

KRAKEN

Kraken is a leading producer of pressure-tolerant batteries for underwater use, revolutionizing the field with its SeaPower batteries. These batteries offer critical advantages in applications where space and weight are limited, allowing clients to double the Autonomous Underwater Vehicles (AUVs) dive times while reducing their overall weight compared to standard pressure-housed batteries.

"Our batteries are designed to be pressure-neutral, which is a significant benefit for subsea operations," said Patrick Paranhos, VP of Business Development for Battery Systems at Kraken.

"We use a polymer to encapsulate the battery cells and electronics, effectively protecting them from water ingress and allowing the pressure to equalise without needing heavy housings, oil, or compensators.

"Capable of functioning at depths up to 6000m, our SeaPower batteries boast the best energy-to-weight and volume ratios for rechargeable subsea batteries in the industry."

Traditional battery designs are encased in robust, pressure-resistant housings, typically made of aluminium or titanium. They

are filled with oil to neutralise the effects of water pressure—a method effective at any depth due to the oil's incompressibility. However, this design increases the overall weight since it includes the power cells and the considerable weight of the housing, oil, and compensators, which do not contribute to the available energy.

Kraken's battery modules, ranging from 5kWh to 23kWh and using Li-ion pouch cells, are customizable for voltages between 45V and 400V.

They are commonly arranged in series or parallel modular banks to meet specific capacity and voltage requirements. These batteries can form systems up to 1MW. Kraken enhances the utility of these power banks with smart power-comms rails equipped with RS485 communications, which facilitate the assembly of power banks and remote management of individual batteries.

Each SeaPower battery includes a Battery Management System (BMS) with solid-state relays that continuously monitor the battery's status. The design minimizes cables and connections, ensuring power transmission via rails and direct temperature and voltage monitoring for each cell through PCBs. It maintains dependable



Power system

communication through a CAN Bus. Rigorously tested for quality assurance, each battery undergoes pressure testing to 660 Bar, adheres to ISO 9001 production standards, and is UN 38.3 compliant.

The batteries also feature integrated cell heaters to facilitate quicker charging times, which is particularly beneficial in challenging environments. With Kraken's 15kW charger, a single 23kWh battery can be fully charged in four hours, with the option to charge four batteries simultaneously.

Kraken SeaPower's exceptional energy density and reliability make it the preferred choice for clients looking to maximize operational efficiency. Crafted with precision and quality in Germany, Kraken's products set a new industry standard.

SEAPOW 1MW SYSTEM

In recent years, 1MW subsea battery modules have emerged as a novel solution in an expanding market.

"Wind energy is produced as turbine blades rotate, but the inconsistent nature of wind affects the power generated. Stabilizing this output is essential and can be achieved in two ways.

"One method is to integrate batteries

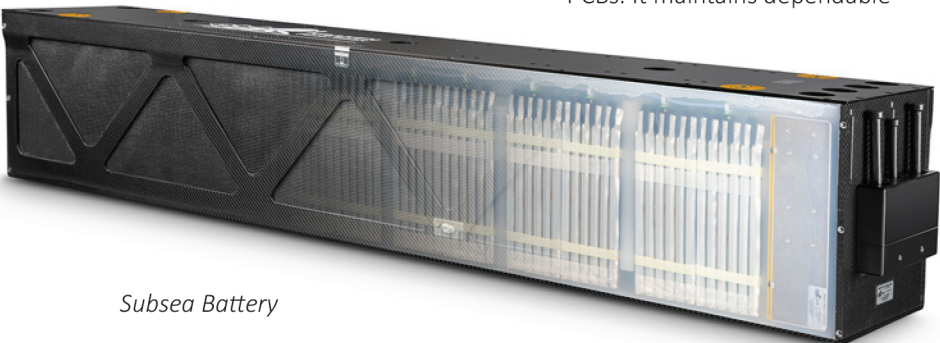
within the turbine structure. This approach, which uses dry batteries, presents logistical and weight challenges inherent to the turbine's design.

"The batteries take up considerable space within an area typically limited in size. Additionally, installing and replacing these batteries poses significant logistical challenges.

"An alternative is to establish a fully operational subsea power system. Such a system, designed for easy deployment and retrieval, avoids the issues associated with turbine-embedded solutions."

The 1MW power bank that Kraken developed provides significant weight and cost-efficiency advantages. The design capitalizes on the inherent efficiency of each battery in terms of power-to-weight and power-to-volume ratios. When combined to create a 1MW system, the resulting weight, size, and cost reduction is substantial.

Patrick Paranhos, Kraken's VP of Business Development for Battery Systems, discusses the benefits of this innovative product line. By eliminating the need for pressure housings, oil, and pressure compensators required for deep-sea conditions, these cost savings are passed on to the customer. Consequently, Kraken's power system is not only the smallest and lightest at this scale for subsea use but also the most cost-effective option available.



Subsea Battery

GREENSEA IQ AND OPT

Leveraging its versatile open architecture platform OPENSEA, Greensea IQ will continue to work with OPT to develop the next generation of OPT's Maritime Domain Awareness Solution (MDAS).

OPT is renowned for its over-the-horizon (OTH) MDAS-equipped PowerBuoy products. The OPT PowerBuoy serves as an innovative renewable energy solution, harnessing its power from a combination of solar, wind, and wave activity. MDAS is integrated with OPT PowerBuoys to monitor and collect data in marine protected areas, mitigate illegal fishing, provide automated vessel traffic data for ports, or support extended offshore monitoring and data collection capabilities for defense and security applications.

The new multi-year contract extension, which will run through to May 2025, will see Greensea IQ's advanced technologies, including OPENSEA and Safe C2, play a pivotal role in the evolution of OPT's MDAS, with Greensea IQ and OPT collaborating on all aspects of system and software design and development, including command and control, communications, and data transfer, including integration of OPT's unmanned surface vehicles (USVs) into the overall architecture.

Initially developed for specific defense purposes, the dual-purpose technologies, OPENSEA and Safe C2, are being reworked to adapt to and support OPT's objectives in maritime security and awareness and will enhance the efficiency and effectiveness of its ocean energy and defense solutions. This partnership will encompass integration of sensory data, user interface optimization, secure data transfer to the cloud, and integrating edge computing and storage solutions.



PowerBuoy