

# Thermal Exposure

Wireless Thermal Protection Sensor  
University of Idaho

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## Team

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## Background

Atmospheric entry environments are extremely difficult to analyze, so NASA Ames has a need for a wireless sensor system that can be integrated into the thermal protection system (TPS) of entry vehicles. The data gathered from such a system would be instrumental in developing a more accurate model of the conditions faced during atmospheric entry. The placement of sensors in the TPS of these vehicles is not widespread due to the weight and risk of so many wires. A wireless sensor system would remove the wiring complexities, thereby allowing a comprehensive sensor suite to be integrated into the TPS material.

## Project Objectives

- Multi-Nodal Wireless Architecture
- Multiple Sensors On Each Node
- Multiple Sensor Types on Each Node
- Integration With VAST Balloon Test
- Testing at NASA Ames X-Jet Facility

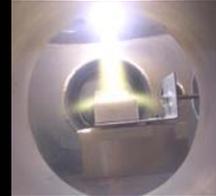
## VAST

Flight readiness testing was conducted aboard the VAST program's high altitude balloon.



## X-Jet

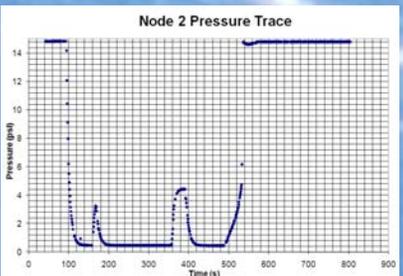
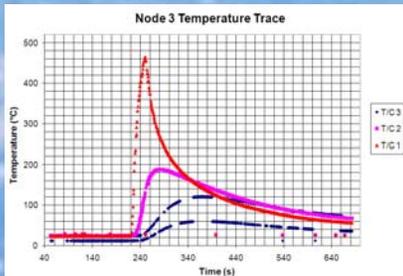
- Plasma Torch inside a vacuum chamber to simulate atmospheric entry
- Plasma torch can reach heat flux of 1000 W/cm<sup>2</sup>
- Used for initial TPS sensor validation and testing
- X-Jet is located at NASA Ames Research Center



## Circuit Board Packaging

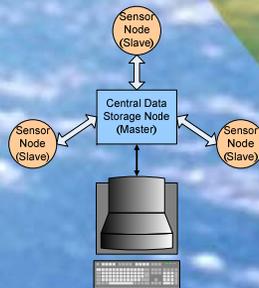


## X-Jet Results

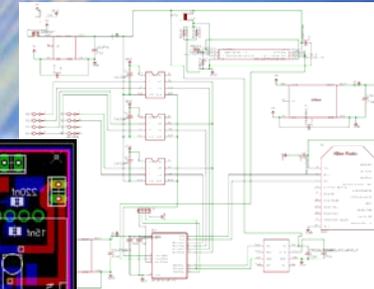


## Software Design

- Wireless Star Network Technology
- Master - Slave Polling Scheme
- Multiple Point Data Check
- Real-Time Data Monitoring
- Data Download
- TCP/IP Interface



## Hardware Design



There were two revisions of the printed circuit board over the last semester. The final revision is only 1.5 X 2 inches. It uses an Xbee chip to wirelessly transmit data collected by the 3 Cold Junction Correction chips, 1 Honeywell pressure sensor, and 1 Resistive Thermal Detector. A PIC microcontroller is used to control the system.

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