Lisa Rose Logel Team #8
Flow Visualization MCEN 4151

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Team Project I Report

The goal of the first team project assignment is similar to the "Get Wet" assignment, but with higher technical expectations. Therefore, teams were assigned to capture an image of any fluid or combination of fluids to demonstrate physics in the flow and provide a good quality picture. Editing of the picture could be preformed by any technique so long as no information is lost in the process.

For the first team project, my team, Team #8, chose to manufacture an apparatus to capture an image of the Kelvin-Helmholtz Instability. Initially proposed was the idea of using a fish tank, however, the dimensions of a fish tank were not desirable and a tank was manufactured by team members instead. Clear plastic was purchased from Colorado Plastics and cut to size in the ITLL manufacturing center. In order to assemble the tank and ensure the edges were fit and sealed sufficiently, the rough edge of the cut plastic were milled in the Durning lab's manufacturing center. The tank was then built using acrylic cement as an adhesive to hold the pieces together and seal the edges. A schematic of the final tank apparatus is shown below in Figure 1.

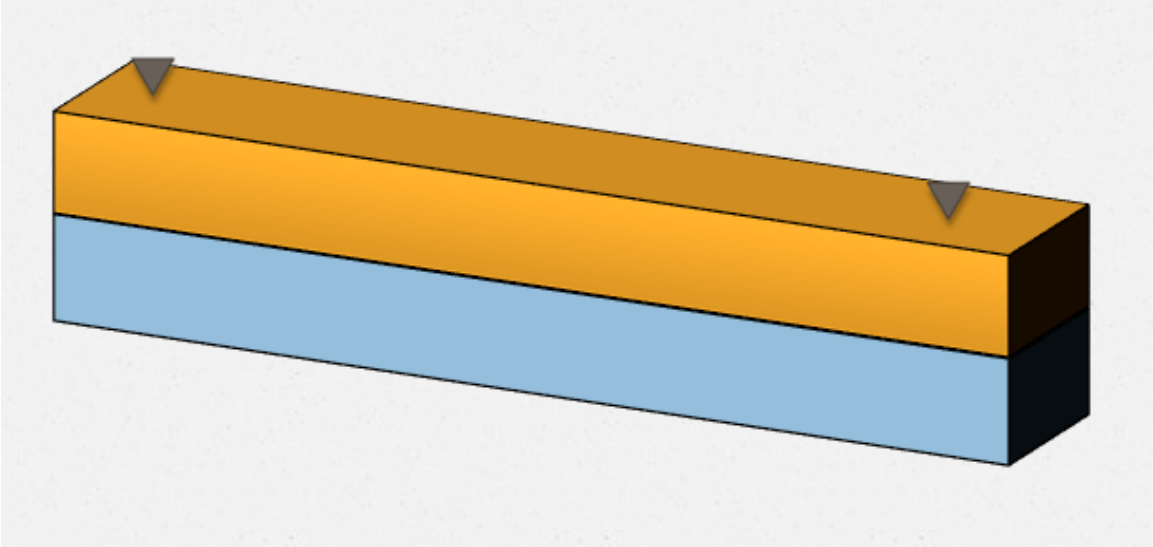

Figure 1: Team Project #1 Kelvin Helmholts Tank

This tank was filled will two liquids, vegetable oil and water. Because oil and water have a density of approximately 0.894 g/ml and 0.998 g/ml, respectively, the oil floated on top of the water as a result of the buoyancy effect. When the box was tipped quickly to a critical degree, the different velocities of the two liquids is great enough to have a shear effect resulting in waves at the interface of the oil and water[i].

I believe that the box my team constructed was not long enough to experience this phenomenon to its full potential. Therefore, we got distracted by playing with the tank, and subsequently created many bubbles with the tank. I found the bubbles aesthetically pleasing and focused my image capture on a suspended bubble. My picture is shown below in Figure 2. The large bubble shown on the left side of the photo is filled with water. This was determined while I was taking the picture because the bubble was stagnant in that location, and if it were filled with water, it would have floated to the top of the tank. Again, this is a results of the buoyancy effect and the fact that air has a lower density than water and oil.

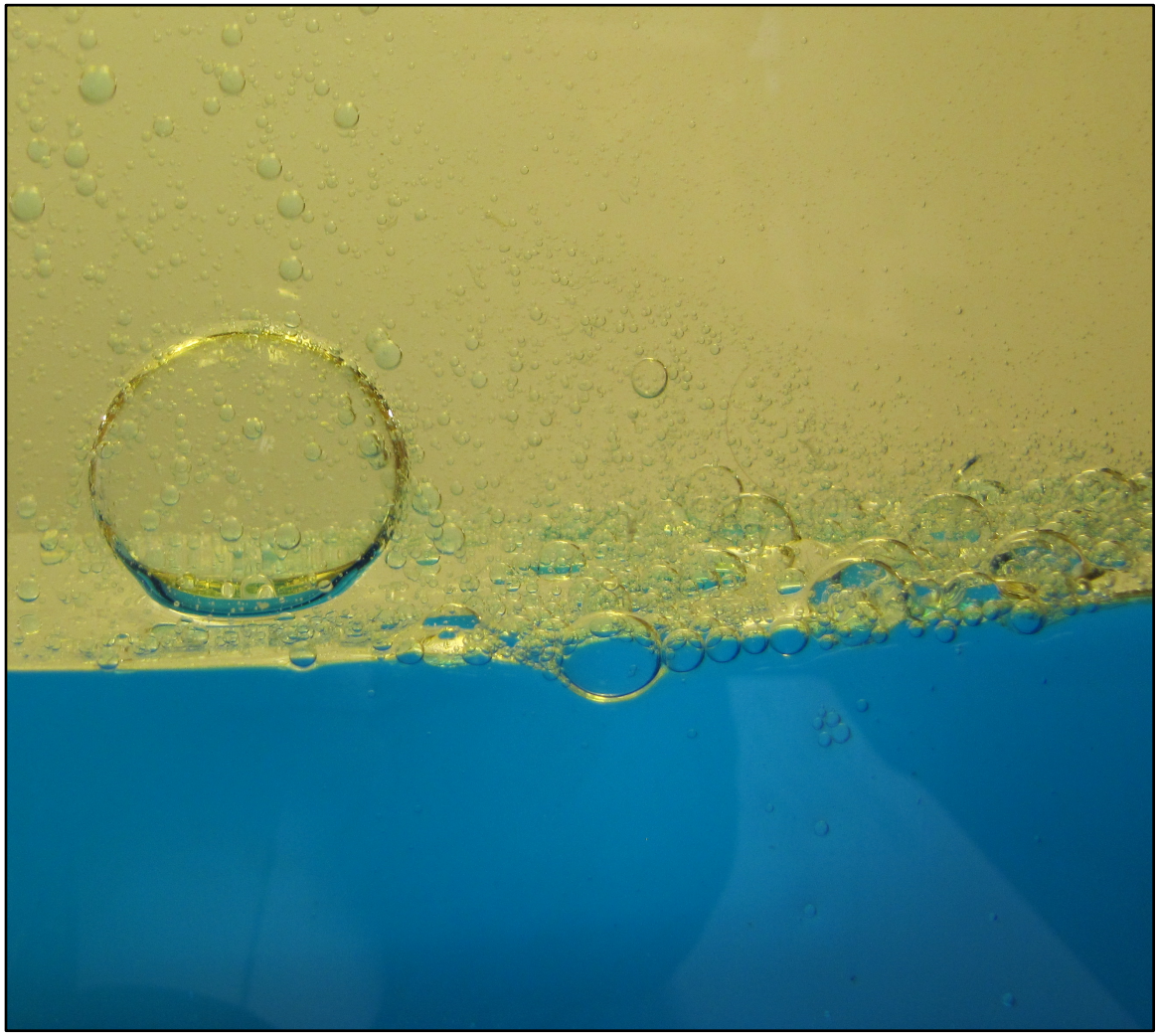

Figure 2: Team Project #1 Photo by Lisa Rose Logel

Because the team desired a higher contrast between the oil and water, a blue, water-soluble dye was used to change the color of the water. No photo adjustments such as contrasting and brightening were done in Photoshop. The only alteration from the original photo was cropping, and it was done in a way do that the large bubble was off-set to the left somewhat. I am very please with the quality image I produced. However, I am disappointed that I was unable to capture a distinct wave pattern at the interface of the oil and water.

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[i] Esler, J. G., and L. M. Polvani. "Kelvin–Helmholtz Instability of Potential Vorticity Layers: A Route to Mixing." *Journal for Atmospheric Sciences* 61 (2003): 1392-404. Print.