

Superconducting Turboelectric Distributed Aircraft Propulsion

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Abstract — Current developments in superconducting and cryogenics technologies offer the potential for dramatic impacts on the future of aviation. The prospective of a modular means for high power dense and highly efficient power transmission is an attractive enabler for decoupling the production of power from the production of thrust on an aircraft. The resulting spatial flexibility removes critical mechanical and geometric restrictions on the propulsion system and allows for greater synergies with air vehicle aerodynamic performance. Nevertheless, significant technology progression is required to prepare cryogenic and superconducting technologies for the unique operational environment of an aircraft system. Power density and efficiency currently dominate concept feasibility studies. However, the practicality of operating a fleet of aircraft driven by superconducting propulsion systems requires consideration of requirements like reliability, fail-safe operations, infrastructure compatibility, and system maintainability. In addition to individual technology developments, innovative systems architectures are required which provide novel means for balancing redundancy, reconfigurability, and fault recovery in a manner which capitalizes on the unique behaviors of cryogenics and superconducting.

Keywords (Index Terms) — Aircraft, turboelectric, distributed propulsion, hybrid electric, safety, reliability, fault accommodation.