CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Derek M. Abbott

Project Number

J0101

Project Title

Aerodynamics of a Golf Ball

Abstract

Objectives/Goals

The purpose of my project was to see if the number of dimples on a golf ball changes its range.

Methods/Materials

Materials:
Golf Ball Launcher (home made)
Compressed Air Supply
Multiple Golf Balls (test subjects)
Measuring Equipment
Camera
Safe Controlled Area

Procedures:
1. Obtain different Titleist golf balls for testing
2. Make a golf all launcher to test the golf balls
3. Mark out every meter in an open area
4. Test each type of golf ball ten times
5. Record data while testing
6. Make a tables and graphs
7. Average the length for each ball
8. Share your results

Results

The results of my experiment showed that the golf ball with no dimples flew the farthest when launched at 7.6 bar and the ProV1 with 332 dimples flew the farthest when launched at 5.2 bar, proving my hypothesis partially wrong.

Conclusions/Discussion

During the testing of my project I was proved partially right. I believed that the ball with no dimples would fly the farthest when launched at my high pressure 7.6 bar (110 PSI), while the ball with 392 dimples would go the farthest when launched at the lower pressure of 5.2 bar (75 PSI). My hypothesis was proved right as the ball with 0 dimples went the farthest at 7.6 bar but, was also proved wrong as the ProV1 with 332 dimples went the farthest at 5.2 bar.

Summary Statement

My sience fair project was to test the effect of dimples on the range of a golf ball.

Help Received

I Used the machine shop and welder under the supervision of my father at his place of business.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Lucas Alfonso; Thomas Wilson

Project Number
J0102

Project Title
Does Creating a Liquid Vortex Affect Drain Time? Coriolis Effect: Fact or Fiction?

Abstract

Objectives/Goals
Our goal was to see if creating a liquid vortex would affect the time it takes for water to drain from a one-liter bottle. We also wanted to find out if the Coriolis Effect was true for small bodies of water.

Methods/Materials
Step 1: Gather all the materials for this test (2 1 liter bottles, 1 tornado tube, 1 sharpie, video camera, tripod, water, Styrofoam ring.
Step 2: Fill a one liter bottle about two inches from the top with water.
Step 3: Mark the top of the water with a Sharpie pen on the bottle.
Step 4: Connect a one liter bottle with a tornado tube to the bottle filled with water.
Step 5: Start the video camera.
Step 6: Flip the two bottles over and the water should not fall to the bottom bottle, and there should be no leaks.
Step 7: Then, spin the bottle as follows within the confines of the ring:
Test #1: Counterclockwise, 4 spins. Test #2: Clockwise, 4 spins
Test #3: Counterclockwise, 8 spins Test #4: Clockwise, 8 spins
(This part requires two people, one to hold the bottle, and one to hold the ring.)
Step 8: Stop the video camera after the upper bottle has completely drained.
Step 9: Keep track of how many runs you do.
Step 10: Put each run on a computer and record each time.
Step 11: Repeat these steps 1 # 10 for Tests 2, 3 and 4.

Results
We hypothesized that the bottle that we spin counterclockwise with more spins would drain the fastest. Our hypothesis was incorrect with regard to the greater the number of spins the faster the drainage. Our hypothesis that the direction of the spin would affect the speed of drainage was also incorrect. We found no correlation between the direction of the spin and drainage time. The fastest time was the sixth test. In this test that we spun the bottle counterclockwise four times without a tornado tube.

Conclusions/Discussion
Based on our testing, creating a vortex in water decreased the drain time from a one-liter bottle. We found no correlation between the drainage speed and the direction of the vortex (clockwise or counterclockwise). This would mean the Coriolis Effect is not true for small bodies of water such as used in our experiement

Summary Statement
Does a liquid vortex decrease the time for water to drain, and does the direction of the vortex have an effect?

Help Received
Mother helped type and proofread report.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Rohun K. Atluri

Project Number
J0103

Project Title
Blowing in the Wind: The Optimal Design of a Horizontal-Axis Wind Turbine

Abstract

Objectives/Goals
The objective of this experiment was to determine the optimal design of a horizontal axis wind turbine.

Methods/Materials
Five model wind turbines with identical rotor, yaw and windswept area, but different pitch and number of blades were constructed. Three turbines have 4 blades with varied pitch. After determining the optimal pitch from these three turbines, two new turbines with 2-blade and 3-blade configurations with the same pitch were built. The electricity generated by the turbines at three different wind speeds was measured.

Results
The wind turbine with a 3-blade configuration at 30° pitch provided the most efficient design for a wind turbine.

Conclusions/Discussion
The conclusion from this experiment is that the pitch and the number of blades are important factors in the optimal design of a horizontal-axis wind turbine at various wind speeds.

Summary Statement
My project is about the wind turbines that are used to generate electricity and their efficiency.

Help Received
My teachers Mrs. Trevino and Mrs. Schumpelt provided encouragement. Dad helped with the tools to build the wind turbines. Mom and brother helped with pictures.

Name(s)

Namrata R. Balasingam

Project Number

J0104

Project Title

On the Rate of Flow of Liquids in Tubes and Its Implications to Cardiovascular Health

Abstract

Objectives/Goals

The purpose of my experiment is to determine how the rate of flow of a liquid through a tube is affected by the following factors: (a) pressure driving the flow, (b) the length of the tube and (c) the diameter of the tube. I became interested in this topic when I learned that heart disease results when plaque reduces the diameter of blood vessels, causing a dramatic decrease in flow rate. This topic is of interest because the American Heart Association estimates that heart disease costs the U.S. economy nearly half-a-trillion dollars each year.

Methods/Materials

I modeled the human circulatory system using a set of latex tubes, and a large container filled with water. The latex tubes were connected to the side of the container, via a valve. I investigated flow rate dependence on (a) pressure by changing the height of the water in the container, (b) tube length using a set of latex tubes of the same diameter, but different lengths, and (c) tube diameter, using a set of latex tubes of the same length, but different diameters. I measured the flow rate by determining the amount of time (delta_T) taken for a small volume of water (delta_V) to drain from the container through the tube under investigation. The flow rate Q was calculated from the ratio delta_V/delta_T. Since the flow rate can be fast I used a high-definition camcorder to record the change in the height of the water in the container. I viewed the video on my computer in slow motion, and obtained accurate readings of delta_T, and delta_V.

Results

I collected data at 25 conditions, and repeated each measurement 3 times. So I extracted a total of 75 data points from 75 video clips. From this data, I found that the flow rate (a) increases with increasing pressure (agreed with hypothesis), (b) decreases with increasing length (contradicted hypothesis), and (c) increases dramatically with increasing diameter (agreed with hypothesis). My results are in good agreement with the Hagen-Poiseuille Law.

Conclusions/Discussion

I found that a change in tube diameter can dramatically change the flow rate of water. For example, I found that when tube diameter decreases by a factor of 2.65x flow rate decreases by a factor of 18x! This explains why a decrease in blood vessel diameter can be very harmful to health. By exercising more and changing our eating habits we can reduce plaque in our blood vessels.

Summary Statement

My experiment showed how a small decrease in the diameter of a tube can lead to a substantial decrease in the flow rate of fluid in that tube; this explains why plaque-induced blood vessel narrowing is harmful to our cardiovascular health.

Help Received

I would like to thank my father, Dr. Pratheep Balasingam for his encouragement throughout the course of this experiment. I would like to thank my mother for purchasing the necessary materials for me to set up my experiment.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Vikas C. Bhetanabhotla

Project Number
J0105

Project Title
A Study of Magnetohydrodynamic Propulsion and Dimensionless Numbers

Abstract

Objectives/Goals
The objective of my research is to study Magnetohydrodynamic flow of different ionic solutions varying voltage, amperage, conduit cross-section shapes and sizes, and the sizes of magnets and electrodes. The time taken for the flow to travel across the conduit and the amount of sound produced are measured, and the flow velocity and Reynolds number, a dimensionless number that enables scalability of results, are calculated.

Methods/Materials
Two Neodymium magnets are placed on the outside and two Nickel electrodes are placed on the inside of several plastic conduits so that the electric and magnetic fields are perpendicular to each other. This conduit is placed in a NaCl or KCl solution, and electrodes are connected to lead-acid batteries, which cause the ionic solution to flow. Several drops of an oil colloid are injected into the flow and the time taken by the drops to travel the length of the conduit is measured to calculate the flow velocity. Sound produced by the flow is measured by a Decibel meter. The Reynolds number is calculated based on the velocity, solution properties and conduit characteristic lengths.

Results
As voltage and current increased, the flow velocity, sound produced, and Reynolds number all increased. As the distance between the magnets increased, the flow velocity and sound produced decreased. These results were about the same for NaCl and KCl solutions. Larger magnets and electrodes also increased the flow velocity and sound produced. These results are consistent for all conduit shapes and sizes. All the relationships are linear. Since Reynolds Number includes the velocity and the cross section size, the various lines for different conduit sizes became closer, tending towards one line.

Conclusions/Discussion
When the magnetic field or electric field strengths are increased, it causes more Magnetohydrodynamic force and makes the ionic solution flow faster. This produces more noise and yields a higher Reynolds number also. When the conduit cross section is increased, or the distance between magnets is increased, the flow velocity decreases due to a weaker magnetic field. Since all these relationships are linear, these results can be extrapolated to higher voltages and Reynolds Numbers.

Summary Statement
This project studied the effect of several variables on properties of Magnetohydrodynamic flow.

Help Received
My father supervised my testing and helped me in soldering and collecting data, which required 2 people.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Anthony J. Blair

Project Number

J0106

Project Title

Keep Your Car from Flying!

Abstract

Objectives/Goals

My project was to figure out if the underside of a high performance vehicle could be modified to decrease lift. I believe that a proper design could reduce lift and result in a safer car.

Methods/Materials

6 test cars with varying designs and one control were constructed. Each design went through 20 wind tests. Wind speed was recorded when the front of the model would lift off the test bed.

Results

The control, with a flat underside, tolerated the most wind. Only one design slightly out performed the control, but there was no significant difference. My results ended up contradicting my hypothesis.

Conclusions/Discussion

My conclusion shows that aerodynamically modifying the underside of a car would not be beneficial in racing, and it might be better to focus on the top of the car where there are stronger air forces to work with.

Summary Statement

My projects focus was on making high performance cars safer through aerodynamics.

Help Received

Dad helped with conducting the experiment; Mom helped with board assembly

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Brittany Buser; Mckenzie Smith

Project Number
J0107

Project Title
Sail and Speed

Abstract

Objectives/Goals
To determine what sail trim 0, 15, 30, 45, 60, 75, and 90 degrees would make the boat sail fastest. We believe that the sail trim of 90 degrees would make the boat sail the fastest.

Methods/Materials
The sail was made out of mylar. Carbon fiber spars ad heat shrink tubing were used for the mast and boom. The hull was made out of plywood, as was the track. Six fans were used to simulate wind.

Results
The boat failed to complete the track with the sail trim, of 0, 75, and 90 degrees. The sail trim of 15 degrees was the slowest, while 30 and 60 were about the same speed. The boat completed the track at the fastest speed with the sail trim of 45 degrees.

Conclusions/Discussion
The boat sailed the fastest when the sail was trimmed at 45 degrees. We proved our hypothesis incorrect. We learned how air particles collide over an airfoil creating high and low pressure areas, and how this combines to create lift. The lift generates movement which can be measured as speed.

Summary Statement
This project determines how sail trim effects the speed of a sailboat.

Help Received
Jess Atkinson provided materials and guided the making of the sail. Brittany's dad used power tools to help build the hull and track.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Taran A. Daley

Project Number

J0108

Project Title

Is Bigger Really Better?

Abstract

Objectives/Goals

How does changing the size of a wing affect the amount of lift produced by the wing? Does lift increase proportionally to the size of a wing? It is hypothesized that as the wings got smaller that the amount of lift that the wings produced would also get smaller.

Methods/Materials

Using two airfoils of the same design, one with a chord length of 10 cm and the other with a chord length of 20 cm. the researcher will test three length sections for the lift that they produce. Each airfoil will be mounted inside the wind tunnel to a fixed frame and attached to a spring scale. A strong fan will be used to generate wind velocity within the wind tunnel. Lift will be measured by the spring scale in grams.

The researcher will need the following materials:

1. One wind tunnel
2. Strong fan
3. Spring scale
4. Two different scale airfoils that can be cut

Conclusions/Discussion

It was hypothesized that as the wings got smaller the amount of lift that was produced would also get smaller. With wing #1, which had a chord of 10 cm, as the wing length got smaller the amount of lift produced was less. A wing length of 15cm gave 29.56 gm of lift on average, a length of 10 cm gave an average of 12.6 gm and the length of 5 cm gave a lift of 2.2 gm.

For the wing with the larger chord the same principal held true. The longest length at 15 cm gave 45.4 gm of lift, the wing length of 10 cm gave 15.02 gm of lift on average and the last wing at 5 mc length produced 5.2 gm of lift.

This data shows that for this wing design that as the wings got shorter the amount of lift produced also decreased as expected.

But the overall wing size provided unexpected data. The hypothesis would make it seem that two wings with the same wing size would produce relatively the same amount of lift. However, this was not true. The 10cm wing with the 10cm chord compared with the 5cm length from the 20 chord wing would give an equal wing size. The lift was very different. W2 wing produced less lift. Wing 1 produced 12.76 gm lift and Wing 2 produced only 5.2 gm lift.

Summary Statement

The project tested the size of airfoils and the lift that was produced.

Help Received

I would like to thank my Dad for helping me build my wind tunnel. I would also like to help Christopher Chew, who voluntarily came over and helped build the wind tunnel.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Eleanor O. Frost

Project Number

J0109

Project Title

Blades of Glory: A Study of Producing Electric Power from Wind Energy

Abstract

Objectives/Goals

MY STUDY EVALUATES THE ELECTRIC POWER PRODUCED BY THREE DIFFERENT WINDMILLS AT THREE DIFFERENT WIND VELOCITIES. EACH EXPERIMENT WILL COMPARE THE POWER PRODUCED TO THE THEORETICAL MAXIMUM, BETZ' LAW.

Methods/Materials

I BUILT A WIND TUBE AND A WINDMILL. THE WIND TUBE WAS MADE OUT OF A HOUSE FAN AND PLASTIC SHEETING. THE FAN HAD THREE DIFFERENT SETTINGS. THE WINDMILL USED THREE BLADES WITH THREE DIFFERENT ANGELS: 45, 30 AND 15 DEGREES. I USED A MOTOR FOR A GENERATOR. FOR EACH EXPERIMENT I MEASURED AT THREE LOCATIONS THE WIND SPEED AT THE MOUTH OF THE WIND TUBE WITH AN ANEMOMETER. I THEN PLACED THE WINDMILL AT THE VERY FRONT FRONT OF THE WIND TUBE. AFTER REACHING A STEADY STATE, I MEASURED THE VOLTS AND THE AMPS THREE TIMES EACH WITH A VOLT AND AMP METER. FOR EACH BLADE AND FAN SETTING I RAN 6 EXPERIMENTS

Results

THE 30 DEGREE BLADE AT THE HIGH AND MEDIUM FAN SETTING PRODUCED THE MOST POWER AND WAS THE MOST EFFICIENT.(75% AND 43% MORE POWER THAN THE 45 DEGREE BLADE.) THE 45 DEGREE BLADE, HOWEVER PRODUCED THE MOST POWER AND WAS THE MOST EFFICIENT AT THE LOW FAN SETTING. THE 45 DEGREE BLADE EFFICIENCY WAS 3 TIMES MORE THAN THE 30 DEGREE BLADE AT THE LOW SETTING. EFFICIENCY WAS DETERMINED BUY COMPARING OBSERVED POWER TO BETZ' LAW CALCULATION THE 15 DEGREE BLADE DID NOT SPIN FOR THE LOW OR MEDIUM SETTINGS. AVERAGE WIND SPEED FOR THE HIGH FAN SETTING: 8.46 METERS PER SECOND FOR THE MEDIUM SETTING: 5.71 METERS PER SECOND FOR THE LOW SETTING: 4.34 METERS PER SECOND

Conclusions/Discussion

THE BEST BLADE ANGLE FOR PRODUCING POWER DEPENDS ON THE SPEED OF THE WIND. THE BEST EFFICIENCY WAS 2.2% OF THE THE BETZ' LAW CALCULATION. THE DIFFERENCE IS DUE TO THE FLOW AT THE END OF THE WIND TUBE, THE NOSE OF THE WINDMILL, THE GAP BETWEEN THE BLADES, THE FRICTION, THE GEAR NOISE AND THE DRAG ON THE BLADE. I SUPPOSE THERE ARE ALSO LOSSES INSIDE THE GENERATOR.

Summary Statement

A STUDY OF PRODUCING ELECTRIC POWER FROM WIND ENERGY

Help Received

DAD HELPED WITH DRILLS AND DATA COLLECTION; MOM AND DAD GAVE ME SUPPORT AND DROVE TO STORE FOR BOARD AND SUPPLIES AND TO LA COUNTY SCIENCE FAIR.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Jen H. Kelly

Project Number

J0110

Project Title

Tubular Turbulence: A Study of Water Flow

Abstract

Objectives/Goals

My objective was to determine how the flow rate (discharge) through different sized siphon tubes is affected by the diameter of the tubes. I predicted that the discharge would not double with doubled diameter, but would increase by 4 times if the diameter were doubled.

Methods/Materials

I built siphons using four different sized tubes made of the same material, with each tube being twice the diameter of the next smaller tube. I used tubes that were 1 inch, ½ inch, ¼ inch, and 1/8 inch in inside diameter. I made my siphons all the same length and height, and used the same amount of water each time. Then I used multiple trials to time how long it took for four liters of water to flow from the top bucket to the bottom bucket through each tube. I used the discharge of the smallest tube as the reference point, and then compared the discharges of the bigger tubes to this reference point.

Results

I found that the discharge did not increase four times with double the diameter, but found that the discharge increased 5 to 6 times with each progressively larger tube.

Conclusions/Discussion

The diameter of a tube is not the only thing that influences how the water flows through it. Other factors such as tube length, tube material, friction, and turbulence are extremely important, especially in smaller tubes. I also learned that people such as farm irrigators, engineers, and even fish biologists must use complex discharge calculations, such as Bernoulli#s equation, to design water flow structures.

Summary Statement

I examined flow rates of water through siphon tubes to determine the influence of tube diameter.

Help Received

Father helped build siphon assembly and helped with math, typing, and background research. Mother helped format the graphs on the computer. Both parents helped run the trials.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Weston R. Kramer

Project Number

J0111

Project Title

Wind Energy and a Better Blade

Abstract

Objectives/Goals

The objective is to determine what number and angle of windmill blades can produce the most energy.

Methods/Materials

1. I constructed the windmill stand and blades with pine and balsa wood.
2. I used an erector set motor and reversed it into a generator.
3. I connected the turning part of the motor to the windmill shaft, and then connected the motor to a volt meter to measure the energy output.
4. I used a small house fan as a wind source to maintain a constant wind speed.
5. First I tested a windmill with 2 blades at angles of 0, 15, 30, 45, 60, 75 and 90 degrees.
6. With each combination I took volt measurements from the volt meter. Then I did the same with 4 and 8 blades.

Results

The 2 bladed windmill produced the least amount of energy, the 4 bladed windmill was in the middle in energy output, and 8 blades produced the most. The 15 degree angled blade was best.

Conclusions/Discussion

The 8 bladed windmill at a 15 degree angle was the best of all I tested. My hypothesis of 8 blades at a 45 degree angle was partially incorrect. While 8 blades did turn out to produce more volts, the 15 degree angle had the highest output. I think the 15 degree angle had more surface area for the air to hit but it also had an escape route so that the air could flow through and turn the blade. Then I wondered why windmill farms had 3 blades instead of 8. I found out that it is a cost and safety issue (it would turn too fast with 8 and cost more), and it is the blade length that really impacts the energy output.

Summary Statement

For my project "Wind Energy and a Better Blade" I wanted to figure out what different types of windmill blades (angle and number) would produce the most energy (in volts).

Help Received

My dad helped me build the stand that the windmill turns on. He supervised my use of power tools. Greg at Radio Shack suggested turning a motor into a generator since I couldn't buy a generator.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Timothy R. Le

Project Number

J0112

Project Title

Which Wind Turbine Blade Design Will Produce the Most Power?

Abstract

Objectives/Goals

The objective of my project is to determine the best aerodynamic blade design of a wind turbine that would produce the most power. I hypothesized that the feather shaped design (Design No. 4) would produce the most power (milliwatts).

Methods/Materials

Seven sets of three blades each were constructed by making a proof set and making duplicates of the blade. The blades were constructed of Model Magic because of its lightweight, fast drying, and non-cracking properties. These blades were then mounted on a wind turbine. The wind for the experiment was produced by a 45 centimeter diameter fan with the turbine 90 centimeters away. The voltage and amperage was collected at 100 samples per second for 60 second runs. The wattage was then calculated. This procedure was repeated for ten trials for the seven sets of blade designs.

Results

The average wattage produced for: Design No. 1 was 12451.86 milliwatts, Design No. 2 was 1756.21 milliwatts, Design No. 3 was 1644.82 milliwatts, Design No. 4 was 2771.62 milliwatts, Design No. 5 was 1181.83 milliwatts, Design No. 6 was 1324.47 milliwatts, and Design No. 7 was 3994.87 milliwatts. My hypothesis was correct, being that Blade Design No. 1 would produce the most wattage because of its largest surface area, and Blade Design No. 4 would produce the most wattage out of the six designs with the same surface area and weight.

Conclusions/Discussion

I concluded that my hypothesis was correct. Blade Design No. 4 (feather shaped design) was the best in power production out of all the regular surface-area blades. Blade Design No. 1 (larger surface area but same weight) proved that surface area does affect the output of a wind turbine. This science Fair project has significant real life applications for three reasons. First, along with other renewable resources, it could decrease our dependency of foreign oil. This decrease in dependency would help resolve the more than $10 trillion deficit along with helping the economy during these times. Second, the increase of wind energy would make more jobs for other people (maintenance and construction of the turbines). Third, this decrease in dependency on oil would also slow down the rate of global warming.

Summary Statement

The purpose of this experiment was to determine the best aerodynamic blade design that would create the most wattage from a wind turbine.

Help Received

Mr. Revel helped with determinig resistor for measurement circuit; Mr. Pehl helped with statistics; Mr. Salamon proofread research report; Mr. Stephen Hubbard proofread conclusion; Dad paid for equiptment

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Heidi L. Lederhos

Project Number
J0113

Project Title
Swimming Can Be a Drag! Does Form and Surface Condition (the Suit) Affect the Speed of the Swimmer?

Abstract

Objectives/Goals
To determine the effect surface condition (the suit) and different forms or body strokes (good form, bad stroke and streamlining) can have in relation to the speed of a swimmer.

Methods/Materials
Make wooden scale models of myself of 3 different swim forms or strokes. Use pennies to match density of a human body. Construct a swim tunnel using 8" pvc pipe. Attach a scale to measure drag force. Determine water speed. Conduct tests at different flow rates, measure the force on a scale, measure height of water in pipe, and calculate water speed. I conducted 108 trials.

Results
The experiment went well. The drag on the swimmer as related to form showed that at higher speeds, good form is important. For my size, the results indicated that a drag force of 2-6 pounds can be expected at my swimming speeds. My research indicated that swimming is only 9% efficient. So you have to apply 11 times more force to overcome the drag. Streamlining is more efficient than surface swimming, but it is hard to propel yourself underwater. The data showed that the speed suit had the least amount of drag when compared to the other suit, no suit, and wood body. In the Ratio of Drag Compared to a Regular Suit, results showed that the speed suit was 20% faster than a regular suit. The drag suit, had the most drag. The results showed, that if a good swimmer has an average speed of 5.3 feet/second, then by wearing the speed suit, the good swimmer would get an average speed of 6.3 feet/second giving them about a 4 second faster time for a 50 yard freestyle.

Conclusions/Discussion
I determined that drag was directly related to speed. The speed suit was generally faster. My hypothesis about the form (good to bad) was correct at higher speeds; the streamliner swimmer had less drag than the good swimmer. When you are swimming, the type of material you are wearing can be a factor in achieving a better time and having less drag. An observation I have made is at high speed, the water separated from the model, causing waves. Also, when you change the conditions of the experiment, like the rate, it took time to stabilize the conditions. This experiment used about 32,000 gallons of water.

Summary Statement
My project is about determining the effect that different forms or body strokes (good form, bad stroke and streamlining) can have in relation to the speed of a swimmer.

Help Received
Father supervised construction of wooden body forms and use of family farm irrigation system. Mother helped type report.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Aidan P. McCay

Project Number

J0114

Project Title

Factors That Affect a Hovercraft's Speed

Abstract

Objectives/Goals

The objective of this project is to learn about how a hovercraft works, determine the factors that affect performance, and improve design. This project studies a number of forces acting on a homemade hovercraft such as weight, gravity, friction, and lift.

Methods/Materials

The 4-foot (1.22 m) diameter hovercraft was constructed out of a 3/8 inch (9.5 mm) plywood platform and a skirt made from visqueen plastic sheeting. A leaf blower was used to provide lift and duct tape was used to prevent air to escape at interface of the platform with the skirt and engine.

A surface test, skirt test, weight test were performed. The surface test analyzed concrete, artificial turf, and natural grass. The skirt test analyzed a six-foot (1.83 m) and a seven-foot (2.13 m) skirt. The weight test examined three different payloads, 39.91 kg, 28.57 kg and 0 kg. The engine test was conducted using three different engine settings with varying flow rates/air velocities.

Results

The four hypotheses tested included 1) surface roughness slows a hovercraft's speed; 2) the larger the skirt, the faster the hovercraft will go; 3) the more weight applied onto the hovercraft, the faster it will go; 4) the more powerful the blower, the faster the hovercraft will go. Only hypothesis 1 on surface roughness was found to be true. The 3 other hypotheses were found to be false. Many forces are at work on the hovercraft like gravity, friction, and the lift (air cushion) of the hovercraft. For example, during the weight test with no weight added, there was less momentum to force it faster down the hill, than the test with 39.91 kg, the heaviest payload. However, when the medium sized payload (28.57 kg) was tested, the craft travelled fastest. It is likely that the medium-sized payload achieved an optimum balance of high momentum and low friction.

Conclusions/Discussion

The study concluded that skirt shape, which can be affected by payload weight, skirt size, and engine power seemed to be a key factor in hovercraft performance. The best performance may be accomplished by balancing these three design modifications to achieve the fastest hovercraft possible. Finding the right balance would require much more study, design modifications and additional experiments.

Summary Statement

This project studies the effects of a number of forces acting on a homemade hovercraft such as weight, gravity, friction, and lift.

Help Received

Father was a timer and assisted with graphing; Sister was the pilot for the medium weight test.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Peter A. Mellinger

Project Number

J0115

Project Title

Comparing Power Output of Wind Turbine Blades with Different Angles of Attack

Abstract

Objectives/Goals

In the real world, it is important to get a significant amount of power from a wind turbine. One of the main things that determines how much power you can get from a wind turbine is the type of turbine blades you are using. In my experiment, I decided to find out which Angle of Attack for a wind turbine blade would produce the most electricity at varying wind speeds.

Methods/Materials

I had three turbine blades with different Angles of Attack (8x4, 8x6, 8x8), and I hooked each of them up to an AC motor and a 20 Ohm resistor to generate electricity. Then, using a homemade wind tunnel, I found out how many volts each propeller made in a 1m/s airstream, a 2m/s airstream, a 4m/s airstream, a 8m/s airstream, a 12m/s airstream, and a 16m/s airstream. Then, I plugged the number of volts into an equation (P= e^2/R) so that I could find the total amount of power generated, which I measured in Watts.

Results

My results clearly showed that the propeller with the highest angle of attack (the 8x4 propeller) was able to generate the most power. This is because the propellers with the lower angles of attack cannot generate as much lift as the others.

Conclusions/Discussion

My data both proves and disproves my hypothesis. My Hypothesis stated that if wind speed and angle of attack were related to the amount of power a wind turbine could generate, then turbines with lower angles of attack would generate more power at lower wind speeds and turbines with high angles of attack would generate more electricity at higher wind speeds. My data clearly shows that the 8x4 prop made the most electricity in all wind conditions, not just at higher wind speeds. I think that my hypothesis would have been completely correct if I had found a prop with a higher angle of attack that would stall at the lower wind speeds or if I had used a resistance higher than 20 ohms. I think that my experimental procedure worked well because its results were very repeatable, suggesting a high level of precision. If I did this experiment again I would find a propeller with a very high angle of attack that would stall at lower speeds, and I would also use a larger wind tunnel. My findings could help people who are building wind farms to use blades with the right angle of attack.

Summary Statement

Which Angle of Attack for a wind turbine blade produces the most electricity in varying wind conditions?

Help Received

Dad helped with understanding the electrical concepts in my project. MBARI loaned me some test equipment.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Lucas Miller; Brendan Peddie

Project Number

J0116

Project Title

Does a Rocket That Spins As It Climbs in Altitude Go Higher than a Rocket That Doesn't Spin?

Abstract

Objectives/Goals

The purpose of our project is to compare a rocket that spins to a rocket that doesn't spin and see which one will reach higher altitude. Our hypothesis is " A rocket's spinning motion will have an effect on how high the rocket climbs into the atmosphere. A rocket that spins will go higher than a rocket that does not spin. When the rocket spins it will go straighter up in the air reaching higher altitude than when it doesn't spin. Our results showed that rockets that spun too much reached the lowest altitude, and rockets that spun a small amount reached a higher altitude than rockets that did not spin at all. We concluded that there is just a right amount of spin that will make the rocket reach its highest altitude for a certain amount of thrust.

Methods/Materials

Materials: 1. Launching Pad; 2. Four 2-liter soda bottles; 3. 4 pieces of balsa wood; 4. Four jugs of water; 5. Air pump; 6. Kite string; 7. Measuring tape; 8. Scissors and Duct tape; 10. Safety goggles.
Methods: 1. First we took four 2-litre soda bottles and cut the top off. Then we taped the top of a 2-litre soda bottle to the bottom of another soda bottle. 3. Then we cut 12 fins out of 4 pieces of balsa wood and taped them to 3 different rockets at 90 degree, 80 degree and 70 degree angles. 6. We then took the rockets to an open field. We tied the end of the kite string to the rocket. We filled the rocket about halfway with water. 10. We put the rocket onto the launching pad and pumped the pressure up to 40 psi. 11. We launched the rocket and when it came it down, we measured how far the kite string went. 12. We repeated this process 10 times for each rocket with a different fin angle and we recorded our resultes.

Results

Launch Height (ft)

Fin Angle										
90º	64	65	61	68	59	62	61	65	62	64
80º	74	71	76	72	75	76	71	69	79	74
70º	48	51	45	49	51	47	50	46	38	49

Conclusions/Discussion

We have concluded that rocket with too much spin does not go very high, but a rocket with some spin goes the highest. A rocket with some spin goes higher than a rocket with no spin. Our hypothesis was correct.

Summary Statement

Showing how some spin can make a rocket go higher.

Help Received

Mother helped putting board together. Father helped build and launch rockets.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Peter S. Min

Project Number

J0117

Project Title

The Effects of Different Blades on Generating Electricity at Low Wind Speed

Abstract

Objectives/Goals

The current wind turbine design can generate electricity only at a high wind speed. The objectives of this project were to evaluate the blade type that would produce the most electricity and compare the effects of blade size, angle, and sweep area on energy production. The goal of this project was to develop a more efficient blade design for generating electricity at a low wind speed.

Methods/Materials

The materials used include: DC motor and stand, 18V battery, a fan, multimeter, wires, wooden craft sticks and plastic cups (for blades), drill and glue.

More than 14 different types of wind blades were made using craft sticks. The blades were attached to a generator, and a multimeter was used to measure the current and voltage. For each blade different conditions including wind speed and distance of a wind source were tested. The blades varied from 6 cm to 25 cm in length. For each blade, several tests were conducted, but two conditions (low & high wind speed) were used for final tests where low, high and average amps and volts were recorded for each test.

Results

The electricity produced by each blade (watt) was calculated by multiplying the volts and the amps measured during the experiments. The highest electricity producing blade was a small horizontal blade with a variable blade angle at high wind speed. Approximately 160 mW of power was produced from this design. This provided about 100 times more electricity than the worst blades. For the low wind speed however, vertical blades produced more energy as some horizontal blades did not even turn at low wind speed. The general formula for estimating the wind energy is based on the blade area where the wind is exerted. However, the experiments demonstrated that area is not necessarily the most important factor in power production for wind blades. In fact, the largest blade, 5 times more area than the most efficient one, produced less than 1% of the power from the smaller blade.

Conclusions/Discussion

The horizontal blade was the most efficient at the high wind speed; however for low speeds, the vertical blades produced more in power by harnessing the low wind. Based on the tests, how the blade harnesses the wind is more important in producing more electricity as it is related to efficient spinning of blades.

Summary Statement

This project evaluated different types and configurations of wind turbine blades (vertical and horizontal) for optimal energy production at low wind speeds.

Help Received

Father supervised and helped in designing of blades, teacher reviewed written material

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Teresa H. Netro

Project Number

J0118

Project Title

Do Dimples Make the Difference?

Abstract

Objectives/Goals

This project applies the dimples on a golf ball to a car for better mileage. This idea comes from two different types of wind flows, laminar for a smooth surface, and turbulent for a rough/ dimpled surface. For a spherical golf ball, the turbulent flow helps it conserve energy, making it fly farther. My question is can this effect apply to a car, or in this case a non-spherical shape.

Methods/Materials

To test this I first used an irregular shape (water bottle) to test if the dimpled surface would conserve more energy than a smooth one on a non-spherical shape. The bottles were hung and tested on a pendulum structure to ensure air resistance was the major variable.

Results

I found that the dimples did in fact have an impact on the bottle#s energy lost. When doing the multiple swing tests the dimpled bottle lost less height than the smooth, and when doing the one-swing tests to convert energy lost, the bottle had a lower energy lost percentage.

Conclusions/Discussion

I have concluded that turbulent flow transfers to irregular objects for more efficiency, and therefore would apply to a car.

Summary Statement

My project is a step along the way to applying the dimples on a golf ball to a car for better mileage.

Help Received

Grandfather helped take data

Name(s)

Loren J. Newton

Project Number

J0119

Project Title

Vexing Volant Vortices: How to Chart and Reduce Wingtip Vortices

Abstract

Objectives/Goals

To chart the vortices generated by different combinations of winglets and dihedral angles, and then determine the most effective configuration to minimize wingtip vortices.

Methods/Materials

With help, I designed and built a wind tunnel test rig based on my hypothesis that if smoke was introduced to visualize the airflow over wingtips, then spray paint could print the wingtip vortices generated.

Five test wings of varying winglet tilting angles, but equal area and airfoil shape were crafted.

Vortices generated by each wing, set on seven different dihedral angles were recorded using 6 second test runs.

Results

My test data showed that vortices were reduced with greater +ve winglet angles and smaller -ve winglet angles, while different dihedral angles caused no noticeable change in vortex size.

Conclusions/Discussion

I concluded that wingtip vortices could be reduced with winglets of greater upward tilting angles. I could also conclude that wingtip vortices could be recorded; and that the paint coverage reflected the size of the vortices.

Summary Statement

To investigate how to chart and reduce wingtip vortices.

Help Received

My dad helped construct the test rig. My mom advised on the display board.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Brandon T. Nguyen

Project Number

J0120

Project Title

A Novel Approach in Determining the Temperature Dependence of Newtonian and Non-Newtonian Fluid Viscosities

Abstract

Objectives/Goals

Viscosity can be determined using the falling ball viscometer and Stokes' law. It is, however, limited to flows at Reynolds Numbers (Re) less than one. A method is needed to determine viscosity at any Re. This method can then be used to study the effect of temperature on the viscosity of a fluid. The objectives of this study are (1) to formulate a novel approach in determining the viscosity of a fluid, and (2) to determine the effect of temperature on the viscosity of representative Newtonian and non-Newtonian fluids. It is hypothesized that the viscosity of a fluid decreases as the temperature of the fluid increases.

Methods/Materials

Experiments were conducted to determine the viscosity of three Newtonian fluids (water, corn oil, and olive oil) and two non-Newtonian fluids (10W30 and 10W40 motor oils). The experiment with water was performed at room temperature to validate the procedure for determining viscosity. A ball made of Acetal Delrin was dropped into a graduated cylinder filled with the test fluid, and the transit time between two points on the cylinder was measured. Using a novel approach applicable to flow at any Re, I determined the viscosity of the test fluids from the test data. To determine the temperature dependence of viscosity, I curve fitted the data with an exponential function of temperature and obtained the correlation coefficients to assess the strength of the curve fits.

Results

The measured viscosity of water compares very well with the value published in the literature and provides a validation of my method. The results for corn oil, olive oil, 10W30 oil, and 10W40 oil show that the viscosity of a fluid decrases as the temperature of the fluid increases from 20 to 40 deg C. They also compare well with the published data, further validating my proposed approach. The correlation coefficients of the curve fits are very high, indicating a strong exponential relationship between viscosity and temperature.

Conclusions/Discussion

Using falling ball viscometry and a novel approach that applies the fundamental principles of fluid dynamics, I determined the viscosity of water at room temperature, and the viscosities of corn oil, olive oil, 10W30 oil, and 10W40 oil at various temperatures. The results show that the viscosity of a fluid decreases as its temperature increases, and therefore my hypothesis is correct. Besides proving my hypothesis, I formulated a novel approach whereby viscosity could be determined for all Re, thereby removing the limitations of Stokes' law.

Summary Statement

A new experimental and analytical method was developed to determine the viscosity of a fluid at any Reynolds number, and the method was used to assess the effect of temperature on viscosity.

Help Received

Mother helped format board; father explained fluid dynamic concepts.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Riley J. Norman

Project Number

J0121

Project Title

Don't Be a Drag: The Effect of Dimples on an Airplane Wing

Abstract

Objectives/Goals

To determine how wing drag is affected by dimpling the top of the wing.

Methods/Materials

Two identical wings were constructed. Dimples were then drilled into one of the wings and weights were applied to equalize the weight. The wings were then tested nine times on three different occasions by suspending them in a wind tunnel and exposing them to a steady wind current. A spring scale was used to measure the amount of drag.

Results

The dimpled wing consistently produced less drag.

Conclusions/Discussion

A dimpled wing produces less drag than a smooth wing of the same shape. I observed the dimpled wing leaning towards its bottom, which could insinuate that it decreases lift.

Summary Statement

Determining how wing drag is affected by dimpling the top of a wing.

Help Received

Dad helped assemble wind tunnel, Mom gathered materials for display board.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Grace Park

Project Number

J0122

Project Title

How Wind Direction Affects a Wind Generator

Abstract

Objectives/Goals

A Wind Turbine is a powerful machine that plays a big deal in helping our environment during this type of economy today. And what powers a Turbine? A Wind Generator. Using a wind generator I will find which degree angle will produce the highest amount of voltage compared to other angles.

Methods/Materials

My project consists of positioning a wind generator in different angles in front of a high-speeding fan. The experiment is the testing on the variety of voltages (electricity) the different angles produce. The Angles are included: 0 degrees, 30 degrees, 45 degrees and 70 degrees, all on the left side since if I were to test it on the right side, there will be absolutely no voltage because the back side of the wind generator is blocked by its frame so the wind cannot get through.

Results

The experimental results proved my hypothesis correct with the Zero Degree having the highest amount of voltage (1.2, 1.0, 1.0). This is the angle degree having the Generator facing its whole front side to the fan.

Conclusions/Discussion

The reason I chose this experiment is because wind can come from all directions, and I was wondering which angle would produce the most voltage from the wind. Such real-life examples of wind having different direction would be the Sea Breeze and Land Breeze and their cycles. Wind direction can be differed by the topography of the Earth. This fact led me thinking to wind turbines and windmills and then eventually to my Question: WHICH ANGLE DEGREE WILL PRODUCE THE MOST VOLTAGE FROM A FAN SET UP ON HIGH SPEED TO A CONNECTED WIND GENERATOR?

Summary Statement

My project is testing a wind generator direction from multiple degree components and see which angle will produce the most electricity.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Michael B. Patacsil

Project Number
J0123

Project Title
Dimples on Wings

Abstract

Objectives/Goals
My objective is to determine if airplanes will stall, or suddenly lose necessary lift, at a steeper angle of attack if the dimple design of a golf ball is applied to the airfoil's surface.

Methods/Materials
2 identical airfoils made from balsa wood are tested in a homemade, open-circuit wind tunnel approximately 4 feet long. It is powered by a vacuum cleaner blowing into the front and a house fan pulling the air from the rear. Strings taped on the top of the airfoil (known as tufts when applied this way) indicate stall. To test, I slowly increase the airfoil's pitch while the tunnel is running and record its angle of stall. I do this 15 times while the airfoil is still smooth, I then add dimples to the top of the airfoil and test it 15 more times. I repeat with the second airfoil to ensure valid data.

Results
The airfoils slightly performed better dimpled over smooth in every comparison regarding stall.

Conclusions/Discussion
Test results show that dimpled wings stall at a slightly steeper, yet consistant, angle of attack. Research following my experimentation indicate that dimples may create friction on a wing's surface hindering its performance. If this problem is solved this concept can theoreticly shorten take-offs and landings (STOL) and allow aircraft to be more manuverable; futhermore, I believe that my experiment has supported my hypothesis that dimpled wings stall at a steeper angle of attack than a traditional smooth wing.

Summary Statement
This project verifies if the dimples that reduce a golf ball's drag can also increase an airpane's critical angle of stall.

Help Received
Pilot answered introductory questions; Grandfather supplied advice and tools; Built wind tunnel with tools and supervision of Uncle; Father took pictures; Mother helped with display.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Ravi B. Patel

Project Number

J0124

Project Title

The Effect of Winglets on a Radio Controlled Plane

Abstract

Objectives/Goals

Since I was a young boy I have been interested in aviation. I have witnessed an increase in the use of winglets; airlines have been adding them to aircraft stating they increase stability and fuel efficiency. I wondered how winglets might affect the speed of a remote controlled aircraft under calm and turbulent conditions. Based upon my review of the literature and seeing winglets in nature such as in bald eagles, I hypothesized that winglets would help stabilize the flight of a remote controlled plane both under calm and turbulent conditions.

Methods/Materials

I purchased a battery powered Ember 2RTF remote controlled plane. This plane has wings without winglets. I cut two flat balsa wood pieces into the shape of winglets and attached the winglets to the leading edge of the wings of the remote controlled plane. I performed a series of test flights with the airplane attached to the ceiling of my house with fishing line. I tested the speed of the remote controlled plane more than 40 times. In all tests I used a fixed throttle setting, and tested the speed of the plane with and without winglets as it flew in circles under calm or turbulent conditions. Turbulent conditions were simulated using a fan blowing into the flight path of the remote controlled plane.

Results

I found that under calm conditions with or without winglets the plane flew at the same speed. Turbulence caused a significant decrease in the speed of the plane without winglets, but with the attached winglets, the plane flew the same speed whether under calm or turbulent conditions.

Conclusions/Discussion

According to my results, the addition of winglets to a remote controlled plane allows the plane to fly in a more stable manner and at a more constant speed. Some radio controlled plane designs include winglets, but they are so small they appear to be added for appearances only. I recommend that much larger winglets, such as the winglets I constructed, be tested and added to remote controlled planes to improve flight characteristics when planes are flown outdoors. This would give operators more control and perhaps avoid crashes and the loss of model airplanes.

Summary Statement

My project tested the effects of winglets on the speed and stability of a remote controlled plane under calm and turbulent conditions.

Help Received

Thanks to my father who supervised me and purchased the supplies I gathered for my experiment. Thanks to my science teacher for inspiring me and providing guidance. Thanks to my mother for encouraging me.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

H. Grace Prall

Project Number

J0125

Project Title

Unleash the Power of the Pinwheel!

Abstract

Objectives/Goals

The objective is to determine if the orientation to the wind affects the amount of power generated by a wind turbine.

Methods/Materials

A wind turbine was constructed using an empty oatmeal canister weighted with heavy bolts to keep it grounded, a wooden skewer, a homemade rotor, two feet of thread, one end secured to the aft shaft and the other to five #1 size paper clips. Using a hair drier, wind was directed toward the rotor at the following angles; 0 deg., 45 deg., 90 deg., 135 deg., and 180 deg. The time to raise the load of paper clips to the base of the shaft was calculated in seconds, using a stopwatch, and the distance the paper clips were raised at each position was measured in inches, using a tape measure, but then converted into meters. After conducting three trials, times and distances were averaged to determine which orientaion to the wind source created the most power.

Results

After testing all five angles three times, I#ve found that the 45 deg. angle generated the most power. It had taken it an average of 22.3 seconds to raise the paper clips 0.60960 meters. The total power generated was 0.000577 watts. I believe this angle generated the most power because the kinetic energy of wind at the 45 deg. angle caused a greater displacement of the rotor, resulting in the generation of more work. Whereas the 135 deg. angle generated the least amount of power, producing 0.000162 watts of energy.

Conclusions/Discussion

I#ve come to conclude that the 45 deg. angle generated the most power due to the larger surface area impacted by the wind source, causing a greater displacement of the rotor, resulting in the generation of more electrical energy. I#ve also noted that the horizontal axis wind turbines, such as the one I created, have a huge affect on today#s society. These massive power sources generate power for thousands of cities. To do so, horizontal axis wind turbines must be at an angle which the wind is most powerful, in this case, a 45 deg. angle. Wind is also a renewable source of energy and the use of wind turbines could greatly reduce our dependence on foreign oil as well as aid in the creation of more job opportunities.

Summary Statement

My project was to determine whether or not the different orientations of the rotor to the wind source effects the amount of power generated by the wind turbine.

Help Received

My mother assisted me in testing by operating the hair drier around the various angles of the rotor.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Luke H. Prestridge

Project Number

J0126

Project Title

What A Drag!

Abstract

Objectives/Goals

Can a functional wind tunnel be constructed that allows the aerodynamic testing of automotive models? Will this testing match known aerodynamic values for modern vehicles? Can a model be constructed that is aerodynamically superior? What design features would this model incorporate?

Methods/Materials

Construct wind tunnel using plans from the internet. Build five model cars out of styrofoam blocks. Test each car ten times to determine aerodynamic force measured in ounces on a postal scale. Compare these values to known aerodynamic coefficients. Use derived information to begin independent testing of aerodynamic features. Cut and shape styrofoam blocks in pursuit of aerodynamically superior body shape. Analyze the effects of various features.

Results

The aerodynamic forces measured were similar to the results I hypothesized. The cars in order of least force to greatest drag force were: EV1, Toyota 2000GT, Porsche 911, Chevrolet Z28, and Hummer H2. The EV1#s average force was .64 ounces. The Toyota 2000GT#s average was .88 ounces. The Porsche 911#s average was .89 ounces. The Chevrolet Z28#s average was 1.08 ounces. The Hummer H2#s average was 1.30 ounces. These values were proportional to the real aerodynamic coefficients for these vehicles that I found on the internet. Independent testing of aerodynamic features is in progress currently.

Conclusions/Discussion

The author concludes that the cars tested in the wind tunnel for drag force had similar results to the published aerodynamic coefficients of real cars found on the internet. Some cars had more drag than they should have but they were ranked similarly. Testing procedures required great precision. The controlled variable was the air velocity in the wind tunnel, because the velocity of the wind stayed the same throughout the testing. The manipulative variables were the car shapes, sizes, and frontal area. A controlled variable was aerodynamic force of the Hummer. Because it was the car with the most drag, I tested the Hummer first to see the results and then at the end just to make sure that the results didn#t change. The responding variables were the measurement of the force on the postage scale. To add to my project, I installed strings to the wind tunnel to see if the flow is straight (laminar) or wavy (turbulant). The Hummer caused very turbulent airflow. The EV1 was very aerodynamic and kept the wind flow mostly laminar.

Summary Statement

This project uses a self-made wind tunnel to test the aerodynamics of model cars and to discover which features decrease wind resistance.

Help Received

Dad helped me build the wind tunnel

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Hannah J. Richey

Project Number

J0127

Project Title

The Efficiency of Different Savonius Wind Turbines

Abstract

Objectives/Goals

My project is determining which of three constructed Savonius wind turbines (built with different designs) will be most efficient in utilizing the power of wind. I will compare the advantages of a Savonius wind turbine to that of a Horizontal Axis Wind Turbine used frequently today.

Methods/Materials

First I will construct an apparatus to display and hold the designs for testing when finished. Three different turbines of identical weight and size will be constructed and tested. Each has a different design on its vertical axis. They will be tested using the same fan, with the same wind velocity, at the same angle and distance from it for revolutions per minute. Each will be tested 10 times for accurate results that will then be averaged.

Results

I found that when three different Savonius Windmills were tested under the same circumstances that Savonius A had the largest number of revolutions per minute.(RPM)Thus proving my hypothesis that Savonius A has the highest ability to utilize low velocity wind. Therefore it is appropriate to say that Savonius A is the most efficient and that using this design would be far more advantageous over the commonly-used Horizontal Axis Wind Turbine.

Conclusions/Discussion

My project is one in many steps bringing society closer to a much more efficient, dependable, and reliable energy source. The possibilities are endless when you consider what this could do for the world. These ideas and many others can be explored through my experiment and future experiments I intend on conducting.

Summary Statement

My project is about advancing the technology of windmills by studying and testing alternatives to the turbines used today.

Help Received

Mother and sister took me to buy materials. Mother paid for the project.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Canyon C. Robins

Project Number
J0128

Project Title
The Green Machine: It's Only Rocket Science

Abstract

Objectives/Goals
The objective of my project was to determine the effect of altering the mass and aerodynamics of a vehicle (rocket) on its fuel efficiency.

Methods/Materials
A pressurized, water powered, bottle rocket was chosen as the vehicle to remove the variables of ground friction and driver's style. After designing the optimal test rocket and establishing the controlled variables--namely the amount of fuel (propellant) and engine thrust (air pressure)--through testing, experiments were conducted to determine the effect of varying amounts of mass and different aerodynamics on the relative fuel efficiency of the rocket as measured by the altitude achieved during each test flight.

The effect of mass on fuel efficiency was determined by placing varying amounts of cargo in the test rocket and calculating the altitude that each flight reached. The effect of aerodynamics on fuel efficiency was determined by placing nose cones of varying angles on the test rocket and calculating the altitude that each flight reached. The altitude was determined by using a sight, distance measurements, and trigonometry.

Results
The mass of a vehicle has a significant impact on its fuel efficiency. For every gram added to the mass of the test rocket, the altitude reached was reduced on average by 0.4 feet (using the controlled amount of fuel and engine thrust).

A vehicle#s aerodynamics has a significant impact on its fuel efficiency. Within a certain range, for every degree added to the angle of the nose cone (worsening its aerodynamics) the altitude reached was reduced on average by 0.6 feet(using the controlled amount of fuel and engine thrust).

Conclusions/Discussion
Lighter vehicles (rockets carrying less mass) and more aerodynamic vehicles (rockets with sharper nose cones) were much more fuel efficient (achieved higher altitudes) when controlling for the amount of fuel (propellant) and engine thrust (air pressure). These results confirmed my hypothesis and helped me understand the impact mass and aerodynamics have on a vehicle#s fuel efficiency.

Summary Statement
My project was to determine the effect of altering the mass and aerodynamics of a vehicle on its fuel efficiency.

Help Received
My dad taught me the math and physics I used to design and complete this experiment. He was also an extra set of hands during rocket launches. My mom helped me lay out my backboard.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Alap A. Sahoo

Project Number
J0129

Project Title
Effect of Blade Type and Blade Angle on Power Generation in a Wind Turbine

Abstract

Objectives/Goals
The objective of my project was to find out which combination of blade shape and blade angle would produce the most electricity on a model wind turbine.

Methods/Materials
For my experiment, I used a model wind turbine, bass wood, a multimeter, sandpaper, a protractor, a fan, a hobby knife, glue, a wire cutter, a measuring tape, and a stopwatch. I tested four different blade shapes (leaf, box, jack knife, and arrowhead) at four different blade angles. Because preliminary research showed that low angles work the best, I decided to use 5, 10, 15, and 20 degree blade angles. My hypothesis was that the leaf blade would produce the most power at a 10 degree angle. I first built 3 blades of each type using bass wood, the hobby knife, and glue. I made sure that each blade was 6.5 inches long. I then placed my wind turbine 2 ft. away from the fan. I attached one set of blades to the turbine and took 7 readings (one reading every 10 seconds) at 3 different wind speeds, at 4 different angles. I repeated the experiment for each of the blade sets. After collecting all the data, I converted it into watts using the formula Watts = Volts * Amps. I assumed 0.5 for amps as amps are very difficult to measure.

Results
The highest output for each blade was always at 15 degrees at the high wind speed. The box type blade#s highest output was 5.21 watts, the leaf#s was 5.62 watts, the arrowhead#s was 5.26 watts, and the jack knife#s was 5.35 watts.

Conclusions/Discussion
The leaf blade type produced the most energy at a 15 degree angle. Therefore, my hypothesis, which predicted that the leaf blade at 10 degrees would produce the most energy, is partially correct. This information suggests that real wind turbine blades should be curved and be tilted at around 15 degrees.

Summary Statement
My project is to find out which combination of blade shape and angle produces the most power in a wind turbine.

Help Received
My father ordered the model wind turbine from WWW.KIDWIND.ORG and bought the other equipments. My mother was supervising me while doing the experiment as sometimes blades were coming out of the turbine.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Ankankshya Samal; Saachi Sikaria

Project Number

J0130

Project Title

Rocketology

Abstract

Objectives/Goals

To determine the correct ratio of baking soda to vinegar that will result in the highest launch of a plastic canister

Methods/Materials

Material :

1. Plastic Fuji film canisters with the tops (at least 3). 2. Construction paper, any color, 9 inches (in.) X 12 in. (1 pack). 3. Sotch tape (1 roll). 4. Scissors. 5. Permanent marker. 6. Ruler, in inches. 7. Optional: Ladder. 8. Baking soda (1 box). 9. White vinegar (1/2 gallon bottle or jug). 10. Measuring spoon, 1/8 teaspoon (tsp.). 11. Measuring spoon, 1 tsp. 12. Bowl. 13. Water. 14. Spoon. 15. Safety goggles. 16. Adult volunteer. 17. Lab notebook.

Methods :

1. We collected all oyr materials and put it on the Table.
2. We read the instruction for the experiment and made one change. The change was that we did not put construction paper onto the film canister as the canister was heavy and was not lifting up too much anyway.
3. We made a measuring scale using construction paper and hung the scale on the wall in the backyard.
4. We put 3 teaspoons of vinegar in the film canister
5. We then put the right amount of baking soda and pasted it on the canister cap.
6. The Cap was then tightened by our adult volunteer on the canister.
7. The Adult volunteer then turned the canister upside down and placed near the measuring scale.
8. We did a lot of trials with different amounts of Baking soda and Vinegar and noted our results.

Results

Vinegar and Baking soda when came in contact there was a small explosion and the Canister went up following Newton's 3rd law of motion.

Conclusions/Discussion

Our Conclusion was that more the baking soda used for same amount of vinegar, the higher the canister goes.

Summary Statement

Newton's third law of motion helps to propel a rocket.

Help Received

Father helped in typing the application. Both parents helped in our experiments and literature survey over the Internet.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Jessica S. Stein

Project Number

J0131

Project Title

Shape and Surface Texture, What a Drag!

Abstract

Objectives/Goals

I will demonstrate that the more aerodynamically shaped and smother an object's surface is, the lower the object's drag coefficient [C(d)] will be. I will do this by comparing the air velocities (V) required to keep objects of different shapes and surface textures floating in a vertical tube.

By making all the objects' weights (ma) and cross sectional areas (S) the same and assuming air density (p) remains constant, I will make all the variables in the drag force [F(d)] equation constant except the C(d) and V. When the objects floats in the tube, F(d) and the gravitational force [F(g)] are equal.

F(g) = F(d)
ma = 1/2C(d)pSv^2

Since V is inversely proportional to the C(d), any increase in V required to keep an objects floating equals a reduction in the C(d). The lower an objects' C(d), the more aerodynamic the object is said to be.

Results

I was able to rank and compare the objects by their C(d) by comparing the V's required to keep them floating. The smooth tear drop shaped object required the highest V to float which means it had the lowest C(d) (i.e. it was the most aerodynamic). The rough square required the least amount of V which means it had the highest C(d) (i.e. it was the least aerodynamic).

Conclusions/Discussion

I thought that the rough and smooth cubes would have the highest C(d) but the C(d) of the smooth cube turned out to be about medium compared to the other objects. I noticed that both cubes tilted sideways in the tube forming a diamond shape. I believe this happened because the cubes tried to positioned themselves to create the least amount of drag. I also noticed that the balls were rotating at different speeds. I believe that this rotation had some effect on the balls' C(d) but I am not sure how much.

At first, I tried to make the surface areas and the weights of the objects equal. Since some of the object's shapes are complex, this turned out to be too difficult to do so I just made the weight and the largest cross sectional areas of each object equal. Since I formed each object out of clay by hand, I could not make them exactly round, straight or smooth. I am sure this also affected my results but I don't know how much.

Summary Statement

How An Object's Shape And Surface Texture Effects Its Drag Coefficient

Help Received

My dad made the dimmer switch for me.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Matthew Wong

Project Number
J0132

Project Title
Searching for Stability

Abstract

Objectives/Goals
The objective of my project was to determine if winglets on an airplane improved stability. If so, what shape and angle of winglets would make an airplane the most stable. I hypothesized that 90-degree winglets would increase stability the most.

Methods/Materials
A wind tunnel and five balsa wood airplanes were designed and constructed for testing. Each airplane had varying shapes and angles of winglets (no winglets [control], 90-degree winglets, 135-degree winglets, wing fences, and a curved wing). To test for stability, methods of testing roll, pitch, and drag were developed. Each airplane was tested accordingly. All data was recorded and reviewed, and conclusions were drawn.

Results
The airplane with no winglets had the greatest variations of movement in the roll and pitch tests as well as the greatest amount of drag. The airplanes with 135-degree winglets and wing fences had smaller variations in the roll and pitch tests, and less drag than the airplane with no winglets. The airplanes with 90-degree winglets and a curved wing had the least variations of pitch and roll, and the least amount of drag compared to all of the other airplanes. Lower variations of movement indicate a more stable airplane.

Conclusions/Discussion
Overall, I concluded that winglets do increase stability. Based on the results of my tests, the airplanes with 90-degree winglets and the curved wing proved to be the most stable. To further support my hypothesis, the airplane with no winglets proved to be the least stable. Factors that could have affected the outcome of the experiment were the airplanes' center of balance, and the weight of the airplanes. Another factor that could have affected the outcome was the calibration of the pull-spring scales used during testing. I found the planning, design, and construction phases of my project as rewarding as the testing process used to prove my hypothesis.

Summary Statement
My project was to determine if winglets increased the stability of an airplane, and if so, what shape and angle of winglets would increase stability the most.

Help Received
Jon Welte (Hiller Aviation) helped answer some preliminary questions about my project. Parents assisted in driving me to purchase materials. They also helped with cutting some of the materials.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Bryan D. Zollars

Project Number

J0133

Project Title

Producing Electricity with Different Angles and Measurments for Wind Turbine Blades

Abstract

Objectives/Goals

The purpose of my science project is to produce more electricity more efficiently. Evaluating the level of efficiency produced by different lengths, angles, and number of fan blades on turbines, a change in the wind turbine design will help produce more energy to transform into electricity.
My project simulates a wind turbine. The wind is driven by an industrial fan, an alternator is used as a turbine, the power travels through a regulator in place of a transformer, and a twelve volt battery acts as the storage unit. The light bulb shows that wind has been converted into energy and the volt meter tells me how much energy the new wind turbine is putting out.

Methods/Materials

Second Experiment- A taller prototype with new angles. The two blade turbines: New angles of 28(°), 29(°), 32(°), and 34(°) increased wind flow for comparison with the new findings of four blade turbines. The new four blade turbine angles are: (<)15(°), at angles of 13(°), 12(°), 11(°), and no (<)10(°). The new turbine is connected to a generator, 12 volt light bulb, and a 12 volt battery was added for energy storage. The volt meter gave higher readings and the light bulb lit up with power generated by greater wind flow. The tower height was increased to 36 inches. The new turbine blades are 32 inches long. The base plate is 18 inches in diameter to accommodate the new tower height.

MATERIALS
Flat round steel base plate, 1 small spool of aluminum automotive wire, White spray, paint, 12 inch copper pipe, 12 volt alternator to a turbine, 12 volt regulator, 12 volt battery, 2-way connection switch, 1 12 volt light bulb red clearance light off of a truck, 32 inch turbine blades made out of 12 gauge flat bar = 1/16 inch x 2 inch steel.

EQUIPMENT USED
Volt meter, Grinder, Protractor, Industrial Fan, Iron Press, Pry bar, Cutting torch, Number punches, Lathe, Table vice.

Results

Results pending more trials

Summary Statement

Changing angles and measurements of wind turbine blades, to produce electricity more efficiently.

Help Received

My mom helped me type this report, and my grandpa helped me by showing me how to run the machinery and working with the lathe.