Contribution ID: **494** Type: **Invited Oral**

M3Or4A-03: [Invited] Development of a 1 MW+ High power density induction motor for electric aircraft propulsion using Cryogenic Aluminum Windings

Wednesday 21 May 2025 17:05 (20 minutes)

Our team is developing and demonstrating a 1 MW plus high power density motor intended for electric aircraft propulsion as part of an ARPA-E program. The target power density is > 16 kW/kg with 97+% efficiency. The motor is an asynchronous design with an outrunner rotor configuration, based on previous developments at OSU CAR. However, the stator and rotor windings are cryogenically cooled monolithic aluminum conductors. The Al is 3 nines, and the target operational temperature is between 60-120 K. Originally conceived as using LNG as the cooling media, we have broadened the design to allow for a secondary cooling loop with a variety of primary fuel coolants, including LNG and liquid hydrogen. In this talk, basic motor architecture is discussed, including aspects of the design which allow for a very lightweight and simple cryostat and minimal bearings issues. Our approach starts with the rotating machine requirements and the cryogenics are adapted as needed for a novel solution. We also describe the potential for motor drives integrated into the cryogenic machine and discuss testing performed to de-risk this approach. Flow cooling studies are described along with basic magnetic circuit, coolant flow design, and structural design. The present state of machine fabrication and test is described.

Author: SUMPTION, Michael

Presenter: SUMPTION, Michael

Session Classification: M3Or4A - [Special Session] Transportation IV: Motors and Generators