OE OFFSHORE ENGINEER

THE FUTURE OF OFFSHORE ENERGY & TECHNOLOGY

SEPTEMBER/OCTOBER 2019 WWW.OEDIGITAL.COM

Plug & Abandonment

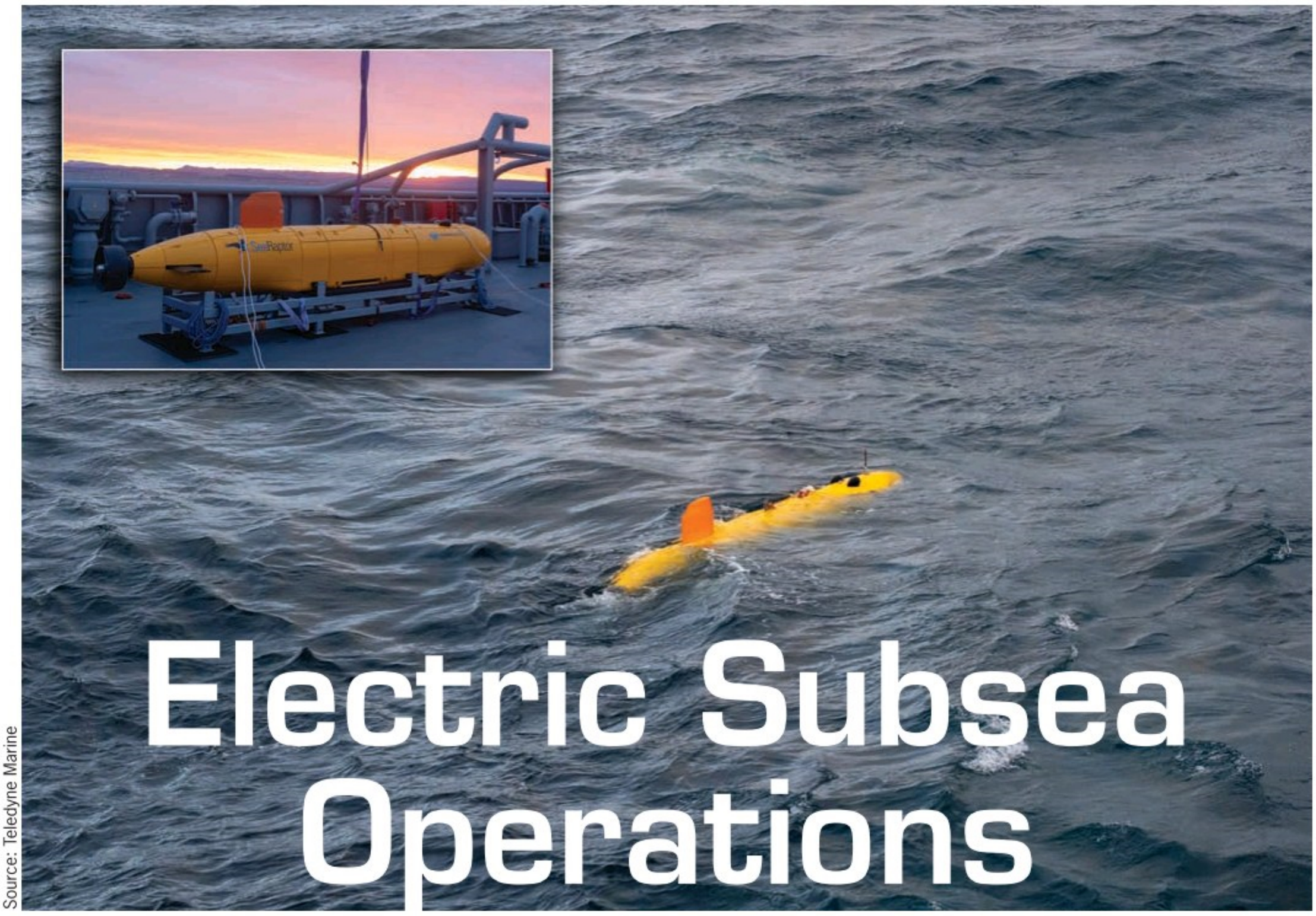
A New Slant on Decommissioning

Big Data
Doubling Down on Digital

Resident Subsea Vehicles
New Tech Takes Off

Brazil
Rife with Opportunity

VOL. 44 / NO. 5



Source: Teledyne Marine

Electric Subsea Operations

By Leon Adams - VP Sales, Southwest Electronic Energy

As the offshore oil and gas industry recovers from the downturn, business has focused on operating more efficiently. The transition from hydraulic power to electric power is a part of that equation.

Subsea batteries can safely power subsea operations requirements and save operators cost efficiency through extended battery life and smart status reporting resulting in longer and more reliable mission times. Numerous lithium-ion applications are emerging, such as driving hydraulic pumps and powering autonomous underwater vehicle (AUV) operations.

Batteries may not seem like a natural choice for subsea operations, however, lithium-ion batteries have revolutionized stored power technology. As such, properly designed and engineered batteries can safely be used subsea.

Traditional lead acid batteries are heavy and bulky. Lithium-on batteries, such as Southwest Electronic Energy's line of (SWE) SeaSafe batteries, deliver up to a six-fold lifetime improvement over lead acid batteries at 25% of the size and weight.

SWE SeaSafe batteries powered by large lithium-ion polymer cells are engineered into modules to provide 30 volts at 28 amp hours with other options available. The battery modules are pressure tolerant and able to operate in water depths to 6,000 meters. Multiple SeaSafe battery modules can be linked together to meet the voltage and power needs of various applications. These applications may require periodic high bursts of power, such as controlling a remotely operated vehicle's manipulators, or longer low-draw demands for powering sensors.

When subsea batteries are deployed, monitoring their performance is critical to ensuring that the batteries are operating dependably and sustainability. With SWE SeaSafe II and SeaSafe Direct, condition-based monitoring is built-in with the user-friendly Battery Management System (BMS), patented by SWE. The BMS automatically manages and tracks the safety, reliability, charge and discharge of the batteries and reports technical information at the user's demand. These safe and smart batteries are self-functioning. The reporting software excels over other systems as it provides data on each and every battery module,

down to the individual cell voltage level, and in real-time.

In a subsea oil and gas installation, it is necessary to power workover controls, chokes, valves, blowout preventers and well heads, among other equipment. Requirements include electronic control, valve control, electrical drives, primary and backup power, more precision, condition-based monitoring, and long-life sensors. Batteries used in such applications must deliver safety, more capacity, smaller size, less weight, longer life and high reliability with on demand data reporting.

An electric motor for a hydraulic pump may require a high-power surge exceeding 100,000 watts for operations lasting only a matter of minutes. This could serve subsea chemical injection unit and provide subsea local power for hydraulic pressure on demand instead of hydraulic pressure furnished through an expensive umbilical or by bulky accumulators that both get more burdensome and costly the deeper you go in subsea operations.

SWE SeaSafe II and SeaSafe Direct battery modules can provide power solutions as deep as 6,000 meters. Modules can be configured in higher series module strings for higher configured system DC voltage. Parallel strings provide higher current and thus higher power at the configured DC voltage. Battery system reliability is enhanced via redundancy of power available at the system DC voltage because each Diode ORing string can provide standalone power at the DC voltage even if another string goes down. The max current per string will be less than the total current from combined strings, but will still provide the same voltage. Parallel copies of the voltage string can also provide high burst current for high instantaneous power needs. This parallel battery module string inter-connect is facilitated by the SWE SeaSafe Diode ORing Module.

For example, SWE supplied a SeaSafe II Battery system for a subsea electric motor hydraulic pump power drive that required a maximum of 250 kilowatts at peak demand. The system configuration was 17 series string of 37-volt battery modules connected in two parallel strings by Diode ORing Modules, providing 629 volts nominal, 56 amp hour nominal capacity, and 400 amps peak current. This subsea battery system is currently in testing and performing as planned. When released, it promises to be a leader in safe and efficient condition-based monitoring subsea infrastructure.

Multiple SWE SeaSafe II battery systems with 188-kilowatt power each are in production for a subsea chemical injection unit. This battery system will dramatically reduce or eliminate the copper wire demand for the umbilical. The battery packs will deliver sufficient power density to run 120 barrels of MEOH at 1,034 bars and 15,000 psi for six hours.

Subsea robotics, such as AUVs, require longer survey runs, deeper dives, with more simultaneous types of sensor and scanner technology. Pressure tolerant battery packs, such as SWE SeaSafe II and SeaSafe Direct, can provide long-term power needs by eliminating the weight and cost of a pressure vessel for the batteries. The AUV needs to power thrusters, small electric motors for servo control and actuation of manipulators, digital cameras plus the lighting to enhance video and still photos, control processors and interface electronics, sensors and scanners for measurement and feedback of node status information to the control processors. Furthermore, the AUV also needs to power communications systems to issue commands, manually pilot if in hybrid ROV mode, or communicate feedback, whether visually or through data communication.

SeaSafe battery packs can be configured in low count series module strings for low to moderate DC voltage with parallel copies of the voltage string to provide higher capacity of amp hours and redundancy of battery voltage for reliability. Parallel strings can be interconnected on output via the Diode ORing Module for common output to the load. Each Diode ORing string can provide standalone power at the DC voltage even if one goes down. In that case, the max capacity per string will be less than the total capacity from combined strings, but will still provide the required system voltage.

SWE SeaSafe Direct modules power the applications for the Teledyne Marine SeaRaptor, an AUV approximately 5.5 meters long, which includes acoustic modems, ascent and descent weight releases, a black box pinger locator, sub-bottom profiler, multi-beam echosounders, obstacle avoidance multi-beam sonar, Doppler velocity log, current, temperature, depth sensor and onboard processing software.

SeaRaptor has a maximum speed over 4 knots. While its endurance depends on speed and the exact configuration of the AUV, the SeaRaptor can typically survey for 24 hours at 3 knots with a standard configuration. The standard battery configuration comprises 13- to 16-kilowatt-hour lithium-ion rechargeable SWE SeaSafe Direct modules. The vehicle's operating criteria require the batteries to power all of the AUV functions. The ability to change batteries with ease without reconfiguring the SeaRaptor is critical for efficient mission execution.

While the SeaRaptor is in the water, a second set of battery modules can recharge in about 4 hours, thus providing the AUV the capability to quickly change batteries topside and continue its operation flawlessly.

The industry is in the midst of a subsea electric revolution that will see electric robotic vehicles and infrastructure performing underwater tasks. The reason for this is simple: industry experts recognize electric motors and robotics are more efficient and cost effective in subsea applications than hydraulic systems due to advances in technology and miniaturization. Couple that with condition-based monitoring benefits that are inherent in electric systems and then the efficient, safe, and reliable subsea systems of the future will be substantially electric.

IMAGINE YOUR WORLD
Untethered

SeaSafe Direct Smart Battery Modules

4X Longer Mission Run Time
6X Longer Battery Life Time
ABS Certified & 2nd Generation Learned

6000 M Pressure Tolerant Tested
No Pressure Vessel Required
Direct Connect and in Water Viable

SOUTHWEST ELECTRONIC ENERGY CORP
Advanced Battery Solutions
AN ULTRALIFE COMPANY

SERVICE QUALITY RELIABILITY

281.240.4000 | seasafedirect@swe.com