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

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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℃ temperature window around the 30℃ 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.
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