



Making AND Breaking: How Reliable Are Some Water Pipes?

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Abstract

Three different types of pipes were tested to see at what point in altitude they would break. The purpose of the experiment was to test the reliability of the pipes by way of stress through expansion pressure created by the frozen water. It was predicted that the pipes would burst under the pressure provided by the frozen water that is caused by colder temperatures at that altitude.

Introduction

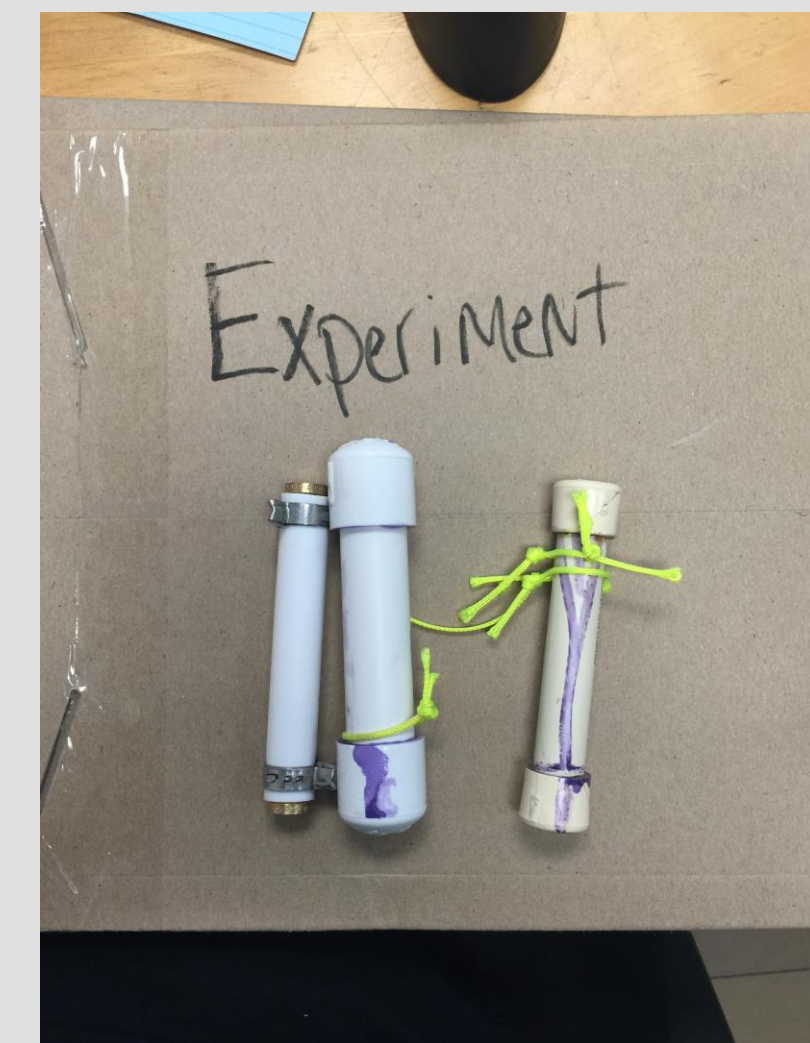
Hopkinsville Community College Balloon Satellite Team is a hand-picked group of students who join together to design experiments that have potential to be effected by near space. These experiments are then 100% student led and conducted. However, the team is not just designing experiments. The students are also responsible for assembling, launching, and tracking a weather balloon and tethered payload that carry the experiments into near space.

The weather balloon and payload can climb to an altitude of approximately 100,000 feet, where the temperature can reach approximately -50 degrees Celsius.

Materials & Methods

The pipes that were tested included PVC pipe, PEX pipe, and CPVC pipe and they were all 1/2 inch in diameter. They were filled with water to the maximum capacity and then closed with the appropriate caps. The pipes are not made to withstand temperatures that are predicted in near space.

A "ghost frame" was made from a Styrofoam box and holes were made to suspend the pipes with fishing line. The pipes were secured at both ends and tied to the top and bottom of the frame. This was to ensure that they would not move around the box. It was essential to the experiment that the pipes did not touch the frame or each other. This was important because going into the experiment it was known that PVC becomes brittle when it is placed under cold temperatures. If/when this happened in this experiment the pipe had to be secluded so that the only thing impacting the break was the pressure from the cold temperatures. The box was then surrounded by cheese cloth and secured with duct tape. Once the cheese cloth was properly secured to the box, paracord was wrapped around the experiment in order to fasten the experiment onto the payload. A control with the same pipe qualities was made and placed in a freezer for 24 hours.

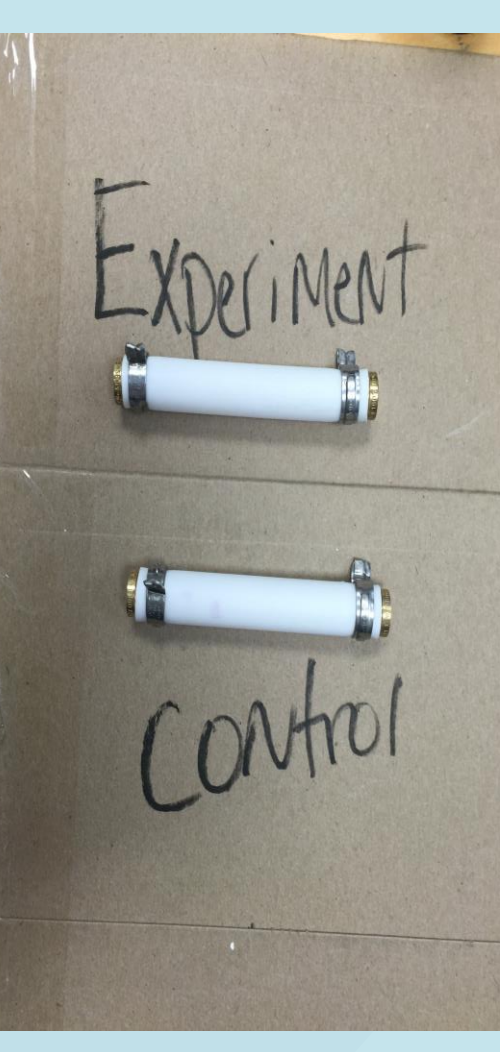
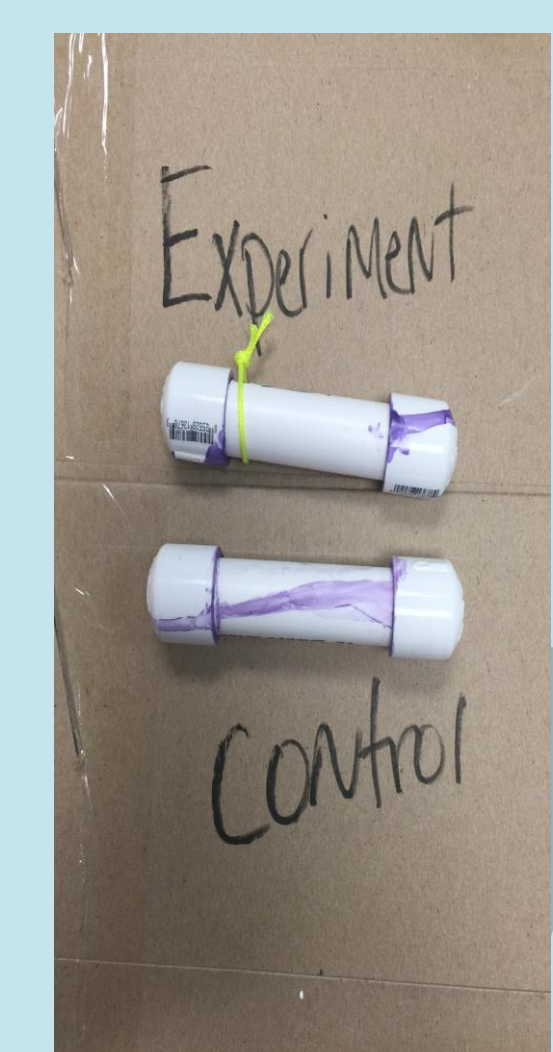


Results

Results from the experiment showed that the CPVC busted in near space. The PVC pipe had noticeable differences that led one to assume it had begun to get brittle. The pipes themselves also had slight changes in their outer diameters (shown in chart). This was not the predicted results. These results can be interpreted as the pipes are reliable and able to withstand cold temperatures.

Conclusion

It can be concluded from the following data that the pipes are able to withstand the cold temperatures of near space for a short period of time. This leads one to believe that the pipes can also withstand the cold temperatures of Earth for an extended period of time without severe damages.



CPVC

PVC

PEX

