CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Samuel W. Adams

Project Number

J0101

Project Title

Need a Lift

Abstract

Objectives/Goals

My objective was to see which had a greater effect on lift, the shape of an airplane wing or the weight of the airplane. I believe that the shape of the airplanes wing will have a greater effect on lift.

Methods/Materials

Materials and method: I used a wind tunnel, a small scale, to measure lift a bolt to secure the airfoil to the scale, three nuts to be screwed on to the bolt and used to add weight, tape to secure the flap on the airfoil in a position to change shape of the wing, and two paper towels as a flow straightener.

Results

Results: When I added weight to the airfoil, there was little effect in the lift generated. However, when I changed the flap position on the airfoil, there was a greater effect on lift.

Conclusions/Discussion

Discussion: I think that the U.S military is focusing on making new planes and aircraft light weight when they should be focusing on improving the wing design and plane shape. With new wing shape, we can make our aircraft invisible to radar possibly even make our aircraft completely quiet.

Conclusion: The lift generated was effected more by the shape of the wing.

Summary Statement

My project is about testing which had a greater effect on lift, the shape of the plane's wing or weight of the plane.

Help Received

Father helped to build the wind tunnel due to the use of a circular saw.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Elana R. Baldwin

Project Number

J0102

Project Title

Splashology

Abstract

Objectives/Goals

How do you make the highest splash? My project looks at the physics and variables involved in making a splash. I have focused on measuring the "jet", or vertical splash, of an object dropped into water. After isolating the variables of weight, volume, and surface area of an object, I predict that it is surface area that will produce the highest vertical splash.

Methods/Materials

I have conducted both laboratory trials and human field trials. The laboratory trials used four marbles that all weighed the same 4 grams, but had different densities, volume, and surface area. I used a stand with a grabber to drop the marbles into a pre-measured volume of water 20 times each. Each marble drop was filmed on video and was cut down and the highest point of each splash was found and measured. The human field trial used one human with same weight, density and volume, jump into a pool a total of 45 times. These jumps consisted of 15 trials of 3 different styles of jumping creating 3 different surface areas. Again each jump was measured and the vertical splash height was recorded.

Results

In human trials, the can-opener dive (greatest surface area) had the highest vertical splash on average. The cannonball dive (medium surface area) followed with the pencil dive (small surface area) having the shortest vertical splash. Similarly, three out of four ball trials showed that the height of the vertical splash increased as the volume and surface area increased. These ball trials also showed that as density increased, vertical splash height decreased. One of the ball trials, ball d, completely contradicted all other findings. Its average vertical splash height went up as its density went up and vertical splash height went up as surface area and volume went down.

Conclusions/Discussion

I conclude that the surface area of an object dropped into water does affect the height of the vertical splash more than the objects weight and volume. My hypothesis that the increased surface area would produce an increased vertical splash was proven correct in the human trials. When tested in the laboratory with marbles, the data shows that 3 out of 4 trials were consistent with this hypothesis. The fourth trial had contradictory data which I believe could be as a result of the high density in comparison of the low surface area of the small marble.

Summary Statement

"Splashology" answers the age old pool party contest question of "How to make the highest splash."

Help Received

Sport Chalet and scuba instructor/life guard provided heated pool and safety watch, Amy my loyal friend was my human subject that repeated dove into the pool 45 times, my mom who provided transportation and was my trial assistant

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Ziv H. Batscha

Project Number
J0103

Project Title
What Fin Shape Causes a Model Rocket to Reach the Highest Altitude?

Abstract

Objectives/Goals
My science fair project is titled, "What fin shape causes a model rocket to reach the highest altitude?" The purpose of this project was to find out which of the shapes, rectangle, parallelogram, triangle, trapezoid, and elliptical, caused a model rocket to reach the highest altitude (apogee).
My study relates to aerodynamics and engineering.

Methods/Materials
In my study, I built five rockets each with the same weight, shape, dimensions, and engine. The only difference between the rockets tested were the geometrical shape of the fins, but the area of all the fin shapes were the same. Each rocket was launched several times with an altimeter in the payload section in order to record the highest reached altitude of every flight. The altitude (dependent variable) that each rocket will reach will depend on the fin shape (independent variable).

Results
The results of my experiment show that the elliptical fin design is the best fin design, with a maximum apogee of 961 feet and an average apogee of 949 feet. The rectangular fin design came in second place with a maximum apogee of 878 feet and an average apogee of 838 feet. The third best fin design was the parallelogram, with a maximum apogee of 861 feet and an average apogee of 823 feet. The triangular fin design came in fourth with a maximum apogee of 834 feet and an average apogee of 817 feet. The least successful fin design tested in my experiment was the trapezoidal design. It came in last with a maximum apogee of 820 feet and an average apogee of 810 feet.

Conclusions/Discussion
Through this experiment, we can conclude that the best possible fin design is the elliptical. My study proved that my hypothesis was correct in that if I launched five rockets each with a different fin shape (rectangle, trapezoid, triangle, elliptical (half circle), and parallelogram), then the rocket with the elliptical (half circle) shaped fins would reach the highest altitude. The reason I think that the elliptical fin design had the best results is because its curved design cuts through the air more smoothly, and so creates less air turbulents and has less drag on the rocket.If I were to do this project again, I would test more unique and complex fin designs.

Summary Statement
My project tests which fin shape (elliptical, parallelogram, rectangle, trapezoid, and triangle) causes a model rocket to reach the highest altitude, while maintaining all other aspects of the rocket the same.

Help Received
My parents drove me to Sante Fe Dam to launch my rockets, payed for the materials needed for my project, and helped me recover my rockets when they got stuck in the tree.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Annie C. Benedict

Project Number

J0104

Project Title

Wave Hello to Blue-Green Energy: The Effect of Blowhole Cavern Depth on Water Ejection from a Simulated Oceanic Blowhole

Abstract

Objectives/Goals

The goal of my project was to determine what average water level would allow the greatest water ejection, and thus the greatest wave energy collection, from a blowhole cavern assembly. I hypothesized that more water would be ejected from a deeper cavern configuration

Methods/Materials

I designed and built a wave tank (2.4 m long x 32 cm wide x 45 cm deep) with a motor-driven wave generator at one end, and a simulated blowhole cavern (15 cm diameter) at the other end. Waves entered one end and water was ejected and collected from a small vertical blowhole spout (1.2 cm diameter) protruding from the opposite end of the cavern. I changed the depth of the cavern six times and ran the timed experiment with multiple trials at each depth.

Results

My results showed that the most water was ejected from the spout when the top of the blowhole cavern was 0.32 cm below the still water level. Energy collection rate at this depth was equivalent to 3 milliwatts. When the blowhole cavern was placed below or above this depth, less water was ejected (and thus less power was obtained). As waves entered the cavern, air and water were carried forward. When the cavern was raised, more air was inside, so more air and less water was ejected. When the cavern was lowered, there was not enough air to push much water through the spout.

Conclusions/Discussion

While my original hypothesis was rejected, I was able to determine the optimum cavern depth for maximum energy collection. I believe blowholes could be used as a novel source of renewable energy in the future. In the real world, the water could be collected from a natural or artificial blowhole with the configuration designed for maximum lift. The elevated water collected could be used to turn a water wheel and generator. Thus, clean, renewable energy could be harvested from the inexhaustible power of the ocean.

Summary Statement

For my project, I tested how changing the depth of a blowhole assembly in a wave generation tank affected the amount of water ejected from the blowhole spout (which is a measure of how much energy was collected).

Help Received

My dad assisted me with the construction/set-up of my wave generation tank. My neighbor, Mr. Banner, allowed me to use his wood-turning lathe to make the wooden cylinder for my wave generator.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Michael Bigley; Fionna Jensen

Project Number

J0105

Project Title

The Sky's the Limit: How Do Fin Configurations Affect a Rocket's Altitude?

Abstract

Objectives/Goals

The objective of our experiment was to determine which of six different fin configurations was most aerodynamically efficient by observing which one achieved the highest performance (altitude) on several test flights conducted under consistent weather conditions.

Methods/Materials

Six model rockets of an identical type were equipped with altered fin configurations (with identical surface area, but different shapes and number of fins). These fin configurations were developed from designs that we had seen on actual rockets currently in use, or rocket designs which have been proposed, but not used. The rocket masses were verified and adjustments to weight were made if necessary to ensure consistency. All rockets were equipped with Estes B6-4 motors providing identical thrust. Each Rocket was flown 6 times. Altitude observations were made by multiple observers using home-made inclinometers.

Results

Tests showed that the Composite Trapezoid fin design achieved the highest altitudes, averaging 558 feet. Second highest was the 1950's style rocket fin which achieved an average altitude of 513 feet. Third highest was the Delta Control design which reached an average altitude of 396 feet.
Lower altitudes were achieved by the Wright Brothers (5 fin rectangular) fin configuration which averaged 375 feet and by the Space Shuttle (two larger wings and a smaller vertical stabilizer) fin configuration which achieved an average of 333 feet. The rocket with the tubular fin design was unstable and did not generate any meaningful altitude data.

Conclusions/Discussion

Our conclusion is that rockets with the minimum number of fins that provide stability (enough drag to keep the center of pressure behind the center of gravity) and generate the same amount of drag on all sides of the rocket, allow the rocket to maintain a vertical course while minimizing the aerodynamic drag which allows these rockets to achieve the highest altitudes.

Summary Statement

Determining which fin designs are most efficient (provide stability and generate the minimum aerodynamic drag) thus allowing a rocket to achieve the greatest altitude.

Help Received

Partner's father helped assemble the rockets, partner's father trained us on altitude calculations, partner's father supervised rocket launches

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Evan T. Clark

Project Number
J0106

Project Title
Can the Wind Really Work for You?

Abstract

Objectives/Goals
The objective of my project was to find out what type of rotor design on a wind turbine generates the most wind energy. My hypothesis was that I thought the rotors that were rectangular in shape and curved in opposite directions would generate the most wind energy.

Methods/Materials
Seven different rotor designs were made using bendable straws, paper clips, paper, tape, and glue. The designs were: rectangular curved clockwise, rectangular curved counter clockwise, rectangular curved in opposite directions, rounded, serrated, zigzag, and angled. The rotor designs were tested on a turbine that was made from a 1 L. plastic bottle, 500 mL. plastic bottle with cap, bendable straws, strings, tape, paper clips, metal washers, and metal key chains. Using a small table fan, each rotor was tested three times to see how much weight it could carry.

Results
The results consistently showed that the rotors that were rectangular and curved in opposite directions produced the most energy.

Conclusions/Discussion
My conclusion is that the design of a rotor does make a difference in how much energy is produced. Curving the rotors in opposite directions produces a greater amount of energy than not curving the rotors or even curving them in the same direction.

Summary Statement
My project tested different rotor designs to see which generated the most energy.

Help Received
My dad helped me drill holes in the bottles and my mom helped me with the board.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Noah M. Contreras

Project Number

J0107

Project Title

Rocking the Boat

Abstract

Objectives/Goals

My project was conducted to determine what length of fin helps to stabilize a boat the most. My hypothesis is that the longest fin(bilge keel) will steady the boat out the most.

Methods/Materials

One model boat was constructed out of a 2 liter soda bottle. The boat was then placed in bath tub. The first test was done with no fin. The second test was done with a fin that extended 5 cm. from the boat. The third test was done with a fin extending 4 cm. The final test was conducted with a fin that extended 3cm. The testing was done by tilting the boat to the same amount each time and letting it oscillate until it stopped, the oscillations and amount of elapsed time was recorded. Each test was done with a total of three trials.

Results

When the boat had the 5 cm. fin on,it oscillated the least and had the least amount of time compared to the others on every trial. Where as, the boat with no fin oscillated the most and had the greatest amount of time that passed.

Conclusions/Discussion

My conclusion is that the length of the fin does matter for the steadiness of a boat and that a boat with a longer fin will rock less than a boat with a shorter fin.

Summary Statement

The focus of this project was to detremine how the length of a fin helps to stabilize a boat.

Help Received

Dad bought supplies; Mom and Dad proofread the writing; Dad helped with watching the time while the boat rocked

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Jessica K. Dell'Acqua

Project Number

J0108

Project Title

The Effect of Increasing a Hole's Diameter on a Flying Disc

Abstract

Objectives/Goals

My objective was to determine if changing the size of a hole in a flying disc affects the distance it flies. I hypothesized that the larger the circle cut from the center of the disc the farther it would fly.

Methods/Materials

I made nine discs three layers thick of glued poster board. Three discs had a 5 inch hole cut from the center, three discs had a 3 inch hole cut from the center, and three discs had no holes. Each disc was thrown ten times and the distance measured.

Results

The solid discs flew an average of 17.74 feet. The 3 inch hole discs flew an average of 20.11 feet. The 5 inch hole discs flew an average of 22.13 feet.

Conclusions/Discussion

My conclusion is that the hole size in the center of a flying disc does have an effect on flight distance. The disc with the largest hole flew the farthest.

Summary Statement

The effect on flight distance by increasing the diameter of a hole in the center of a flying disc.

Help Received

Parents purchased materials, took pictures to document her doing the experiment.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Trevor J. Filseth

Project Number
J0109

Project Title
An Improvement on the VAWT Wind Turbine

Abstract

Objectives/Goals
I wanted to improve the performance of the standard Savonius Vertical Axis Wind Turbine (VAWT) by at least 10%.

Methods/Materials
I developed a modified Savonius turbine design which incorporates a movable flap (the #Filseth Flap#!) which sits on top of the standard Savonius blade. The flap is hinged and angled so it opens while the wind blows in one direction and shuts while the wind blows in the other direction. I tested my design against two other designs (the standard Savonius, and the standard Savonius with a cover on the top) at four different distances from a wind source (24, 30, 36, and 42 inches) for both generated voltage (with a DC electric motor and 2 K-ohm resistor), and time taken to reach 60 revolutions (which I later converted into RPM).

Results
The flap design performed well. In the test of voltage, the flap-equipped VAWT exceeded the next best configuration (the VAWT with the covered top) by an average of 24%. In the case of rotation speed, the flap VAWT beat the next best one # again the covered top design # by an average of 21%.

Conclusions/Discussion
My flap design improves the efficiency of the Savonius VAWT by about 20-25%, relative to the next best configuration over a range of different wind intensities.

Summary Statement
In my project, I developed a 20-25% more efficient version of the Savonius wind turbine.

Help Received
My dad helped me with data collection. Also, my mom helped with some of the gluing.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

John Ghantous

Project Number

J0110

Project Title

Wind Power

Abstract

Objectives/Goals

The initial idea and purpose of this project was to learn what affects windmills, and possibly make a discovery that could change the ways windmills produce power.

Methods/Materials

This experiment was done by first, constructing a windmill and six blades all of the same shape, then placing a fan (a steady and constant wind source) a foot away from the windmill and measuring the power produced in millivolts. After that, six blades were placed on the windmill and the angles were changed to 5 degrees, 15 degrees, 25 degrees, 45 degrees, and 90 degrees (control) and power measurements were taken to see how the change in angles affected the output. The same was done for three blades. To make the experiment accurate, this procedure was done to both three blades and six blades three times.

Results

The contributions and benefits of this experiment were twofold. First, six blades produce more power than three blades; and second, less deviated angles produce more power than more deviated angles. This is because when the angle of the blade is less deviated, there is more space for the air to hit it.

Conclusions/Discussion

In conclusion, this project determined that six blades produce more power than three blades. This proves that in most circumstances, wind turbines with the most blades produce the most power. Also, this project proved that less deviated angles produce more power than more deviated angles. In addition to that, this project determines that with the right circumstances changing the angle and the amount of the blades can affect the amount of power produced by the wind turbine.

Summary Statement

The effect of the angle and the amount of blades on a wind turbine's power.

Help Received

Father taught me how to use CNC drill.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Raymond U. Gilmartin

Project Number

J0111

Project Title

Spare the Environment, Spoiler the Car: The Effect of Rear Spoilers on Drag and Lift

Abstract

Objectives/Goals

The experiment was to measure the effect of the size and the angle placement of a rear spoiler on the amount of drag and lift/downforce on a SUV-type automobile. It was hypothesized that a small level spoiler would increase drag and not affect lift; that angling a spoiler would decrease drag and increase lift; and that increasing a spoiler's size would increase drag and not affect lift.

Methods/Materials

A cardboard wind tunnel was built using a house fan. Two spoilers, one large and one small, were carved from balsa wood. Each was attached to a model SUV at two angles, 15 degrees downward and 0 degrees, level with the car's roof. Using a force sensor and the wind tunnel, the car's drag and lift were measured. Five drag and five lift measurements were taken for each configuration and for the control, the car without a spoiler.

Results

The small level spoiler decreased drag by 20% and did not affect lift. Angling spoilers decreased drag by 3% - 9% and was inconclusive for lift. Increasing spoiler size increased drag by 12% - 18% and was inconclusive for lift. The spoilers reduced drag by 8% - 29% and either did not affect lift or decreased lift by 29% - 55%.

Conclusions/Discussion

Rear spoilers on SUV-type automobiles reduce drag without increasing lift. They will improve gas mileage without decreasing handling or safety and will help stop global climate change.

Summary Statement

The effect of adding rear spoilers to cars was measured to determine if drag can be reduced without increasing lift, which would improve fuel efficiency and reduce carbon emissions.

Help Received

My mother helped me research aerodynamics on the web and proofread my writing. My father supervised the building of my wind tunnel. My teacher supported me and answered many questions.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Robert P. Hasen; Roland E. Steinebrunner

Project Number

J0112

Project Title

How Does Pressure Affect the Bottle Rocket's Flight?

Abstract

Objectives/Goals

The purpose of this experiment is to find out what amount of pressure will create the farthest flight. Our hypothesis was that the more pressure there was in the bottle the further it would fly. We also thought that at a certain point, the bottle would not fly any further, no matter how much pressure was applied. We thought this because after a certain point, the bottle would lose control and spin out or not go any further.

Methods/Materials

Launcher, bottle rocket, and bicycle pump.

Fill the bottle 1/3 full of water. Tip the launcher so that the end is 1.5 m above the ground. Place the bottle on the launcher and lock the mechanism. Attach the bicycle pump and insert the desired amount of pressure. Unravel the release cord, stand back, and pull the trigger.

Results

After the experiment, we found that the distance changes depending on the amount of pounds per square inch. After about 40 PSI the distance has no correlation. We found when you place the bottle on the launcher, you must tip the launcher to keep the water from going inside the PVC pipe. The wind speed also was a big factor of in its overall flight pattern and distance. Sometimes there would be a downburst of wind which would decrease the distance the bottle flew.

Conclusions/Discussion

Our science project helped us learn more about pressure. We also learned that pressure has more power than we anticipated. We learned how to make a successful experiment and how to organize data. This project helped us be able to have more fun while being safe. We learned that if your pressure is too high, the bottle will spin out of control.

Pascal's principle is used in the bottle. This states that pressure is transmitted undiminished in an enclosed static fluid. Newton's second law - the more massive an object is, the more force is required to move it - helped us formulate our hypothesis.

In all, our experiment was a success and not at all a waste of time. We learned a lot and had a good time.

Summary Statement

Our project is about the effects of pressure and fuel on the flight of a bottle rocket.

Help Received

Ms. Dang critiqued the board and suggested using s.i. units instead of standard measurement (such as inches). One father demonstrated the use of PVC glue and one mother transported the launcher to and from the site of the launch.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Akemi M. Ito

Project Number

J0113

Project Title

Marble Viscosity Race

Abstract

Objectives/Goals

The objective is to determine the viscosity of common liquids, honey, ocean water, and vegetable oil, by measuring the time it takes the marble to travel through the liquids.

Methods/Materials

Measure down about 2 cm from the top of each glass with a ruler, and mark it with tape. Fill each glass to the tape with a different liquid. Hold two marbles level with the tops of two glasses. Say, "Ready, Set, Go!" and start the stopwatch while the helper drops the marbles. Record your observations. Race the marbles a second and third time. Race another two liquids the same as above.

To measure viscosity of the liquids fill the graduated cylinder up with one of the liquids to a level 5 cm below the top of the cylinder. Measure down at least 2 cm below the surface of the liquid and mark a starting line on the cylinder with the tape. The starting line needs to be lower than the surface of the liquid to allow time for your marble to reach its terminal velocity before you start taking measurements. Measure up from the bottom of the cylinder, approximately 5 cm, and mark an ending line on the cylinder with the marker. You don't want the ending line to be at the bottom of the cylinder because the marble will slow down as it approaches the bottom of the cylinder. Measure the distance between the starting point and ending point. This is the distance that you will use to calculate the speed of the marble as it travels through the liquid.

Results

For the marble race, the marble average speed was .32 seconds for ocean water, .46 seconds for vegetable oil, and 73 seconds for honey. For the viscosity experiment, ocean water viscosity was 129 kg/meters squared, vegetable oil was 167 kg/meters squared, and honey was 46,890 kg/meters squared.

Conclusions/Discussion

In the end my hypothesis was right! My hypothesis was if the honey, vegetable oil, and ocean water are compared for viscosity, then the marble will travel slower in honey compared to ocean water and vegetable oil. I discovered that my marble traveled slowly because the viscosity was high in honey.

Summary Statement

The viscosity of common liquids.

Help Received

Mother helped with dropping the marbles, the range on my graphs, and some math conversions.

Name(s)

Harrison M. Jantz

Project Number

J0114

Project Title

Efficiency Study of Wind Turbine Blade Design

Abstract

Objectives/Goals

To determine which blade pitch is most efficient for wind turbine blade design in a high wind area.

Methods/Materials

By using three identical wind tunnels, I was able to test multiple, scaled down, wind turbine blade designs of varying pitch.

Results

I found that my hypothesis was correct and the blade with the 25 degree pitch was the most efficient.

Conclusions/Discussion

The 25 degree pitch blade was found to be the most efficient, because it had the most surface area in contact with the airflow. This could help maximize the electricity produced from a wind turbine farm making this form of green energy more efficient.

Summary Statement

My project is about determining which blade design is most efficient in high wind areas.

Help Received

I received help in fabricating the scaled-down wind turbines from my dad who used a solid model printer.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Nicholas J. Katzer

Project Number

J0115

Project Title

The Effect of Hull Shape on a Ship's Efficiency

Abstract

Objectives/Goals

The goal of this project was to determine the shape of a ships hull that would provide the least drag for a given unit of the ship's volume.

Methods/Materials

4 single hulled, 4 twin hulled and 4 triple hulled ships carved to the same scale and size parameters had their front ends tapered to varying degrees, one of each hull type with a blunt end as a control. The volume of each hull was then measured. One at a time they were then attached to a force sensor and put into a slightly inclined trough containing flowing water. The test was repeated 3 times for each hull and the force sensor results recorded.

Results

The flat faced hulls were consistently the most efficient and the single hulled ships were on average more efficient than either the twin hulled or triple hulled boats.

Conclusions/Discussion

The conclusion was that while drag plays a key role in the efficiency of a ship the volume it carries is even more important. A ship that carries more will use less fuel per unit of cargo than a ship of lesser volume.

Summary Statement

This project was performed in order to find the most efficient shape for a ship's hull.

Help Received

Father helped with power tool usage; Teacher loaned measurement equipment

Name(s)

John Kissel; Maanek Singh Sehgal

Project Number

J0116

Project Title

Long Live Wind Energy

Abstract

Objectives/Goals

The purpose of our study was to see how the shape of the wind mill rotor blade affected the power output of the blade. Our hypothesis was that aerodynamic blade would give the most power output.

Methods/Materials

We made a wind turbine of straw and paper. A long thick straw served as an axle. The rotor was made by folding 10cm x 8 cm paper over one end of a straw and gluing it in place. The length of paper blade was kept constant at 10 cm. Two such straws were joined end to end to make a complete rotor and attached to the axle in the center. The axle was then threaded into a hole in the cap of a 500ml bottle so that the other end of the axle protruded through the hole in the bottom of the bottle. A string with paper clip to be used as washer weight holder was attached to this end. The maximum number of washers lifted by the spinning axle straw was the power output measured. This turbine was taped to a bigger soda bottle that had cement rocks as weights. This served as a stand. A fan on high, 130 cm from the soda bottle provided the wind energy. We made and tested 7 different shapes of paper blades, 3 trials on each.

Results

The rectangular blade (10cm x 4 cm) with tear drop profile lifted up 11 washers.
A cylindrical blade with no aerodynamic profile lifted 0 washers.
A triangular blade (10cm x 4 cm) with 4 cm base towards the end of the rotor and apex towards the axle lifted 7 washers.
However the same triangle was glued on the straw with the 4 cm base to the center of the rotor and the apex to the end lifted only 1 washer.
Rectangular blade 10cm x 2.5 cm lifted 1 washer.

Conclusions/Discussion

Our research proved our hypothesis correct. Aerodynamic shape of the wing was important for the power output of the windmill. We also found out that the angle of the wing to the wind was important determining factor, when we placed the wing at 90 degrees to the wind and it just got pushed back into the housing without moving at all. After this we placed all wings at 45 degrees. We also noted that the area of the wing and the length between the maximum lift force applied by the wing to the point of rotation of the rotors also affected the power output.

Summary Statement

The project was to find out what kind of wing gives the maximum power output in a wind mill.

Help Received

Teacher gave us tips on how charts and tables should be made. She reviewed our work. Mother helped me type.

Name(s)
Timothy N. Meziere

Project Number
J0117

Project Title
Patterns of Fluid Dynamics

Abstract

Objectives/Goals
How does the shape of an object affect the water flow? This project was designed to understand how different shapes are more efficient than others. It could also potentially help save energy.

Methods/Materials
1. I sketched designs of testing equipment that I would need to machine. 2. Using Solid Works I designed the bottom plate. 3. Using a mill at Meziere Enterprises Inc. I machined bottom plate. 4. Using the test tube I tested the fit of the bottom plate. 5. Using a mill at Meziere I machined top plate. 6. I machined five legs for the mechanism to stand on. 7. I put it together to test the fit. 8. I collected testing parts. 10. I tested all objects 3 times each. 11. I collected data from the video camera. 12 .I analyzed the data collected. 13. I made graphs.

1. Two aluminum plates 610mm x 610mm x 13mm; 2. Five aluminum rods 37mm diameter x 762mm long; 3. eight steel 3/8-16 threaded rods 457mm long. 4. One aluminum spool 110mm diameter x 120mm long. 5. One stainless steel rod 20mm x 610mm long. 6. One plastic tube 406mm diameter x 406mm long. 7. Five stainless steel test objects: 19mm diameter x 30mm long 8.680g weight 9.2 pulleys 10.6mm diameter x 213cm rope

Results
All of the tests in my project proved incredibly consistent. The teardrop and double radius parts showed the least amount of drag. The double indent had the most drag. It appeared to make large currents. This could be the cause of its odd path. You can also see this, but less, in the double flat shape. The most dynamic shape was the teardrop point forward.

Conclusions/Discussion
In my testing objects with smooth transitions cause the least amount of drag. This also explains why objects with rough transitions build up great amounts of drag. The double indent, the object with the most drag, has no place for the water to travel to once it is in it. The teardrop shapes start at a point and rounds in to a half radius at the opposite side. My hypothesis was, #The shape of the object will affect the resistance of water flow.# This hypothesis proved right. This is because no objects had the same amount of resistance as another. Although every shape has the same frontal area, none of the objects have the same shape.

Summary Statement
In my project I tested the difference of drag through water on six different objects all containing the same frontal area.

Help Received
Meziere Enterprises provided material, machines, video camera, and computers so I could make test fixtures; Kyle M. provided information on design of test fixture; Michel M. provided information on machines and materials; Don M. provided information on machines and programs; Joel M. videotaped

Name(s)

Michael P. Montgomery

Project Number

J0118

Project Title

Making Waves: How Water Depth Affects Tsunami Wave Speed

Abstract

Objectives/Goals

The objective of my experiment was to see firsthand how water depth affects a tsunami wave's speed. I predicted that the shallower the water, the slower the wave would travel.

Methods/Materials

I built a 203.2 cm x 60.33 cm wave tank for my trials, and I used a 30.48 cm x 30.48 cm plywood board to initiate the tsunami waves. A stopwatch and tape measure were used to measure time and water depth. For each wave, I lifted the board, or wave-maker, up to nearly the free surface, generating a tsunami-type wave. After five trials at the depths of 2, 3, 4, 5, 7, 8, and 10 cm, I calculated all the wave speeds, plugged the water depths into an equation for theoretical tsunami wave speed, and graphed the results.

Results

My results showed a curve that, when matched up with the theoretical speeds, supported my hypothesis. The shallower the water was, the slower the generated waves travelled.

Conclusions/Discussion

After analyzing my data, I came to the conclusion that water depth has a great effect on tsunami wave speed. The shallower the water is, the slower the wave will travel.

Summary Statement

I performed this experiment to see for myself how water depth affects tsunami wave speed.

Help Received

My father got me started with a useful book on waves and helped me with timing and calculations in the trials. My mother proofread my paper, and my grandfather designed and ordered materials for the wave tank. Both my parents helped me build the wave tank.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Kai T. Narum

Project Number
J0119

Project Title
Baffling Baffles: Culvert Design for Fish Passage

Abstract

Objectives/Goals
Salmon populations are decreasing, in part because they can not reach their spawning grounds due to poorly designed culverts. Engineers have been putting baffles (devices that impede the flow of water) in culverts to improve fish passage conditions by increasing the depth and decreasing the velocity of water. My objective was to evaluate different baffle designs in culverts to determine which one is most effective in doing this.

Methods/Materials
This project was conducted in a hydraulic flume at Humboldt State University. I tested three culvert models (big baffles, small baffles, no baffles) under high (0.247 ft3/s), medium (0.138 ft3/s), and low flow conditions (0.009 ft3/s). I also ran the experiment with clear water only, water and sand, and water and gravel. The laboratory flume allowed me to control water flow, channel slope, and sediment input. I measured the water depth (feet) with a point depth gauge and velocity (ft/s) by timing a float over a known distance. Each depth and velocity measurement was repeated four times and a total of 27 flume runs were conducted.

Results
The culvert with no baffles had the highest velocity and lowest water depths of the three culverts under all flow and sediment input conditions. Adding baffles increased water depth by 39-524% and decreased the velocity by 30-80% over the range of conditions tested. The big baffles had a higher depth than the culvert with small baffles (26-196%), however, the big baffles did not significantly decrease the velocity compared to the small baffles (0-10%). In addition, the culvert with big baffles was the most effective at moving sediment through the culvert and had the highest calculated shear stress (the force applied to the sediment by the water). In small baffles, sand and gravel filled in the fish resting areas behind the baffles because of lower shear stress.

Conclusions/Discussion
I can conclude that the culvert with no baffles was the least effective at increasing depth and decreasing velocity, and that overall the culvert with big baffles was the most effective. My background research suggested that most baffle designs in culverts are based on experiments with water only. Adding sediment into the culvert significantly decreases the effectiveness of the design, and including sediment is a very important factor to consider in culverts designed for fish passage.

Summary Statement
This project evaluates the effects of baffles on water flow in culverts modified for fish passage.

Help Received
Used hydraulic flume at HSU under the supervision of Dr. Cashman; Teacher and parents helped with editing.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Xavier J. Prochaska

Project Number

J0120

Project Title

Air Resistance: What a Drag! Does the Shape of a Car Affect the Amount of Air Resistance?

Abstract

Objectives/Goals

My objective was to determine if the shape of a model car effects the amount of air resistance it experiences. I believe that the smallest car will experience the least air resistance.

Methods/Materials

To do this I built a wind tunnel and three model cars because wind tunnel provide controlled air flows. Three model cars were made, one was found online with instructions. Two cars I made myself. All were made out of card stock. One wind tunnel was built of plexiglass and 1,848 straws. I had a video camera to film the experiment and a book tied to a rock to keep the car still. I used a ruler to measure the distance of the cars and a balance to keep the cars masses the same plus one fan to provide airflow. I would take a video of each car, measure time and distance to get speed, to acceleration to air resistance.

Results

The smallest car experienced the least amount of air resistance and the cars with the medium and big surface areas experienced about the same amount of air resistance.

Conclusions/Discussion

My conclusions are that a car with a smaller surface area will experience less air resistance then bigger cars, so smaller cars don't burn as much gas. Another conclusion is that surface area is not the only key to air resistance. My guess for why the medium and big cars experienced the same amount of air resistance is the force turbulence. More turbulence means more air resistance so if the turbulence is different then the two cars could experience similar air resistance.

Summary Statement

I built a wind tunnel and three model cars out of card stock to find out if their shape effects the amount of air resistance experienced.

Help Received

Dad helped learn about topic and revised my report. Mom helped put board and wind tunnel together. Dad helped with distance estimations. Teacher revised report.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Julienne Sauer

Project Number

J0121

Project Title

Reducing Drag of Metal Objects through Water Using the Leidenfrost Effect

Abstract

Objectives/Goals

The purpose of this research project was to investigate whether the Leidenfrost effect can be used to reduce the drag on a metal object traveling through a liquid.

Methods/Materials

A steel ball, which had its temperature adjusted to 13 degrees, 67 degrees, and 330 degrees Fahrenheit, was dropped down a cylinder filled with room temperature water. The drop time was recorded to determine whether the Leidenfrost effect can reduce the drag of the metal ball traveling through water. It was hypothesized that if a metal ball is cooled/heated to various temperatures (below and above the boiling point of water) and dropped down a cylinder filled with room temperature water, then the ball heated to above the boiling point of water will travel through the cylinder significantly faster than at the other two temperatures.

Results

The steel ball experienced the shortest average drop time of 0.612 seconds at 330 degrees Fahrenheit, followed by 0.657 seconds at 67 degrees Fahrenheit, and 0.663 seconds at 13 degrees Fahrenheit.A one-tailed paired t-test was used to analyze whether the average drop time was statistically different for each of the three temperature-specific data groups. The obtained p-value was much smaller than the assigned alpha value of 0.05 showing that the steel ball at 330 degrees Fahrenheit traveled significantly faster than at the other two temperatures. This supports the research hypothesis and rejects the null hypothesis.

Conclusions/Discussion

The results of this research can be used for new drag reduction technologies to reduce energy costs for a broad range of applications, such as in nautical applications, pipeline transport, and microfluidic devices.

Summary Statement

This project investigates whether the Leidenfrost effect can be used to reduce hydrodynamic drag for the purpose of decreasing energy costs for a broad range of applications.

Help Received

My math teacher helped me with the data analysis and my dad helped me set up the Excel spreadsheet to perform the T-test.

Name(s)

Nilay S. Sawant

Project Number

J0122

Project Title

A Comparison of Viscosities of Different Biofuels at Various Temperatures

Abstract

Objectives/Goals

Though biodiesel is a renewable source of energy, it has a tendency to gel at lower temperatures. Viscosity is a measure of fluid's resistance to flow. The objective of my project is to make biodiesel from various vegetable oils and determine which vegetable oil based biodiesel is a better choice for colder temperatures.

Methods/Materials

Vegetable Oils, methanol and sodium hydroxide are needed to make biodiesel. Pour 250mL methanol in glass bottle. Add 31.5g of sodium hydroxide to the glass bottle. Stir the mixture until sodium hydroxide is completely dissolved. Add this solution to 1L of vegetable oil in a 2L soda bottle. Shake the solution for five minutes and let the mixture stand still for 2 hours. You will see the liquid start to separate out into layers. Top layer is biodiesel, bottom layer is glycerin. Carefully pour out biodiesel. To measure viscosity, fill the funnel separator with 100mL of biodiesel. Measure time taken to empty the biodiesel from the funnel. Record the time required to empty 100mL of biodiesel at various temperatures. The more time taken indicates higher viscosity.

Results

For all three biodiesel, viscosity increases when the temperature of biodiesel is decreased. Soybean biodiesel has higher viscosity at all measured temperatures compared to canola and corn biodiesel. Corn biodiesel is better choice of biodiesel with respect to viscosity for all kinds of weather because the drop in viscosity compared to the increase in temperature is minimal. Change in viscosity of canola biodiesel is very much comparable to that of corn biodiesel. Hence, canola biodiesel is also good for all kinds of weather. Soybean biodiesel is the worst biodiesel in comparison with the other two biodiesel tested, with respect to viscosity.

Conclusions/Discussion

Biodiesel is made from vegetable oils which is a renewable source unlike petrodiesel. Petrodiesel emits higher pollutants, some of which are linked to lung cancer. It also contributes to global warming. Biodiesel burns cleaner and emits fewer pollutants. It is simple to use, biodegradable, nontoxic and essentially free of sulfur, hence better for environment. A good choice of biodiesel is determined by two factors: cost and viscosity. The cost of oils from lowest to highest is soybean, corn, and canola. Soybean biodiesel has the highest viscosity. Canola and corn biodiesel viscosity is comparable. Canola biodiesel is the best choice among the three.

Summary Statement

Certain biodiesel exhibit a smaller increase in viscosity for the same decrease in temperature, making them more suitable for use in colder climates.

Help Received

My science teacher, Mr. Kai Brown, supervised me during making of biodiesel in the school laboratory.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Michael J. Shane

Project Number

J0123

Project Title

How Do Flaps Affect Wing Lift? An Experiment on Aircraft Stall Speeds

Abstract

Objectives/Goals

Takeoff and landing are called the critical phases of flight. What does a pilot do during this time to help control the aircraft? My hypothesis is that the pilot uses flaps to decrease stall speed in order to slow the aircraft, and therefore has more control during critical phases of flight. For this experiment I will be testing the relationship of an aircraft wing's stall speed in different flap settings using flight simulator software. Exending the flaps should allow the airplane to fly slower during takeoff and landing.

Methods/Materials

For this experiment I used Microsoft's Flight Simulator X, using a variation of airplanes. I picked three small engine propeller airplanes, two twin engine propeller airplanes, a smaller business jet, a regional airliner, a small airliner, and a huge airliner. I then used the software to fly each plane and stall them with flaps up and also flaps down. While doing this, I recorded the speed that the stall occurred for later comparison. Once I had stalled each aircraft with both flaps up and down, I compared all the data and noted the results.

Results

As I conducted my experiment I kept track of the stall speeds, with flaps up and down. I also kept track of the percentage difference the speed resulted in with the flaps down. Please see table. In all cases,having flaps down decreased the stall speed. This makes it easier for pilots to land their airplanes at slower speeds. They can add a small margin of airspeed above the stall speed for safety but still fly at a much slower speed than if the flaps were up.

Conclusions/Discussion

My experiment proved that the stall speed can be lowered by extending flaps. As flaps are extended the total wing area increases and the top half of the wing becomes longer than the bottom half,known as the wing's camber. My hypothesis was proven correct. As the aircraft was larger rather than smaller, they stalled at a higher speed, but always stalled slower with the flaps extended than with no flaps. I concluded that stall speeds are always slower with flaps extended whatever the size/weight of aircraft. Flying at a slower speed without stalling improves flight safety no matter what type of airplane. I learned how simulator software is very precise which is very crucial in the training of pilots.

Summary Statement

This project shows how a wing's lift increases when flaps are extended to allow a pilot to fly slower during takeoff and landing thereby reducing the wing's stall speed, making it safer during the critical phases of flight.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Ryan D. Sloane

Project Number

J0125

Project Title

Lift Off: Testing Airfoils

Abstract

Objectives/Goals

What is the most important factor for a wing to make lift,the thickness of the airfoil or where the thickest point is located? I ran two trials in a wind tunnel measuring the lift generated. I hypothesized that airfoil thickness will be more important than where the thickest point is located. I tried to prove that airfoil thickness will be the factor that affects the flow of air traveling over the wing and creates the most lift.

Methods/Materials

All wings are constructed from wood and tissue paper the same way you would build a flying scale model. Great care is givin so that all are identical except for the variable of airfoil thickness and location of thickest point. All wings were tested the same way,at a constant airspeed, in a wind tunnel we built of wood and cardboard, powered by four box fans. I ran trials for each variable. Mounting the wings inside the viewing chamber of the wind tunnel and measuring the amount of mass lifted when the wing achieved level flight.

Results

Airfoil thickness had more effect on lift than where the thickest point was located. Location of the thickest point of the airfoil generated a smaller range of mass lifted. Thicker airfoils lifted the most mass. Five of the airfoils succesfully tested,the airfoil with the greatest thickness generated no lift.

Conclusions/Discussion

Though the airfoil with greater thickness lifted the most weight, supporting my hypothesis, the most interesting fact was that every airfoil shape had very different flight characteristics. Some were very stable in flight. The airfoil that was the most symetric was the most stable. The wing that lifted the most had a very unstable leading edge. It would seem that wing shape is very important in how lift is generated and an aeronautical engineer would have to choose what shape would be needed to get the lift and flight characteristics required. A fast military jet would need a very different wing than a very large cargo transporter. I am sure that if I changed any of the variables my results would be much different.

Summary Statement

What factor of an wing's shape affects generating lift the most, thickness or location of thickest point?

Help Received

My father helped me build the wind tunnel in our garage.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Anthony D. Sorace

Project Number

J0126

Project Title

Drop Zone

Abstract

Objectives/Goals

My project was to determine if the shape of a parachute will have an effect on the amount of time it takes an attached object to fall to the ground.

Methods/Materials

Three parachute models were constructed from the same cotton fabric. Each parachute had the identical surface area but a different shape. There was a circle, square and an equilateral triangle parachute. To each parachute I attached the same plastic float (fishing bobber) with 6 nylon strings(fishing line). The lines were attached to the hook on the bobber. Each parachute was dropped from the same height 15 times and the time for each drop was recorded. As a control, I also dropped just the bobber with no parachute, and recorded the time for each of the 15 drops.

Results

The circle and square parachutes had virually the same rate of descent. The triangle parachute had a slightly faster rate of descent. The bobber (control) fell significantly faster than when attached to any one of the parachutes.

Conclusions/Discussion

The shape of a parachute will affect the rate of descent of an attached object.

Summary Statement

I designed an experiment to determine if the shape of a parachute will affect the rate of fall of an attached object.

Help Received

My dad helped me by timing the drops; my mother took the photographs and helped me organize the display

Name(s)
David C. Tom

Project Number
J0127

Project Title
Parachute Drop

Abstract

Objectives/Goals
This project looked into what effect the shape of a parachute's canopy has on its descent performance.

Methods/Materials
Six different parachute shapes constructed out of paper and tape were used. Three were in the shape of open boxes, while another three were in the form of flat sheets. Circular, square, and triangular shaped canopies were employed. All the parachutes had equal total surface area. For the open box shapes, half of the total surface area was applied to their skirts. The flat sheets had no skirt. Prior to conducting the experiment each parachute was weighed to ensure that each had the same weight. A smiley face pendant was used as the common payload. There was a 5 minute wait period between drops to ensure air currents caused by people moving in and out of the test area dissipated. Each parachute with its payload was released from a height of 12 feet. Time from release to ground impact was determined using a stopwatch.

Results
The six parachutes displayed a different average drop time. The parachute shape with the shortest descent time (1.76 seconds) was the open circular box shape. The parachute shape with the longest descent time (2.19 seconds) was the open circle shape. Based on visual observations, the ability of the open circular box shape parachute to enter a glide after being released helped it to stay airborne longer. The open circle shape parachute tended to descend with its canopy tipped at an angle. The resulting smaller projected surface area translated into faster descent times.

Conclusions/Discussion
Shape plays an important role in parachute descent performance.

Summary Statement
My project looked into what effect the shape of a parachute's canopy has on its descent performance.

Help Received
Dad helped me find books related to how parachutes work and to explain what drag and lift are in the world of fluid mechanics. He also operated the stopwatch during the experiment.

Name(s)

Mario Z. Torresan

Project Number

J0128

Project Title

When Air Masses Collide

Abstract

Objectives/Goals

The objective is to determine what happens when a warm air mass meets a cold air mass, by modeling air masses with water masses. I believe that a tornado will be formed.

Methods/Materials

Materials for this experiment include a 10-gallon fish tank with a divider down the middle, hot water dyed red and cold water dyed blue, and a camera. The water masses were carefully poured simultaneously into each side of the fish tank, the divider was removed, and the waters were allowed to mix. Photos and video were taken at timed intervals, from t=0 minutes (min) to t=15 min. The photos and video were used to record and analyze the results. The experiment was run 4 times.

Results

No tornado was produced. Instead, photography showed that the collision between hot and cold water resulted in violent waves and turbulence as the cold, more-dense water dived down under the hot, less-dense water. As the test progressed from t=0 to 15 min, the turbulence was high for the first minute, and the cold water moved rapidly back and forth across the tank in a wave. After the first minute the turbulence dropped dramatically and the contact between the cold and hot water grew smoother, yet never completely smoothed out even at t=15 min.

Conclusions/Discussion

When air masses meet they form a boundary that separates them, which is called a front. Fronts are transition zones. Fronts are important to study because it's where major catastrophic weather events can occur. In my experiment I studied what might occur when cold air advances into warm air, hoping to see tornado-like features created when a body of cold water meets a body of hot water. Although I saw turbulence I didn't see tornado-like features. From the literature I learned a cold front occurs when a mass of cold air advances into a region of warmer air. The colder air is denser than warmer air so the cold air will push under and up through the warm air, causing the less dense, warm air to rise and create turbulence, which can result in violent weather.

Summary Statement

The project focused on modeling what occurs when warm and cold air masses collide, by using warm and cold water masses to simulate warm and cold fronts.

Help Received

Parents helped me type and organize my report; mother helped me with my graph and graphics and arranging the pieces

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Jack T. Williams

Project Number
J0129

Project Title
Change Is in the Wind: A Study of How the Design of a Wind Turbine's Blades Can Affect the Electrical Output Generated

Abstract

Objectives/Goals
My goal was to measure the effects of blade design on electrical output generated by a wind turbine. I created 3 different blade designs; a V-shaped blade, an airplane wing shaped blade, and a design inspired by the aerodynamic shape of a dolphin's tail.

Methods/Materials
I calculated the surface area of 3 new blade designs. I cut balsa wood to create 6 blades of each design. There is less that 1% difference between the surface areas of all 3 blade designs. I assembled the wind turbine kit, attached the turbine to a water bottle with rocks to keep it stable, and taped my first blade design to the turbine blades. I turned on the fan to high and measured the energy output with a voltmeter in mA. I recorded the data. I did this 5 times for each of my 3 blade designs.
I used: a voltmeter, to measure electrical output, balsa wood to create different blade designs, plastic water bottle, for the base of the wind turbine, rocks to weigh down the water bottle, 3-speed fan to create wind, tape to hold new blade designs, and a Wind Turbine kit that included: fixed position plastic wind turbine blades, a tail and generator.

Results
After 5 trials the averages were: Dolphin Tail Fin Blade=29.4 mA, V-Shape Blade=17.1 mA, Airplane Wing Blade=23.2 mA. My dolphin tail blade produced about 70% more energy than my V-shaped blade, approximately 25% more energy than the airplane wing.

Conclusions/Discussion
In my hypothesis I predicted that the V shaped blade would generate more electricity and be more aerodynamic because it would scoop the wind from all directions. I disproved my hypothesis. The aerodynamic qualities of the curved dolphin fin shaped blades moved through the air with less drag, so the blades moved faster. This is similar to why a dolphin can move so fast through the water. I observed that when the dolphin tail fin blade moved fast, the shape created by the blades moving together was smooth and concave, like a dish. The other blade designs created shapes that were very angular. I believe that what was created was an aerodynamic vacuum that pulled air into the center of the wind turbine better than the other designs creating faster moving high and low wind forces that moved the blades faster. Because of the improved aerodynamic qualities of my dolphin tail fin blade design, the high and low pressure exchange as seen in the Bernoulli Principle is occurring at a more efficient rate, making the blades move faster.

Summary Statement
After creating three different blade designs, I discovered that by using aerodynamic properties inspired by nature, greater efficiency of electrical output could be produced by wind turbines.

Help Received
Mom helped type some parts of the report; dad helped with calculating the surface area of the blades to ensure the blades I cut were almost identical in surface area.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Jennifer N. Zurlinden

Project Number

J0130

Project Title

Ducted Propeller Efficiency

Abstract

Objectives/Goals

The objective is to determine if a marine propeller operating in a duct is more efficient than one without? If so, how long should the duct be to make it most efficient?

Methods/Materials

I dropped a scale three blade propeller with four different duct lengths through a tank of water 22 inches deep and counted the number of revolutions the propeller spun on a threaded shaft. Each propeller/ duct assembly was dropped 20 times and the revolutions made by the propeller were counted to within 1/21 of a revolution.

Results

I found that a propeller has a greater efficiency with a duct rather than without one. I also found that the longer the duct the greater the efficiency. The data for a 3 inch ducted demonstrated a 12% increase in efficiency.

Conclusions/Discussion

My conclusion is that a propeller has a greater efficiency with a duct rather than without one. I also found that, to a point, the longer the duct the greater the efficiency.

Summary Statement

My project is to determine if a ducted propeller is more efficient than a non-ducted propeller.

Help Received

Father helped me build propeller mount.