National Aeronautics and Space Administration

HEATheR

HIGH-EFFICIENCY ELECTRIFIED AIRCRAFT THERMAL RESEARCH

PROBLEM: Aircraft thermal management systems are heavy and cause drag if used to cool MW level electrical systems required for aircraft propulsion

Air taxies and <9 passenger planes
1 MW power, 200 kW

50 passenger short-haul hybrid and 150 passenger partial turboelectric:
3 MW power, 600 kW heat

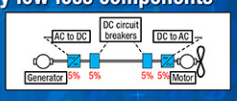
150 passenger single-aisle full turboelectric:
30 MW power, 6 MW heat

PROPOSED SOLUTION

Less Heat

Build a power system with four times lower losses
- Eliminate half of the conversion steps and associated components, losses components, and complexity
- Make extremely low loss components

State of the art



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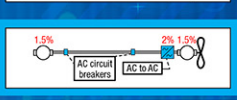
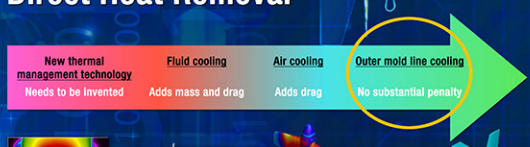
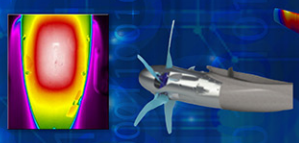
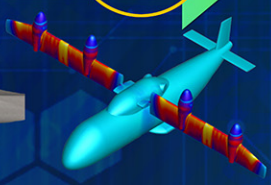


Direct Heat Removal



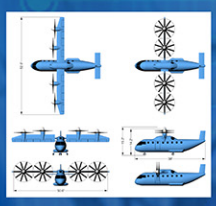




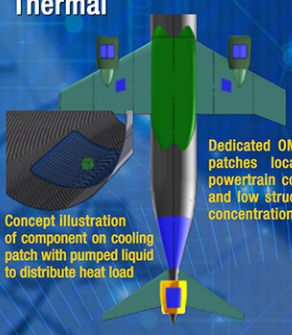
FEASIBILITY DETERMINATION WORK

Analysis

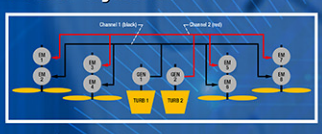
Aircraft Level



Thermal



Power System



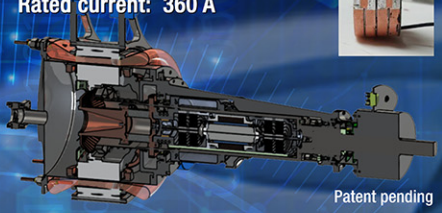
Computational Fluid Dynamics (CFD)

Hardware Prototypes

High-Efficiency Megawatt Motor

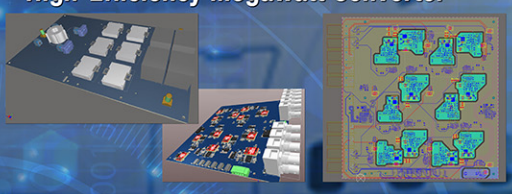
Key Parameters

Type: Wound field synchronous
Rated power: 1.4 MW (1875 HP)
Rated speed: 6,800 rpm
Rated voltage: 1,200 V
Rated current: 360 A



Patent pending

High-Efficiency Megawatt Converter



TEAM

NASA

- Propulsion and power models
- Component feasibility demonstration

- Fixed-wing aircraft models

- Thermal modeling

- VTOL aircraft modeling
- CFD to determine heat limits

INDUSTRY

Aurora FLIGHT SCIENCES, A BOEING COMPANY
- Assess HEATheR for lightning strike

United Technologies
- Thermal management recommendations and modeling

Parker Aerospace
- Motor high-altitude operation, certifiability, and manufacturability

CONVERGENT AERONAUTICS SOLUTIONS

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