



Contribution ID: 601

Type: **Invited Oral Presentation**

## [Invited] Cryogenically Cooled 1-MW Inverter

*Monday, 10 July 2017 16:00 (30 minutes)*

We describe the general design and development progress of a cryogenically cooled 1-MW inverter. The goal is to achieve an efficiency of 99.3% at 500-kW power and a specific power of 26 kW/kg. The design must be compatible and scalable with cooling by both liquid hydrogen and liquid natural gas, but the experimental prototype will be cooled by liquid nitrogen. The input dc voltage is 1000 V, and the output frequency is 200-3000 Hz. The inverter requires sufficient filters to meet DO-160 EMI standard, and both conventional and superconducting inductors were evaluated for this purpose. The candidate commercial off-the-shelf power semiconductors were characterized from 77 K to room temperature for on-state resistance, breakdown voltage, and switching energy loss. The inverter design uses a three-level active neutral-point clamped topology that uses different power switches for the fast and slow switching. A calorimeter was developed that can measure the efficiency of the 200-kW and 1-MW prototypes by the dissipated losses to the liquid nitrogen to better than 0.1% of the total power. Phase I of the project is complete, with a design that meets the project goals. Phase II of the design is ongoing with fabrication of a 200-kW inverter to reduce the risk of key design elements. Phase III of the project will be construction and test of the 1-MW inverter.

This project was partially funded by NASA AATT under Contract No. NNC15AA01A.

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**Session Classification:** M1OrE - Focused Symposia - Propulsion IV: Power Electronics, Energy