jack-up vessel. Essentially, we're Naval Architects, Designers, Marine Engineers and our expertise lies in platforms, adapting vessels, designing special tools for handling parts and taking old vessels and turning them into new working vessels. We're involved in accommodation vessels, and we have designed cable layers too, which may be of particular interest to your readers.

PES: When did the company first apply itself to the wind industry?

EP: Our first TIV design, now the MPI Resolution, was completed in 2002. However things didn't really begin to take off until 2007, and now more and more trade is coming from the sector.The amount of work we do varies from year to year, and we have worked on big projects where we've supported all the installations (often with companies that have little marine experience).Most installations have now levelled off, so we are waiting for the next round of work to begin.

PES: Where in the world are you currently doing business? Have you identified any areas of notable growth?

EP: We employ 75 people across the world and have offices in Denmark, London, Australia, America, Greece and the Faroe Islands. A lot of our wind projects come from Denmark, but we've been involved in many off the various British installations (often through Danish companies). Most of our focus is on northern Europe, Germany, Holland. there is talk of Japan and India, but we're yet to move into that arena.

PES: Tell us about how you tailor your designs for the specific needs of the wind industry…

EP: Well, as a ship design consultancy, all our projects are bespoke. we work with the clients and sit down with them to find out what they want. we tease out what works best, and come up with some sketches (although it depends on how hands-on they want to be). We will then refine that until they are happy with what they've got. Then it will go out to tender for the build.

PES: And similarly, to what extent can individual vessels be arranged and specified to meet the owner's requirements?

EP: As long as it meets the laws of physics and regulatory requirements, anything is possible! But it's seldom a complete blank page as weoften re-use elements that have solved similar challenges before (although it's not cut and paste) and our work is usually evolution, occasionally revolution.

PES: What are your thoughts about prospects for the coming year with regard to your organisation, and the wind industry in general?

EP: The economic climate seems ok and banks seem to be lending. However, the wind industry seems to be undergoing a period of transition at the moment. Having said that, public opposition to onshore turbines increases demand for offshore turbines, and in the UK, there are the 2020 obligations to live up to. Larger wind turbines are now also in the pipeline that will present new challenges in transportation and installation. All these represent opportunities for us and the industry.

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