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Impact of Cryogenic/Superconducting Components for Hybrid-Electric Aircraft Propulsion

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Hybrid-electric-vehicle (HEV) or electric-vehicle (EV) propulsion is well understood from the automotive industry, and achieves very significant increases of energy efficiencies of 2-3x from the use of non-combustion technologies and 'smart' energy management including brake regeneration. The possibility of battery-electric and hybrid-electric propulsion for aircraft has increasingly been considered in the last 5 years, and has been successfully implemented in 2 and 4 passenger aircraft. This paper will summarize recent progress in this field for aircraft, and present impact studies of how cryogenic/superconducting components can positively impact hybrid-electric or all-electric power systems and capabilities, for different size and power level aircraft. Drivetrain components studied include generators and motors, power transmission cables, power storage devices including Li-batteries and superconducting magnetic energy storage (SMES), power electronics including inverters, and cryogenic technologies. Properties of cryogenic systems and components will be compared to Cu-wire or conventional based systems.

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Primary author: HAUGAN, Timothy (U.S. Air Force Research Laboratory)

Co-author: Dr PANASYUK, George (UES Inc.)

Presenter: HAUGAN, Timothy (U.S. Air Force Research Laboratory)

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