Design and Construction of an Asymmetric Spinnaker For the New Navy 44' Sail Training Craft Mk II

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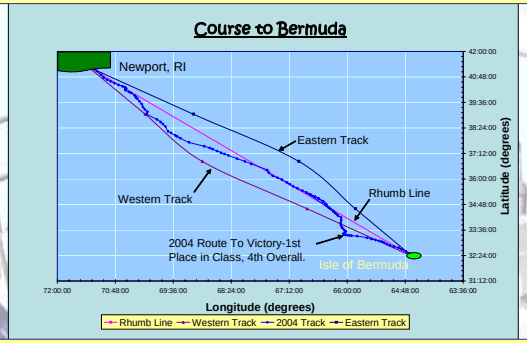
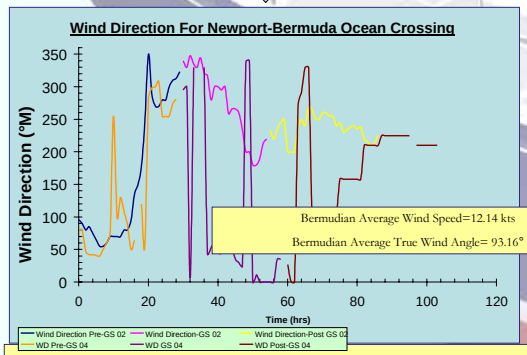
Faculty Sponsor- Associate Professor Paul Miller

Research



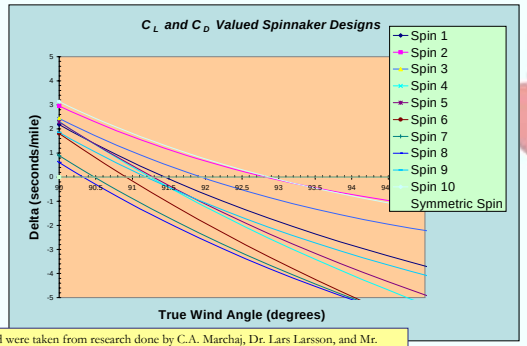
The course to Bermuda is approximately 143 degrees true at a distance of 635 miles. The common term used for the straight line course in yacht racing is the "rhumb line" where the yacht theoretically has the shortest overall distance between the starting and finishing lines. Two theoretical Eastern and Western tracks were also created to account for the Gulf Stream's effects flowing from the southeast to the northwest, barring any warm or cold eddies.



Bermudian Average Wind Speed=12.14 kts

Bermudian Average True Wind Angle= 93.16°

The Naval Academy Offshore Sailing Program provided logbooks from the 2002 and 2004 Newport to Bermuda Races.



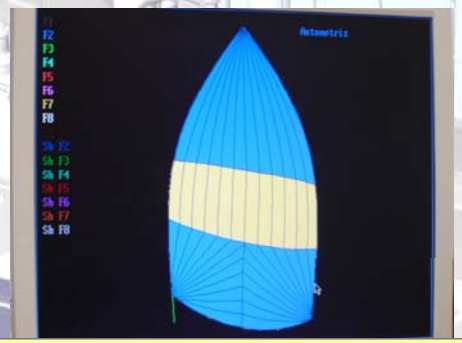
The values used were taken from research done by C.A. Marchaj, Dr. Lars Larsson, and Mr. George Hazen. Ten of the best combinations are displayed above. The lift/drag combination that worked best was C_L=1.2 and C_D=0.2.

Project Statement

The Naval Academy Sailing Program has 20 Navy 44' Sail Training Craft which are used to train midshipmen in the ways of the ocean and allow them to race against civilians in many different races and regattas. These yachts employ symmetric spinnakers, a proven tool. The recent, rapid development of asymmetric spinnakers however may lead to greater performance and easier handling. Through this research, a modern asymmetric spinnaker will be created to determine which design best suits the Naval Academy's program.

Methods and Strategy

This project continued work accomplished during the fall of 2006 on an asymmetric spinnaker. The fastest design was optimized to fit certain parameters and converted to computer language for actual construction at the Navy Sailing Loft. Sailmaking techniques were learned from experienced sailmakers to make the best possible sail.



Once the lift and drag combinations were found, the non dimensional values were converted into values of camber for the particular combination. After running the conversion, the camber values were too flat realistically even for a Code 0 gennaker. The camber values were deepened to create the above computer design on ASPINN.exe, a Windows DOS-based program provided by Mr. John Jenkins.

Full Scale Testing

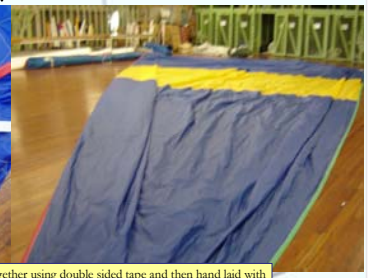
The main objective of this project was to validate the results given by the Velocity Prediction Program data initially gained in the fall of 2006. The full scale testing required two Navy 44's with two crews who were competent in sail handling an asymmetric spinnaker. One crew was trained by MIDN 1/C Scott, 1/C Leigh Loesel, and 2/C Mark McClure. The training solved one half of the equation however the Offshore Sailing Team could not spare another crew to accomplish two boat testing. Suggestions have been made to complete one boat testing in the future. This testing is scheduled for the month of May when crews are available.

Another problem that disrupted the project was the delay in delivery of the Navy 44' Mk II. Due to unforeseen problems, the new yacht has not arrived to USNA. In the meantime, the Mk I Navy 44' STC must be used as a testing platform. Once this yacht is delivered, then a true comparison can be completed.

Many thanks are due to Mrs. Lottie Smith, Al Golden, and John Jenkins of the Navy Sail Loft, Coach Peter Carrico of Navy Offshore Sailing and Prof. Paul Miller. Their expertise and trust were highly valuable to the quick completion of the sail.

Sail Construction

After confirming the design with John Jenkins, head Navy sailmaker, Prof. Paul Miller, project sponsor, and Coach Peter Carrico, Offshore Sailing Team, the design was placed in the PatternSmith CAC (Computer Aided Cutting) program that translated the language from ASPINN to language that the CNC machine could understand. Each run of the cutting machine, shown above on the left, was considered one table of cloth. The number of panels per table was maximized to save as much cloth as possible.



Once all the panels were cut, they were taped together using double sided tape and then hand laid with each neighboring panel. Red and Green Dacron tapes were stitched on the luff and leech edges of the sail as well as a White Dacron tape along the foot or bottom of the sail. Reinforcing patches of White Dacron were then applied and then stitched to the corners of the sail where the stress on the free flowing surface is the greatest. Steel rings were placed in the corners of the sail where the control sheets from the sailboat would be attached.

After nearly three weeks of work in the Navy Sail Loft, the spinnaker was ready to fly. The sail was initially set and flown on a Friday by an Offshore Sailing crew aboard the yacht, *Swift*. On the initial run, the windspeed was nearly 14 knots. The breeze died down to 8-9 knots of speed however, the yacht attained 56° Apparent Wind Angle and on successive sets after two weeks, attained 35° AWA.