Electric Aircraft Power Systems: Design and Testing of an Efficient Inverter

Craig Weeks · Oregon State University · Summer 2020

Mentor: Dr. David Avanesian

Overview

- Design mechanical packaging for a new 250 kW AC inverter
- Continuation of the 72 kW HEATheR electric aircraft test hardware project from Spring, 2020

Four commercial inverters installed at NEAT

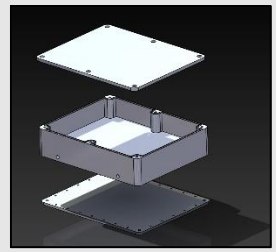
- Requirements
  - Power efficiency goal: >99.5%
  - Capable of interfacing with the Nasa Electric Aircraft Testbed (NEAT)
  - Hermetically Sealed to simulate altitudes of up to 40,000 ft
  - Power-to-weight-ratio: >20 kW/kg

Thermal/Connectors

- Previous analysis by colleagues revealed substantial cooling margins when operating with existing NEAT Coolers
- ORB-10 connectors integrated into coolant channel wall

Mechanical

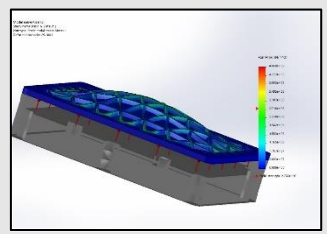
- 6061 Aluminum chosen for prototyping
- Double pocket design for ease of machining water-cooling channels
- Sealed with Face Seal O-rings compressed by 6 x M10 bolts.



Mechanical design concept

Strength Analysis

- Original flat 10mm thick lid took away too much of the mass budget.
- Redesign with external isogrid to limit deflection and save weight.
- Deflection under pressure load reduced to 1.8mm.



Exaggerated deformation of packaging under 50 PSIG coolant pressure

Next Steps

- Electrical component design to be completed Fall 2020
- Expected to be manufactured at Glenn Research Center in Winter 2021
- Targeting Summer 2021 testing of components at NEAT (Sandusky, OH)
- Important benchmark scaling up to larger 1.4 MW scale inverters to be used in future hybrid-electric single-aisle passenger aircraft.

Acknowledgments

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