

Project Name CubeSat Inflatable Heat Shield

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CubeSats are a cost effective and simpler way to operate in space, but they are not capable of surviving atmospheric re-entry. Introducing this capability can provide many opportunities to CubeSats such as returning material and samples from space, reducing space debris, and even interplanetary exploration missions. The CubeSat Inflatable Heat Shield team is currently developing a heat shield for a 6U CubeSat, with the system constricted to a 2U section. The heat shield is inflatable, and will be able to expand out for its mission operations. Inflatable tubing is comprised of a Kevlar-Kapton-Kevlar composite, held together using Kevlar strapping. The tubes will be deployed using a telescoping poll and inflated with Nitrogen. The Thermal Protection System (TPS) protects the CubeSat from heat flux generated during re-entry. The outer fabrics of the TPS are Nextel 440, which act against convective heating on the surface of the heat shield. The TPS's insulator is Pyrogel 3350, keeping temperatures safe behind the shield. Analysis and testing was conducted on the materials to determine their viability for the heat shield design. ANSYS modeling showed the heat transfer across different layups of the material. This was then followed by using a 2.2kW CO2 laser to apply heat flux onto the layups. This provided verification of material properties, and supported the ANSYS modeling results. Further analysis into this design will be conducted both thermally and structurally, with hopes of acquiring funding to test fly the design, and eventually implement it into the CubeSat market.

