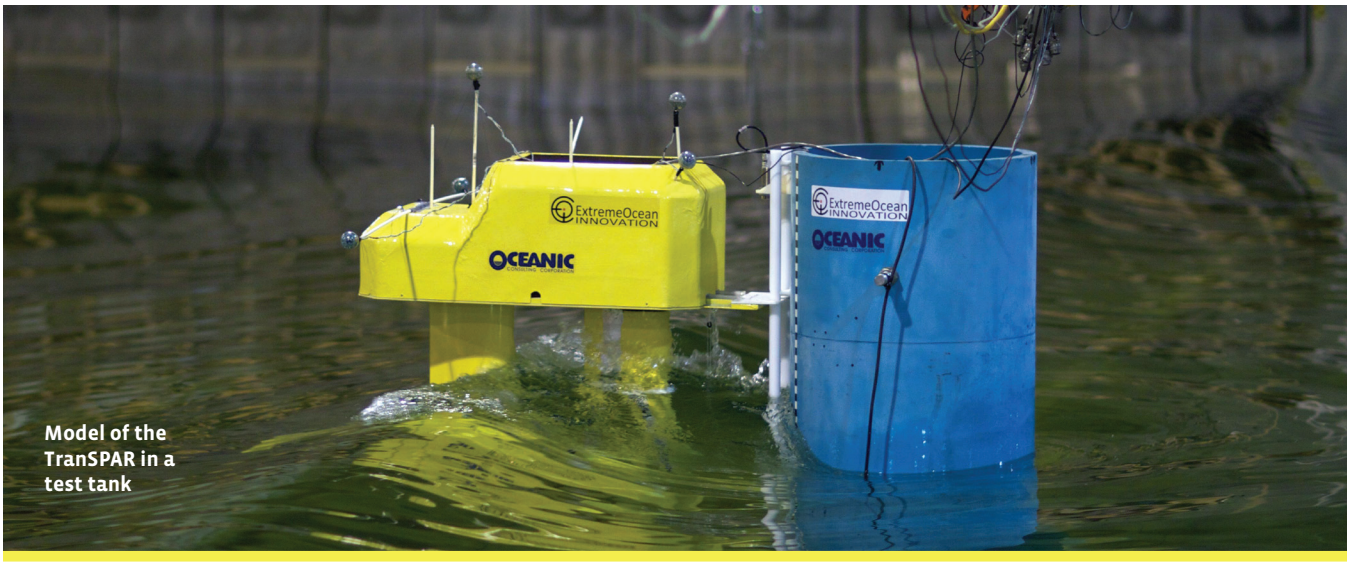
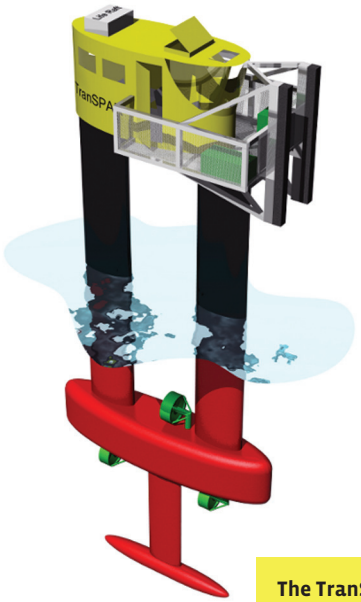


Model of the TranSPAR in a test tank

Offshore wind market puts development of TranSPAR craft on the fast track

Market pull is fast-tracking the development of the TranSPAR craft a year ahead of schedule, reports Peter Gifford, President and CEO, ExtremeOcean Innovation, St. John's, Newfoundland, Canada. The TranSPAR is a self-propelled spar vessel for safely transferring maintenance personnel and equipment to wind turbines on Round 3 offshore wind farms, in wave heights up to three meters at locations up to 300 km offshore. ExtremeOcean Innovation is one of seven companies developing new offshore wind access systems for the Carbon Trust's Offshore Wind Accelerator (OWA) collaborative R&D program, focused on creating solutions to significantly improve uptime at these wind farms by providing turbine access in high sea states. The goal of the OWA is to reduce costs by at least 10 percent by 2015. The OWA is a joint industry project involving the Carbon Trust and eight UK-based wind farm developers—E.ON, DONG Energy, Mainstream Renewable Power, RWE Innogy, ScottishPower Renewables, SSE Renewables, Statkraft, and Statoil. Technical experts from each of these companies are represented on the OWA Access Systems Technical Working Group.

Of 450 applicants to the OWA Access Competition, 13 were selected to receive financial and technical support for concept development in 2011. One of these finalists recently received an order to build six vessels and a further seven designs have been selected to receive further financial and technical support to help commercialize the designs. Carbon Trust and the OWA partners have invested £1.5 million in the finalists to date.



The TranSPAR is a self-propelled vessel that will transfer personnel and equipment to wind turbines

"The TranSPAR is arguably the most radical concept that we saw from the competition," notes Phil de Villiers, Head of Offshore Wind for the Carbon Trust. "The spar design means it's inherently very, very stable. It's much more stable than a vessel of that size using a conventional design." Asked how the industry representatives are viewing it, he says, "They are extremely positive. They see this as a potential game changer for offshore wind."

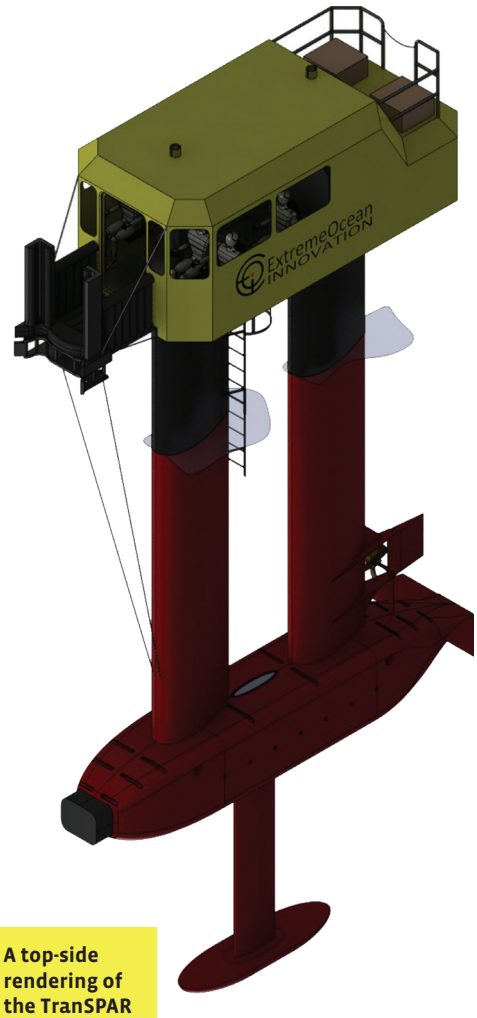
The TranSPAR craft has two vertical struts that provide a small water plane area—the spar element of the design—a crew cabin three meters above the water surface, and a heavy-hulled propeller-driven bottom that provides a center of buoyancy above the center of gravity. It is 8.75 meters long, 16 meters high, has a 3 meter beam, and a 10 meter draft.

"Its mixing one kind of offshore structure technology with a vessel," explains co-inventor Dr. Bruce Colbourne, professor of Faculty of Engineering and Applied Science, Memorial University, St. John's, Newfoundland, Canada. "We're trying to keep the desirable motion characteristics of the spar structure and make it so it can be moved around from place to place and stay under control. As far as we know, there's never been anything like this."

In October, Gifford, 27, was awarded first prize and $10,000 in the Natural Sciences and Engineering Research Council of Canada's 2012 Innovation Challenge Award for his entrepreneurial leadership in the development of the TranSPAR craft. He received his Master's degree in ocean and naval architectural engineering at Memorial University in April 2012.

TESTING INNOVATION

ExtremeOcean Innovation has completed two rounds of model testing of the TranSPAR in a tow tank. The company has also built a mock-up of the turbine foundation and developed a numerical model of the vessel to create a simulation of the TranSPAR's motion in the ocean as well as the critical point at which personnel are transferred from the deck of the vessel to the turbine foundation. "We were able to figure out how much the TranSPAR craft would move in different types of waves," says Dr. Brian Veitch, Chief Technology Officer, co-inventor, and Gifford's former professor in Memorial University's Faculty of Engineering and Applied Science, "and what kind of motions you could expect." They input the time histories from model tests in 1-meter and 1.5-meter wave heights into the six-degree-of-freedom motion bed at Memorial. Standing on top, Gifford was able to experience the vessel's motions, and demonstrate a transfer onto a turbine foundation. "In those conditions," Dr. Veitch adds, "it was very easy and safe for him to make the transition to the platform." ExtremeOcean Innovation sent videos of the demonstration (www.ExtremeOceanInnovation.ca) and tank tests to the Carbon Trust. "Very compelling videos of tank tests showed the characteristics of the vessel in different



A top-side rendering of the TranSPAR vessel

Peter Gifford is President and CEO of ExtremeOcean Innovation and co-founder of the TranSPAR technology

sea states," says de Villiers. "This was really important for the technical experts to understand the performance potential of the design."

Model tests during Phase 1 had revealed significant motions for the TranSPAR at zero speed, particularly in pitch conditions. In Phase 2, Extreme-Ocean Innovation adjusted the vessel's stability characteristics and increased its mass by adding a fiberglass shell to the outside of the buoyancy chamber. "We were able to reduce most of the significant motions," reports Gifford, "and we didn't need to add more power despite making it a little larger, due to efficiencies in design." They also innovated a new connection system, after determining it was required in high sea states. The resistance of the vessel was decreased by streamlining the buoyancy chamber and changing the vertical struts from an elliptical cross section to one that is foil-shaped. A new model was built to incorporate and evaluate these changes.

To demonstrate to the Carbon Trust the difference between the TranSPAR and conventional offshore wind service vessels, they developed a logistics model that compared the anticipated failures in a wind farm using a conventional vessel (limited to operating in 1.5 meter significant wave height) to a scenario where the TranSPAR was used. They determined that by accessing turbines in wave heights up to 3 meters, the TranSPAR craft allows for 292 accessible days per year—a 39 percent increase from an estimated 210 days via existing wind farm service vessels. In addition to increasing uptime, Gifford notes that the ability to operate in high sea states should translate into higher profits because it is the ideal time to generate wind power.

A further revision to the design of the TranSPAR craft's connection system is currently underway. Once complete, they will test a self-propelled model in an offshore engineering basin for the final detailed design evaluation. Extreme-Ocean Innovation plans to have the fabrication package completed by June 2013. Gifford and Dr. Veitch are currently raising funds to build and test a field prototype. The Carbon Trust estimates there will be 40 gigawatts of installed offshore wind power in Europe by 2020, and that enabling transfers to turbine foundations in three-meter waves will improve the industry's bottom line by $3 billion.

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