

# **Team Third Report**

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Flow Visualization

Spring Semester 2018

MCEN 5151

May 2, 2018

University of Colorado, Boulder

## Background

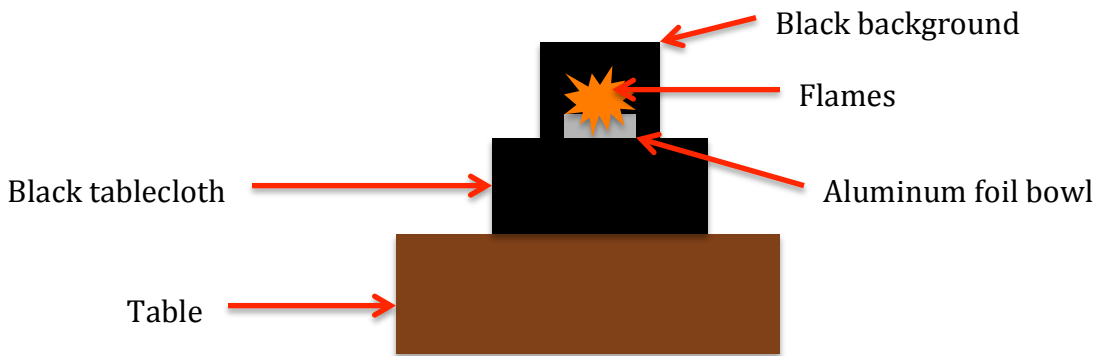
The purpose of the third team image project was to capture a fluid flow phenomenon that results in an interesting and good-looking image. The experiment needed to be controlled so the steps in the experiment process could be repeated to get similar results. In my third team experiment, I decided to douse a piece of aluminum foil in isopropyl alcohol and light it on fire against a black background to get a cool image of the flames.

## Setup



**Figure 1:** *Team third image materials*

To setup this experiment, I went to the store to pick up 91% isopropyl alcohol and some aluminum foil. The full set of materials that I used can be seen in Figure 1.



**Figure 2:** *Experiment setup*

To begin this experiment, I tore out a square piece of aluminum foil that was approximately 20 in x 20 in and curled up the edges so the aluminum foil was shaped like a bowl. Then, I found a cardboard box that I put a black tablecloth over to put the aluminum foil bowl on top of. I poured about 3 teaspoons of isopropyl alcohol into the aluminum foil bowl when I captured my image. I had to go through a trial and error process to get the right amount of alcohol. Initially, I started with about a half a teaspoon of alcohol, but when I lit it on fire, the flame only lasted a couple seconds, which was not enough time for me to capture a good image. I upped the dosage to a teaspoon and a half of alcohol; however, there still was not enough time to get a good image with a large flame. Finally, I used 3 teaspoons of alcohol and this allowed for a burn time of about 30 seconds and flames that reached about 12 inches in the air. Once I figured out how much alcohol to use, it was time to take my final image. I would like to recognize my roommate, Eric Etl, for helping me light the alcohol on fire and standing by with a bucket of water just in case I burned the house down.

The burning isopropyl created a diffusion flame, which is very easily seen on camera. Diffusion flames come from the oxidizer combining with the fuel by diffusion. The combustion causes a yellow orange flame that emits heat and light. It is difficult to give this flame a Reynold's number because it is hard to know the velocity of the flame. However, by inspecting the image, it appears that the flames

near the bottom of the image is laminar, with flames out toward the edge of the picture are in between transitional and turbulent flows.

### **Visualization Technique**

Once my roommate lit the isopropyl alcohol on fire, it was time to capture the flow phenomenon with a high quality image using my Nikon D90 DSLR camera. I went through several iterations of taking the picture, changing the lighting source, the focus on my camera, and the distance from the lens of the camera to the flames. When the final picture was taken, the distance from the lens to the flames was about 2 feet.

### **Photographic Technique**

As explained earlier, I used my Nikon D90 DSLR camera to capture the image.



**Figure 2:** *Original unedited image*

The image in Figure 2 is the original image I took with my camera. I did not like how much of the surrounding background was in the picture, so I uploaded this image to Photoshop to do some cropping and image enhancing.



**Figure 3:** *Final edited image*

Figure 3 shows the final image that I uploaded to flowvis.org. I cropped the picture so that the flames were the main focus of the image and to get rid of the background. I also increased the color contrast and used Photoshop's color enhancing tools to make the flames in the photo pop.

## **Conclusion**

In conclusion, I was pretty happy with the final result on my third team image. I really like the look of the flames, how there are flames contacting the aluminum foil and one flame that seems detached from everything else. One thing I would like to change if I repeated this experiment is to add more isopropyl alcohol to result in larger and more colorful flames. Overall, I think this is a very interesting and colorful image, and this assignment taught me more about Photoshop, fluid flow of flames, and different lighting techniques.

## **References**

- [1] Diffusion flame. (2018, February 28). Retrieved February 28, 2018, from [https://en.wikipedia.org/wiki/Diffusion\\_flame](https://en.wikipedia.org/wiki/Diffusion_flame)
- [2] FLAMES. (n.d.). Retrieved February 28, 2018, from <http://www.thermopedia.com/content/766/>