



# High Altitude Thermal Control

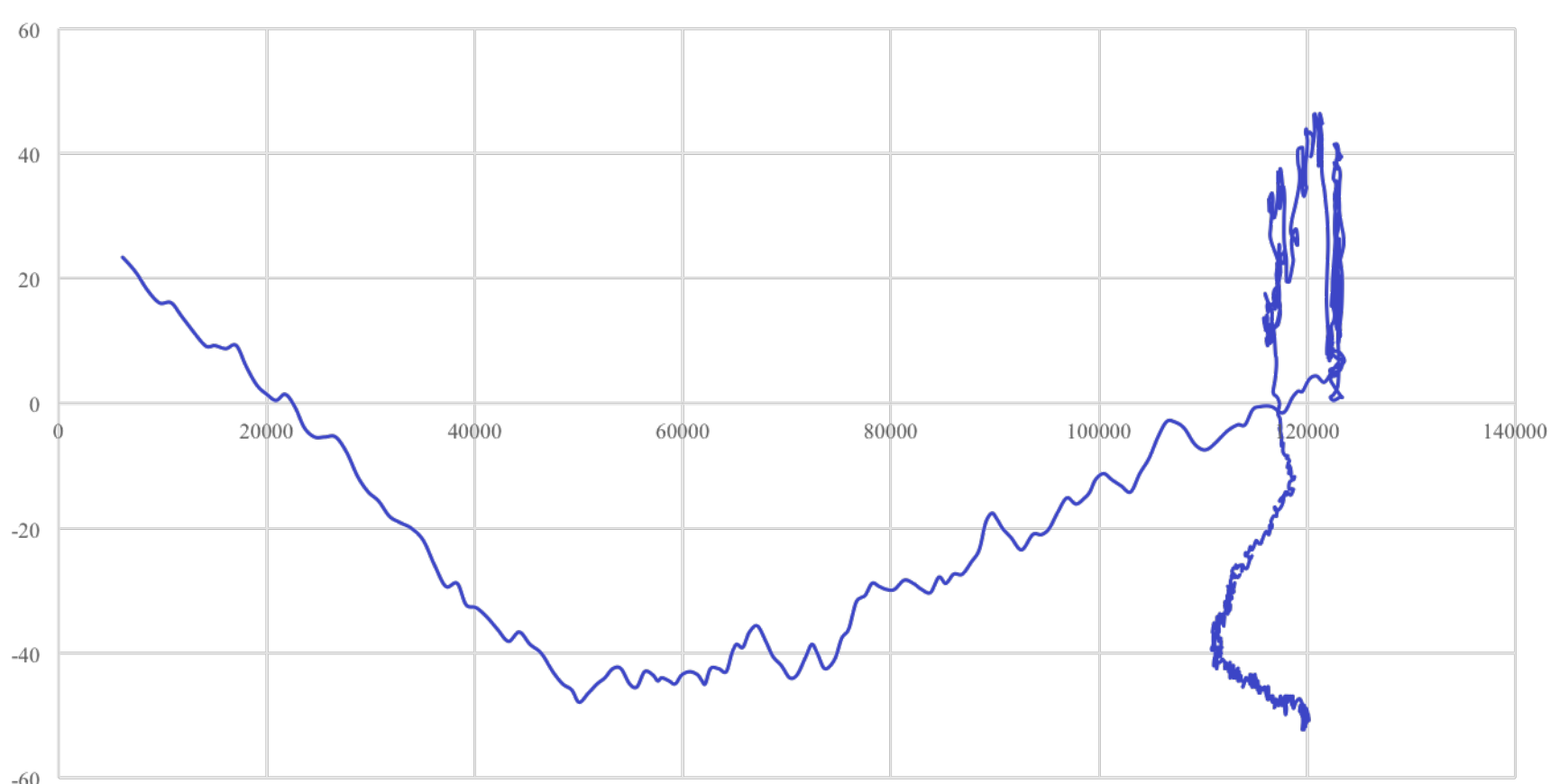
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## INTRODUCTION

On September 1, 2016, a high altitude student platform (HASP) was launched from NASA's Columbia Scientific Balloon Facility in Fort Sumner, New Mexico with 12 student payloads. The University of Bridgeport sent a robotic arm with three servo-motors and servo-motor testbed to the fringes of space. The objective was to test the motors at very low temperatures and in vacuum conditions. The payload has heaters and temperature sensors fitted on all its walls that can automatically respond to the thermal conditions to assure that the motors operate.

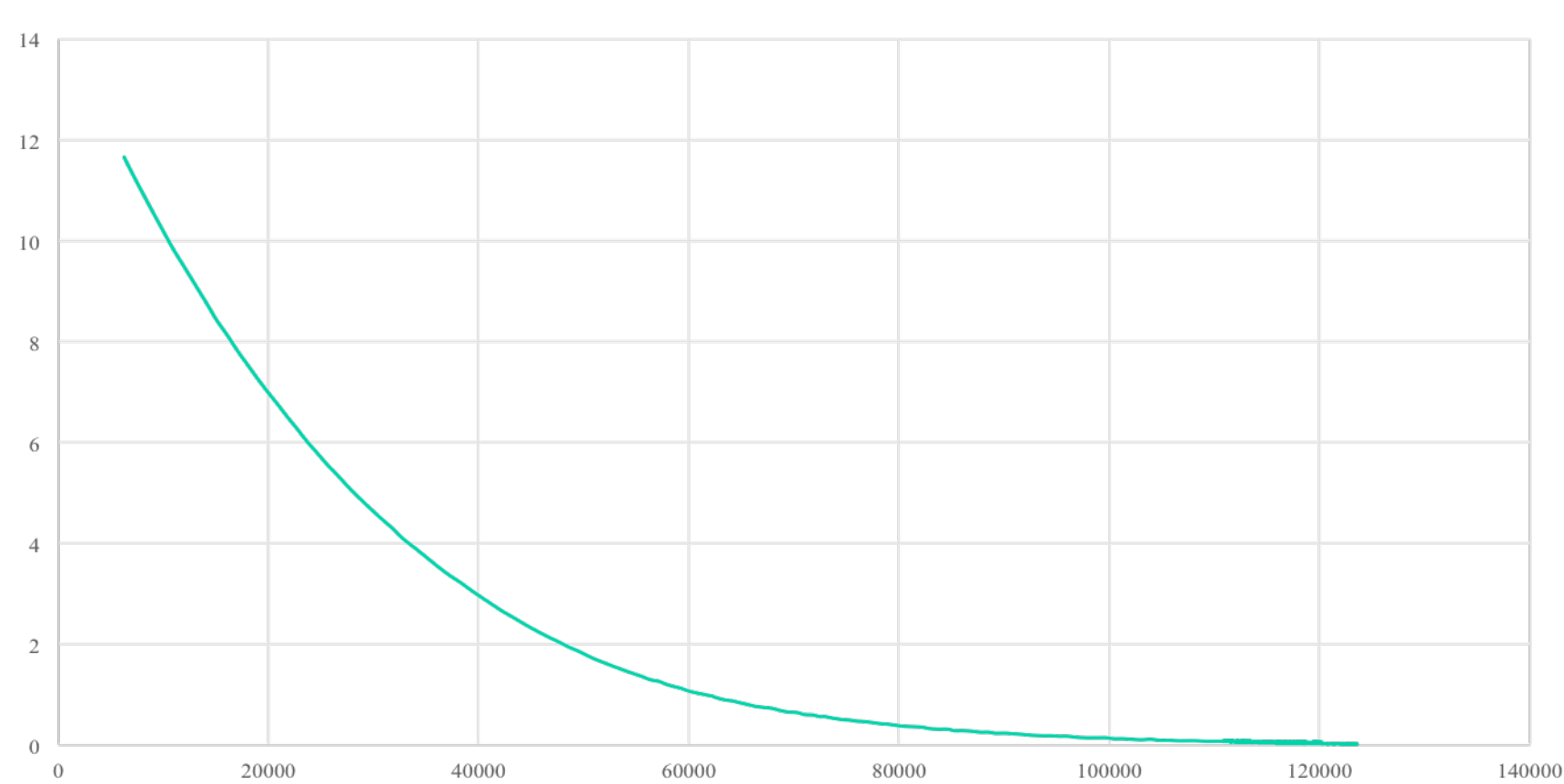
## DATA OBTAINED

Total mission time = 18hrs 26 min  
Maximum Altitude Reached = 120566 ft  
**Altitude vs Outside Temperature**



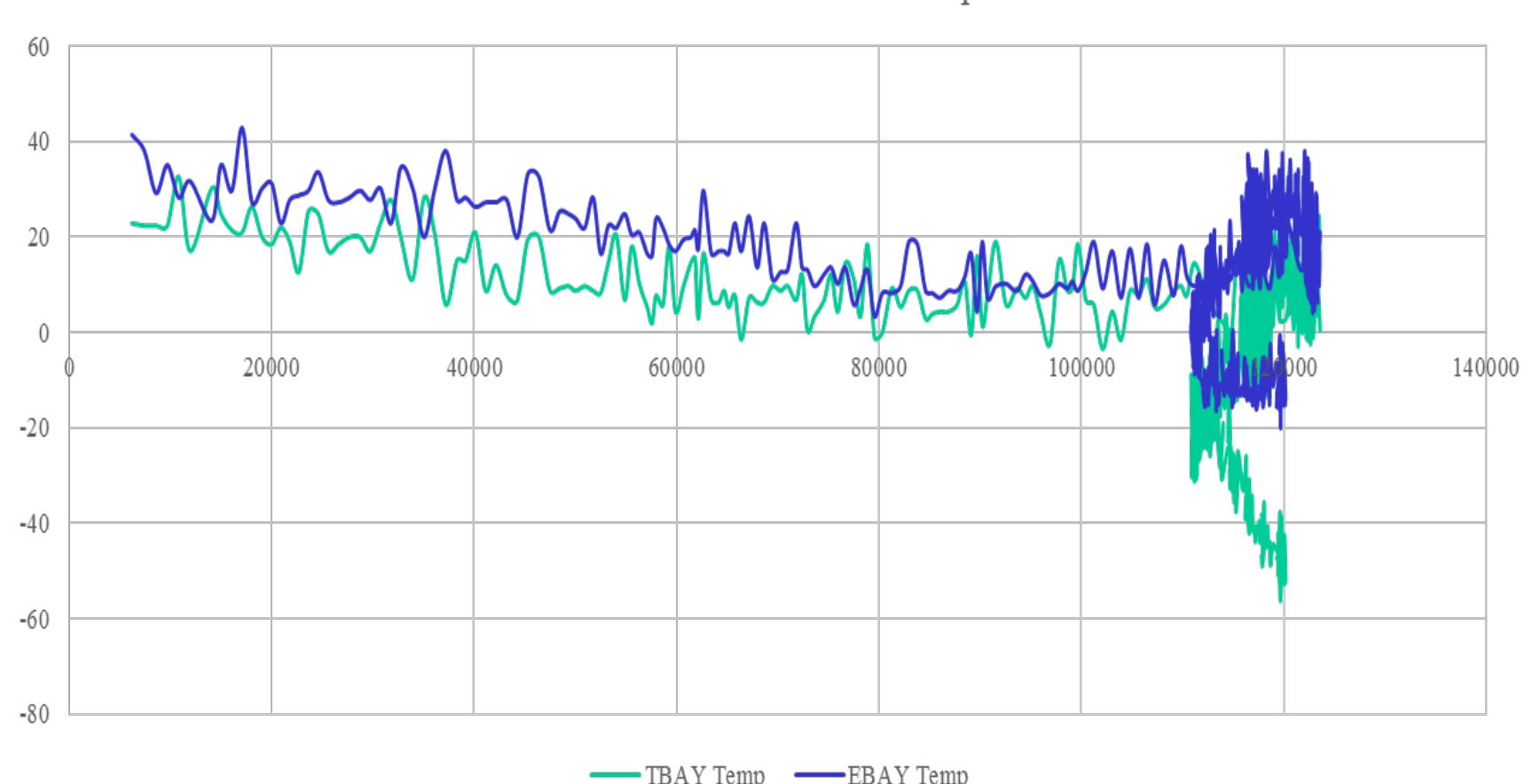
—OUTSIDE Temp

**Altitude vs Pressure(PSI)**



## HEATERS

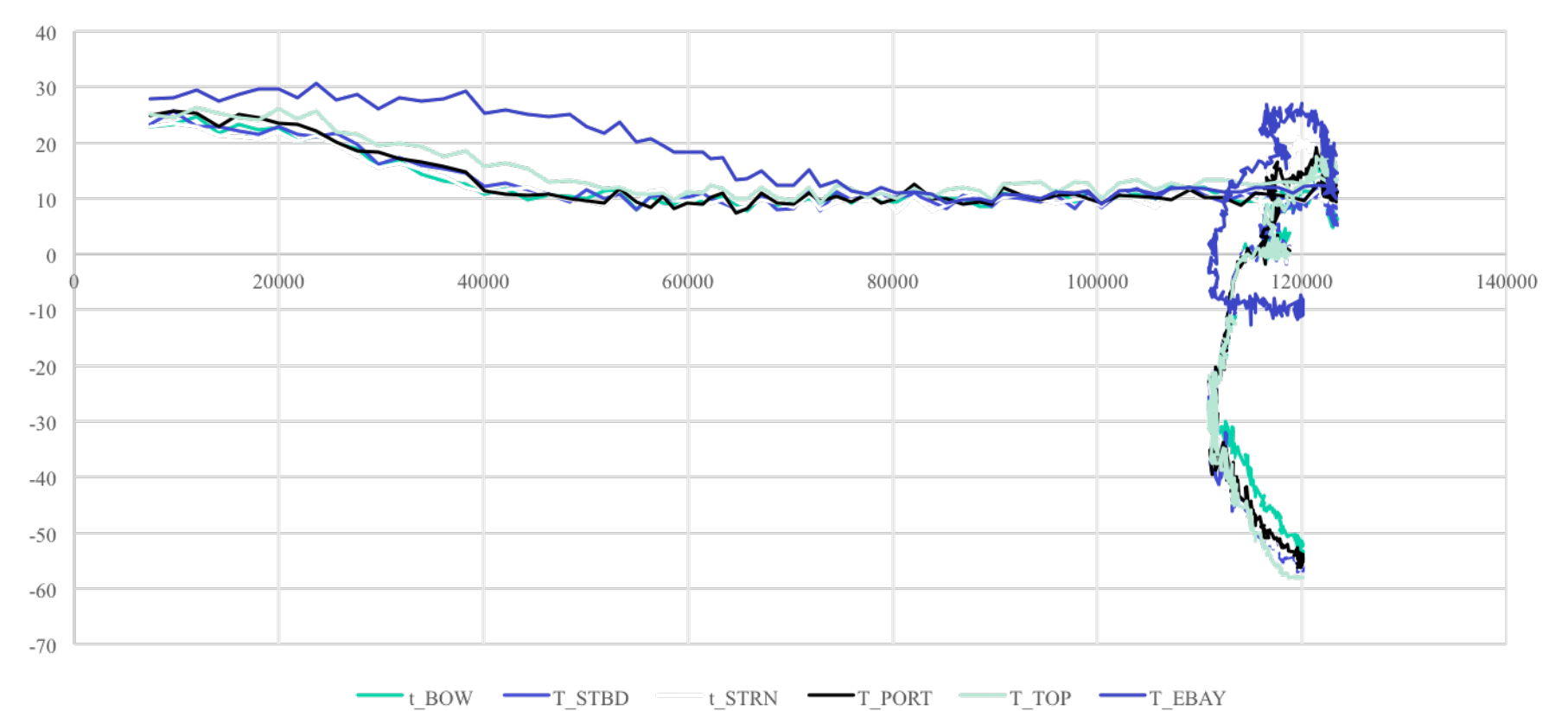
Altitude vs TBAY and EBAY Temperature



## HEATERS (CONTINUATION)

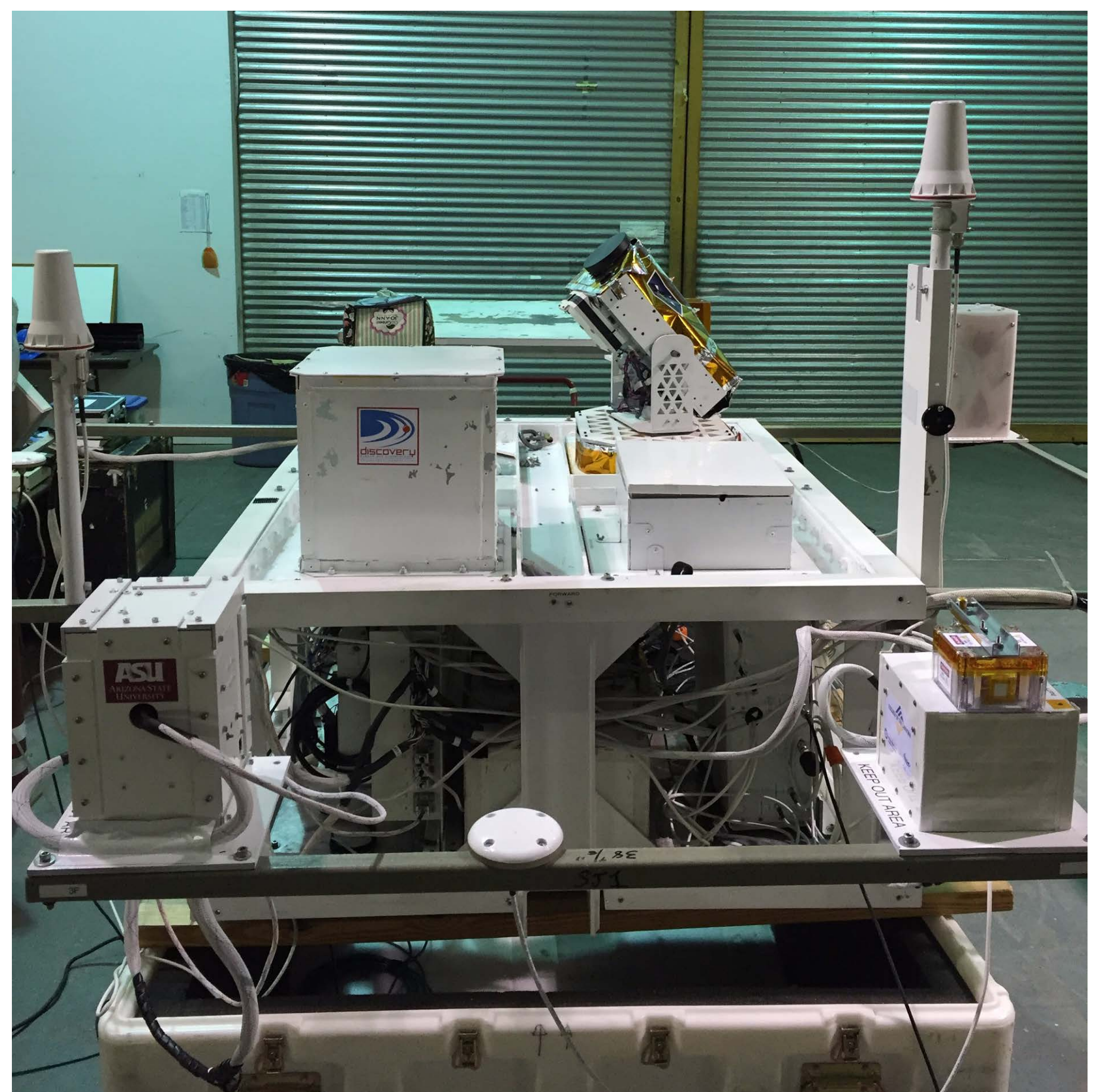
When the heaters are on

**Altitude vs Temperature ( Heaters On)**



Team members developed software and hardware that would automatically control the temperature of the inside of the payload's container. In a vacuum there is no heat transfer due to convection – there is no air to convect the heat. Thus heat transfer is primarily achieved by radiation (which is not very effective). A microcontroller was coded to automatically adjust the temperature, but commands could be uplinked during the flight to “manually” adjust the temperature.

## UB PAYLOAD ON HASP PREFLIGHT



## CONCLUSION

In this project data was collected every 12 minutes during the 18 hour flight. These information enabled us to review the functions of our servos and collect data about the pressure, and temperature at various altitudes. These results will help our UB Team to continue our future high altitude robotic puppet project. Subsequently our team has been awarded a second HASP flight for a prototype of an orbital satellite and has received over \$90,000 from NASA to continue the robotic arm project.