

Topic: N181-048

Galley Power LLC

Ultra-Low Ripple 1000 Volt Direct Current Battery Charger

The 1kV Lithium-ion battery bank requires a high-power-density maintenance charger with ultra-low ripple charging capability to maximize battery life. This new technology will be able to supply ultra-low ripple charging power for all conditions while maintaining high efficiency. This system uses high bandwidth SiC MOSFET and soft-switching technology to substantially improve the Space, Weight, Power and Cost (SWaP-C). The charger can be integrated into an energy storage system or serve as standalone charger. Galley Power specializes in providing advanced solutions to Lithium-ion battery or battery packs including high voltage banks, 6T and BB2590 within the fields of battery management, 3-phase high efficiency bi-directional power conversion and optimize charging profile based on battery chemistry. Our goal is to integrate and transition this technology into Navy high voltage battery charging systems.

Technology Category Alignment:

Ground and Sea Platforms

Energy & Power Technologies

Advanced Electronics

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SYSCOM: NAVSEA

Contract: N68335-20-C-0154

 Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-20-C-0154

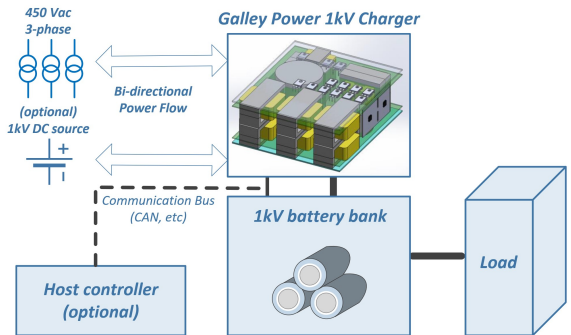
 Tech Talk: <https://www.youtube.com/watch?v=tjYbYk5yx4M>

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WHO

SYSCOM: NAVSEA
Sponsoring Program:
Transition Target:
TPOC:
(215)897-1722
Other transition opportunities:



WHAT

Operational Need and Improvement: High power 1KV Lithium-ion battery charger extends battery bank service life time with ultra-low charging ripple that reduces the heat generation from battery internal resistance. The charger is designed for high efficiency and high-power-density to substantially improve the Space, Weight, Power and Cost (SWaP-C). The charger also supports high control bandwidth with optimized charging profile.

Specifications Required: A 33kW 1kV charger achieves 96.5% efficiency with 3MW per cubic meter power density. The battery charging ripple is below 0.25%. The charging profile supports constant voltage, current and power. The charger input is standard 3-phase 450Vac with a power factor control that is compliant with MILSTD1399 300B. The AC input to the battery bank is galvanically isolated. Complete protection designs support output over/under voltage, output short circuit, over temperature, Input over voltage, power foldback and AC brown-out. All the controls are software programmable. The system can be controlled remotely through CAN bus. The charger module is designed for a 19" rack form-factor with a 33kW rating per 4U standard rack height (7"). The module has the capability to provide higher increments of charging power.

Technology Developed: Galley Power's high power high voltage solution fully transitions to SiC based high frequency power devices with soft-switching techniques. The advanced charging control is capable of supporting various battery chemistry including Lithium-ion, LiFePO4 or Lead-acid. The charger is a modular design with real-time synchronization capability which allows interleaving operation, significantly reduces the charging ripple, and allows variable switching frequency. The bi-directional 3-phase power inversion technology supports both battery charging and state-of-charge (SOC) adjustment.

Warfighter Value: TBD

WHEN

Contract Number: N68335-20-C-0154

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Lab prototype of 6kW 1kV low ripple charging module	Med	Satisfactory functions and charging profile	4	October 2020
Lab prototype of interleaved 13.2kW 1kV low ripple charging modules	Med	Satisfactory performance to meet module level specification	4	August 2021
Lab prototype of 33kW 1kV high efficiency and high-power-density low ripple charger	High	Satisfactory performance to meet system level specification	6	June 2022

HOW

Projected Business Model: Galley Power business model for 1kV Lithium-ion battery charger is primarily targeting to sell as a fully functional charging module for system integration. Galley Power also sells the charger as customized product based on the requested power level, input power source, battery bank voltage and capacity.

Company Objectives: We anticipate that the navy SBIR/STTR Transition Program (STP) forum will facilitate connections with Navy system integrators to explore the opportunities for high power high voltage Lithium-ion battery bank charging needs. Galley Power can customize the charger's functions, form-factors and control protocols to accommodate the feasible redesign into the targeting systems.

Potential Commercial Applications: This technology can be applicable to high voltage grid energy storage systems. This technology can also be applicable to the fast charging of electrical vehicle batteries.