

Team 24 Vacuum Protection of Electronics

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Background

- Limitations of current harsh environment electronics:
 - Self heating in an insulated package limits processor power and speed
 - Protection from external heat also implies reduced heat dissipation potential
 - Conventional insulation technologies can provide heat conduction path
 - Use of Vacuum significantly reduces heat conduction, convection
 - Packaging must protect against heat radiation

Problem Statement

Acquisition of data in harsh temperature environments such as downhole drilling for the oil and natural gas industries is difficult due to electronic component limitations at high temperatures.

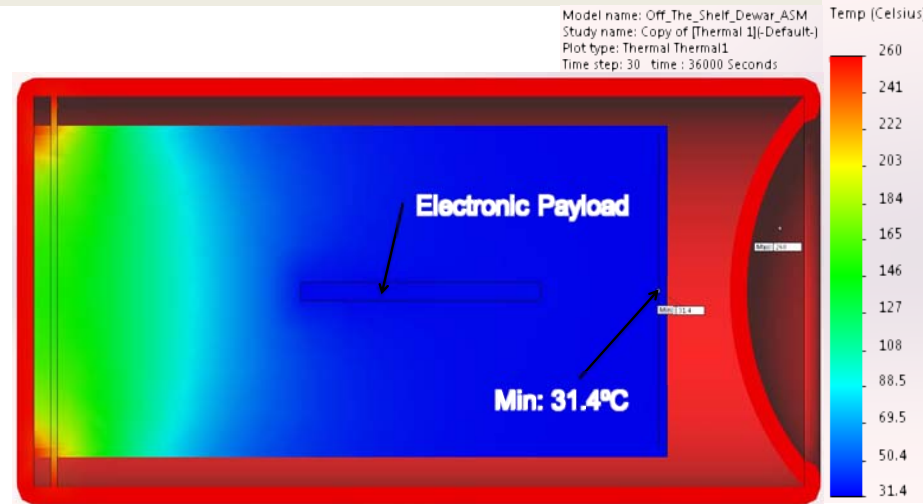
Conventional insulation technologies use materials with low thermal conductivity, although long term temperature exposure eventually heats up electronic payloads.

Objectives

- Explore the use of vacuum as an insulating medium for electronic payloads.
- Maintain internal components at or below 85°C
- Minimize size and weight as much as possible
- Provide a method to monitor and maintain vacuum insulation space

Thermal Simulation

- Simulates extended exposure to high temperature environments
- A 10 hour duration temperature exposure will be simulated
- As can be seen in diagram to the right, red indicates hottest temperature, while blue indicates coldest temperature



Potential Challenges and Risks

- Keeping internal temperature below 85°C
 - Whether heat generated from self heating will compromise integrity
- Minimizing heat transfer through conduction
 - Ensure that the data cables themselves do not generate any extra heat
 - Minimize heat conduction through cabling
- High temperature environments will compromise the outer shell of the vessel that holds the electronics

Future Work

- Test an off the shelf prototype
- Complete a 24 hour temperature test
- Adjust design for optimization

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