

Group Project 1

The focus of Team Alpha's first group project was simply to experiment with water in the flume of the University of Colorado's ITLL. A flume is an open air water channel that directs water in an artificial manner often used for mining or diverting water from dams. The flume located in the ITLL is used for experimental purposes and features clear acrylic sides to allow careful observation of flow. The team used many techniques to visualize turbulent as well as laminar flow including dye, light reflection, and video.

The setup featured in the photograph is very simple. A slow flow is forced around a metal tube which causes the flow to briefly appear turbulent before returning to laminar-like behavior. While the rate of water flow was not measured, the velocity was approximately .1 m/s. With a cross sectional area of .015 m², the flow can be approximated as .0015 m³/s. Using a characteristic dimension of .13m (4 * cross-sectional area / perimeter) and water's kinematic viscosity of 1.155 x 10⁻⁶ m²/s, the Reynolds number of the flow is approximately 56,000. Such a large Reynolds number indicates that the entire flow region is turbulent, not just the section around the obstacle. While other portions of the flow appear to be laminar, the reflection portrays the surface behavior only and is therefore is a poor representation of the entire flow's behavior.

The photograph was captured using a Sony Alpha 100 DSLR and a 50mm prime (fixed focal length) lens. Light was provided by two high-powered shop lights projected from above the surface of the flow while the picture was taken from below the surface. The on-camera flash was not utilized in order to minimize further unwanted reflections.

The ISO was set at 400 which allowed a large aperture of F13 to ensure sharp focus. The shutter speed was set to 1/160 of a second to “freeze” and clearly depict the flow. While the photograph was largely untouched with respect to colors or saturation, a lot of work was done to remove many distracting elements such as reflections, scratches, and water droplets that occupied the flume’s walls. Adobe Photoshop CS3 and Lightroom 2.0 were employed here for these tasks. The image was vertically cropped from 3872 x 2592 (10 megapixels) to 3872 x 2269.

I really liked this photograph for the geometric shapes as well as the metallic-finish of the water. The combination of lighting from above, shooting from below, and reflection from the metal rod resulted in a water surface reflection that uniquely resembles liquid metal. In addition, I found the many parallel features, cropped with the triangular elements in the corners to be very interesting.