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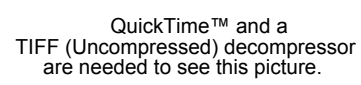
Flow Visualization
Get Wet! Project Report
9/15/04

The image I chose for the Get Wet! project hits very close to home, almost to close in fact. With limited supplies in the early part of the semester as well as a limited background in flow visualization techniques, I had limited ways of creating a final image. In the end, after hours and hours of experimenting with various household tubes, cups, appliances as well as backgrounds, and lighting, it was only fitting that I chose something I knew would produce results. Within the all too familiar toilet bowl, we are observing turbulent flow.

The flow apparatus is simple and well known. Water jets from a storage tank above rush into the bowl (~14in diameter) while at the same time gravity and a vacant exit flow tube which takes the "waste" water away. The fluid flow circulates around the exit hole (~4in diameter) until gravity overcomes all of the exiting water, leaving the bowl virtually empty. My image is just before the last of the wastewater exits through the bottom. Just like most modern toilet bowls, the flowrate is slow, something around 6 gallons/minute. The specific Reynolds number is hard to determine from the test apparatus due to the inaccessibility,



potential hazard, and spiraling turbulent flow. We do know, however, that the Reynolds number is at least 4000.

For this image, I actually used melted ice pops. I discovered that it works much like a fluid dyed with water coloring. After the ice pops were melted, syringes were used to insert the blue liquid into the swirling toilet bowl. I then stood over the scen and took the picture just after starting to insert the dye into the toilet water. The lighting was about as simple as the apparatus. A set of somewhat dim 40W bulbs were located above the toilet and towards the right hand side which accounts for the shadow seen on the right hand side. Based upon my simple configurations this project, it would be extremely easy to repeat.

Figure 1. The Final Image

The total window size was approximately 4 foot wide by about 3 foot tall with the distance from the lens to the object being about 3 feet. If I was an closer the zoom on the camera

tends to misfocus on the given object. The camera that I used for this shot was a Kodak DX3600 digital camera. My camera has a aperature range of 3.3 to 4.5, a fixed shutter speed, and a 2X zoom. This image has been cropped, rotated, leveled and sharpened with the help of photoshop. Figure 2 is the original image shrunk to fit on the page.

This image is simple but yet interesting at the same time. Although many of us do not care to look down we are using the facilities, this really shows what interesting fluid dynamics is occurring right beneath us everyday. This image clearly shows turbulent flow and changing fluid velocities as a result of natural forces. After completing the images and doing the best I could to present it using Photoshop, I do have a few improvements that I would like to make for the future. First of all, this image, although having been through Photoshop still seems unsophisticated, and downright crude. I certainly fulfilled my intent and learned a lot in the process of this first assignment. For future visualizations, I am going to get a closer shot of the "action" as well as accentuate the dyes in the liquid in order to really bring out contrast and create a stunning image.

Figure 2. Original Image