Contribution ID: **386** Type: **Invited Oral**

M1Or3G-03: [Invited] DC Superconducting Buses for Electric Aviation

Monday 10 July 2023 16:55 (20 minutes)

Turboelectric distributed propulsion (TeDP) is one concept which has been explored in the development of all electric aircraft. TeDP allows for the motor and generators to be decoupled from one another and connected through a DC cable distribution network. This enables various airframes to be explored such as the blended wing body (BWB) which allows for greater aero dynamical performance compared to conventional aircraft. For TeDP to be feasible for BWB and other aircraft frames high power density targets have been set. The ambitious power density targets required for large-scale electric aircraft are amenable to superconducting power device such as generators, motors and cables. To achieve the required power density of the power system in a safe and reliable manner requires consideration on the topology, devices, and integration of the necessary cryogenic environment for superconducting technology. Designing the electrical power system without concurrently designing the cryogenic infrastructure has the potential to cause significant interruption to the power system in the event of cryogenic failure. As part of our continued research into superconducting power cables for electric aircraft as part of the NASA University Leadership initiative - IZEA we are assessing the power design and how to develop a resilient DC superconducting bus in the event of failure within the cryogenic system. As part of this study we will perform a review of previously developed DC Superconducting bus topologies for aviation application and assess the suitability in the event of cryogenic failure. This analysis will also provide consideration if superconducting or non-superconducting technology is utilized as part of the motor drive.

We will also provide consideration on the notional power system we are developing as part of the IZEA for a 20 MW BWB all electric aircraft. As part of the power system we consider the aircraft having two superconducting generators and eight superconducting motors. As part of the presented work we will explore strategies to ensure each generator is connected to each motor to increase the resiliency of the power system. We will also discuss the HTS cable topology being developed with the associated termination to the motor drive. This analysis will include commentary on cryostat selection for the HTS cables and the associated volumetric and spatial constraint of installing the DC superconducting buses with the IZEA airframe.

Primary author: Mr NIAZI, M.Tahir Khan (FAMU-FSU College of Engineering)

Co-authors: Dr DAS, Arup Kumar (FAMU-FSU College of Engineering); KIM, Chul (Florida State University); CHEETHAM, Peter (FAMU-FSU College of Engineering); PAMIDI, Sastry (FAMU-FSU College of Engineering)

Presenter: CHEETHAM, Peter (FAMU-FSU College of Engineering)

Session Classification: M1Or3G: Transportation Symposia I: System Level