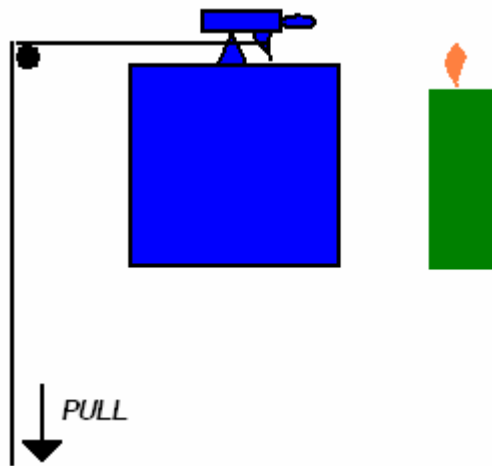


After having completed several projects and having gained some experience with different methods of capturing still images of fluid flow, our group has decided to attempt to capture a flame while burning in mid air as our second project. By sending a combustible fluid into open air, the fluid should have its own fluid motion properties. Along with that movement, the burning of the fluid will show the motion of the flame while burning the fluid.



In order to successfully capture this image, it was necessary to send a fluid into air and having a way of igniting it so that the fluid would catch and burn. An apparatus of a spray bottle and that was triggered using an attached string that was pulled from a distance behind the bottle to avoid any dangerous situations. This was done as a safety precaution, in the event that the fluid in the top caught fire and traveled into the plastic spray bottle. From the spray top, a candle was placed approximately 2 inches in front of the nozzle opening. The fluid used was an Everclear alcohol, nearly 100% alcohol that can be bought at liquor stores. Each attempt that was captured was done with a timer on the camera. At the instant

before the camera would trigger to capture an image, we would send fluid over the candle and into the open space. The Reynolds Number in this image that shows to be turbulent would be > 5000 . The flame that propagated burned over a distance of several feet, approximately 4 feet. The image captured has a flame that was 1 - 2 feet in length.

Visualizing the fluid effects desired were described previously with the alcohol and lighting the fluid on fire with a candle. A timer was used to trigger the camera _____ and a flash bulb from the camera was used to shine more light on the flame. Lighting also came naturally from the fire burning. The object itself was a source of light.

When capturing the image, a Pentax ZX-5N camera set at about 50mm was placed approximately 5 feet away from the flame. The fluid was perpendicular to the direction of the camera. The shutter speed of the camera was set at $1/125$ of a second and the aperture was set at 3.8. The film used was a 400speed Fuji Superia X-tra.

In this particular image, while the alcohol is being burned by the flame, the alcohol/ flame combination is in a turbulent state. The lower right of the image shows a vortex rotating clockwise. This was created by the droplets of alcohol in the mist furthest from the center of the spray line are being slowed by the ambient air. This creates a "swirling" or vortex effect within the mist. The vortex that occurred during this particular image I found to be particularly beautiful because of the symmetry within the vortex.

I was pleased with the way that the images came out. I would however, next time choose to take the pictures with a larger zoom to capture a larger image of the flame. We did it as a precaution to not lose any part of the flame, but after developing the images we saw that they could have been closer. Other ideas were to choose fluids that would burn in different colors to create different effects. I tried to Photoshop the image to make

the flame stand out more in the image; however the results that I obtained were not the ones that I wanted. More experience was necessary to get the results desired.