High Power | HVDC | Low Weight | PCDM

5kW Tethered UAV

Increasing Payload with HVDC and Power Dense Components

The Customer's Challenge

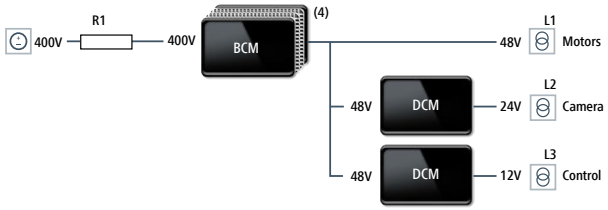
UAV designers are being asked to mount even more instrumentation on the vehicles they design, all requiring increased power. This means making decisions about the range and flight time trade-offs they are willing to take, to allow for this increased payload. Many UAV designers have been able to change to tethered designs, moving the power off the vehicle to increase payload capability. Yet the tether itself is still a weight the UAV has to carry as it flies and hovers, even with a retraction system incorporated into the design. And the higher the UAV needs to fly, the longer and heavier the tether becomes.

One tethered UAV manufacturer was looking for creative ways of maximizing the power-hungry payload of one of their designs. After an initial review it was clear that the 5kW power solution was a key target for redesign to reduce non-payload weight. At the same time, the team was looking to increase the quality of the images and sensor data transmitted over the tether, meaning the power system EMI had to be reduced.

The Solution

Our applications team, having worked with many engineers facing similar challenges, were able to suggest a move to a high voltage (400V) DC transmission solution to meet the objectives for this design. An array of four high voltage bus converter modules provided isolation and conversion of the 400V tether voltage directly to the 48V needed to drive the motors and the control system. Two DCM DC-DC converters regulated the 48V bus and provided the 24V for the HD camera and 12V for control and telemetry.

Link to Whiteboard »



The Results

Using a high-voltage-based ground supply, converted onboard the aircraft to the low voltage needed, resulted in a significant reduction in the size and weight of the tether, and reduced its 'sail' effect. Onboard, using the ultra-high power density (2,750W/in^3), low weight BCMs (41g) and DCMs (29.2g) the total 5kW supply was achieved in a package size of just 75.4cm^3.

The high efficiency of the BCM (98%) and convenient double-sided cooling capability of all the components used, reduced heat sink requirements, further reducing the size and weight of the power solution. In addition, the Sine Amplitude Conversion topology of the components minimized EMI, and the weight and size of associated filters.

The space and weight savings from both the tether and the onboard power conversion solution significantly increased the vehicle's payload capability. In addition, as paralleling is straight forward and requires no further components, any future expansion of power levels is simple to achieve with no major redesign of the UAV.

Product Family Key Specifications	
BCM High Voltage Bus Converter Module	
Input Voltages	260 – 410V 330 – 365V 360 – 400V
Output Voltage	From 8.1 – 51.3V
Output Current	Full Chip: Up to 28A 6123 ChiP: Up to 125A
Efficiency	Up to 98%
Dimensions	Full ChiP: 32.50 x 22.00 x 6.73mm 6123 ChiP : 63.34 x 22.80 x 7.26mm
DCM DC-DC Converter Module	
Input Voltages	9 – 50V_{DC} 16 – 50V_{DC} 18 – 36V_{DC} 36 – 75V_{DC} 120 – 420V_{DC} 160 – 420V_{DC} 200 – 420V_{DC}
Output Voltages	3.3, 5, 12, 13.8, 15, 24, 28, 36, 48V
Output Power	4623 ChiP: Up to 600W 3623 ChiP: Up to 320W
Efficiency	Up to 93%
Dimensions	4623 ChiP: 47.91 x 22.8 x 7.21mm 3623 ChiP: 38.72 x 22.8 x 7.21mm