



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

Name(s) Hanna M. Vincent	Project Number J0126
Project Title Forces on the Sails of a Club Flying Junior	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To compare the forces on the Main sail and Jib sail of a CFJ sail boat in different wind conditions and directions to see if the forces are consistently proportionally to the difference in the surface area of the two sails.</p> <p>Methods/Materials A CFJ One-Design Sail Boat, with standard rigging: mainsail, jib, and sheets. -Force Meter (SHIMPO digital force meter, Model #FGE-20X) -Wind Speed Meter (Skymate Speedtech SM-18, digital wind speed gauge) -Open space in Santa Barbara harbor for data collection, with adequate wind.</p> <p>Wind speed was measured and recorded just before each run. The force meter was connected to the end of the Main Sheet (line) or Jib Sheet and the force in pounds was recorded for each reading, as many times as possible before running out of room in the harbor.</p> <p>Results Force on the main remained constantly more than that on the jib and there was always more force on both sails when there was more wind. The main sail had about 7.4 times more force than the jib when going downwind at about 6.5 knots. The mainsail had about 3.3 times more force than the jib when going upwind at about 6 knots. Therefore, the difference in force between the mainsail and jib is not proportional to their surface areas, and differs in different conditions.</p> <p>Conclusions/Discussion Upwind forces were always considerably larger than downwind. This is because when a sailboat is going straight downwind, it cannot go faster than the wind because the wind is pushing it. As the boat goes faster, and closer to the speed of the wind, the pressure on the sail from the wind begins to diminish because the forward and backward forces begin to equal each other. This, along with friction between blocks, may have resulted in an inaccuracy of testing. Downwind testing was surely influenced by many variables (oscillating and shifty winds, swells, currents, and measurement variables with the line and force gauge). However, under the circumstances, testing was as accurate as possible. Future testing should include collecting more data in many different conditions. This would help reduce at least the wind variable. Otherwise, testing would have to be conducted in a more controlled way, perhaps with a model sailboat in an indoor pool with fans to create winds at constant speeds.</p>	
Summary Statement Does the Main or Jib sail of a Club Flying Junior sail boat produce more force, and are the forces proportional to their size in different sailing conditions?	
Help Received Father helped collect data in the boat, took pictures, and helped me format the data tables and graph.	