High Altitude Student Platform

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ABSTRACT

Our project focuses on the testing of critical components of the next phase of a high altitude robotic puppet that will be used on Near Space balloon missions to engage younger students (K- 6). The prototype robotic puppet has been under the development at the University of Bridgeport (UB) supported by a Connecticut Space Grant College Consortium (CSGCC).

INTRODUCTION

The purpose of this flight was to test hobby grade electronics and servo motors in a Near Space environment (near vacuum and -70^{o}F). There were seven servo-motors of different sizes and manufacturers. These servos were activated, measuring the speed of movement and energy required. There was concern that lubricant could leak or freeze or that the servo-motor gear boxes could rupture in the vacuum of Near Space.

This testbed examined the effect of low temperature on the servos, and to determine at what point (temperature and vacuum) they might fail. The flight also tested an Arduino Mega 2560 processor, a Byonics high-altitude GPS, an Adafruit 16-channel 12-bit PWM driver board, and analog and digital temperature sensors.

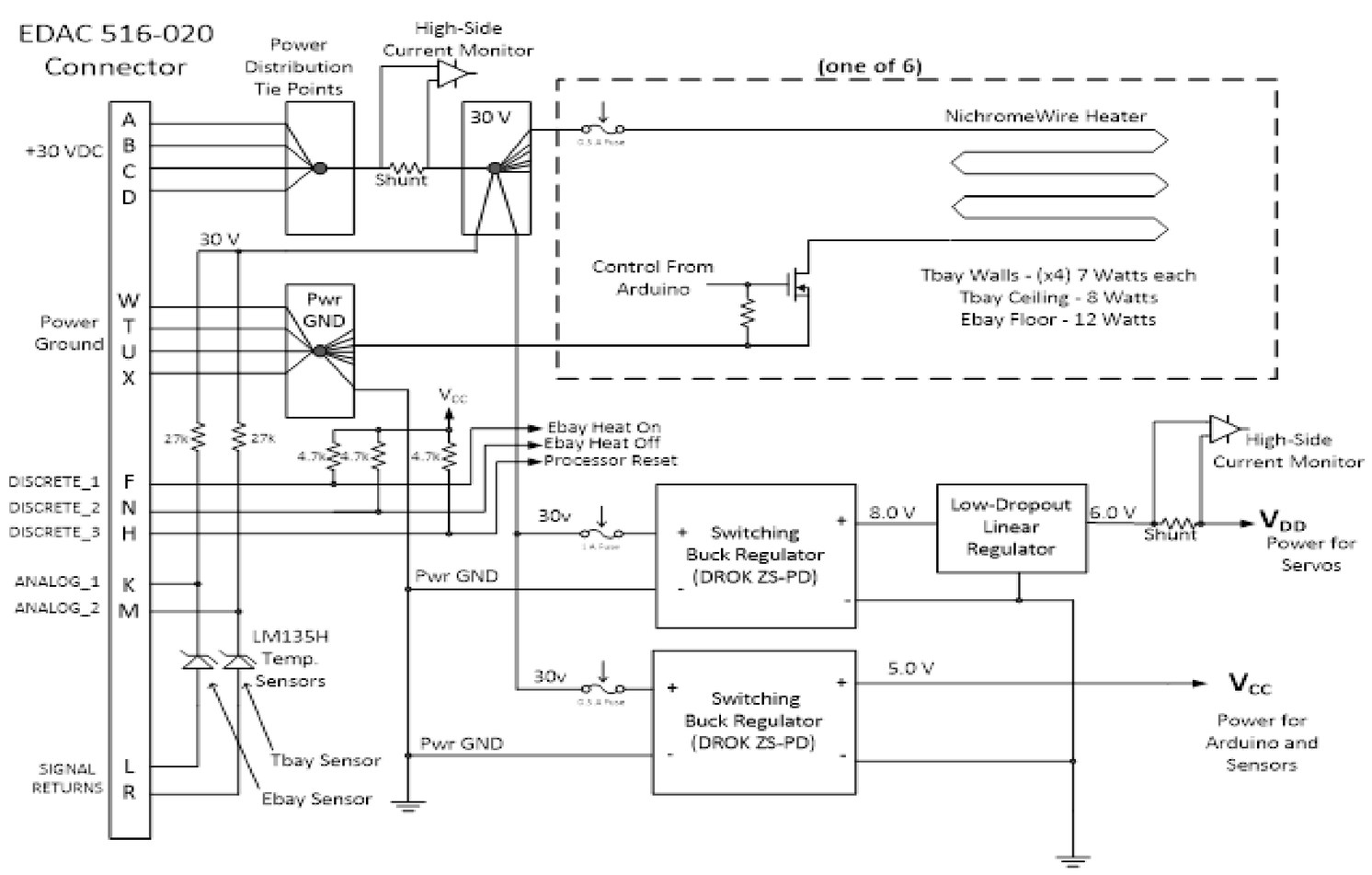
The inside of the flight package contained nichrome wire heaters, and part of the experiment was to determine how much energy is needed to maintain a variety of temperatures.

Servos are tested one at a time, once per minute. Each servo is commanded to its maximum position, and as it moves the current it uses from the 6V supply is measure 100 times per second until it stops after about 0.5 seconds. Commands were developed to operate and control the servos function well at the low temperature.

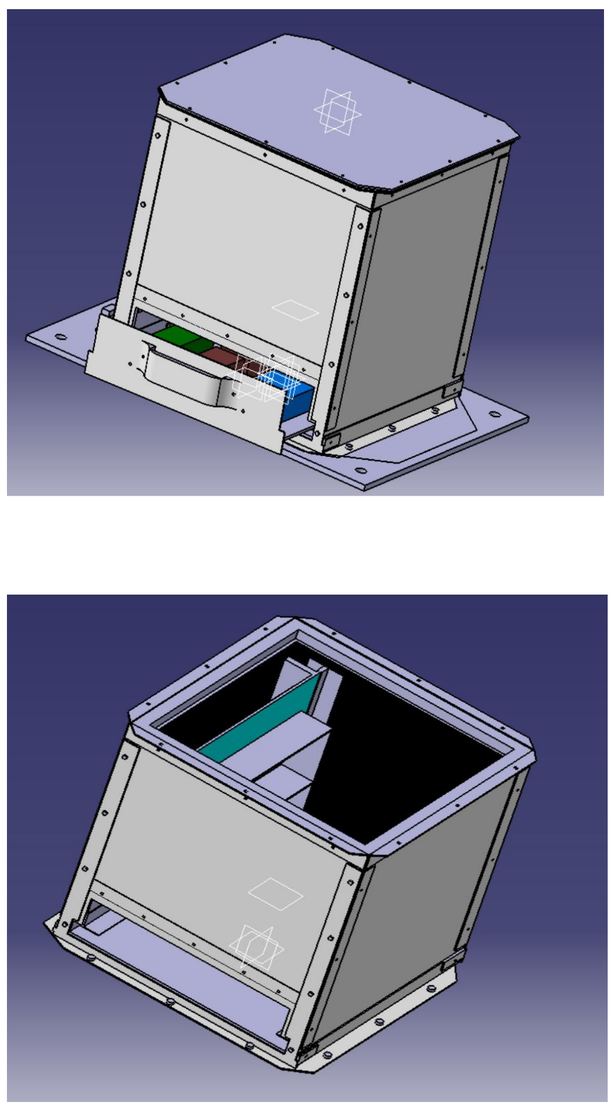
HASP 2016 FLIGHT INFO

Flight number: 670n
Launch time: 9/1/2016 16:08 utc (10:08 mdt)
Launch location: 34.473162n 104.242232w
(Fort Summer, New Mexico)
Float start: 9/1/2016 18:32:34 utc
Termination: /2/2016 9:41:28 utc
Float time :15h:08m:54s
Impact: 9/2/2016 10:27:05 utc
Impact location: 34.41n 112.78w
(Prescott National Forest – north of Phoenix, AZ)

POWER DISTRIBUTION



PAYLOAD 3D MODEL



HASP LAUNCH (CONTINUATION)

The flight itself lasted from 12:08 PM on September 1 to 6:27 AM on September 2. Mission Control was operated in a computer room at University of Bridgeport. The test was a success!

HASP LAUNCH

The High Altitude Student Payload (HASP), a joint project between NASA and Louisiana Space Grant, was launched from Fort Sumner, New Mexico with 12 university payloads in its gondola. Once the balloon had launched into Near Space, with payloads in tow, the UB HASP team took turns monitoring the status of the capsule and operating controls, checking transmitted data and ensuring that the servo-motors inside operated throughout the flight.

CONCLUSION

Our HASP flight was successful. We determined which motors operated best at very low temperature and near vacuum conditions. The robotic arm tested is the prototype for our future high altitude robotic puppet project. The future robotic puppet will interact with young students during high altitude balloon flights. UB has subsequently received approximately $93,000 from NASA to continue the project.

Thank you to NASA Connecticut Space Grant. Louisiana Space Grant and NASA for their support.