Flow Visualization Team assignment 2
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The purpose of this assignment was to capture the detailed image of the fluid in motion to better understand the dynamic behaviors and its relative surroundings. In particular, this was second project, group working on the nebulizer. The goal was to take as many pictures or videos to gain useful information on how fluids interact as the nebulizer begins to change liquid into fine droplets.

What is a nebulizer? A nebulizer is most commonly used medical industry to treat patients with asthma and other respiratory diseases. All nebulizers use oxygen, compressed air or ultrasonic power, as means to break up medical solutions into fine droplets and this is also referred as aerosol droplets. A nebulizer operates by vaporizing small amount of water particles mixed with hot ambient air, then cooled down and condenses into a fine cloud of visible airborne water droplets. A nebulizer inhalation therapy can be very effective because inhaling aerosol droplets can penetrate into the narrow branches of the lower airways in the lungs. Although it is important to note that not all the nebulizers currently available succeed in delivering the aerosols in small enough droplets to achieve an acceptable efficiency for the medicine to reach the lungs.

There are a few types of nebulizers are currently available in market: vibrating mesh nebulizers, jet nebulizers, and ultrasonic wave nebulizers. For this assignment the group used a commercialized ultrasonic wave nebulizer as seen in fig.1. Although nebulizers are widely known for its use in the medical industry, this device is sometimes can be seen at a local art store. Combination of mist and multi-color LED lights can create a very interesting and attractive device used as a display.

Figure 1. Ultrasonic wave nebulizer

The group's ultrasonic wave nebulizer set up came in a wide circular wavy shaped bowl (12 inches in diam. and 6 inches in depth). The nebulizer was about a typical size of a hockey puck and it was located in the center of the bowl and had multiple LED light bulbs attached on top (approx. 2.5 inches in diameter). The actual nebulizer sensor was circular and a quarter alike in size. The setup also had a power cord connected and the cord was positioned on the bottom of the bowl. Along with a power cord this machine had a physical switch that controlled the LED lights and the intensity of the aerosol droplets. The water was poured into a bowl until the nebulizer sensor was submerged about 1.5 inches and the setup was turned on and began capturing images of the working setup. Two experimental setups were used to capture the functionality of the aerosol

droplets. In the first setup, a series of photos were taken with no lights in the room other than LED lights from the nebulizer setup. The second setup was similar to the first except the blackboard was placed underneath the experimental device and the device was left on for a few minutes. Once the aerosol droplets began overflowing from the bowl the images were captured. The blackboard was chosen for the purpose of creating higher contrasts between the mist and the background. This can be seen in figure 3. No other additional setups were used other than what was discussed above.

Figure 2. Setup 1 only LED lights

Figure 3. Setup 2 Blackboard was place underneath the nebulizer

In this section a detailed photographic technique will be discussed. The size of the field of view was relatively close to the object. It was near 12inches away from the object. Canon t2i rebel digital single lens reflection (DSLR) camera with macro lens was used to capture the images in see in this report. F-stop or aperature value was set to f/19 while ISO speed ratings and shutter speed was set to 400 and 1/60sec. During photoshop, curve function was used to make a necessary color inversion. Thus, giving a greater definition of flow interactions.

Although it was a lot of fun working with a nebulizer I had a difficult time

capturing the images I wanted. I like my final image because it showed dynamics aerosol interacting with its surroundings but at the same time I didn't think my final image portrayed the true phenomenon of a functioning nebulizer. Based on my research I learned a lot about the nebulizer itself however I was unsuccessful at locating a non-dimensional unit. For future improvements I would like to begin the assignment with a photographic technique. Currently, I'm interesting in doing High Dynamic Range (HDR) stuff. It would have been interesting to see how nebulizer would have reacted with other various types of fluids.

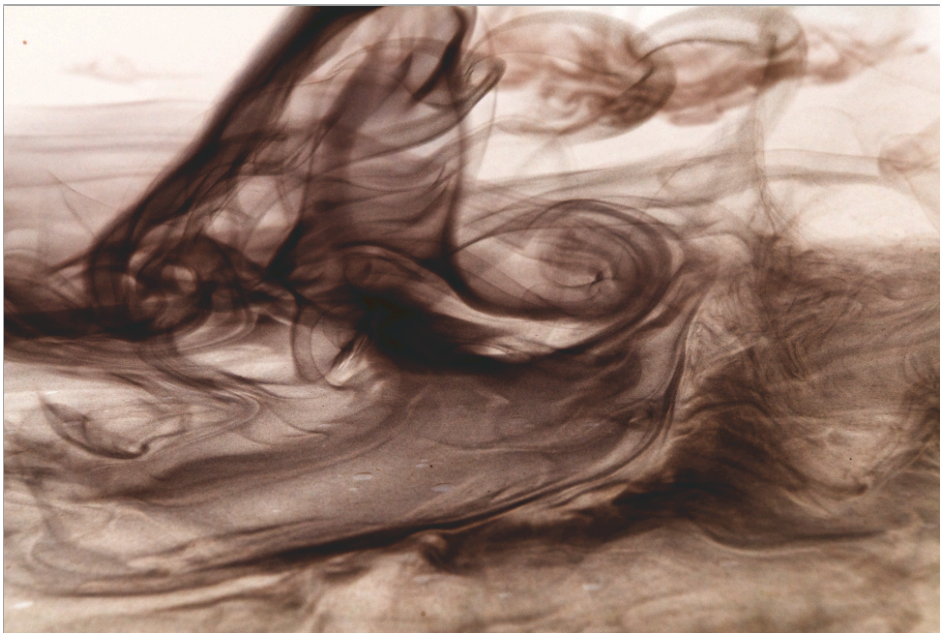

Figure 4. Final image