

# Fog

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## Abstract

The Fog image was taken for the second group assignment of the University of Colorado at Boulder Mechanical Engineering course MCEN 5228 – Flow Visualization. The objective of this assignment was to create fluid phenomena and capture the phenomena in an image. The Fog image was intended to demonstrate the phenomena of fog and the dynamics of a fog cloud in still air. The image was taken in the hope that with this visualization more individuals will be able to appreciate and understand the complex fluid relations behind this commonly seen phenomenon.

## Image Set Up

The image was taken inside of a dark room and illuminated by 3 watts of white light coming from a flashlight that was positioned 30 degrees below the fog at a distance of 2 feet. The camera was located on the other side of the fog, again 30 degrees below the fog. The background of the pictures was set up so that behind the fog was a long distance to the next nearest feature so that the background would be completely dark. Additionally, the image was taken at approximately 120 degrees from the light source, 2 feet away, as seen in Figure 1, so that the reflection off of the fog would be the most noticeable.

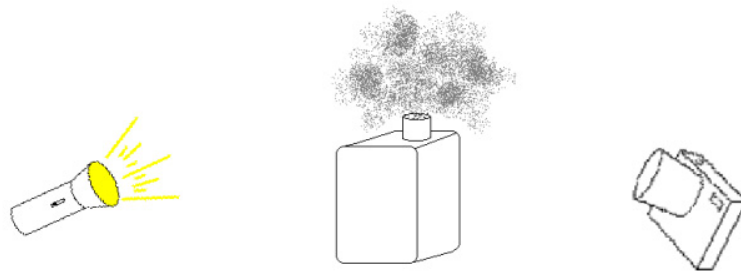


Figure: 1  
Set up for Fog image.

The fog present in the image was created by a Vicks brand ultrasonic humidifier with the flow restriction nozzle removed for a slower flow. Then, the air was steadied and cleared of any remaining fog of previous images. Once the fog emerged from the humidifier it billowed for approximately 5 seconds before the picture was taken. After the image was taken, the fog proceeded to slowly sink and dissipate into the surrounding air.

## **Phenomenon Explanation**

The phenomenon seen in the image is an example of the cavitation effect in which the formation of vapor bubbles of a moving liquid in an area where the pressure of the liquid falls below its vapor pressure. Ultrasonic humidifiers use a piezo-electric transducer to create a high frequency mechanical oscillation of a metal disk at the bottom of a pool of water, usually oscillating around 1.7 million Hz. The water tries to follow the high frequency oscillation but cannot because of its weight and mass inertia. Therefore, a vacuum is created momentarily on the downward portion of the oscillation, causing the water to cavitate and transform into vapor. The metal plate follows the downward portion of the oscillation with an upward oscillation that causes a high pressure compression on the water's surface, forcing tiny vapor molecules of water into the air. The vapor that is released is an extremely fine mist, about one micron in diameter, which can be quickly absorbed into the air depending upon the ambient air's humidity level. Since the mist is created by oscillation in this case, not heat, the water temperature need not be raised and the resulting vapor is cool and not hot such as steam.

## **Camera Settings**

The photo was taken as a digital image with a Casio EX-Z600 set with a focal length of 18.6 mm in order to capture the entire fog cloud and none of the backdrop or surrounding features of the room. F-Stop of 5.2, exposure time of 1/100 sec, ISO of 200, size of 2816x2112 pixels, and an aperture value of 2.8 was chosen to attempt to capture the clearest image of the fog. Cropping of the image as well as an adjustment in contrast and sharpness was not used. However, colors were adjusted to create a bluish-purple color to the fog in order to set more of

a calming effect for the image. Brightness levels were also minimally reduced to incorporate a slight feeling of darkness and mysteriousness to the image.

## Conclusions

This image shows the beauty that fluid flows can have and the complex physical phenomena that can produce these events. Overall the image that was captured came out well. The photo presented the phenomenon that it attempted to convey and it was done in a visually pleasing way. In the future, capturing this image would be easier if it could be done in a more controlled manner and with a camera that had higher capabilities.

## Works Cited

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Original photo, pre-Photoshop edit.