Thermal Management Ideas and Challenges

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Thermal Management Panel- Challenges and Opportunities
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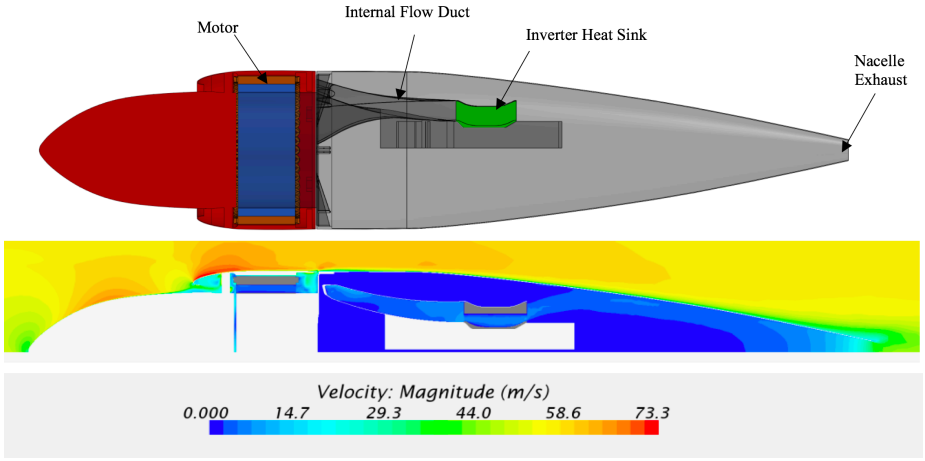
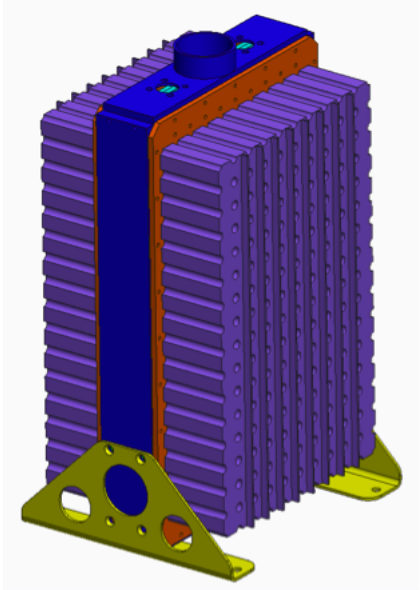
Challenge: Current electrified aircraft concepts produce large amounts of **low-grade waste heat** and require **large, heavy thermal management systems** that cause **drag**.

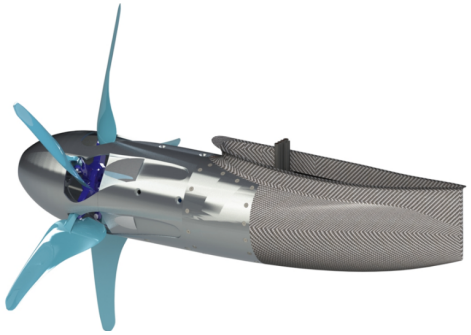
X-57 takes a Passive Thermal Management (TM) Approach

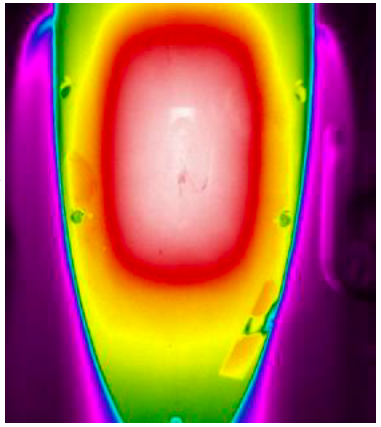


Internal flow cooling



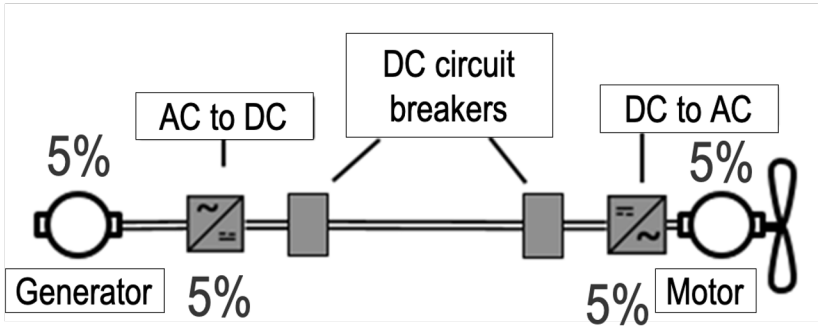
Thermal Soak

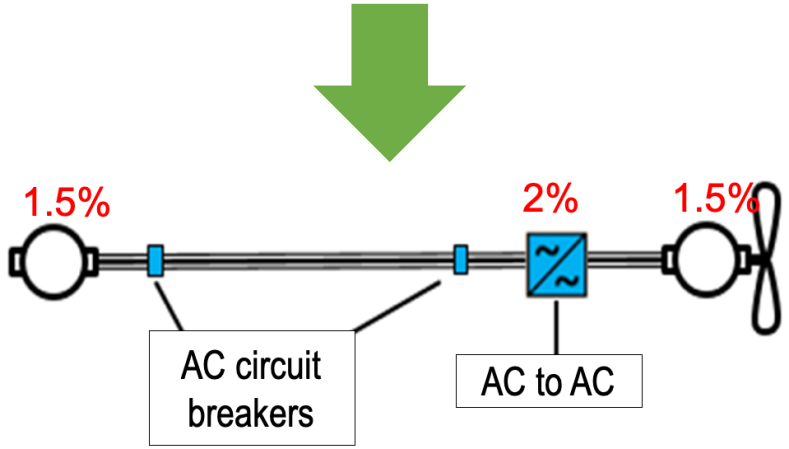


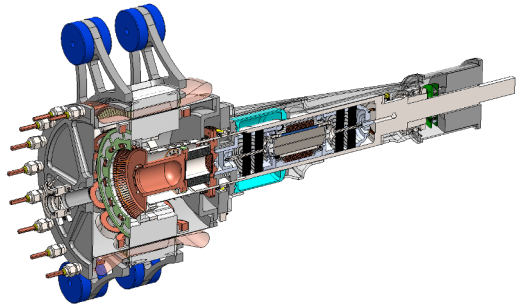


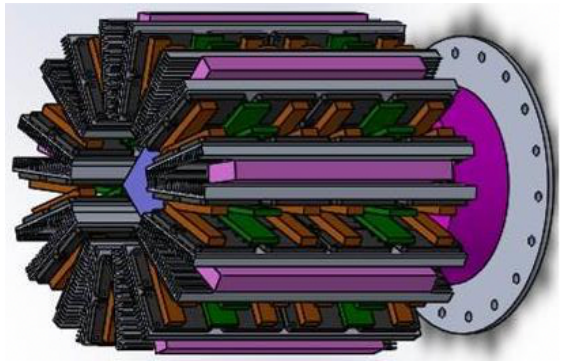
Outer Mold Line (OML) Cooling

High-efficiency Electric Aircraft Research (HEATheR) TM Approach: lower losses









High Efficiency Megawatt Motor (HEMM):

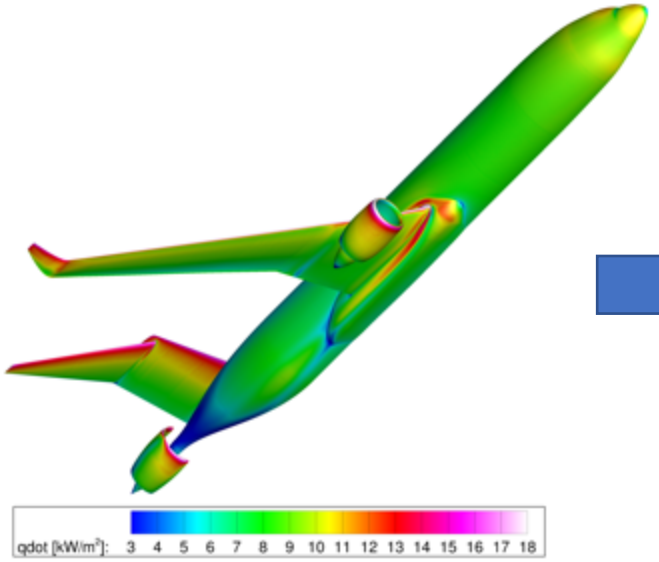
- 98.5% efficient
- 16 kW/kg
- Superconducting DC rotor
- Slotless stator
- Rotating cryocooler

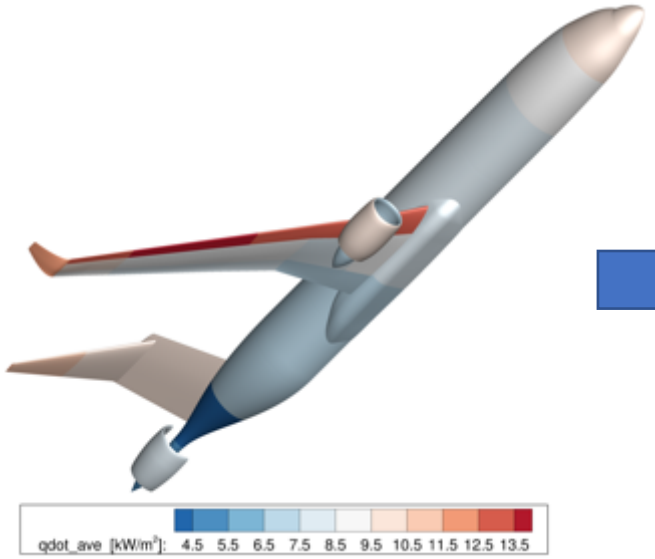
AC-AC Converter

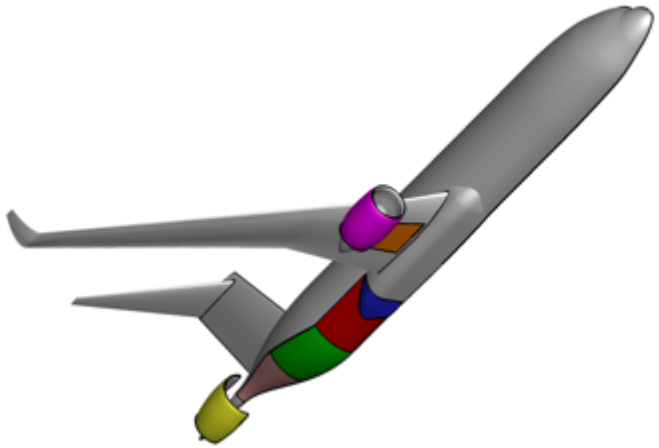
- 99% efficient
- 10 kW/kg
- DC-link architecture
- Interleaving
- Multilevel topology

High-efficiency Electric Aircraft Research (HEATheR) TM Approach: OML cooling

Idea is to use the existing aircraft skin area to reject waste heat







1. Estimate Heat Transfer

2. Identify areas with high heat rejection

2. Identify patches that have heat transfer capabilities and close proximity to components

Thank you!

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