Medium Voltage Grounding System and Common Mode Mitigation for Medium Voltage System

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Other Potential Programs:
Shipyards, vendors to integrate into shipyards, shipbuilders

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THE CHALLENGE

Common-mode (CM) voltage and current can create a host of issues in power systems with power electronic converters. CM can create electromagnetic interference (EMI) due to unwanted field emissions that couple with neighboring components. They can create ship hull currents. Further, CM can degrade insulation in conductors, can add noise to data lines, and also create damage in bearings of rotating machinery, diminishing naval ship reliability and service life. Naval ship electrification and power electronic device inclusion within modern electrical systems opens the potential for CM issues in America's Navy, regardless of the architecture selected (i.e., medium voltage AC or DC). Indeed, CM has already created a host of disruptions in US Naval shipboard power systems.

THE INNOVATION

Over the past five years, Continuous Solutions has partnered with Purdue University under STTR N16A-T012 "Medium Voltage DC Grounding Systems" to address CM design considerations in shipboard power system. Tools have been developed to predict the CM behavior of multi-converter systems, specify filtering requirements, and to construct the filter components. The solutions are readily applied to AC/DC power systems and continue to be validated at increasingly higher power, voltage, and frequency. Over the next two years, Continuous Solutions plans to scale these products and demonstrate them under the requirements expected for low and medium voltage AC ship integration. The specific goal is to continue the existing STTR Phase II option funded through 2024 with PMS 460 and a strategic SBIR Phase III partnership with the Florida State University Center for Advanced Power System (FSU CAPS).

THE NAVY BENEFIT

Currently, the ability to predict CM behavior prior to full system integration and testing is limited. A common practice is to ensure components pass prescribed standards, for example, MIL-STD-461. Although useful, the existing standards are limited converters under a single 50 Ohm CM load. However, when multiple converters are placed together and once the system components are in place and CM problems are found, commercially available solutions such as common mode filters typically do not meet Navy specifications (e.g., power, voltage, impact). Developing tailored solutions requires considerable resource and can lead to appreciable ship deployment delays. The combination of these factors has led the Navy Electric Ships Office for future Naval ships to pursue CM prediction and mitigation methods.

THE FUTURE

Continued Phase III collaboration and testing of land-based systems at FSU CAPS will enable Continuous Solutions and Purdue to further prove validity and improve system of solutions. We are actively looking for investments into this technology via Phase III and for partnerships with vendors and shipbuilders to pilot our solution.

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