

Andrei Molchanov  
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Team Project 2 Report  
Flow Visualization

## **Flame Jug Report**

This report is for the second team project, working with flame propagation using a glass jug and isopropyl alcohol. The goal was to create a flame that beautifully moves across the inside of a glass jug. The fumes from the alcohol leave the jug and can be lit. The flame will trace the fumes back inside the jug and propagate beautifully. I worked on this project with engineering students Zack Stein, Stephen Wong, and Da Zhou.

The apparatus consisted of a one gallon size jug, one oz. of alcohol, and a blowtorch as an ignition source as seen in the sketch. First the alcohol is poured into the jug then shaken and around until all of the inside has a thin coating of alcohol. The jug is place on a stable surface with the opening facing upwards and no cap screwed on. The blowtorch is then brought closer and closer to the opening until the torch ignites the flame. First there is a very quick flame that shoots out of the opening and then the flame moves to the inside of the jug and will travel through it in various patterns. The flame moves through the gas very quickly because it is so flammable and contained, and yet oxygen is also present to help it burn. The flame burns for approximately one to two seconds before dying out.

The flame itself is easily visualized in a dark environment because of the light that flames emit. All of the lights in the room where off and no flash was used. Once the image was captured on video, I used Final Cut Pro X to slow down the footage, mirror it on itself, and change the color of the flame. It is also very difficult if not impossible to notice, but other than the very first torch to light the first flame, I edited out the torch in

all of the other shots in the video using masks. This is much more difficult than Photoshopping an element out of a picture obviously because what is edited out is moving through space and time, and therefore may only be repeatable by highly trained, professional video editors.

The field of view of the final edited video (mostly turned on its side) is 2 feet wide and 18 inches tall. I used a shallow depth of field for the image at an F stop of 4. The flame was approximately two feet away from the camera. The lens focal length was set to 30mm. The camera used was a DSLR Canon T5i. The video was captured at 720p, 1280x720 @ 59.94fps. The ISO was set to 1600.

Once the video was slowed down the movement of the flame was visible in a way that the human eye can not process. New details emerge that are lost in real time. And once the colors are changed, the effect is incredible. The flames look like they came from a supernova or nebula. I really love the way that the mirroring turned out, the flame becomes more of an elegant dance with engineered structure that goes beyond the natural world. The experiment and video far surpassed their original intent. The only thing I could improve upon, according to the critique received is to make the video longer because it is so good.