Aerodynamics and Hydrodynamics report

Data Analysis: In this lab my group created a boat using the hull and sail that we thought would create the least drag. We chose the Vee hull, which we thought that it would cut through the water better than the other hulls. It did cut through the water however we had trouble balancing the boat, because it had a smaller center of gravity as opposed to a catamaran. After testing it in the tank we found that it was tilting. We decided to put led shot through the back on the opposite side that it was tilting. This did improve its balance but in a very low current it continued to capsize. We decided to add led shot to the keel to keep the keel at the lowest point in the water it could be, because in most boats the keel is very heavy to prevent the boat from capsizing. Adding the lead shot to the keel did prevent it from capsizing, however we forgot to include the mast and sails weight in keeping the boat from capsizing. In the first competition our boat did not capsize our tip because we added the led shot. After the first competition we added the mast to see what would happen. After adding the mast the boat capsized immediately, we decided to add more led shot to the bottom of the boat help its balance. It did prevent the boat form capsizing however the lead shot slowed the boat down. After the boat could withstand the mass of the mast we began making the sail. We decided to make a small sail, so that the boat would stay balanced. We made a very small jib but a large main sail. We mainly focused on a sail that was adjustable, and that would do well in the downwind race. We connected the sail onto the mast and boom with string. After testing the entire boat in the water we found that it was very unstable. We took out the wooden boom and replaced it with a straw making it less top heavy. The boat did stay still this time. When choosing our sail we were aware that the bigger the sail the better it would do in the downwind

race but our boat could not withstand a large boom and mast. Once we put the boat in the water with all the parts that we would be racing with it was balancing fine. We added a metal loop to the back of the boat and tied a string connecting the boom to the loop so that we could adjust how far the boom was let out relative to the boat. In the downwind race we let the sail out at a 45-degree angle relative to the boat. So that the sail would catch all the wind coming from the fan. Luckily it stayed on course, and did not capsize or rock from side to side. The reason that it did not rock is because the keel was heavy enough that the boat was pulled down more by the keels weight than it was pushed up by buoyancy. The same thing happened when we first added our mast, it fell to a side because it was top heavy, and adding weight to the keel would pull the boat down in the water more preventing the boat from tipping. In the upwind challenge we set our sail directly over the center of the boat preventing it from going backwards. However it did go backwards. Out of all the competitions our average was third. I was very surprised on how hard it was to make a boat that was stable.

Conclusion:

I learned why a boat stays stable. I learned what the keel does in a boat. I learned how hard a boat is to design and built. I was very surprised on how hard it was to make a boat that was stable. I found this lab very interesting.

Note: This lab was very different then our normal labs so not all of the data analysis sections made sense to do in this lab.