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MCEN 4151

Professor Hertzberg

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Team Second Report



Figure 1: Team Second Image

Introduction

The purpose of the team second image was to collaborate with the team and create an image that captured the fluid flow of the dry ice fog in an aesthetically pleasing way. This was accomplished by getting dry ice from King Soopers and then blacking out a classroom to get the images that we wanted. The setup that we used involved laying down black paper to create an all-black background for the images. We had a few different setups that we used to capture images. For this project I worked with Lara Buri, Madison Emmett, Cara Medd, and Michael Guenther. When we first started taking pictures we had some trouble getting the thick fog that we were expecting to see, but after some trial and error with our setup we figured out how to make thicker fog.

Flow Physics

To create the image that I used for this assignment I filled my water bottle with approximately 8 oz. of water and then put in three chunks of dry ice that were approximately 3-4 cm in diameter into my water bottle as it lay on its side. Once the dry ice was inside the water bottle I gently held the cap to my water bottle in front of the mouth to help build up more fog inside the bottle. After waiting for roughly 10-15 seconds I removed the cap and Lara started to take pictures. When the cap to my water bottle was removed the fog flowed out of the mouth of the water bottle and down onto the black paper that was on the table. This is due to the fact that the fog that was created in the water bottle by the dry ice is more dense than the surrounding air. As the fog was flowing we see a slight hydraulic jump in the image. A hydraulic jump is a phenomenon where a fluid that is flowing at a high velocity, rapidly slows down. This rapid deceleration causes the flow to move from the laminar regime to the turbulent regime. This deceleration also causes the fluid to pile up on itself during this transitional region [1].

Experimental Setup

To create this image, we laid black paper down on the table that we were using as. We then positioned the camera on a tripod and set the camera down so that it was roughly 12-18 in. away from the water bottle. Once the camera and the water bottle were in place I placed a lamp to the right of the water bottle out of frame to provide adequate illumination for the picture. Once everything was setup to capture the image I placed the dry ice in the water bottle and gently placed the cap over the mouth of the bottle. After waiting for 10-15 sec. I removed the cap and let the fog flow out of the water bottle.

Photographic Technique

For this image I wanted the focus of the image to be on the mouth of the water bottle, so we made sure that the camera was close enough to the water bottle so that only the top third of the water bottle was in the shot, but not too close that the flow ended up out of frame. The camera used to capture the image was a digital Canon EOS 5D Mark II with a 28-75mm, 1:2.8 lens. The shutter speed was 1/25 sec. the f number was 2.8, and the ISO speed was ISO 1000. The field of view was approximately 8 in. to make sure that the mouth of the water bottle and the flow were both captured in the frame. Once I had my original image I cropped out the glove on the left side of the image and cropped out the edge of the paper on the right side of the image. I also turned the image into grayscale because I thought that it would look better considering that the background and the table were not the same color.



Figure 2: Original image before post-processing

Conclusion

I really like the way that the image turned out. I think that making the image grayscale worked very well. The image reminded me of a drainage pipe or a spillway with the way that the fog is flowing out of the mouth of the water bottle. This is also helped by the fact that you can't see the rest of the water bottle so it seems to look like a pipe. If I were to edit the picture more I would crop the right side of the image a little more to get rid of the raised edge of the paper that the water bottle is sitting on. If I ran this experiment again I would want to try to use multiple images to try and make a stop motion video of the fog coming out of the water bottle, or maybe a composite image where as you move from left to right you see the flow expanding as it hits the paper with every subsequent image.

References

<http://large.stanford.edu/courses/2007/ph210/bechtol1/>