CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Ryan J. Anzil

Project Number

J0101

Project Title

Car Spoiler Efficiency

Abstract

Objectives/Goals

An experiment was conducted to determine which rear car spoiler angle will be the most efficient in speed and traction.

Methods/Materials

Wind was blown from an electric blower into a wind tunnel over a model car. A ruler was placed inside the wind tunnel to calculate how far the car was blown by the wind at different spoiler angles. There was also a scale to measure how much downward force was applied on the back of the car. The greater amount of downward force on the back leads to more traction on the back. The hypothesis that a 20 degree spoiler angle will be the most efficient in speed and traction, was confirmed

Results

The angle with 21 degrees was the most efficient for reducing drag and increasing traction. The angle with 60 degrees was the best for improving traction but not drag. The angles -68 were the best for the least amount of drag but not for the most amount of traction. I was very surprised that the largest angle had the least drag.

Conclusions/Discussion

My original problem was what car spoiler angles will be most efficient for speed and traction? The angle with 21 degrees was the most efficient for reducing drag and increasing traction. The angle with 60 degrees was the best for improving traction but not drag. The angles -68 were the best for the least amount of drag but not for the most amount of traction.

I found it hard to measure the downward force because the wind was not staying at a constant speed, so I had to estimate the weight. I was surprised that angle 7(-68 degrees) had the least amount of drag. The angle was so large that it looked like it would create the most amount of drag. I came to find that my hypothesis was correct (I expected that a wing angle of twenty degrees will be the most efficient.)

Summary Statement

An experiment was conducted to determine which rear car spoiler angle will be the most efficient in speed and traction.

Help Received

My dad helpd me build the wind tunnel. My science teacher guided me through the steps. My mom helpd me with the display board.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Garen Arabian

Project Number
J0102

Project Title
Guilty of Turbulence!

Abstract

Objectives/Goals
The purpose of my project was to determine whether or not pipes with different geometrical shapes, yet with identical cross-section areas will conduct water at the same rate.
I hypothesized that my different geometrical shapes will cause different turbulence patterns in my pipes, therefore affecting the flow rate of the water.

Methods/Materials
I equipped the bottoms of 5 identical water containers with 5 drainage pipes of different geometrical shapes, with a constant cross-section area.
My setup allowed me to pour the same volume of water under the same conditions into each of my 5 containers, and measure the time it took for the different pipes to drain the water.

Results
My circular pipe conducted the water the fastest. The second fastest was my star-shaped pipe, followed by my square and my rectangular pipes. The slowest drainage occurred through my triangular pipe.

Conclusions/Discussion
I observed that the polygon with most sides conducted the water the fastest, my circle being considered a polygon with an infinite number of sides.
And the flow rate decreased with the decreasing number of sides of my shapes.

Summary Statement
How will the cross-section shape of a pipe affect the flow rate of water through it?

Help Received
My father helped me cut the plexiglass to built the different geometrical shaped pipes.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Joshua M. Arreola

Project Number
J0103

Project Title
The Powerful Windmill: Creating the Most Efficient Windmill Blade

Abstract

Objectives/Goals
The objective was to determine what blade factors (length, shape and the number of blades used) on a windmill would produce the most energy output at a high wind speed. By creating three various shapes and sizes, and using two different blade designs, I hypothesized that a 12.7cm by 2.54cm sickle-shaped four-blade design would produce the most energy output.

Methods/Materials
A windmill was built out of Tinkertoys. Twenty-four blades made out of balsa wood were cut out into three different shapes and sizes: rectangular, trapezoid and sickle-shaped at 10.16cm by 2.54 cm, 12.7cm by 2.54cm, and 15.24cm by 2.54cm (eight of each shape and size). The blades were placed at a 20° angle on a windmill hub using two different blade designs (a four-blade design and an eight-blade design.) A DC motor was attached to the windmill, and a multi-meter was hooked up to the output of the motor to read and record the DC voltage. A room fan set at high speed was used as the wind source, and was placed one meter away from the windmill. Each design was tested for thirty seconds. A total of eighteen tests were conducted from all the blade designs.

Results
The overall results showed that the four-blade designs produced more energy output than the eight-blade designs. The 10.16cm by 2.54cm sickle-shaped four-blade design produced the most energy output, and the 15.24cm by 2.54cm sickle-shaped eight-blade design produced the lowest output.

Conclusions/Discussion
My results showed that my hypothesis was incorrect. My background research shows that using shorter and fewer blades on a windmill should produce more energy output. For future experiments, I might change the variables such as the blade pitch, materials used, and/or the weight of the blades. I would then isolate and test each blade design variable one at a time. And finally, I would run more trials for better accuracy of my results. This experiment can benefit society by aiding in the creation of an efficient blade design for energy production. This could also help to reduce the use of fossil fuels in order to create a safer, cleaner environment.

Summary Statement
This project was conducted to determine what blade design factors on a windmill would produce the most energy output.

Help Received
Mr. Hellman (Math teacher) explained how to measure the blade angles on my windmill hub. Dad advised on how to place the motor on my windmill and how to use a multi-meter. Mom assisted with purchasing the materials, taking pictures, and pasting some of my board.

Name(s)
Elizabeth J. Bouchard

Project Number
J0104

Project Title
Wind Wind Go Away, Come Again Some Other Day

Abstract

Objectives/Goals
My project, Wind Wind Go Away Come Again Some Other Day, is to see if specially designed sculptures can reduce and redirect the wind made by the venturi effect at the base of tall buildings and beautify the environment at the same time. The venturi effect is when wind accelerates as it is funneled through a gap, such as an alley way between sky scrapers. The venturi effect can cause wind speeds to become annoying and sometimes dangerous for pedestrians.

Methods/Materials
I tested four different geometric shapes in a wind tunnel in front of two model buildings, one of which was 25 centimeters tall the other 27 centimeters tall. The four shapes I tested were all made of wood and at least 2.5 centimeters tall. The shapes were a slab, a triangular prism, a sphere, and a hemisphere. In order to measure my dependent variable I did two things. First I measured the wind speed directly behind each shape using an anemometer. Then I visualized the wind flow by using styrofoam beads and a digital camera.

Results
My results prove that geometric shapes can be used to reduce the wind speed behind them. The slab shape was by far the most effective in reducing the wind speed from 7.6 kph to 0 kph. The sphere and triangular prism both reduced the wind speed to 4.3 kph. The hemisphere did the worst at 6.6 kph.

Conclusions/Discussion
The venturi effect can be reduced and redirected by different geometric shapes and the best shape to do that, out of the shapes I tested, is a slab like shape. It is possible to use properly designed sculptures to redirect the wind flow as opposed to glass screens or cement blocks. I was not able to create a completely accurate wind tunnel with my budget and skill set. The fan speed was not accurate, the tunnel inlet air flow was not perfectly straight, and my rig was only as good as I could make it. Furthermore, my fan was not able to reach the high speeds of wind when it becomes dangerous for pedestrians. The next test I would perform would be to actually create a sculptures based on the results of my experiment and test them in a more accurate wind tunnel with a faster wind speed.

Summary Statement
The purpose of this experiment is to see which shapes, if any, are best for lowering the severity of pedestrian level wind in a specific area.

Help Received
My mom helped me get materials for my project.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Kieran A. Czerwinski

Project Number

J0105

Project Title

Blade Efficiency of Wind Generators

Abstract

Objectives/Goals

The objective of my experiment was to find out how the number of blades and the angle of blades effects the amount of electricity a wind generator produces.

Methods/Materials

I built a simple stand from my Erector set for the generator to stand on. I bought some balsa wood at a hobby store and cut out the blades using an exacto knife. I drilled holes into a bass wood rod spaced so that they were evenly apart from each other. I attached paper clips to the blades and inserted the ends of them into the holes I had drilled. I then set up a 3-speed box fan a foot away from the front of the generator. I set clip leads from the DC motor of the generator to the volt-meter so that I could measure the amount of electricity it was producing. The last step was to perform the tests and record the data.

Results

The results concluded that out of 2-6 blades, the 3 blade design did the best in both the 45 degree test and the 25 degree test. I performed 2 tests on different degrees because I thought the results might change from the first test of 45 degrees. When I performed the angle test at 15 degrees, 30 degrees, 45 degrees, 60 degrees, and 75 degrees the angle that turned out to be the best was the 15 degree angle.

Conclusions/Discussion

My hypothesis was close to the actual results. I discovered that both the number and angle of blades on a wind turbine effect how fast it turns and therefore how much energy it produces. After completing this project I am anxious to continue experimenting with how the length, shape and curvature of blades effect efficiency. I believe all this information could be important today considering that we are in need of developing more efficient & clean alternative energy.

Summary Statement

To maximize the amount of energy wind turbines produce by determining the number and angle of blades that work best.

Help Received

Dad loaned me a volt-meter and explained how to use it. Mom helped me cut out paper for the backboard.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Mary R. Data

Project Number

J0106

Project Title

Serve It Up: The Effects of Spin on the Volleyball

Abstract

Objectives/Goals

The purpose of this science fair project was to determine which volleyball serve is the hardest for the opponent to return based on the effects of the spin on volleyball.

Methods/Materials

The experimental method I used was to videotape a live volleyball match. I drew a diagram from the measurements of the court showing the lines on the court and walls of the gym to use as reference points to determine the trajectory and speed of the volleyball for each serve. I analyzed 59 overhead serves and 45 float serves. A total of 112 serves were analyzed frame-by-frame and recorded on an Excel spreadsheet. Each serve was analyzed for the type of serve (determined by the rotation of the ball), the maximum height, the launch angle of trajectory, the distance the volleyball traveled, the time it took from the initial impact (serve) to when the ball lands, the travel speed of the volleyball and the level of difficulty to return the volleyball. I also designed and built a wind tunnel to confirm the Bernoulli Effect on a spinning volleyball.

Results

The float serve is the hardest serve to return because 58% of the aces in the volleyball match were the result of a float serve. The average level of difficulty to return a float serve on a scale of 0 to 4 was 2.8 as compared to 2.4 for an overhead serve. In an overhead serve the ball with a backspin has lift in an upward motion and tends to curve upward as it reaches the end of its path. The float serve is when the ball has no spin and the pressure around the ball is constantly changing. This causes the ball to swerve erratically through the air making it harder for the opponent to predict the ball#s trajectory.

Conclusions/Discussion

My hypothesis was correct and proves that the float serve is the most difficult serve to return over the net or to set a pass to the setter because it is harder for the player to judge the ball#s erratic trajectory keeping the opposition off guard. As a volleyball player, physics has given me a competitive advantage; I can change the spin on my serve to keep the other team off guard.

Summary Statement

My project demonstrates which volleyball serve is the most difficult for the opponent to return based on the spin of the volleyball.

Help Received

My dad videotaped the volleyball match and cut out the plywood for the smoke machine box on the table saw. My parents talked with me about my design concepts. My brother helped me with one of my spread sheets. My mom proof-read my report and display board.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Henry W. Downs

Project Number

J0107

Project Title

Making the Perfect Paper Air Plane

Abstract

Objectives/Goals

My experiment is to make a paper airplane that can rival some of the best paper airplanes. To accomplish this, I will first gain an understanding of how real planes work, and observe the principals of flight in action by testing a few different kinds of paper airplanes. My data showed that the design elements, such as placement of weight, and wing structure are the key to designing a good paper airplane. Unfortunately, I learned that designing a paper airplane is not child#s play, and is more difficult than it appears.

Methods/Materials

Material- Paper; stop watch; tape measure; chalk; a starting point;a second person to start and stop the time;notebook

Procedure- Test different kinds of paper airplanes, using standard data points, and learn from comparing the data to create the best paper air plane that I can.

Results

My data showed that the plane needs to be small enough to be able to survive a hard throw, yet it needs to be large enough to take full advantage of gravity's pull, and use it to create lift. The plane also needs to be balanced, so that its angle of attack does not change so drastically that the plane can't stabilize itself. Positioning of the weight affected the angle at which the plane would turn down when gravity took over. If the angle was perfect, the wings could catch the wind, and swoop up. If the plane turned too far down, it would fly into the ground. If the plane had most of its weight on its nose, it would probably create too steep of an angle for the wings to catch the air and create forward thrust to move the plane forward. If the plane had most of its weight in its middle, the weight wouldn't pull its nose down at as sharp of an angle, and therefore would be able to use the gravity to its advantage, speeding up, as well as generating more lift, because the wings were able to catch the airflow at the right angle of attack.

Conclusions/Discussion

The structure of a plane is important because as soon as the initial thrust provided by the throw decreases, gravity takes over and helps provide thrust. If the weight is in the right position, the plane will be able to go down at an angle gentle enough for the plane's wings to easily catch the airflow and use it to create lift and forward thrust. If the weight is not in the correct position, the plane goes down at an angle too steep for the plane's wings to catch the airflow and generate lift, resulting in a crash.

Summary Statement

Designing the perfect paper air plane is more difficult than it may seem because you must balance The Principals of Flight, know to us as lift, thrust, gravity, and drag.

Help Received

Step Dad helped to type up the project, put together the display board, and guide me.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Julie A. Ferguson

Project Number

J0108

Project Title

Fastest to Flow

Abstract

Objectives/Goals

Determine how different shaped holes with the same area effect flow rate. I think overall, the water will flow through the circles the fastest because they have no sharp corners to slow the flow down.

Methods/Materials

A flow box was designed and constructed to test the flow rate through various shaped holes with different areas. Three different shapes were used; circles, squares and equilateral triangles, and each shape had four different areas. The shapes were cut into plastic caps which were fitted onto a pipe at the base of the flow box. The time required to flow an equal amount of water through each hole was recorded.

Results

The data proved the flow rate through the triangular shapes to be the fastest. In addition, the calculated velocity of the water flowing through each shape was nearly identical and independent of area for a given shape. However, the calculated velocity through the triangular shapes was higher than the other shapes, which confirms the flow rate through the triangle was the fastest.

Conclusions/Discussion

Through my experiments my hypothesis was proven wrong. Overall the triangle had the fastest flow rate. The velocity of the water through the holes was similar for each shape independent of the area of the opening. However, the velocity through the triangles was faster overall than either the circles or squares, because the triangles had the fastest flow rates. The flow pattern through the circle was circular, though the square had a pattern of two intersecting planes, and the flow through the triangles developed into a Y-pattern.

Summary Statement

Test how different shaped holes with the same area effect flow rate.

Help Received

Mom & Dad paid for all materials; Dad helped cut holes in caps with Xacto knife, with box assembly and testing; younger brother turned fill hose on and off.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Jason G. Franklin

Project Number

J0109

Project Title

The Effect of Humidity on How Far a Baseball Travels

Abstract

Objectives/Goals

My objective was to determine the affect humidity has on how far a baseball travels.

Methods/Materials

I used a glove my hand could go into and stick through the fish tank so I could launch the balls. I used 2 different size balls, one that was approximately 1 inch in diameter and one that was approximately 3/4 inch. The smaller one was also a little heavier and denser. I used two different ball sizes so I could test if the humidity would affect a ball differently with less density or mor density. I used a humidifier with a hose attached to it to increase the level of humidity in the tank. I tested 2 different levels of humidity, 24% and 82%. I did the experiment 10 times for each ball and at each humidity level. After I launched the balls, I would put stickers on wherever the ball would hit the glass. Lastly, I measured how high the stickers were on the wall of the fish tank.

Materials: 1ft x 4ft fish/reptile tank; 1 rubber glove; 1" ball; 3/4" ball (heavier density), A cooking clamp; Round different color stickers; duct tape; A tennis ball; felt fabric; Plastic sheet to seal top of tank; A 1 1/2" plastic ring; A humidifier; a hose; A hygometer to detect humidity level

Results

After shooting Ball 1 10 times with 25% humidity, the average height where it hit on the wall of the tank came out to be 8.7 inches. I used the humidifier to raise the humidity to 82%. I repeated the test and came out to an average of 7.5 inches. I used a smaller but denser ball and I called it Ball 2. Ball 2 was easier to shoot and went further tha Ball 1. At 25% humidity, Ball 2 went almost 9 inches. At 82% humidity, Ball 2 went an average of 7.6 inches. More humidity definitely does reduce the distance the ball travels.

Conclusions/Discussion

Humidity can affect the distance a ball travels. When there is more humidity in the air the ball tends to not go as far. With less humidity, the ball goes further.

This experiment taught me that a baseball player does most of the work but not all of it. This experiment opened up a whole new way of looking at science for me. I love sports, and now I can see how science can impact sports. According to www.city rating.com, the average humidity in different cities is: Jacksonville, Florida 72.5%; Phoenix, Arizona 36.5%; and Denver, Colorade 53.5%.

If I were to pick what stadium I would like to play at it would be in Phoenix. It has the lowest average humidity of all major cities.

Summary Statement

My project is about testing how different humidities affect the distance a ball travels.

Help Received

Parents helped assemble tank.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Yuki Fukurai

Project Number
J0110

Project Title
Automotive Drag: Which Type of Car Design Has the Least Amount of Drag?

Abstract

Objectives/Goals
I wanted to find out what type of car design has the least amount of drag.

Methods/Materials
Materials: A lot of wood, Plexiglas wall or board, Cardboard, Sand paper, Sponge, A knife or cutting tool that can cut cardboard and sponge, Saw, Carving knives, Large 20 inch Electric Fan, Nail, Hammer,Marker, Ruler, Pen, Comp book, Aluminum foil, Stop watch, Screw, Washer, Dowel, Lego wheel parts, 3 piece wood rasp,Transparent tape

Procedure:
1. A wind tunnel used for the experiment was built according to the design that was show on the internet. Both the width and height of the wind tunnel was set at 6 inches and the length at 3ft.
2. Draw a line using a marker inside the wind tunnel. The line will be drawn about in the middle of the wind tunnel.
3. Carve a car out of wood, using carving knives and sand paper. Try to make them the same size.
4. Then wrap the car using aluminum foil, do not wrap the bottom of the vehicle.
5. Find a sponge that is the same size as the bottom of the aluminum car, and connect it to the Lego wheel parts. Put the aluminum car on the sponge that is connected to the Lego parts.
6. then put the car in the wind tunnel and turn on the fan, at the same time start the stop watch then stop it when the car reaches the end.

Results
I collected my results by putting the fan on one speed and measuring how long it took for the vehicle to reach the other end of the wind tunnel. If the car had a lot of drag, the vehicle moved backward quickly, meaning less time and if the car had less drag, the vehicle moved slowly, meaning longer time. In the end the race car had the least amount of drag followed by mini-van, sedan S.U.V.,and pick-up-truck.

Conclusions/Discussion
The results of my project support my hypothesis that the sports car will have the least amount of drag or air resistance, then followed by mini-van, sedan, S.U.V., and pick up truck.

I believe that the result of my experiment could help people that are thinking to buy a car. On a windy day the fuel efficiency of a pick up truck could be a little bad. If you were to buy the same sized mini-van or a sedan, the mini-van has less drag so it could have a better fuel efficiency. The car with mini-van like

Summary Statement
I had sports car, mini-van, sedan, S.U.V., pick-up-truck, and put them in the wind tunnel to find the car with the least amount of drag.

Help Received
My father and grandfather helped me build the wind tunnel because I am not good at building things. My grandfather helped he solve a problem by finding sponges that was the same size as the bottom of the aluminum cars.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Robert C. Hollar

Project Number

J0111

Project Title

Hovercraft Engineering: Maximizing Engine Thrust

Abstract

Objectives/Goals

The objective of the project was to measure the thrust generated by an electric model aircraft propeller engine and determine if the thrust could be increased by placing the propeller inside a duct.

Methods/Materials

A hovercraft was constructed from balsa wood and fiberglass. Three differently shaped ducts (conical, cylindrical, and Kort Nozzle) were constructed using fiberglass. A electric model aircraft propeller engine was mounted on the hovercraft. The speed of the engine was set at 5000, 7000, 9000, 11000, and 13000 rpm and the produce thrust was measured using a GeoExplorer stain gauge. The test was repeated with the engine inside each of the three ducts.

Results

The engine produced the most thrust at a specific speed when it was mounted inside a Kort Nozzle Duct, followed by no duct, and the cylindrical duct. The engine product the least thrust when it was inside the conical duct

Conclusions/Discussion

The thrust is equal to the mass tranport rate times the differenct in velocity measured at the outlet and inlet of the duct plus the pressure at the outlet times the area of the outlet minus the pressure at the inlet times the area of the inlet. To fully understand the performance of the ducts it would be necessary to measure each of the parameters.

Summary Statement

The purpose of the project is to determine if the effeciency of a propeller engine can be improved by placing it in a duct.

Help Received

My father assisted with constructing the hovercraft and ducts.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Jesse T. Houser

Project Number

J0112

Project Title

Weighty Matters: Paper Airplanes and Center of Gravity

Abstract

Objectives/Goals

The purpose of my experiment was to find the best position for added weight in front of the neutral point on a paper airplane for long distance flight. My hypothesis was that weight positioned in the very tip would give the greatest distance.

Methods/Materials

I assembled a launcher to control the variables of hand launching and researched a plane design, folding enough planes to average human error. I weighted them with a constant weight in a range of positions forward of the neutral point. I launched multiple trials indoors. The launcher misfired continuously in the first test, and I had to hand-launch. I altered the plane design to suit the launcher, and repeated the test. I graphed & evaluated data.

Results

In the hand-launched trial, the evenly weighted plane performed best, but only marginally better than the nose-weighted plane, and all planes performed in a similar range. However, I feel that the auto-launched trial was more accurate due to reduced variables, and in it the nose-weighted plane out-performed the evenly weighted plane narrowly, but both clearly out-performed all other planes.

Conclusions/Discussion

My hypothesis was supported, but not conclusively because the evenly weighted plane performed similarly to the nose-weighted plane, which my hypothesis favored over all other planes. I think this is because positioning weight in any one place may be good at certain points in flight, but at other points it can become unstable. For the plane to be consistently stable, it must either be able to shift its weight to adapt to all conditions along its flight path, or have weight which is evenly distributed. However, if weight is placed in any one point, it should be as far forward as possible, since then more wing area behind the center of gravity is given over to lift. I plan to conduct more trials in order to further support or deny my hypothesis.

Information such as this could help airplane designers plan where to place fuel tanks or cargo bays for stable glide in case of engine failure. It is applicable anywhere that gliding flight is involved.

Summary Statement

My experiment evaluates the effect that changing weight distribution and shifting the center of gravity has on a paper airplane's long distance flight.

Help Received

My parents helped me measure & record data; my Dad taught me how to use Microsoft Excel; my Mom helped me clarify data and edit my report; I received useful advice from paper plane expert Ken Blackburn and former aerospace engineer Bob Bengard.

Name(s)
Jessica O. Laird

Project Number
J0113

Project Title
A New Spin on Things

Abstract

Objectives/Goals
I play club volleyball and wanted to see how using an old volleyball vs. a new one, would affect play. I narrowed my question to "How does the roughness of a volleyball affect the volleyball's amount of spin in a given space?" My original hypothesis was the older volleyballs would spin less in the allotted space due to friction's effect on their motion through a fluid. I believed friction or "drag" would be the main cause for the slower motion of these volleyballs. After further observations I modified my hypothesis: The newer volleyballs, with more defined and rougher ridges, will spin more in the allotted space because of the hand's increased moment of inertia on the volleyball, transferring a greater amount of energy.

Methods/Materials
13 feet and 7 inches of 1- inch PVC pipe, 33 and 3/4 inches of 3/4-inch PVC pipe, three latex rubber gloves, one metal round-clamp, four 1-inch PVC shoulders, 1 42-inch plastic Tupper-ware tank, 1 3/4 -inch PVC T, two 1-inch PVC Ts, 614 grams sand, two 1-inch threaded PVC Ts, protractor, Sony Digital-8 videocam. I built a pendulum with a base around a tank of water. The swinging pendulum arm containing a sand-filled rubber glove to simulate the hand and serving motion in volleyball; the tank with water provided a stable fluid environment to model behavior in air. A volleyball was placed on a stand in the water, and the pendulum arm released. All trials were recorded on video for viewing in slow motion. I performed one hundred trials, twenty on each of five balls ranging in age and wear. After viewing all trials I recorded the ten closest in range and easiest to view trials for graphing purposes. I measured and recorded the number and actual degrees of rotation of each ball in a logbook.

Results
As predicted, the measurements of rotation for each of the balls decreased with the change to older, worn balls. The majority of the measurements were within a close range, showing that the data was conclusive and the results weren't random.

Conclusions/Discussion
My modified hypothesis was confirmed by the data. The newer, more pristine appearing volleyballs spun more than those that were dirty and worn. It was the newer balls that in fact had the more defined ridges and slightly sticky texture which caused their increased transferred energy and increased spin. The difference in spin between the newer and worn balls is enough to affect the serving patterns of a volleyball player.

Summary Statement
This project examines how surface texture affects "spin" or rotation of a volleyball in a fluid (air or water).

Help Received
Mom and Dad provided financial support and took pictures. Volleyball coach provided materials. Dad supervised assembly.

Name(s)

Kevin Lee; Spencer McManus

Project Number

J0114

Project Title

Which Type of Wind Turbine Is More Efficient and Useful?

Abstract

Objectives/Goals

Our question was "Which type of wind turbine is more efficient and useful?" Our purpose for performing this experiment was to determine whether it is more efficient to use Horizontal Axis wind turbines of Vertical Axis wind turbines.

Methods/Materials

First, in order to test our hypothesis, we constructed a Vertical Axis wind turbine and a Horizontal Axis wind turbine from mainly wood and foam board. We also used electrical wire and magnets to produce electricity. When the wind turned the turbine, the magnet rotor rotated over the coils of electrical wire, producing electricity. We conducted the tests at three different wind levels, with 30 trials at each level, in order to get more conclusive results.

Results

The average amount of electricity produced for the Horizontal Axis turbine was 1.85 DCV at low, 1.17 DCV at medium wind, and .92 DCV at high wind. The Vertical Axis turbine produced 2.76 DCV at low, 2.18 DCV at medium, and 1.14 DCV at high.

Conclusions/Discussion

Our hypothesis was not supported by our data. The Vertical Axis wind turbine consistently outperformed our Horizontal Axis wind turbine. We also noticed that as the wind speed increased, the amount of electricity produced decreased. This could be attributed to the way we generated our electricity, since we used magnets and wire instead of a generator. Another problem we had was measuring in alternating current. We tried, but obtained no readings from the multi-meter. This could have been caused, again, by the absence of a generator and the home-made quality of the turbines.

If we were to perform this experiment again, we would probably a generator to generate electricity instead of the magnets, as this might have caused some of the problems we were having. We could conduct further research into wind, alternative energy, and other types of turbines to extend our experiment.

Summary Statement

We tested two types of wind turbines to determine which of the two models produced more electricity.

Help Received

Dawn O'Connor for equipment and information.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Christian C. Lefay

Project Number

J0115

Project Title

Up, Up, and Away! Model Rocket Aerodynamics and Parachute Recovery Systems

Abstract

Objectives/Goals

This project on rocket aerodynamics had two goals. The first goal was to determine which fin shape and location would yield the greatest stability and thus the highest maximum altitude during flight. The second goal was to determine which parachute style would yield the slowest rate of descent and reduce the distance a rocket traveled away from the launch site.

Methods/Materials

Flight stability was tested by constructing four different rockets. Two rockets had downward-facing fins: on one rocket they were located near the base and on the other near the center of the rocket . Two additional rockets had upward-facing fins, again located near the base or near the center of the rocket.

At another time, the efficiency of four different styles of parachutes was analyzed. A drop test was used instead of an actual flight as parachutes used during flights may not properly deploy. Two large parachutes of equal area but different shapes were compared to two small parachutes, one with a spill hole and one without.

Results

The rockets with downward facing fins consistently reached higher altitudes than those with upward facing fins.

The larger parachutes took the most time during descent and traveled the greatest distances, while the smaller chutes dropped faster and traveled less distance.

Conclusions/Discussion

The downward-facing fins created much more stablity than the upward-facing fins, and the greatest stability was achieved when the fins were located closest to the engine mount.

Large parachutes descend slowly and travel great distances while small chutes fall rapidly and do not drift far from the drop point.

Future tests would examine the effect of greater thrust on both models of the rockets with downward-facing fins to see if either design would prove to be less stable if more force were added.

Summary Statement

Fin shape and location directly affects flight stability and maximum altitude attained. Parachute size and shape affects recovery time and distance traveled.

Help Received

My mother helped me type the report; my neighbor advised me on designing and launching the rockets.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Bolun Liu

Project Number

J0116

Project Title

An Experimental Examination of Fluid Viscosities

Abstract

Objectives/Goals

Viscosity is a fundamental property of fluids. The goals were to determine alt classifications of viscosity for representative fluids and to experimentally measure the viscosities against these classifications. I hypothesize the order of transit time of the fluids studied is as follows: rubbing alcohol, water, saturated saltwater (NaCl) solution, saturated sugarwater solution (so called "simple syrup"), engine oil, commercial "artificial" maple syrup, and canola oil. It was also asserted that saturated sugarwater solution and commercial "artifical" maple syrup are trixotropic fluids. It is further asserted that the engine and canola oils will are reopectic fluids. It is also believed that all other fluids examined are Newtonian fluids.

Methods/Materials

To find the viscosity of the fluids (water, rubbing alcohol, saturated saltwater, saturated sugarwater, canola oil, engine oil, and commercial "artificial" maple syrup) I constructed an experimental test apparatus where a steel ball dropped under the influence of gravity through a l cylindrical glass tube filled with the test fluid and the transit period was timed. Each fluid trial was replicated 50 times in order to obtain statistical power. The data was statistically analyzed using a personal computer with EXCEL. Appropriate graphs of the data were constructed and statistical measures calculated to determine the average transit time. Fluid-to-fluid comparisons were made of the graphs and calculated statistics to test the stated hyotheses.

Results

The order of the liquids being timed is: water (1.58 seconds) rubbing alcohol (1.66 seconds), saturated saltwater solution (1.68 seconds), saturated sugarwater solution (2.01 seconds), canola oil (10.77 seconds), engine oil (18.68 seconds), commercial "artificial" maple syrup (58.23 seconds). Furthermore, corn syrup and engine oil were found to be reopectic and commercial maple syrup was found to be trixotroic.

Conclusions/Discussion

The hypotheses of the experiment were supported. The custom made exerimental apparatus performend well. However for future experiments, a revised apparatus should be developed to verify Stokes' Law. It was found that the custom designed apparatus could not support this course of experimentation. Further studies to verify Stokes' Law would use a smaller steel ball and a larger diameter cylindrical tube. The new apparatus would use computer controlled photogates.

Summary Statement

I sought to experimentally verify viscosity theory for representative fluids.

Help Received

Dr. John C. Howe provided the motivation for my looking at a problem in the physics of fluids. My parents provided on-going encouragement and support.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Siegen A. McKellar

Project Number

J0117

Project Title

Getting a Kick Out of Freestyle: Does Foot Angle Affect Swim Propulsion?

Abstract

Objectives/Goals

The objective of my project was to determine if a swimmer's foot angle affected kicking propulsion in freestyle sprints. I believe that if the angle of the foot is increased, and water is kicked backward rather than downward as is usually taught competitive swimmers, the propulsion of the kick and the speed of the swimmer will be increased.

Methods/Materials

I made a reversible pair of fins out of styrofoam, fiberglass, and epoxy. One side of the fins was left flat. The front part of the other side was cut on a 20% angle to propel water backward instead of downward. The angled side was reinforced with pieces of aluminum sheeting. The fins were made reversible to control for variables.

I had each of eight swimmers swim three laps (15 yards)using the flat side as the kicking surface and three laps using the angled side, for a total of 48 trials. I controlled for variables. Swimming was done under the supervision of a USA Swimming certified coach.

Results

The experiment showed that all eight swimmers were consistently faster when they used the angled side if the fins as compared to the flat side of the fins. The results ranged from 14.3% faster to 19.4% faster.

Conclusions/Discussion

My hypothesis was correct. When the swimmer's foot angle is increased, the propulsion of the kick and the speed of the swimmer are both increased in freestyle sprints. At elite, international and Olympic levels, where fractions of a second can make the difference between first and fourth place, drops in time like those in my experiment could help win medals and break records.

Summary Statement

My project investigates the effect of foot angle on the propulsiveness of the kick and the speed of the swimmer in competitive freestyle swimming.

Help Received

(1) My dad took me to Home Depot to help me find suitable materials. (2) After I measured the angles that I wanted, he helped me cut the styrofoam since it was hard for me to work with. He also helped me cut the metal toe plates and bracing strips, and supervised mixing and using the fiberglass and epoxy.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

James L. Newton

Project Number

J0118

Project Title

Lift and Wing Geometry

Abstract

Objectives/Goals

The purpose of this project was to determine what dimensions in the geometry of a wing, such as angle of attack, airfoil shape, aspect ratio, sweep angle, would achieve higher lift of a plane.

Methods/Materials

Experiments involved making a wind tunnel using a large cardboard tube and hair dryer, a fuselage with sets of detachable wings with varying design parameters from balsa wood.

The test craft with various detachable wings, was placed in the wind tunnel and tests were conducted to determine the lift force generated by the different geometric specifications of the wing.

Results

The results of my experiments showed that higher sweep angle and aspect ratio, non-symmetric airfoils and a lower angle of attack generated more lift.

Conclusions/Discussion

Therefore, in real life application, lift is maximized with a lower angle of attack, standard, non-symmetrical airfoil, and a high sweep angle and aspect ratio. When lift is maximized, aircraft can carry more load at higher altitudes, thus reducing fuel consumption.

Future applications could include reusable rentry spacecraft vehicles that allow for the craft to reach the edge of the atmosphere, then to fly back like a conventional aircraft.

Summary Statement

This project investigated and demonstated the lift force generated by various wing geometry.

Help Received

My father who purchased the materials, my mother who helped with the finishig touches, my brother who helped with testing, and my teacher who encouraged and guided me in the preparation.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Hannah R. Ornas

Project Number
J0119

Project Title
Four Fins in Flight

Abstract

Objectives/Goals
The objective of my experiment is to measure the effect of different fin shapes on a rockets stability and altitude.

Methods/Materials
Do three launches with the original trapezoid fins. Measure the altitude of each launch. Then cut off the original fins with a knife. Measured the surface area of the original fins {area=(B1+B2)H/2}.

I made a set of triangular fins with same surface area as original fins. Sanded them smooth and tapered edges to reduce drag. Glued them on and dried them with a hair dryer. Did three launches and measured the altitude of each. Then I cut off triangle fins.

Created rectangular fins with the same surface area. Sanded them and glued them onto the rocket. Did three more launches and measured altitude of each one. Removed fins and launched the rocket a couple of times without fins and measured the altitude. For each set of fins I added the three altitudes together and took average.

Results
Rectangular fins reached the highest altitude averaging 872.3 feet. Triangular fins were second averaging 838.6 feet. Original fins placed last averaging 577.1 feet. Did two launches without any fins. One launch went only 41.6 feet. The other went a two hundred feet. Both spiraled out of control and crashed.

Conclusions/Discussion
The rectangular fins went higher than the other fins in each one of its launches, but only averaged 34 feet higher than second place triangle fins. My experiment didn#t prove that rectangle fins would always be the best fin shape.

Each shape had its own trajectory. For example the rectangular fins flew straight up. The triangle fins curved toward the wind. The original fins curved away from the wind.

Many variables make a difference in the flights so when I went to launch I tried to minimize the variables. We launched at the same place at the same time each day in the same weather conditions. But there might have been more wind one day than another and it might be blowing different directions too. The placement of the homemade fins wasn't perfect. I couldn#t glue them on perfectly.

Summary Statement
My project is about how different fin shapes affect the altitude and stability of a rocket.

Help Received
Dad helped typed the report; Dad showed me how to cut the fins; Brother showed me how to set up the engine starters

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Jacob A. Paoletti

Project Number

J0120

Project Title

How Do Different Centerboards Affect the Hydrodynamic Drag on a Club Dinghy Racer?

Abstract

Objectives/Goals

My objective was to find out how different sailboat centerboards affect hydrodynamic drag. I thought that the CFJ centerboard would have the least hydrodynamic drag, then the Laser centerboard, and finally the Opti centerboard, which would have the most drag.

Methods/Materials

I set up a spinnaker pole which is about 16 feet high. I rigged it with a pulley system that could pull a boogie board 8 meters through the water with different wooden centerboards in it. The centerboards would be a Laser, CFJ, and Opti centerboards. I ran 10 trials with each centerboard. I timed how long it took for each centerboard to travel the 8 meters, assuming that greater hydrodynamic drag would result in a longer time.

Results

The results shows the three different times for the each centerboard. The average time for the CFJ centerboard was 6.544seconds, the average time for the Laser centerboard was 7.192seconds, and the time for the Opti centerboard was 7.591 seconds.

Conclusions/Discussion

My hypothesis was that the CFJ centerboard would have the least hydrodynamic drag, or the fastest time, and then the Laser centerboard would have the next fastest time, then finally the Opti centerboard would have the most hydrodynamic drag, and the slowest time. It turned out that my hypothesis was correct. This seems to indicate that a CFJ centerboard has the least hydrodynamic drag of all the centerboards that I tested. I think that the results turned out this way because the CFJ centerboard is shorter and is shaped closest to a shark fin. I think that the Laser centerboard came next because it is at an angle, slanting back, and is a longer centerboard so the board would run into more water. I think that the Opti centerboard came in with the most hydrodynamic drag because it is rectangular.

Summary Statement

My project was designed to determine how different centerboards shapes affect the hydrodynamic drag on a club dinghy racer.

Help Received

Father helped cut out centerboards, drove me to testing site, and toke some of the pictures.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Emily B. Schisler

Project Number

J0121

Project Title

How the Shape of a Parachute Affects the Average Descent Rate

Abstract

Objectives/Goals

The purpose of this experiment was to determine which of four different parachute shapes of equal area demonstrated the slowest average descent rate. The hypothesis stated that if a circle, rectangle, square, and parallelogram parachute of equal area (400 square centimeters) are dropped from a height of 360 centimeters, the circle parachute would demonstrate the slowest average descent rate. The circle parachute should demonstrate the slowest average descent rate because its natural symmetrical shape would be the most efficient design to maximize wind resistance and create drag.

Methods/Materials

On December 10, 2006, four lightweight plastic parachutes were dropped in an inside area with no wind. Each parachute had four equally spaced 30 centimeter strings connected to a paperclip holding a three-gram washer as a weight. For each of the twenty trial drops, the average rate of descent was calculated using the Pythagorean Theorem and the distance/rate formula.

Results

The circle parachute had the slowest overall average descent rate of 134.88 centimeters per second, followed by the parallelogram parachute with an overall average descent rate of 141.72 centimeters per second. The square parachute had an overall average descent rate of 142.78 centimeters per second, and the rectangle parachute had the fastest overall average descent rate of 157.80 centimeters per second.

Conclusions/Discussion

It was concluded that the circle parachute demonstrated the slowest overall average descent rate, proving the hypothesis correct. Even though all four parachutes had the same surface area, the angles, corners, and dimensions caused the air molecules to create varying degrees of air resistance.

Summary Statement

This project is an investigation into which parachute shape (square, rectangle, parallelogram or circle) demonstrates the slowest average descent rate given that each parachute has equal surface area.

Help Received

My mother, Rosemary Schisler, helped with proof-reading and formatting of my report. Family friend, Paul Lechner, helped as volunteer assistant in the actual testing procedure and data collection.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Jillian R. Selby

Project Number

J0122

Project Title

An Investigation into the Magnus Effect

Abstract

Objectives/Goals

This experiment shows the relationship between the spin of a thrown ball & the movement of that ball off a straight-line path.

Methods/Materials

A double-wheeled baseball-pitching machine was used to adjust the rotational speed of the ball. The rotational speed of the ball was set at zero RPMs to begin the experiment. Using an adjustable stroboscope to measure rotational speed, both wheels were set at 1445 RPMs. This consistently threw the ball in a straight path, hitting a zero mark made on a wall 40 feet away. The linear speed of the ball was set at 47 mph or 21 m/sec. This linear speed was kept constant by increasing the right wheel's rotational speed while decreasing the left wheel's rotational speed an equal amount. Controlling linear speed & establishing a 0 starting point were 2 controls of the experiment. At each setting, 10 pitches were thrown & the location the ball struck the wall was recorded. Three additional controls for this experiment were: using the same dimpled pitching machine ball for all trials, positioning the ball in the machine the same each time,& once the pitching machine was set to throw balls to the zero mark, it was not moved until all testing was completed.

Results

When the wheel speed was set to 475 RPMs the ball's rotational speed was 2090 RPMs, as a result, the ball curved left in the direction it was spinning on average 20 in. or 50.8 cm. When the wheel speed was set to 922 RPMs, the ball's rotational speed was 4057 RPMs, as a result, the ball curved left in the direction it was spinning on average 27 in. or 66.0 cm. When the wheel speed was set to 1392 RPMs the ball's rotational speed was 6125 RPMs, as a result, the ball curved left in the direction it was spinning on average 32 in. or 81.3 cm.

Conclusions/Discussion

The greatest curve of the ball from a straight-line path was on average 32 in. or 81.5 cm & was a result of the Magnus Effect in which the ball surface drags along with it a layer of air. This air or wake of air flowing off the spinning ball is bent or turned in the opposite direction of the direction of spin. This lateral force causes the ball to curve. Physical principles involved in the Magnus Effect are Bernoullis Principle which discusses how air moving at different speeds results in higher & lower air pressures on either side. Newtons first law of motion helps(equal and opposite reation)explain why the ball continues to curve as it continues to spin.

Summary Statement

This experiment shows the relationship between the spin of a thrown ball and the movement of that ball off a straight-line path.

Help Received

My father, securring and adjusting the machine, my mother with the display board, and Mr. Dan Halbur (physics teacher at Foothill High School), explaining the conversions and calculations.

Name(s)
Kevin I.L. Stine

Project Number
J0123

Project Title
Need For Speed? It Will Cost You!

Abstract

Objectives/Goals
The objective of this project was to determine what speed a car gets the best gas mileage. The second objective was to determine if a cargo rack on top of the car as well as the type of fuel made any difference to the fuel economy.

Methods/Materials
I tested this experiment on Canada Road which is a lightly traveled road and highway 280. I recorded the mpg from the multi-function indicator which shows the average fuel consumption. I traveled at 40, 55, and 65 mph. I repeated the tests multiple times with each variable to check for consistency. I also tested with a cargo rack on the car as well as with premium fuel vs. regular fuel.

Materials:
Odometer
Speedometer
Tachometer
Cruise Control
Outdoor thermometer
Multi-function Indicator
Test Vehicle: 2000 VW Passat 1.8 Liter Turbo

Results
The data showed that you get worse mileage when traveling at higher speeds. The faster you go, the more it costs, because you use up more fuel. You also get worse mileage while driving with a cargo rack on the top of the car. The cargo rack produces more drag which makes the engine work harder and this makes the engine use up more fuel. When you drive up steep hills your gas mileage decreases dramatically. On the test going south, there were more uphills then going north. Premium fuel improved the mpg by 15% at 65 mph, but was only 9% more expensive.

Conclusions/Discussion
At 40 mph the car obtained the best mpg, and at 65 mph obtained the worst. Premium fuel increased the mpg but only at 65 mph. When traveling with a cargo rack on the top of the car, the mpg were about 10 mpg worse than without the rack. The cargo rack increased the aerodynamic drag which played a big role in fuel economy.

Summary Statement
This project is about testing to see what speed a car gets the best gas mileage, and to see if a cargo rack as well as premium fuel affects fuel economy.

Help Received
Father for helping with the experiments; Mother for helping make the board.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Timothy J. Struven

Project Number

J0124

Project Title

Will Adding a Triangular Wing Shaped Flap to an Existing Wing Decrease Vortices?

Abstract

Objectives/Goals

The question that I'm going to investigate is if a triangular wing flap is added to the back of an existing wing, will this create an opposite spinning vortex to cancel the potentially dangerous vortex at the wing tip.

Methods/Materials

Method:
#1: Take the block of polyfoam, cut a triangle 3-1/2 in. in height, and 9 in. in length,
#2: Take the wing, and attach the triangular flap with pins 6 in. from the tip of the wing,
#3: Cut up tissue paper 1/4 in. strips, and tape onto specific places on the wing. Place one on the tip of wing, 2 on both ends of triangular flap, and one at the center of the wing,
#4: Secure the wing 30.50 cm. from fan,
#5: With the high speed fan on, watch which way the streamers rotate demonstrating the direction of the vortices, clockwise or counterclockwise. Also, with the meter, measure different wind speeds around wing.

Materials:
The materials that I used for this experiment, were one polyfoam wing, one block of thinner polyfoam for a triangular flap, one sheet of tissue paper cut into streamers, one fan, and a wind meter.

Results

Qualitative: With the triangular wing flap on the wing, the tissue paper streamers from the triangular flap rotate in a counterclockwise direction, demonstrating a counterclockwise vortex. The paper streamer on the tip of the wing rotate in a clockwise direction. Additionally, the wind speeds around the triangular flap are lower than the unmodified wing.
Quanitative: The air speed at the center of the wing on the side without the added triangular flap was 4.8km./hr. near the center to 5.5km./hr. at the tip of the wing. The side with the triangular flap was 4km./hr. near the center, to 6.5km./hr. at the tip of the wing. The air speed without the wing was 13.6km./hr.

Conclusions/Discussion

My hypothesis was, if you change the wing by adding triangular wing flaps to an existing wing, then the vortex created by the added flap will nullify the wing tip vortex. I agree with my hypothesis because the vortices generated and observed did spin in opposite directions.

Summary Statement

My project explored how alteration of standard wing geometry resulted in changing the airflow patterns over and behind the wing.

Help Received

My father advised on project development.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Robert T. Tifft

Project Number

J0125

Project Title

Aerodynamics' Effect on the Downforce of a Race Car

Abstract

Objectives/Goals

My objective is to show how the aerodynamics of a racecar and an airfoil mounted upside down affects the down-force of the car.

Methods/Materials

The materials that were used are, a plexi glass box for test area ,a ten inch diameter aluminum tube for plenum, about fifteen hundred straws for plenum, three scale size cars for test subjects, brass tubing for mounts, glue to bond straws, duct tape to seal leaks, spring scale to measure down force, vinyl skirt to connect fan to plenum, carpet blower to produce wind, brass plate for a platform for the cars, silver solder for soldering brass piping to plate and to scale, balsa wood for the airfoil.An airfoil was sanded from balsa wood, and mounted with brass tubing on the front, middle (roof), and rear of each of the three cars. I tested the amount of down force that is produced from each car with the airfoil on each position.

Results

My results were that the rear of the car produced the most down force. The middle of the car produced the least amount of down force. The Chevy NASCAR produced the most down force and Saleen S7 produced the least amount of down force. And the Ford GT was the most balanced since it had the least amount of curves.

Conclusions/Discussion

Aerodynamics affect the air flow over a car thus interfering with down force. This was tested this by putting three differently shaped cars in a homemade wind tunnel. An airfoil was attached to three positions of each car, front, middle, and rear. The rear produced the most down force because the rear window declined from the roof leaving little air under the airfoil and most of the air on top thus pushing it down. The middle (roof) produced the least amount of down force because the front window inclined from the hood leaving most of the air under the airfoil thus slightly lifting the car.

Summary Statement

My prodject is about how aerodynamics affect the downforce of cars.

Help Received

My dad helped pick out materials

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Lucas D. Unruh

Project Number
J0126

Project Title
Shake, Rattle, and Roll: The Effect of Shock Absorber Piston Orifice Area on Piston Travel Time (Damping Rate)

Abstract

Objectives/Goals
To learn about shock absorbers and evaluate how changing a shock absorber's piston orifice area affects piston travel time (damping rate).

Methods/Materials
A plant duster was used to simulate a shock absorber. A hole was drilled in the piston, the duster was filled with water, a weight was placed on the plunger, and the time it took the piston to travel four inches was measured. Piston orifice area was increased by drilling additional holes in the piston. Piston travel time was measured three times as the orifice area was increased to demonstrate the consistency of the results.

Results
With no holes in the piston (zero orifice area), the piston did not move (infinite damping). As orifice area initially increased, piston travel time decreased quickly. After a quick decrease, orifice area did not appear to affect piston travel time as much. Piston travel time appeared to level off as orifice area continued to increase.

Conclusions/Discussion
As piston orifice area increased, the piston travel time (damping rate) decreased, but never reached zero.

Summary Statement
The focus of this project was to evaluate how shock absorber piston travel time (damping rate) was affected by changing the piston orifice area.

Help Received
Grandfather helped develop project idea and assisted with experiment; mother and father helped with layout of backboard; teacher/project advisor provided guidance and schedule milestones.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Eric E. Young

Project Number

J0127

Project Title

The Fast, the Furious, and the Aerodynamic

Abstract

Objectives/Goals

My objective is to determine which car shape is the most aerodynamic.
Hypothesis: I believe that the car with the small back and a small surface area will do the best in the wind tunnel.

Methods/Materials

Materials: 7 car models 1 ruler
1 Testing chassis 1 wind tunnel
1 instrument to measure amps
Procedure: Made 7 car models
Ran 7 models through the wind tunnel.
measure how many Cm the car moved backwards at wind speeds of 1-10 amps

Results

Car #5 did best and car #1 was close behind. Then there is a big gap between #1 and #2 who was third. #7 was in fourth almost tied by #6. #3 got 6th and #4 was a complete washout compared to the others.

Conclusions/Discussion

My conclusion is that my hypothesis was correct because #1, who embodied all of the characteristics and came closely in second.

Summary Statement

The relation of car's shape to how aerodynamic it is.

Help Received

My dad had the materials and helped me build the wind tunnel and helped me test