

# Cold Test

Friday 12 February 2010

I would like to thank everyone on the high altitude balloon team for making this test possible. With a very big thank you for our volunteers: Bruce, Steve O, Steve M, Christian, Eric, Emily, and Kyle. Without you guys would have never made it this far.

We have the results from Friday's cold test. The cold chamber is currently setup in two stages. There is a small Styrofoam that keeps the LN<sub>2</sub>. There is a fan that circulates the air inside of this cooler. This small cooler is connected to a larger 28"x28"x10" wooden box. This wooden box is insulated by two inches of Styrofoam on every surface. Within the box there is a moveable Styrofoam wall that acts as a barrier between the "warm" side and the "cool" side. There is currently a fan setup on the "cool" side of the box, and in the future there will be a fan setup on the "warm" side of the box. The NiChrome devices were setup on the "cold" side of the box in order to simulate the extreme cold of the upper atmosphere. All of the other electronics were setup on the "warm" side of the box. This was done to shield them from the extreme cold, as they will not experience this in flight. In figure 1 you can see the current setup of the cold chamber,

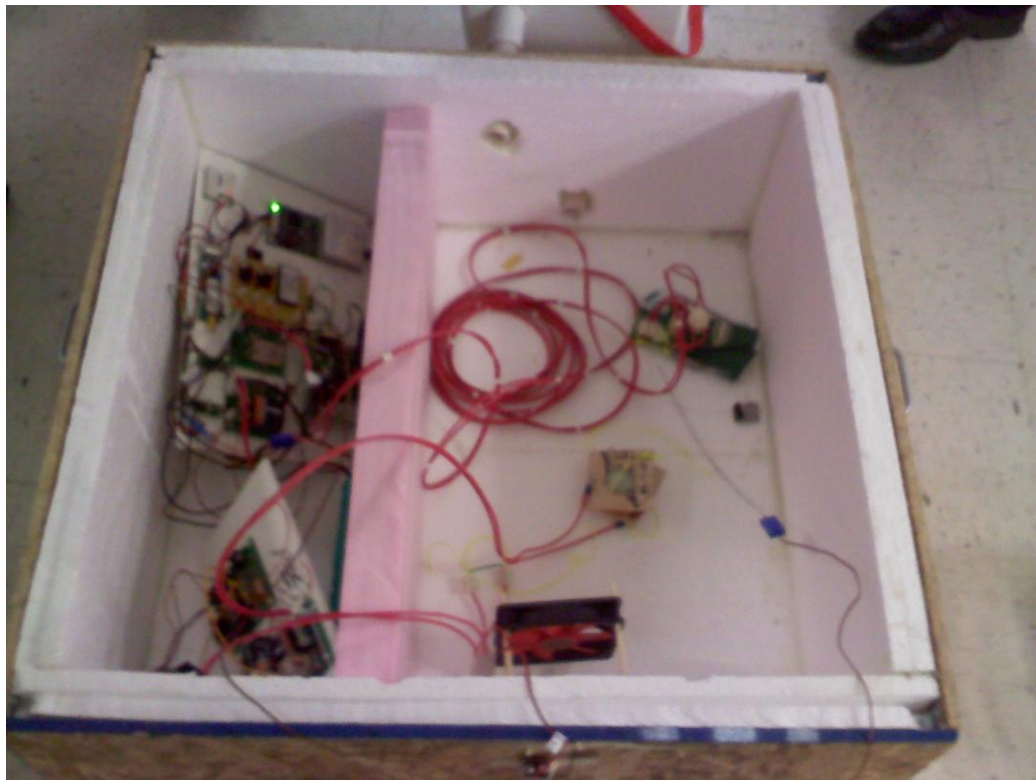


Figure 1, current setup of the cold chamber

It can be seen in figure 2 that there was a huge vertical temperature gradient in the "warm" side of the cold chamber,

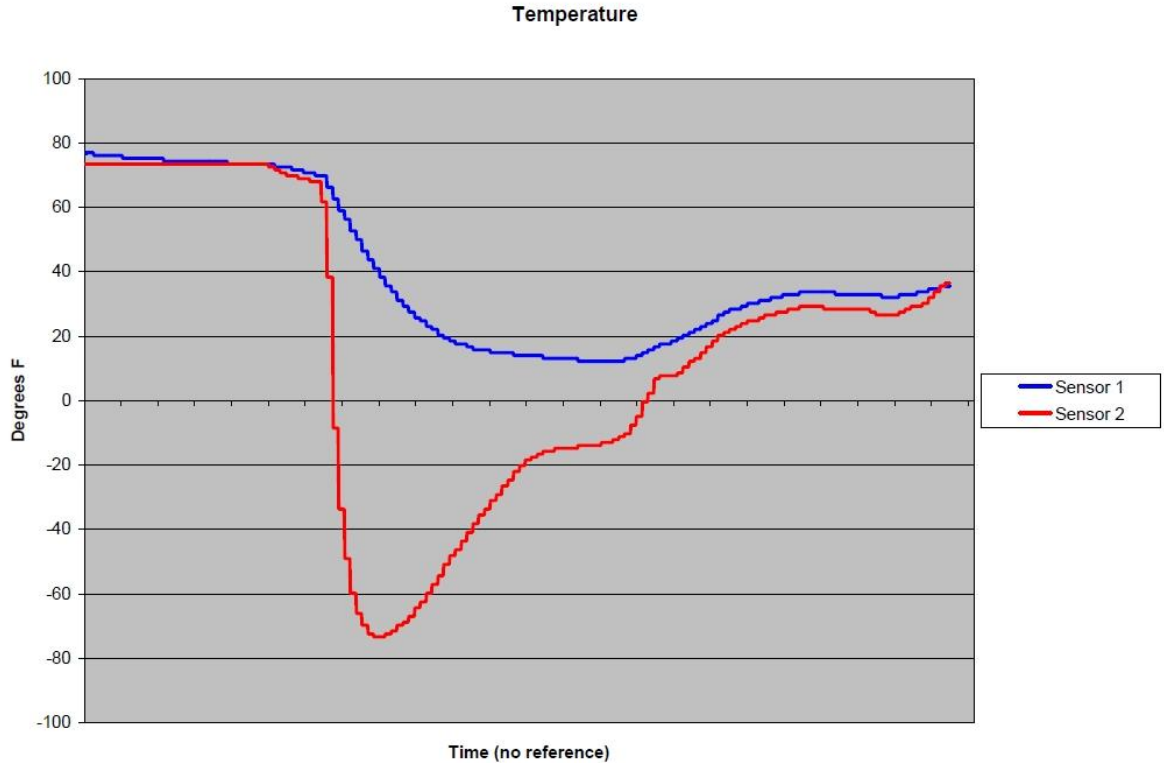


Figure 2, temperature on the "warm" side of the box vs time

The temperature sensors were on the same side of the dividing wall. The sensors had a vertical position difference of about 4 to 6 inches. This shows us that there is no circulation on that side of the dividing wall. This can be fixed by placing a fan on the "warm" side of the wall. This will be done by our next cold test, which is on Friday 19 February 2010. There will also be two or three holes in the side of the box in order to let cords run in and out. This will be done so we can better place our electronics into the box.

From figure 3 the voltage and current can be seen as a function of time. Over this time the temperature was dropping, which caused the voltage in the battery to drop as well.

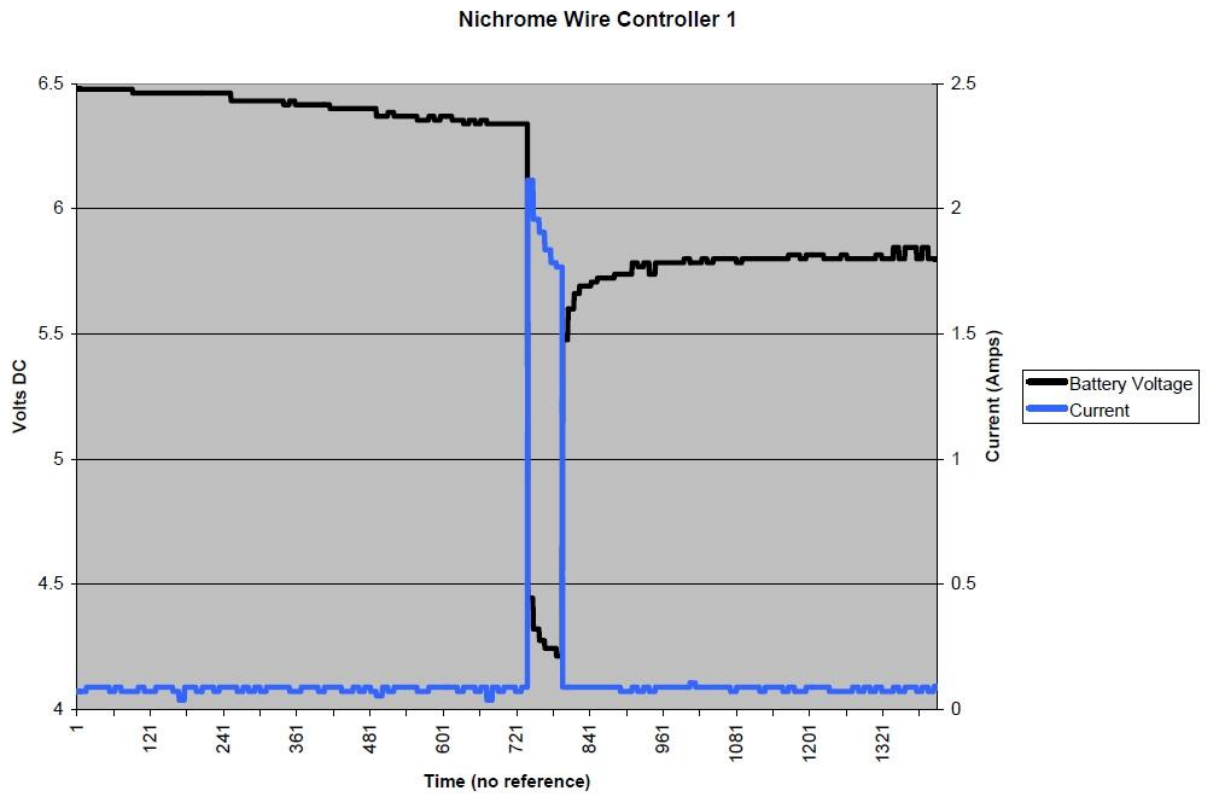


Figure 3, Voltage and current vs time

This shows us that we did not let our battery “cold soak” long enough. This can be seen by the voltage plot from the actual balloon launches. In the actual launch the battery got to be so cold that the voltage it put out before the NiChrome circuits opened was just below 6 volts which can be seen in figure 4,

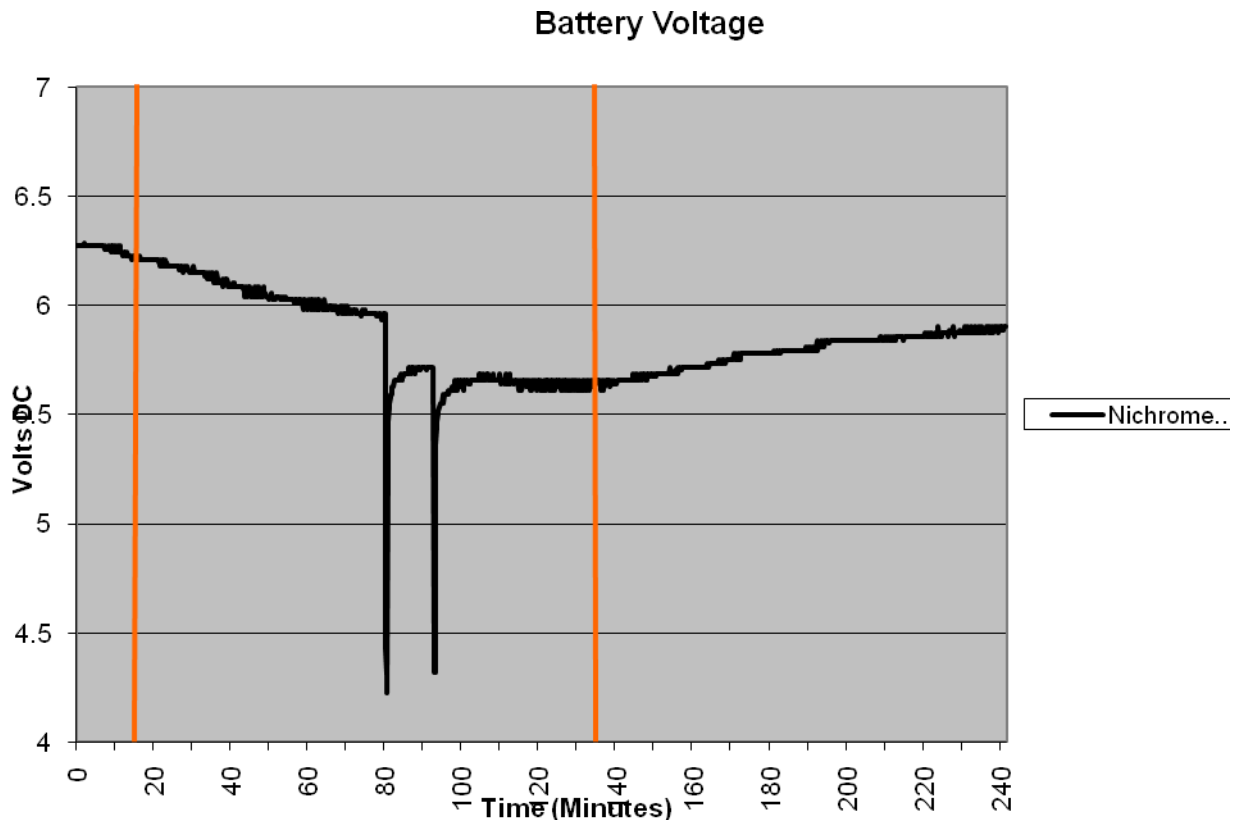


Figure 4, Voltage plot from flight 14

This can be fixed by increasing the circulation in the “warm” side of the box, and by letting the batteries “cold soak” longer.

As far as the NiChrome cut down devices are concerned, two of the three devices worked: Besa’s zero tension release, and Dr. Slater’s idea for a cut down release (the circle cutter). The heat shrink wrapped NiChrome coil did not cut the string, but it did manage to get it very warm. Further refinement of the heat shrink wrapped NiChrome will consist of making the NiChrome wire shorter, and therefore decreasing its resistance and increasing the current through it. From figure 3 it can be seen that the maximum current reached was about 2.1 amps. This gives us a temperature of between  $427^{\circ}\text{C}$  and  $538^{\circ}\text{C}$ . This should be enough heat to burn through the nylon cord.

As mentioned in the above report, the next cold test is scheduled for Friday 19 February 2010 at 13:30 hours. The objective of this cold test will be to keep the temperature more even on the “warm” side of the box for a longer period of time. We will be testing all of the same devices/equipment, plus the Iowa device.