These are various ways we can test the code to improve specific sections. In tests like this it is important to eliminate as many variables as possible to get at the behavior we want.

# Test WindToSailLookup to find the best relationship between relative wind and sail angle

1. Find a way to measure the total force exerted on the boat. Maybe stick a force sensor into the keel block and support the boat fully on that. Ask Dave for ideas for this.
2. Use fans to put a certain relative wind on the boat, like 30 degrees
3. Sweep the sails from full in to full out, and record which position creates the highest force
4. We can thus map relative wind angle to optimal sail position
5. Rinse and repeat for different relative wind angles
6. Try and increase wind speed (more fans?) and see if that changes the results from earlier

Think about how the boat would be heeling in various conditions, and how that would affect the test. Sailor Sutherland paraphrased: “this factor would be awful to account for and barely matters, so ignore the heeling in this testing”.

After doing this testing, use the maximums gathered to make a ‘rel. wind angle against boat speed’ polar plot and try to validate that data on the lake.

# Test ControlHeadingWithRudder to find how the PID values should change with boat speed

The PID values controlling the heading of the boat with the rudder should be adjusted with boat speed, because at high speeds a small rudder motion has a larger effect.

1. Drag the boat at fixed speeds and test PID values to see which ones complete a triggered heading turn with the least overshoot and awfulness
2. We may be using an Auto-tuned PID controller. In this case, test the rudder with and without autotuning to get a feel for what this does.

It’s not clear exactly what the criteria for the test should be here. If we have compass or camera and can measure the boat’s heading we can measure error on the turn and time it takes to make the full turn, or if we’re evaluating the values by eye we can try to roughly time how long it takes to turn and evaluate how much it overshoots by eye.

# Test HowToChangeRegime.vi

How should it choose which direction to turn to get to desired regime? Currently it favors port tack on only when either direction is equidistant. Should port be favored even in some uneven situations?

1. Tell the boat to transition between specific regimes that are even apart, and increase the distance with port favored
2. Time each run many times and see if the transition is faster even when going through more regimes
3. Look at behavior and see if it wavers more with certain amount of port favoring

Time seems to be the best way to determine which is better by repeating the same regime transition. Start with Port favored only when even distance for going each direction and see if performance time in increased when making the Port favored even when going across tack is faster. We may have Amanda look at it and qualitatively give her expert opinion.

## Simulator Test:

In order to test tacking algorithm, options within simulation: n-parameter sweep, n-parameter perturbation+hill climbing, or genetic algorithm. Parameters to refine: sail set values, which angles define certain behaviors. Want to measure exit velocity, time spent in tack normalized by entrance velocity