VICOR

Case study: Tethered, aerial/ underwater vehicles



High-density, high-power modules enable lighter, safer, lower cost tether cables to extend missions

Customer's challenge

This class of unmanned vehicle is powered and controlled via a tether from a ground-based power source. High-voltage tether transmission of 500V to 800V allows for greater tether lengths and smaller cabling, enabling the drone to fly higher or travel longer distances underwater. Tethered drone applications typically require a 1 – 5kW ground power supply tethered to a rotor-wing UAV or UUV, and offer unlimited run time and greater control. The key goals were:

- Optimize the power delivery through the tether
- Rugged, highly integrated power supply for high reliability
- Efficiently convert high voltage to safe 48V SELV

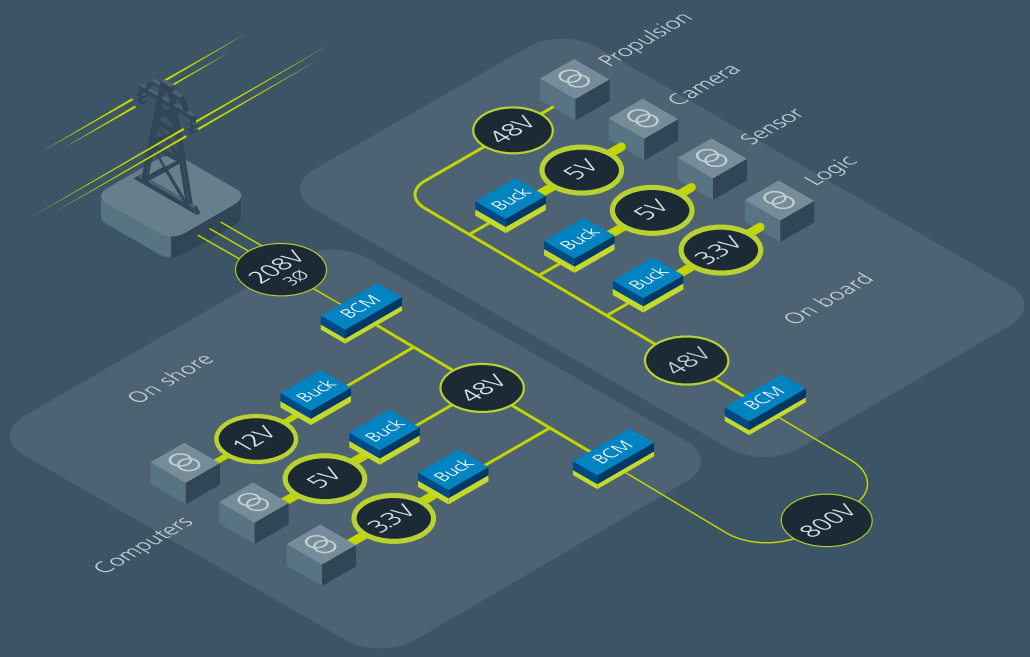
The Vicor solution

The power delivery network (PDN) inside the vehicle must be capable of down-converting the tether's high voltage with high efficiency and power density to not take up important payload space and Vicor fixed ratio converters like BCM® modules are the most efficient way to convert HV to SELV. Key benefits were:

- Significantly reduce tether size, weight, and drag
- Lightweight conversion of HV tether to SELV bus
- Modular design supports flexible design requirements

The Power Delivery Network

The BCM4414 provides 1.8kW of power for either step-up or step-down conversion at 97%+ efficiency. At the ground station, the BCM4414 isolates and steps-down the rectified output from a single or 3-phase AC supply to 48V. A second BCM4414 steps-up the 48V to 800V for transmission across the tether. A third BCM4414 is used to step-down the 800V to 48V onboard the vehicle. The size and weight of the ground supply and UAV are significantly reduced, as are the diameter and weight of the tether itself. The end result is a much more flexible and capable system that can be easily transported to the operating location.





BCM® bus converter

Isolated fixed-ratio

Input: 800 – 48V

Output: 2.4 – 55.0V

Current: Up to 150A

Peak efficiency: 98%

As small as
22.0 x 16.5 x 6.7mm

vicorpower.com/bcm



ZVS buck regulator

Non-isolated regulated

Input:12V (8 – 18V),
24V (8 – 42V), 48V (30 – 60V)

Output: 2.2 – 16V

Current: Up to 22A

Peak efficiency: 98%

As small as
10.0 x 10.0 x 2.56mm

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