Design & Validation of Optimal Forced Air Heat Sink - Team 19

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Summary

Electronics cooling is an essential part of any electrical circuit in order for it to function properly. Team 19 will adhere to the engineering design process in order to determine the major and minor variables in constructing the optimal heat sink design. The main goal is to develop the most lightweight heat sink design possible which will cool a control panel on board of a UAV developed by Unison Industries.

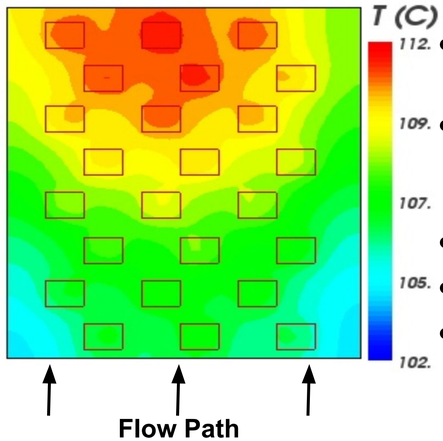
Background

- **Unison Industries has tasked team 19 with developing a forced air, lightweight heat sink that must be able to dissipate 300W of heat and maintain a temperature of 135°C max (preferably lower).**
- **A full-bridge rectifier, which changes AC to DC, is our heat source. It is necessary to cool this device, as overheating results in electrical failure for the aircraft.**

Objectives

- **Design and construct a Heatsink to keep the aircraft's circuitry below an operating temperature of 135°C**
- **Lightweight**
- **Physically small in size**
- **Remove Heat**
- **Minimize use of our $2000 budget**
- **Efficiently organize 24 Semiconductors in sets divisible by 3**

Chip Arrangement



- **Chips arranged in sets divisible by 3**
- **Heat concentrated near back of heat sink due to distance away from fan**
- **Chip dimensions: 20x15 mm**
- **Each chip is 12.5W**
- **Board dimensions: 8.5x7.25 in**

Figure 1: FEA results of our chosen chip arrangement.

Experimental Setup

- **Ohmic heating will be used to simulate heat dissipation on the heat sink for experimental testing.**
- **Resistors will be attached to the bottom of the heat sink.**
- **A FLIR Thermal Imaging Camera will be utilized to prove FEA results.**

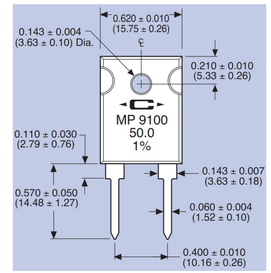
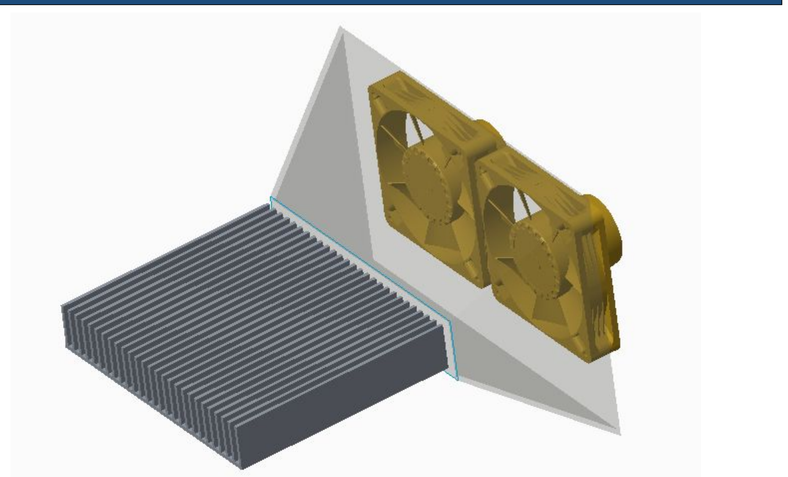


Figure 2: The resistors that will be used for testing.

Design



Future Work

- **FEA Analysis**
  - **Model heat sink in an FEA heat transfer software to give expected results for prototype testing**
- **Prototype Construction**
  - **Machine heatsink and fan shaft**
  - **Order fan**
- **Prototype Testing**
  - **Chip Arrangement and Fan Selection**
  - **FInalize Dimensions**

Acknowledgments

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