Team Second Report

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ATLS 4151 - Flow Visualization

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I.   Purpose

This is our third experimental project of the semester and the second that we were permitted to work in our assigned teams. The guidelines were the same as our previous assignment; we were to experiment with and explore any type of fluid flow of our choice, either in or outside of our teams, with a goal of capturing the artistic nature and science behind the flow using different mediums of photography and documenting our results and process as well as explaining the science behind the flow.

This time around, my team and I decided to use a flume machine to direct a streamlined flow of water down the channel over a small model car to simulate the laminar/turbulent flow over the object. In this report, I will be explaining my process for performing this experiment as well as the science behind how the flow works and my photographic workflow.

II.   Flow Apparatus / Visualization Technique

The procedure of this experiment was straightforward; we started by placing a wooden block about 13.5″ long into the 3″ width channel. It was fashioned with a metal hook that fixed its position so the block would not move. This block would be our base for where we would place our model cars. One of my partners, Ciaran, bought a pack of 6 different hot wheels cars to be the subject of our experiment. Since each of us could use a different model of car, and we all used different rates of flow, our images were all particularly unique.

One of my other partners, AJ Corne, took an introductory course on how to use the flume machine. Once the machine was turned on and we had water in the tank to circulate, we could manipulate the speed at which the water ran up the tube to the top of the channel. This let us change how deeply submerged our cars were under the water. To attach the cars to the block, we just used some

double sided tape and made sure to pack on some extra toward the back of the car for extra support.

The flow portrayed in this experiment is a great example of displacement, where the model car pushes out a volume of water equal to that of its own volume. This is particularly noticeable in my featured image. As for the fluid dynamics of this experiment, this flow tended to fluctuate between close states of turbulent and laminar flow depending on the height of the water. When the height of the water was tall enough to cover the car completely with about another ½″ of depth, and when the intensity of the flow was stable for a few seconds, the state of the water would be more laminar. Inversely, when the height of the water decreased, the top of the car would more easily disrupt the surface tension of the water and the flow would be more turbulent.

III.   **Photographic Technique**

The flume had two clear panes of glass to visualize the water as it ran down the channel, so we placed a large white piece of construction paper on one of the sides to create a backdrop for the image.

The camera I used is my grandfather's old Nikon model COOLPIX P900. I used the manual settings for this and mainly only manipulated the the ISO, f/#, and shutter speed. Of all these settings, shutter speed definitely had the greatest effect since we were capturing moving water. These are the camera settings used for my featured image:

- F-stop - f/8
- Exposure - 1/10 sec.
- ISO speed - 400
- Focal length - 6 mm
- Max aperture - 2.9

These pictures were all captured on Halloween so it was a very busy day and I did not have time to take hundreds of photos. I got a few photos from different angles and did most of the artistic work in editing the photos. The flow was not all that awe-inspiring at first, so I knew that I would have to add something to the photos in editing to make the flow look more special and captivating.

In editing, I added a lot of grain and texture to make the photos look more like drawings or maybe a bit more retro. I also accentuated the red color of my car to make it pop more as the subject of the images. Lastly I manipulated the background of the white paper to a more blue and gritty tone to contrast with the car more. I think all of these edits combined made these images really work, and I'm glad to have a few that I'm really proud of.
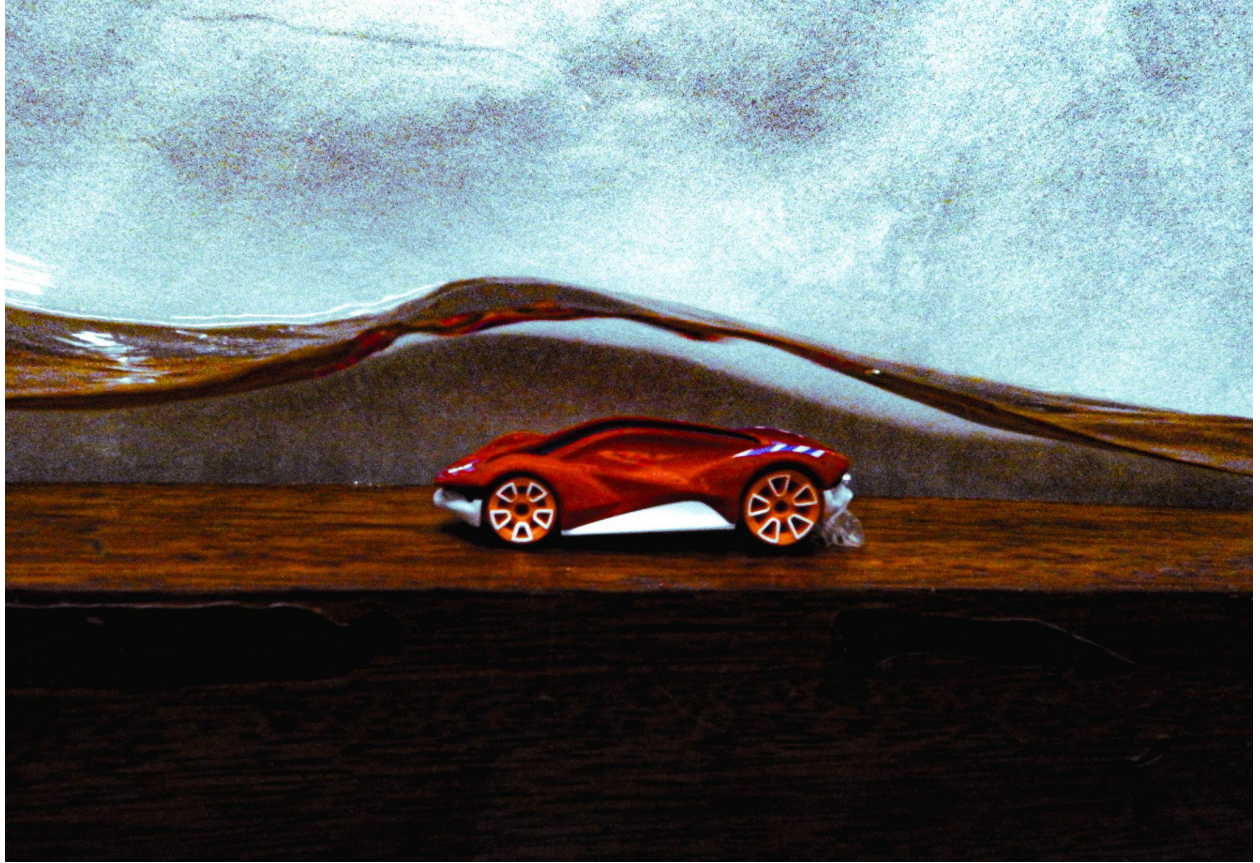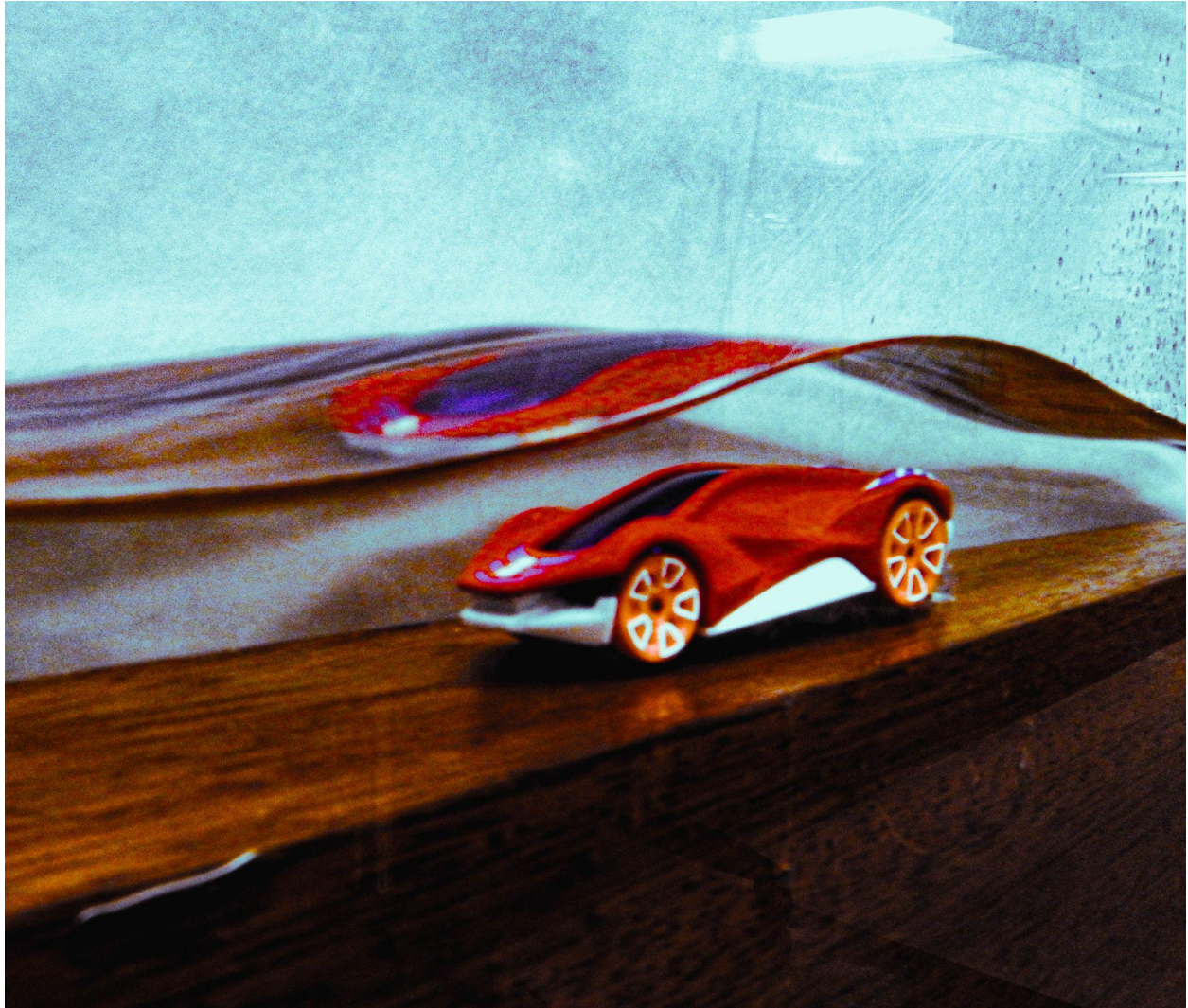
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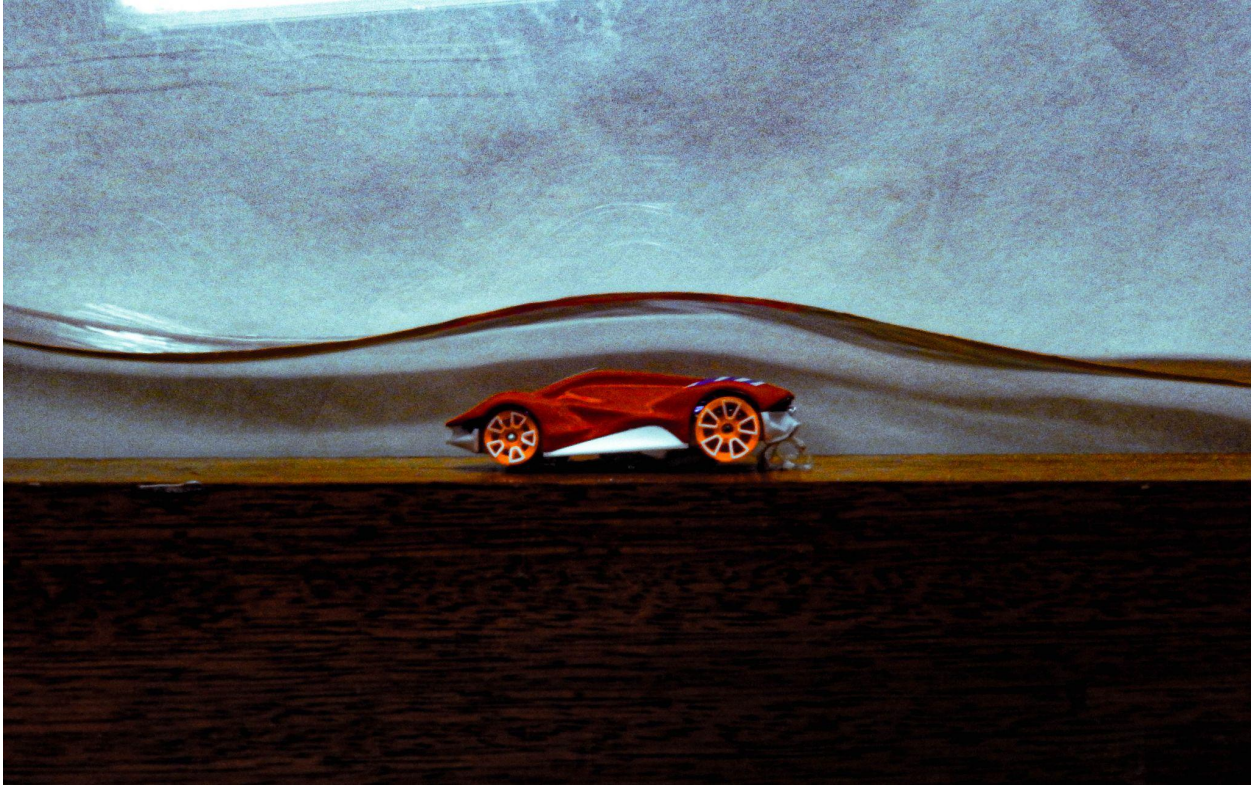
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IV.   Image Revelations / Self Assessment

Working on this experiment I found myself focusing more on the photography and editing aspects of the flow rather than the science behind it. There are a number of things we could have done to more precisely measure things like the speed of the water. One thing I would definitely do differently if I were to ever perform this experiment again would be to add dye to the back end of the car to better show how the water interacts with the car as it flows over it. This would also help to measure the Reynolds number of the flow to better differentiate between turbulence and laminar flow.

I am actually pretty content with the way these images turned out, editing was definitely a huge and necessary part of this project and I think without it, these images lose a lot of their value as artistic representations of scientific flow. In future experiments, involving moving flow like this, I think video would also be a great way to show the changes between the two types of flow.