

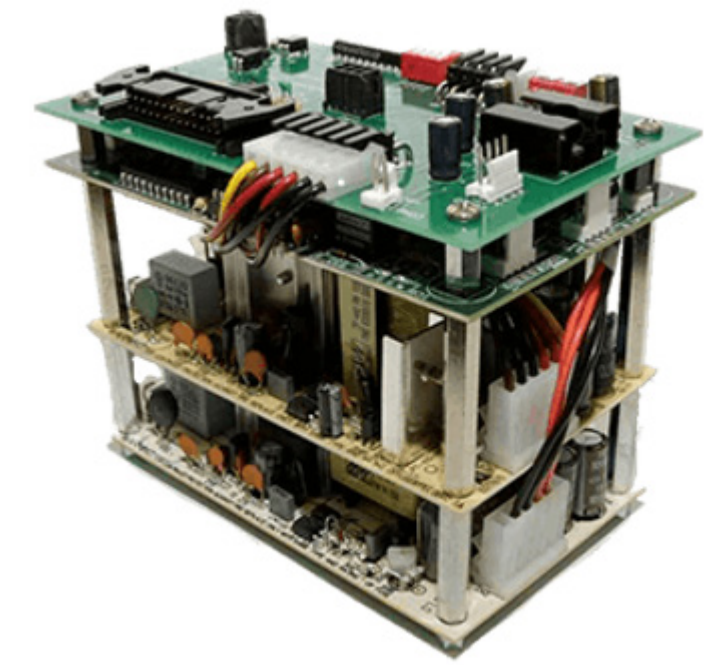
Laterally Constrained Thermal & Mechanical Integrity Challenge

Project Description:

TTM Technologies has tasked our team with designing a vertically stacked set of printed circuit boards capable of withstanding extreme temperatures, altitudes, and aircraft-induced vibrations and shock. We will conduct finite element analysis (FEA) to simulate environmental loading conditions and validate design integrity. In addition, we will evaluate competitor materials and configurations to improve upon previously tested solutions that comply with relevant aerospace standards.

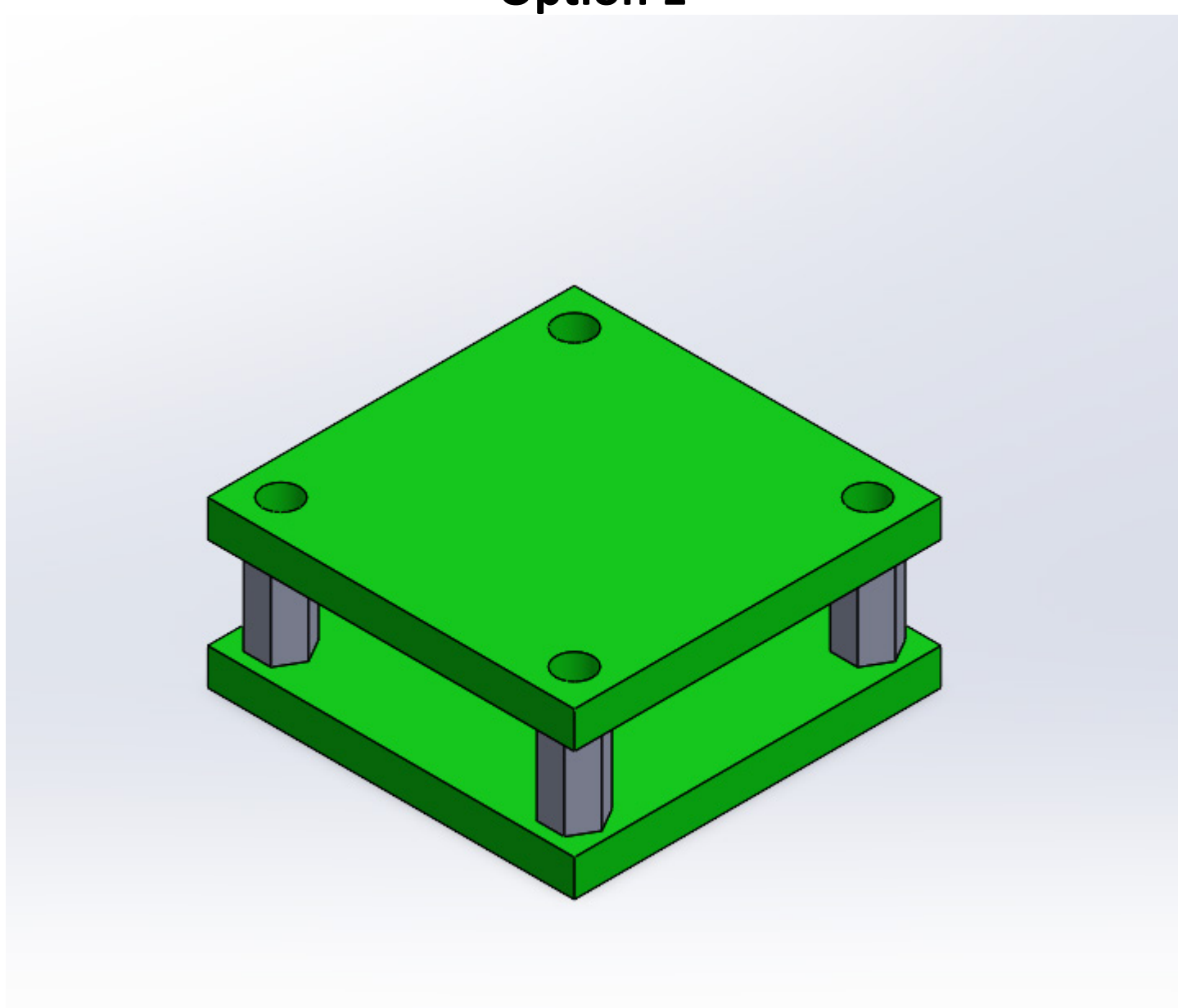
Existing Process:

TTM Tech. provided us with the image on the right of a previous design they had modeled. We are tasked to make this design more compact with the requested dimensions of 10 stacked PCBs all 1inch by 1inch with varying lengths between PCBs

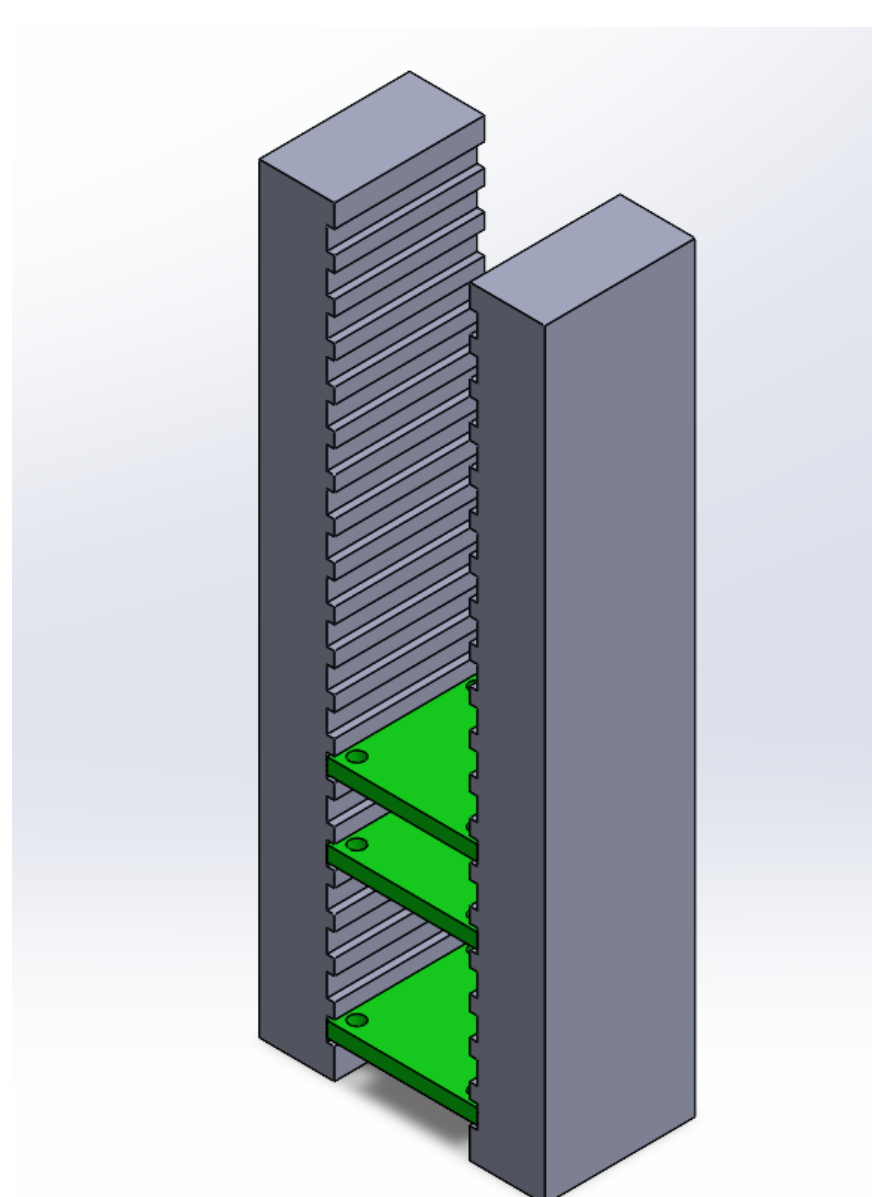


Design Options

Option 1



Option 2



Aircraft Standards and Design Solutions

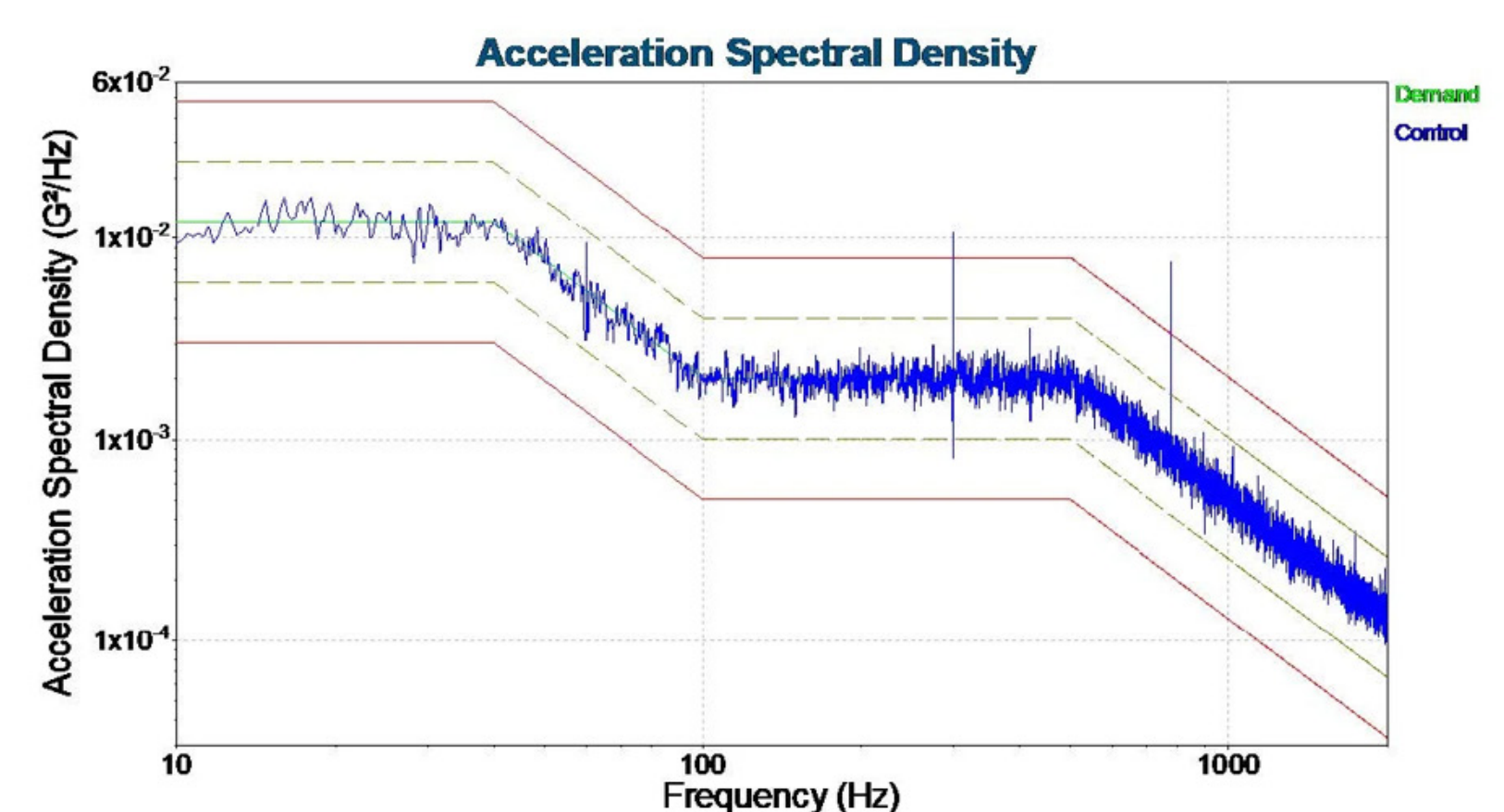
TTM Technologies has directed us to design in accordance with RTCA DO-160, the standard for evaluating the environmental performance of airborne electronic equipment

Operating Temperatures:

The system must withstand operating temperatures from -55°C to 70°C and survive ground conditions up to 85°C . We are evaluating passive cooling strategies, including integrated heat sinks and refrigerant-based cooling plates, based on feedback indicating that forced convection (e.g., fans) is not preferred for this application.

Vibrations and Shock:

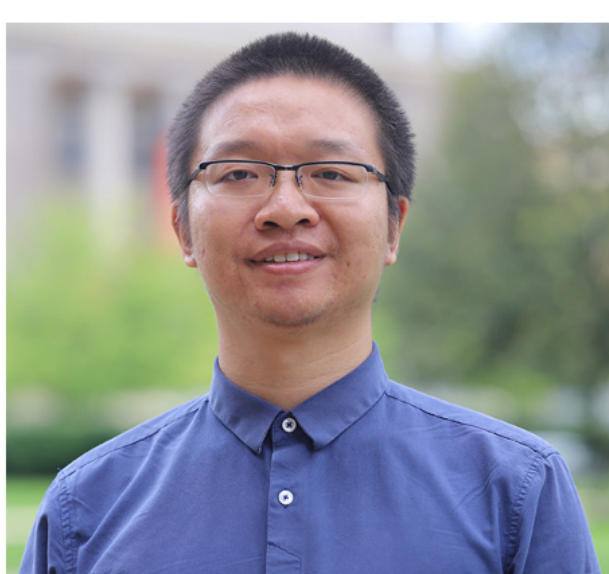
Structural performance will be evaluated under a range of frequencies representative of engine and turbulence-induced vibrations. The acceleration spectral density curve shown below defines the allowable vibration range. Our design must remain within the limits indicated by the green boundaries and avoid resonance peaks that could amplify responses. FEA simulations will guide material and dimensional modifications to eliminate resonance frequencies that could compromise structural reliability.



We will perform FEA on our designs and make changes accordingly(Dimensions or Material) so there will be no resonance frequency's that could excite the product and lead to failure.

Semester Deliverables:

1. Complete final design concepts and get approval from TTM to start testing
2. Run Thermal and Vibrations tests in SOLIDWORKS, Tweak and Improve the Design until it passes the FEA tests
3. Create a 3D Printed Model of the housing and put real printed circuit boards without electronic components.



Faculty Mentor: Dr. Luo



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