Bigger wind comes out of Blue

Blue Ocean Ships has finalised development of a new wind turbine installation vessel, designed to meet current and future requirements of wind farm developers.

Copenhagen based consultancy Knud E. Hansen A/S, which developed the world's first dedicated wind turbine installation vessel, *Resolution*, in operation since 2004, has returned with a new specialised ship for new Danish ship management company Blue Ocean, designed for operations on a wider scale.

The ship is designed for unrestricted worldwide service and tenders for a number of vessels have been finalised. Blue Ocean Ships is now in the process of negotiating the construction contracts for an as yet unpublicised number of vessels.

"As offshore wind park development has become more ambitious, the trend has clearly been to move to larger turbines and into deeper water in search of more productive wind fields," said Ken Goh, Knud E Hansen manager, mechanical projects. "Such an example is the London Array, which will eventually consist of more than 300 turbines up to 7MW in size. This next generation of vessels, with a length of about 160m and breadth of 42m, will be radically different and significantly larger than any other similar vessels, and are designed to install the next generation of 5MW-10MW wind turbines in waters over 60m deep."

Blue Ocean's proposed new generation wind turbine vessel.

A key requirement for the new design was to expand the operational envelope, not only with respect to water depth but also to other environmental factors, such as wind and wave conditions, to maximise the number of operational days the vessel can be used to install wind turbines. Operations in shallow waters and tidal areas are also accommodated by the use of specially designed air-cooled machinery systems.

The new vessels will be able to perform all the necessary stages of wind turbine installation without support from other vessels, from pile driving foundations to the installation of transition pieces, turbine towers and finally the nacelle and blade assembly itself. The capacity will be much higher than before and the installation process will be optimised by reducing the amount of on-site assembly for a wind turbine to the absolute minimum. For example, the vessel's deck is designed to carry the whole turbine tower as a single unit, instead of a number of sections that would need a time consuming stacking and fastening process. The goal is to be able to install one complete wind turbine topside each day, thereby significantly reducing the cost of offshore installations. A 1200tonne main crane rotates around the aft starboard leg to provide the flexibility required for the installation of the tower and nacelle components of future wind turbines, which tend to become even bigger. The vessels are designed to be able to install a 500tonne nacelle at a height of 120m above the water. A smaller auxiliary crane, mounted amidships, supports loading operations and reduces port time, while a further aft-mounted auxiliary crane supports man-riding operations to and from the tower bases.

Six truss structure legs and specially designed high-speed jacking mechanisms will give the vessels what is said to be unrivalled capability and safety.

"There have been several accidents with three and four legged jack-ups," Mr Goh notes. "Unstable clay sea beds, scouring due to ocean currents and punch-throughs make jacking operations risky, but are a necessity for installing the delicate turbines. The new vessels will have to jack up and down many times a week so the safety issue was paramount. With a vessel this size, there aren't too many options for getting help if you get stuck. We can lose footing on one leg completely and still be able to recover safely. Most current jack-up type installation vessels can only use their legs to stabilise themselves, and cannot jack completely out of the water. With the powerful jacking mechanisms and increased leg length afforded by the truss structure, these vessels can quickly jack high above the sea, increase the operations weather window and ride out storms instead of having to run for shelter," he said.

The vessels are powered by a 20MW diesel-electric plant consisting of four main and two harbour gensets. A relatively high speed of some 14knots will reduce transit time to-and-from port and maximise the time that the vessel can spend working at the field. Propulsion and manoeuvring is arranged with four aft-mounted thrusters and three forward thrusters, of which two are retractable azimuthing units, able to operate as tunnel thrusters to support shallow water operations. The units forward can also be deployed to assist in course keeping in difficult sea ways.

"Unlike a normal vessel, the thrust required for dynamic positioning (DP) operations in deep water are extremely demanding due to the drag on the lowered legs from ocean currents," Mr Goh said. "The high powered thruster system is connected by a redundant power distribution system which is necessary to maximize the DP2 operational envelope."

High capacity ballast, heeling and fuel transfer systems have been specified to cope with movements of large load outs. An advanced load management system reads tank ullages, crane and load movements and can calculate vessel stability, trim and stresses for both planning purposes and monitoring in real-time. Heat recovery is maximised for heating and fresh water generation by using exhaust gas boilers on each of the four main diesel generators. The vessels also have a comprehensive waste handling system to reduce the amount of waste needing to be stored and to provide a high degree of operational redundancy. Furthermore, wastewater can be recycled for technical purposes.

"In a market where it is becoming increasingly difficult to attract and retain good crew, much attention has been paid to crew comfort conditions and the amenities available," Mr Goh said. Each of the crew and contractors will have their own cabin with full wash facilities. Noise levels have been reduced through careful isolation of structures and use of materials. Multiple day rooms, a library, a theatre and a fitness centre with panoramic views are also among the other facilities provided to entertain and improve the working life aboard the vessels.

With a large crane and deck space, the vessel will also be able to transport and lift large modules for the offshore oil and gas industries. A medium class helicopter platform and a large moonpool to support ROVs and other offshore operations are also provided. It is projected that the first vessel will be operational in the first half of 2011. *NA*