Travis Gaskill
Flow Vis
12/12/2007

Final Group Project: Schlieren Setup

My groups final project was done using a Schlieren setup. The purpose of the image was to capture turbulent and laminar flow of different kinds with the use of a Schlieren setup. We initially tried to use the Schlieren setup for our 2nd group project but were unsuccessful. Once we were able to take it home and modify the setup precisely, the setup worked perfectly.

The Schlieren setup was composed of 2 5" circular mirrors with a focal length of approximately 48". In order to make our setup functional, we set the mirrors very far apart, almost 275". The mirrors were each approximately angled at 6 degrees from the centerline. The light source was a EG&G Electro-Optics Model PS302 strobe with manual flash and adjustable frequency and intensity. All of this was provided to us by Professor Hertzberg. The key, for us, to creating pictures with such a small amount of light was to take off the lens and shoot with just the camera body at the point at which the light off the 2nd mirror was narrowed down to the size of the CCD. The end product was an incredibly bright picture for one flash of light from a small point source strobe. Also, it is important to have the mirrors as far away from each other as possible to produce a clean image with better alignment. The flow in the picture is produced by hot air rising from a candle, and out through the end of a funnel. The left side of the picture is somewhat laminar with very little turbulence. The right side is turbulent due to interaction with turbulent air from an outside source. The hot air rose naturally out of the funnel through convection. Without outside sources, the air would be completely columnar.

The image specifications are somewhat different from a normal picture. The camera was a Nikon D80 with no lens. The exposure was 3 seconds but this doesn't really come into play because the only light hitting the CCD was the one flash of the strobe. A makeshift book tripod was used for keeping the camera in the same position throughout our picture taking session. To produce the image seen, 2 stock images were taken and cropped so that the protruding funnel end was visible. After this I flipped one of the images and combined the 2 so that you have the illusion of 2 streams coming from a center source, which originally was the funnel end. Once I combined the 2 pictures, I blended them in Photoshop CS3 with the Auto-blend tool until I was happy with the result.

I feel this image reveals symmetry between turbulent and laminar flow. The right and left side of the image are completely different yet they feel very similar to one another. The left side of the image shows very good laminar flow physics while the right side is disorderly and sharp. I enjoyed taking pictures with the Schlieren setup but I thoroughly dislike the difficulty of setting up the system. If I were to do this over I would try and produce sharper pictures, even though I think there is a limit to how sharp you can get them with the setup we have. I would also have like to try the larger mirror setup now that I understand how to produce schlieren images.