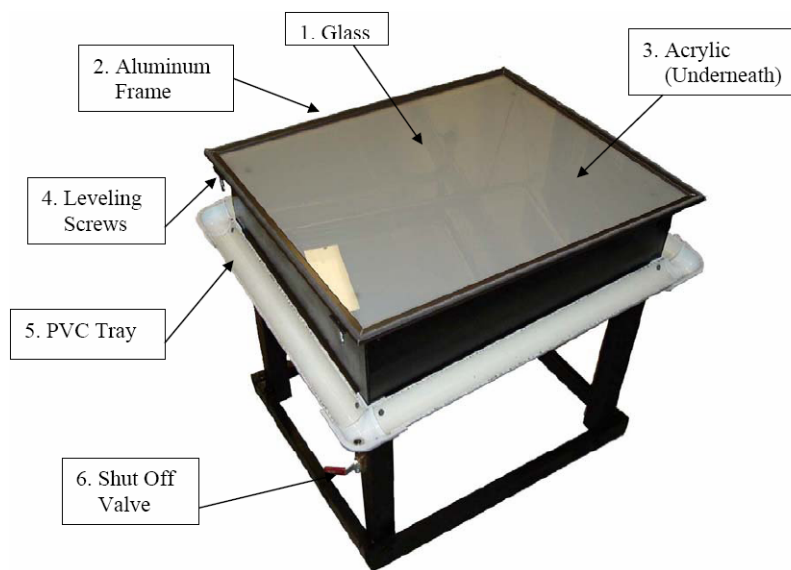


Group Delta - Project 1

The path to success has many twists and turns, and no first group project would be complete without a great deal of missteps and last second changes. Group Delta had originally planned on scheduling a demonstration of a model humming-bird wing in motion with fog and lasers. However at the last minute the persons in charge of the model decided not to set it up due to a lengthy set-up time. A back-up project was chosen involving the Saffman-Taylor Instability. The objective was to observe a viscous fingering of fluids when liquids with two different viscosities are injected into a Hele-Shaw cell.

To obtain the images, the Saffman-Taylor Instability Machine was used. A diagram of the machine is included below.



(Wilke, 2004)

A traditional experiment involving this machine includes a layer of oil (canola oil and Karo syrup were experimented with) sandwiched in-between an acrylic bottom and a glass layer on top. A flow of either air or another fluid (usually dyed with color) is injected with a syringe into the oil via a hole in the center of the Plexiglas. After many attempts of this process, members of Group Delta became more and more interested in the phenomena which occurred when the glass layer was slowly lifted. Channels of air fingered and rushed across the oil layer, closely resembling the same effect of injecting air thru the Plexiglas. The final images in this report were obtained when the glass was moved up and down, affecting a layer of canola oil. The key source of light was from a clamp-light which was reflected and diffused off of a pane of Plexiglas at an angle under the machine.

The field of view for both images is approximately 1 ft². The camera was 3 feet away from the glass and almost directly above the flow. A Nikon D50 6.1 megapixel DSLR camera with a 28-80mm lens was used to obtain the photos. The first image is 2000 x 1017 pixels and the second image is 2000 x 1342 pixels. Image one was captured at a focal length of 80mm, an ISO of 200, a shutter speed of 1/80, and f-stop of 5.6. The second image was captured at a focal length of 52 mm, an ISO of 200, a shutter speed of 1/100 of a second, and an f-stop of 5. Photoshop processing of the original raw images is included in the following tables:

Image 1:

Image 2:

Camera Raw	
Raw Filename	DSC_8921.NEF
White Balance	As Shot
Temperature	4050 °K
Tint	-21
Exposure	+0.85
Recovery	0
Fill Light	7
Blacks	0
Brightness	+65
Contrast	+84
Vibrance	-17

Camera Raw	
Raw Filename	DSC_8922.NEF
White Balance	Custom
Temperature	6000 °K
Tint	0
Exposure	0.00
Recovery	0
Fill Light	53
Blacks	18
Brightness	+79
Contrast	+40
Vibrance	-40

The images were both cropped and then filtered thru a black & white Photoshop filter, followed by contrast/brightness changes.

Both of the images capture a unique flow created by an unexpected procedure. The fingers of oil retreating back as the glass plate is lifted (notice in image 2 how a very faint layer of oil is left behind the fingers) are more round and graceful than the syringe-injected flows. The decision to submit the images in black and white was made to maintain a maximum level of contrast and zero distraction of color. Only the beautiful, flowing lines remain; the ultimate organic reaction to a synthetic environment. Further experimentation with other fluids and dyes would produce more stunning results like these.

Bibliography

Wilke, C. (2004, 10 20). *Group Project 1*. Retrieved 10 24, 2007, from Flow Visualization Course Website: <http://www.colorado.edu/MCEN/flowvis/galleries/2004/assignment4/wilke.pdf>