

ISURUS

I S U R U S

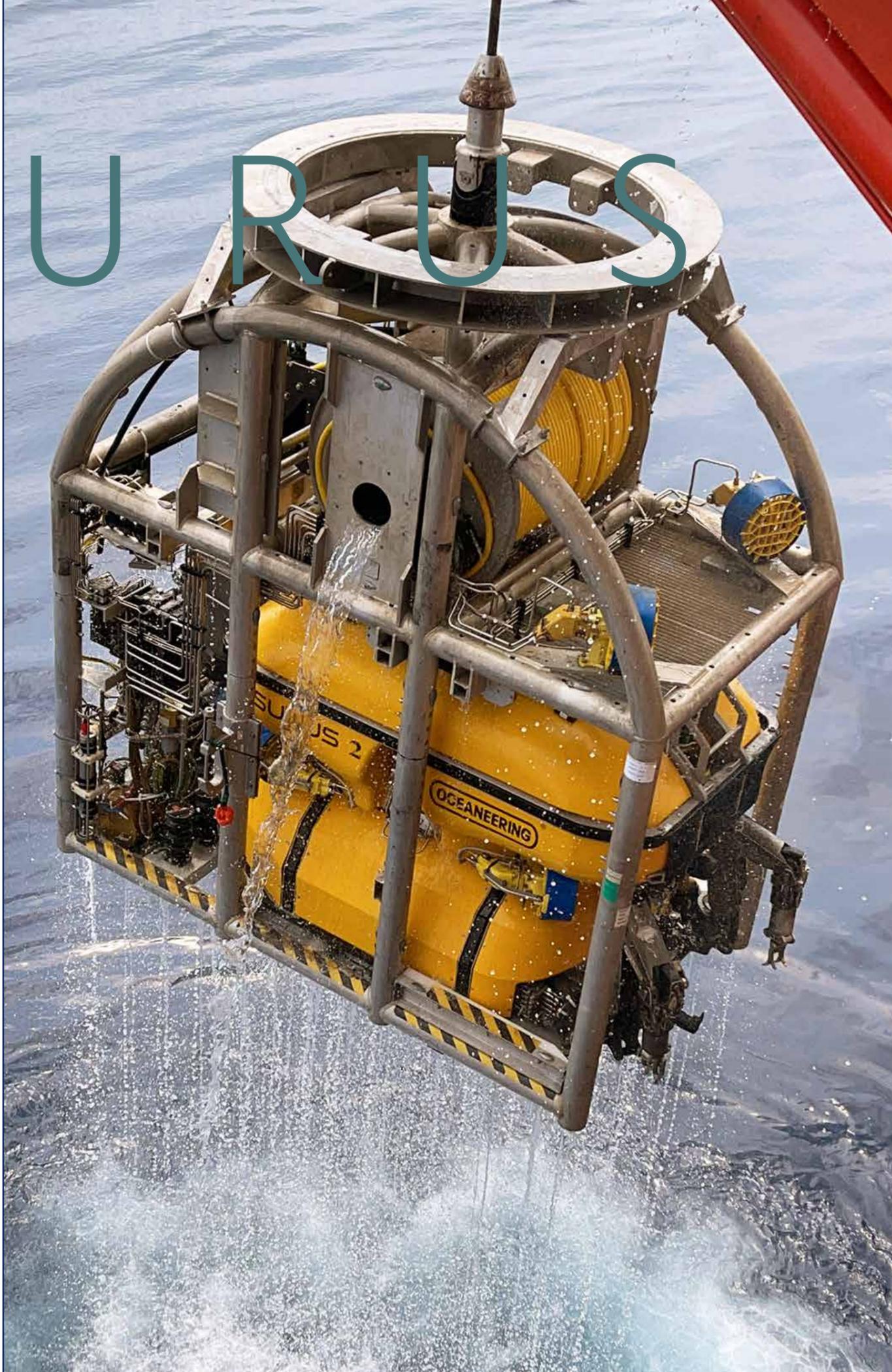
For many years, the Magnum ROV stood out as the backbone of Oceaneering's fleet of high-powered workclass ROV systems. Later, the product range was supplemented by the heavier-duty Magnum Plus. Designed for work in water depths up to 10,000ft, it could deliver a total of 170hp to consumers.

Understandably, the Magnum Plus consequently became the vehicle of choice when Oceaneering looked at the renewables market. It soon became clear, however, that the shallow waters and high-power currents presented new challenges to the ROV that was ostensibly designed for much deeper water applications.

Oceaneering began by looking closely at key sites such as the East Coast of the USA which was affected by the Gulf Stream and other areas in the shallow North Sea and strong East Asian currents, and monitored the prevailing underwater conditions. Armed with this data, Oceaneering designed a specialist vehicle able to increase the operational window in these niche areas.



The Magnum Plus



The result was the Isurus.

"Water currents typically impact against the side(s) of 'box-shaped' ROVs, pushing them out of position and conversely, requiring thrust to maintain position and orientation," said Nick Rouge, Product Manager, Subsea Robotics at Oceaneering. "This flow is not constant and requires continual movement from the ROV just to hold station. The key design challenge, therefore, was to reduce the resistance.

"This challenge was met by sculpting the body shell into a much more hydrodynamic shape. Instead of a big yellow rectangular syntactic foam block, the buoyancy of the Isurus assumes a much more streamlined morphology.

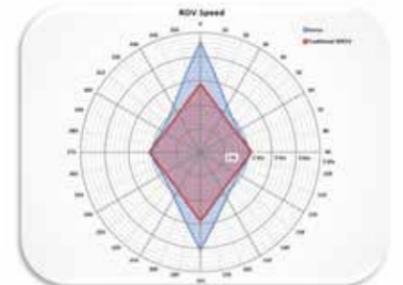
"Most workclass ROVs have the pumps, control, equipment and sometimes even the thrusters area under the buoyancy block. These obstruct the flow, and the resistance causes turbidity and destabilises the vehicle. In the Isurus, however, this area is enclosed in a skirt which encourages the water to flow around the vehicle, further increasing the hydrodynamic efficiency. The skirts can be easily removed for maintenance and repair, and the vehicle can be operated without them with a slightly reduced top speed.

"This enclosed shape is not uncommon in small eyeball ROVs designed mainly for inspection and monitoring," noted Rouge, "but is almost unique in workclass ROVs."

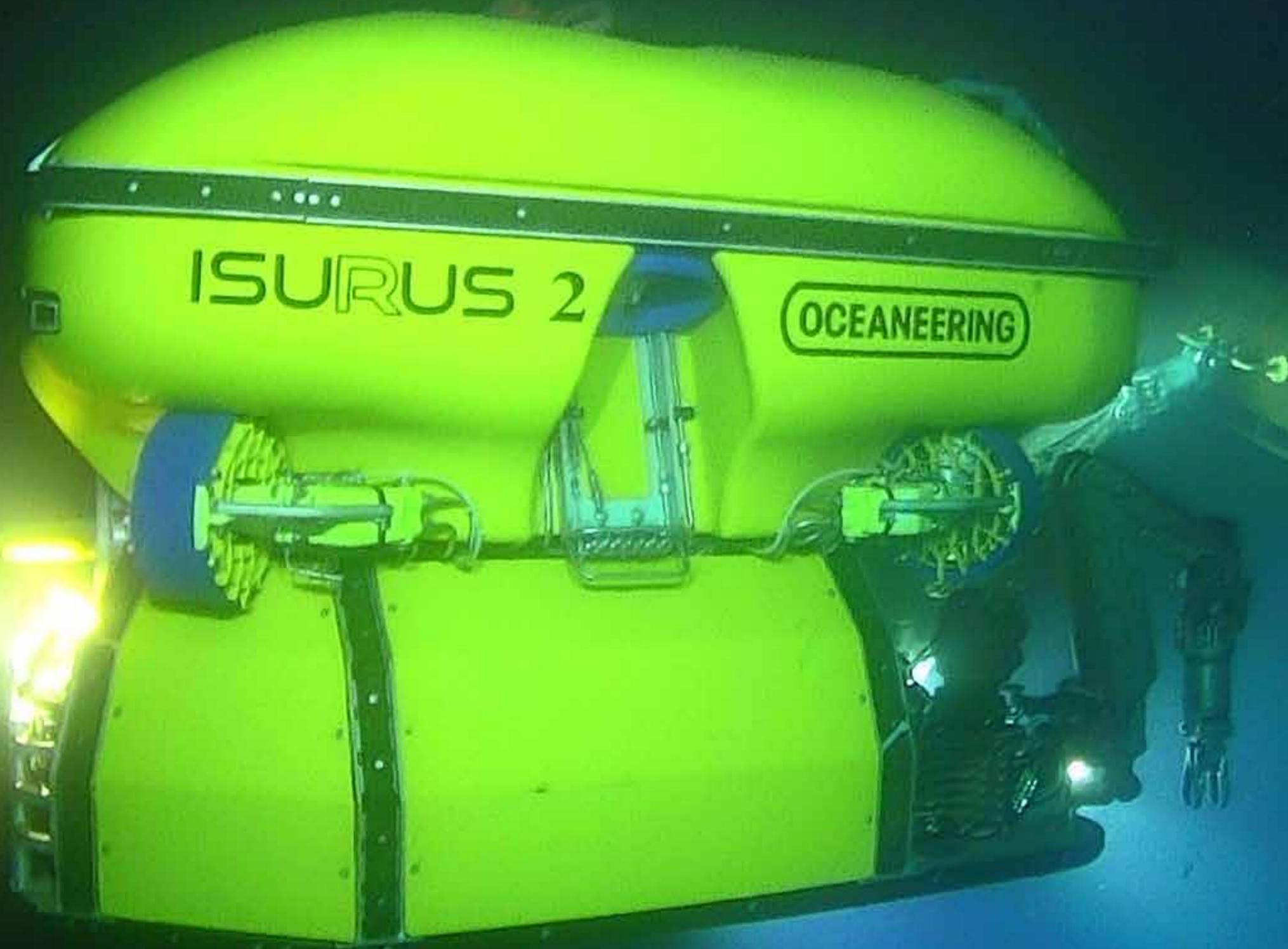
The results have been spectacular.

"When compared to traditional ROV systems that were limited to speeds of 1.5 to 2kts, we have been achieving speeds up to 5kts—more than any other work class vehicle in the fleet," he said. "The step-change in performance has transformed the ability to complete work scopes in high currents and harsh environments, efficiently and economically. Selection of the existing field proven Magnum Plus design as the basis for Isurus has resulted in an highly reliable ROV service totalling 6,695 dive hours with 99.75% uptime without encountering a current exceeding its capabilities."

"While the Isurus is rated to 3000m water depth, the scopes of work requiring high current vehicles are typically found in water shallower than 500m, including cable touchdown monitoring (TDM), cable installation, cable pull-ins, and foundation installations."



An ROV speed rose. The Isurus (blue) achieves a greater speed than traditional ROVs (red)



ISURUS

VEHICLE DESIGN

The Isurus engineering was completed by a global-based Oceaneering team and was manufactured in Morgan City, Louisiana where it also underwent full and robust factory acceptance testing. In late 2019, Isurus completed speed and agility testing where its capabilities were confirmed.

The first vehicle was mobilised in October 2019 and has been delivering operational support since.

"We have had two vehicles working on average of 250 days for the past year," said Rouge.

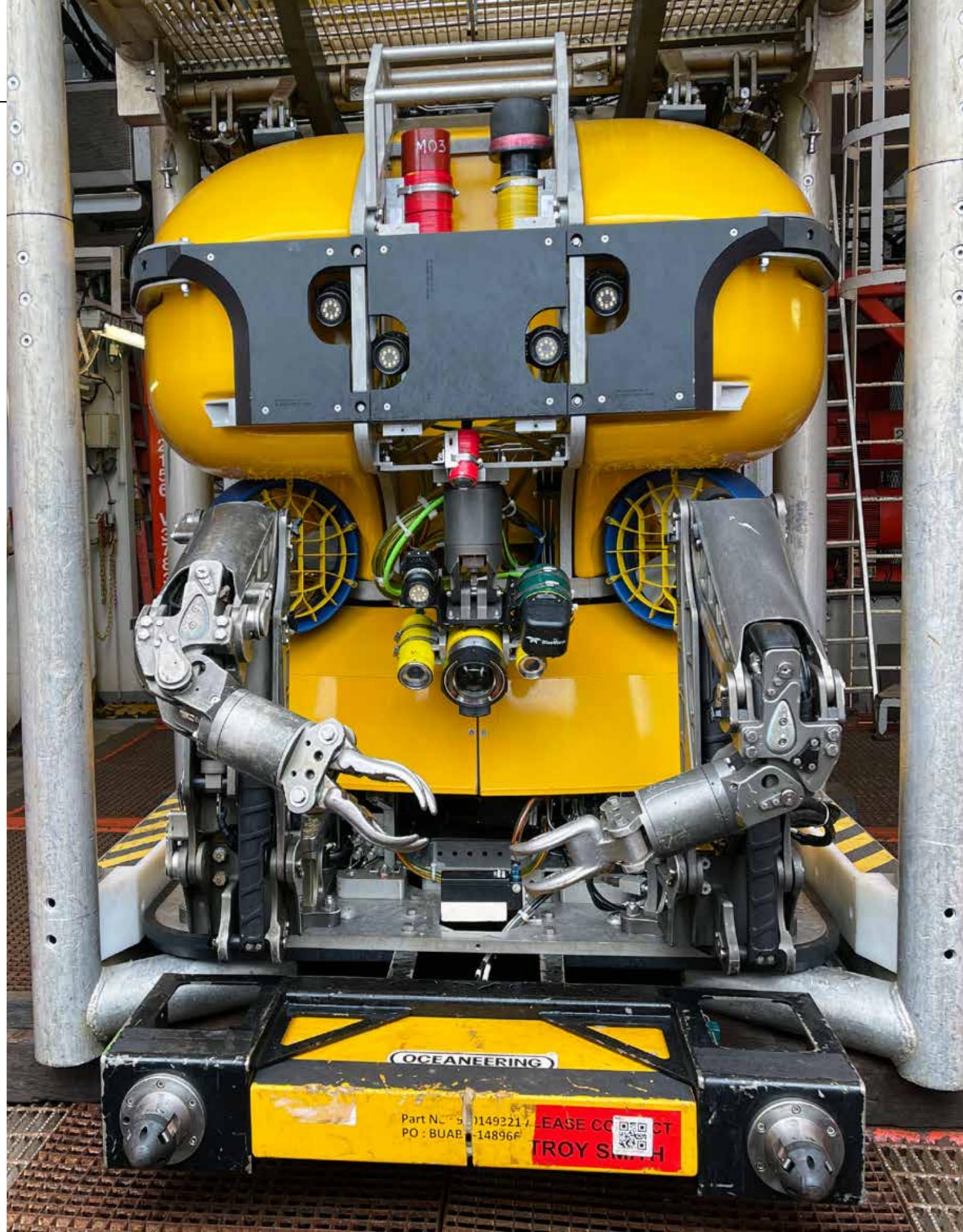
"Isurus #2 and #3 have been operating continuously in Asia supporting foundation installation since they were mobilized in Q1 2021," said Rouge.

"Isurus #1 has performed cable lay and construction operations in Europe and Asia while Isurus #4 has been supporting site surveys in Europe since it was introduced in Q1 2021."

"By the first quarter of 2022, we plan to follow up with two more vehicles, #5 and #6. We will also revise the Isurus design to accommodate a new configuration."

At present, all the vehicles are configured for a fast forward speed, but the new configuration will have more balanced output, sacrificing forward speed to provide a greater lateral movement and control.

"The forward speed is very useful for mapping cables and route survey etc, but for foundation installation jobs, there is often a particular demand to hold station within a high current and observe operations from a particular angle. It might be, for example, that a USBL transponder requires mounting or



removing, and this is only possible from a certain angle or orientation.

"Sometimes when a structure is in the water, the flow around it can be higher and the vortices can mean the local flow is more multidirectional and greater than the tidal or oceanic currents.

"Based on customer need and contracts won in 2022, Oceaneering expect to deliver Isurus #7 and #8. Future configurations of the Isurus ROV will include a Top Hat tether management system (TMS) and electric propulsion.

"Hydraulic thrusters have greater energy density," continued Rouge, "Yet, by not converting from electric to hydraulic in the first place, we create a greater efficiency across the entire system. The whole renewables venture is to reduce carbon footprint and by using an all-electric system, we can fully play our part in reducing the carbon budget of the specific project."

In addition to high currents, offshore renewable construction struggles with visibility due to high water turbidity. Oceaneering has worked with high resolution acoustic sonar vendors to develop solutions for Isurus and its other ROVs.

"Oceaneering's unique solution for subsea switching between multiple acoustic and optical vision systems has provided expanded operational capabilities to the renewables market," noted Rouge. "In the future, Oceaneering will be upgrading the fleet to enable faster installation of additional sensor systems and subsea switching between sensors as required by the operational conditions."

Oceaneering says that the Isurus has provided an increased working window of up to six hours per day in areas with strong tidal currents. With vessel day rates and carbon footprint a high priority, this is clearly an advantage that the team is leveraging to deliver the desired results to their end clients.