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Group Project 2

The purpose of this image was to capture an image of various flow phenomena occurring naturally over a small waterfall. The image is of a small waterfall in Boulder Creek. The picture is trying to capture both the smooth laminar flow as the water moves smoothly over a waterfall, as well as the transition into turbulent flow as the water reaches the bottom of the waterfall. The image is also attempting to capture some interesting diffuse sunlight that was coming through the trees and reflecting off the water.

The flow pictured is water flowing over a smooth rock. The water is approximately 2 inches deep and the channel of the waterfall is about 2 feet across. The flow over the waterfall is clearly laminar and has a Reynolds number of approximately 0.05. As the water becomes deeper the Reynolds number increases to approximately 0.25, and the water moves into turbulent flow. The reason for the sudden jump in Reynolds number, and subsequent transition to turbulent flow is that at the bottom of the waterfall the stream quickly becomes much deeper.

The flow was visualized by the shape of the water flowing over the waterfall and the reflections caused by that shape. As the water flowed smoothly over the waterfall the surface developed ridges which resembled streamlines. These ridges were made visible by the reflection of the ambient light, and therefore the direction of the laminar flow can be seen clearly. The turbulent region is shown by splashing water and a lack of a clearly visible direction of flow. The light was diffuse sunlight, which gave good definition and interesting color to the surface of the water.

The field of view of the image is approximately 5 ft. wide and 4 ft. high. The waterfall is about 15 ft. away from the lens, which had a focal length of 110mm. The

camera was a 35mm Olympus OM-10 film camera. The shutter speed for the image was $1/125^{th}$ of a second, the aperture was set at an f-stop of 16, and the film was 400ISO Kodak HD film.

The image is particularly interesting. First the streamline-like ridges on the surface of the water are both beautiful, and revealing of the flow. Typically this type of flow is not so clearly visible on its surface. For engineers it is particularly interesting to see a something natural which resembles so closely resembles streamlines. The light in the picture is also particularly interesting. After the light was diffused by the trees above the stream, then reflected off the water it became very colorful. The color of the light, while it does not particularly enhance the visualization of the flow, gives the picture added aesthetic quality.