CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
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Project Number
S0611

Project Title
Is the Wind Predictable?

Abstract

Objectives/Goals

The intent of this project is to find out if the wind is predictable within a day. And if so, with this information, can a sailor optimize his route around a racecourse.
Research shows that the wind has some level of predictability within a day. If true, then for a sailboat race, the racer could go out an hour or so prior to the race and collect trend data. Then, during the race, the sailor would use this data to predict upcoming wind direction shifts.

Methods/Materials

The first step in my experiment is to collect highly accurate wind data and then to analyze this wind data for trends. Unfortunately, a conventional wind vane will not work because it has friction, inertia, and it is not very sensitive to small wind direction shift. The technique that will be used to calculate the direction of the wind is to construct an apparatus containing a cross-axis of ultrasonic transmitters and receivers. Sonic pulses will then be sent along each axis. The magnitude of the wind's effect on each pulse's transit time will be logged to determine the speed and direction of the wind (through the use of trigonometry). For example, if the wind is behind an ultrasonic transmitter, the pulse will get to its receiver faster than if there were no wind. Tests were done to verify that there is linear relationship to the sonic pulse transit time. The data were then collected at the Port of Redwood City, and compared to a USGS weather station there. The wind direction and speed were sampled every 20 seconds and store to a memory device.

Results

For the majority of my data, there was a clear periodic nature to the wind. It is sinusoidal in structure and has a typical period of 15 to 50 minutes. Furthermore, when it occurs, it continues throughout the afternoon in that pattern.

Conclusions/Discussion

This data shows that the wind is (within a day) often predictable. Using this data, my device can look at the trends and tell him when to tack to sail a shorter course. This shorter course could save as much as 15%, or a 120 second advantage.
My next step is to make this apparatus into a device that can go on top of a mast or on a sailor`s head so that it can be used in an actual sailboat race.

Summary Statement

The intent of this project is to find out if the wind is predictable within a day.

Help Received

Dad helped organization, floating point software, and display board; Mom gave up ski weekends; Brother for costructing model; girlfriend for staying home all those Saturday nights