



Contribution ID: 469

Type: **Invited Oral**

## **M1Or3G-02: [Invited] Integrated Zero Emission Aviation (IZEA) using a robust hybrid architecture**

*Monday 10 July 2023 16:35 (20 minutes)*

An overview of the “IZEA” NASA University Leadership Initiative (ULI) will be presented to provide context for several other presentations describing details and progress under specific ULI tasks. IZEA addresses removal of carbon emissions for regional aircraft with ~120 passengers, 5000 km range, cruise speed of mach 0.8, and total power 25 MW by using liquid hydrogen fuel. Design of low-loss hydrogen tanks and other factors such as noise reduction motivate consideration of blended wing-body airframes with distributed electric propulsors, which is a significant departure from the present fleet. Primary power is envisioned to come from a 20 MW turbo-electric generator, and cruise power from 10 MW of distributed PEM fuel cells with high-altitude power boost from an oxygen supply to reach 5 kW/kg. The availability of cryogenics permits consideration of superconducting power systems operating at 20–70 K, including a generator, superconducting trunk and distribution lines. Propulsion will connect SiC power controls with novel axial flux motors that incorporate multiple stators tailored for the different mission segments of flight. Motors use conventional magnets and can be adapted to half-superconducting designs. The use of PEM fuel cells requires consideration of a 5 MW cooling system to maintain a ~10°C temperature window around the 30°C temperature of operation. The combined application of several temperature zones, from cryogenic to above 300 K, provides opportunities to optimize the thermal management and efficiency via modification of the airframe and component integration. Acknowledgements: The authors would like to acknowledge the support from NASA under Grant 80NSSC22M0068. The research was conducted at the National High Magnetic Field Laboratory, which is supported by National Science Foundation Cooperative Agreement No. DMR-1644779 and the State of Florida.

**Author:** COOLEY, Lance (ASC/NHMFL - Florida State University)

**Co-authors:** CATTAFESTA, Louis (Department of Mechanical, Materials, and Aerospace Engineering, Illinois Institute of Technology, Chicago, USA); CHEETHAM, Peter (Center for Advanced Power Systems); GLADIN, Jay (1)Daniel Guggenheim School of Aerospace Engineering, College of Engineering, Georgia Institute of Technology, Atlanta, USA. 2)Aerospace Systems Design Laboratory, Atlanta, USA); GUO, Wei (Florida State University, National High Magnetic Field Laboratory); HE, Jiangbiao (1)Department of Electrical and Computer Engineering, University of Kentucky, Lexington, USA 2) Power and Energy Institute of Kentucky, Lexington, USA); IONEL, Dan M. (1)Department of Electrical and Computer Engineering, University of Kentucky, Lexington, USA 2) Power and Energy Institute of Kentucky, Lexington, USA); ORDONEZ, Juan (1)Mechanical Engineering Department, FAMU-FSU College of Engineering, Florida State University, Tallahassee, USA 2) Center for Advance Power Systems, Tallahassee, USA 3) Energy and Sustainability Center, Tallahassee, USA); KIM, Chul (Florida State University); Prof. PAMIDI, Sastry (Center for Advanced Power Systems, Florida State University); ZHENG, Jim (1)Department of Electrical Engineering, University at Buffalo, Buffalo, USA)

**Presenter:** COOLEY, Lance (ASC/NHMFL - Florida State University)

**Session Classification:** M1Or3G: Transportation Symposia I: System Level