CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Andrew A. Asper

Project Number

J0101

Project Title

Watts Up with Fairings? A Technological Breakthrough, Phase II

Abstract

Objectives/Goals

My objective: To determine if teardrop shaped fairings added to the 12 blade-to-strut joints of my innovative Vertical Axis Wind Turbine design, which I constructed in Phase I of this project, will provide more power output as measured in Watts, and increase the actual turbine performance more than my VAWT without fairings. The experimental measurement Power coefficient versus tip-speed ratio will be used to determine the turbine's performance.

Methods/Materials

1)Design and build a wind tunnel with diffuser 2)Design and make a circuit board 3)Test VAWT without fairings at a wind speed of 3.5m/s and again at 2.5m/s-20 trials and record Watts 4)Design and make outside fairings and apply to outside of 12 blade-to-strut joints 5)Design and make inside fairings and apply to inside of joints making a teardrop shape 6)Test VAWT with fairings at same 2 wind speeds-20 trials and record Watts 7) Use mathematical formulas that incorporate Power, air denstiy, swept area of rotor, RPM and wind speed to calculate power coefficient versus tip-speed ratio for all trials and means, with and without fairings to show turbine's overall performance.

Results

After 40 trials, the results showed that my hypothesis was correct. At both wind speeds the fairings improved the power output as measured in Watts, showing that the turbine with fairings produced more power. They also made the output more consistant. The power coefficient vs tip-speed ratio increased at both wind speeds. At a wind speed of 2.5m/s the power coefficient vs tip-speed ratio increased significantly more with fairings than without because the lower wind speed sees a larger increase in tip-speed since the fairings helped decrease the drag in the blade-to-strut joint area.

Conclusions/Discussion

It is interesting to note that the power coefficient vs tip-speed ratio increased more at the lower wind speed - the turbine with fairings was able to capture more power available in the wind because the tip-speed ratio increased more due to less separation and a decrease in drag. Overall, the fairings did improve the turbine's performance because they smoothed out the flow in the blade-to-strut joints, eliminating the vorticies that create extra drag and performance loss. Another benefit of the fairings was that they made the blade-to-strut joints stronger which adds more durability. I plan to pursue the possibility of obtaining a patent for my innovative VAWT design.

Summary Statement

My project is about determining if teardrop shaped fairings added to the 12 blade-to-strut joints of my VAWT will provide more power output as well as increasing the turbine's performance measured as power coefficient vs tip-speed ratio.

Help Received

Mentor-Dr. Dale Berg scientist from Sandia, John Loth-Engineering Professor, dad helped with equipment, Dr. Olson science teacher helped with circuit board.

Name(s)

Colin J. Barkley

Project Number

J0102

Project Title

Folding a Better Plane

Abstract

Objectives/Goals

This project evaluates the effect of changing the length-to-wingspan ratio on a paper airplane's ability to fly long distances. My goal is to control the testing environment so that changes in the distance flown can be attributed solely to changes in the length-to-wingspan ratio of the tested paper plane

Methods/Materials

Five paper airplanes each folded from paper of an area of 900 square centimeters of varying length and width.

All paper airplanes were folded to a delta wing shape with aspect ratios of 0.8, 1.0, 1.5, 2.5, and 3.1.

Each airplane was launched from a homemade launcher seven times and the distance flown recorded. The best and worst flights were discarded and the remaining five values averaged.

Results

Optimal flights were obtained with the launcher by using a five degree inclination and a high speed of launch. Increasing the length-to-wingspan ratio generally increased the distance the plane flew. At a ratio of 3.1, the plane became unstable and flew inconsistently.

Conclusions/Discussion

My launch pad prototype is a successful platform for reproducible airplane flight. For the type of paper airplane tested, a length-to-wingspan ratio of 2.5 is optimal in terms of distance flown. Ratios above this, while providing good distance flight, often become unstable and erratic.

Summary Statement

How does varying a paper plane's length-to-wingspan ratio affect its ability to fly long distances?

Help Received

Advisor helped fine tune my experimental design, My father helped build the launcher

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Samuel H. Bashor

Project Number

J0103

Project Title

Can a Kid Build a New Type of Flying Machine?

Abstract

Objectives/Goals

My objective was to build a new type of flying machine using hovering technology.

Methods/Materials

The materials needed to fulfill my prodject are 2 mm by 6 mm balsa-wood strip, 30-gauge emameled copper magnet-wire, Aluminum foil, 1 tube "Super Glue" or "Krazy Glue" brand cyanoacrylate adhesive, Sewing thread, 1 hobby knife, 1 25,000 volt generator, a DC power supply, and Scotch brand tape roll.

Results

In my results, I had to build to different Lifters. The first one just shock back in forth. The second lifter, lifted off the ground and flew all over the place, but I tied it down to the board securlly. The more precise I was in my measerments, the more it flew.

Conclusions/Discussion

In the conclusion, I was right, a kid can build a new type of flying machine using hovering technology, called Ion Wind. But it would be a lot more difficult to build one big e3nough for a human to ride on it.

Summary Statement

My goal was to find a non-fossil fuel way of transportation.

Help Received

Mother helped typing report, and my Father helped me with safetly building my lifter.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Christopher R. D'Elia

Project Number

J0104

Project Title

www.hover.air/

Abstract

Objectives/Goals

Objective: To create a hovercraft that can support my weight.

Methods/Materials

I created a hovercraft using plywood and a skirt made out of a tarp with a drawstring powered by a leaf blower. I calculated the pressure that it would take to lift the craft than test my theory by making a U tube monometer with some wood and clear tubing. I also calculated the position of the rider and the blower by using sum of the moments.

Results

The hovercraft worked so long as the skirt was properly tightened and the weight was properly distributed.

Conclusions/Discussion

I learned that the most important factor to building a hovercraft was to proerly position the weight and to make sure your moto was strong enough to lift the hovercraft and the rider.By first caluclating the position of the wirght and the presussure needed to lift the craft first made a big difference in the end.

Summary Statement

My project showed the importance of calculating balance and air pressure prior to building a hovercraft to insure the success of the project.

Help Received

I recieved help from my father, Richard Robert D'Elia, in constructing the disk and getting the proper formulas to calculate pressure, sum of the moments, and inches of water. I also received help sewing the skirt together with a sewing machine.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

William Deardorff; Truman Do; Aaron-James Lao

Project Number

J0105

Project Title

Propel Yourself! Do Blade Angles and Number of Blades on a Propeller Change the Speed of a Hovercraft?

Abstract

Objectives/Goals

This investigation was aimed to find out whether blade angles and the number of blades of propellers affect the speed of hovercrafts. Different combinations on blade angles and number of blades were also investigated to find its effect on the moving vehicle.

Methods/Materials

Aluminum sheets were selected from recycled cookie canisters and were used to construct the propellers. Propellers with two, three and four blades were drawn out onto the metal sheets and were cut using scissors. Each blade measured 4.5 cm in length and 1.5 cm in width. A hole of 3 mm in diameter was bored using a power drill. They were bent to create angles at 15, 30, 45 and 60 degrees. To create the angles, the propeller was held down at the center and was placed horizontally on the flat surface next to the triangle. It was bent until the angle of the blade matched the angle of the triangle. A total of 24 propellers, two for every combination, was placed onto the toy hovercraft and tested. Then, the two propeller combinations were tested onto the hovercraft. A string railing was set up, and the hover car was turned on. The forward button on the controller was held down, and the time it took to travel 3 meters was recorded. Similar steps were done using different numbers and blade angles. Data were gathered and analyzed.

Results

The propeller with two blades and bent at 15 degrees worked the most efficiently, while the propeller with four blades that were bent at 60 degrees were the least efficient. When testing how the degree that a blade is bent, the results showed that the propeller with the 15 degrees angle moves the fastest, and the 60 degrees blade did not move. The 30 degree blades moved the second fastest, while the 45 degree blades moved the second slowest. The propellers with two blades worked the most efficiently, while the propellers with four worked the least.

Conclusions/Discussion

From the results and analysis, the conclusion was that as the degree at which a blade is bent increased from 15 degrees, it became gradually less productive. As the number of blades increased from two blades, it also became less productive. The results showed that the propellers with two blades bent at 15 degrees worked the most efficiently. This is because the angle that it was bent at created stronger wind pushing backwards. The propellers with four blades that were bent at 60 degrees were the least efficient. This was because its blades were positioned at an angle that was bent too far to create enough force to move the hovercraft.

Summary Statement

This project is about how the angle and number of blades on a propeller effects the propulsion created.

Help Received

Mother helped purchase materials. Father cut boards for the device to make the angles. Mr. Saramosing, teacher, encouraged us.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Ian D. Earley

Project Number

J0106

Project Title

Awesome Airfoils

Abstract

Objectives/Goals

My project was to determine if toy airplanes would be able to create lift in a wind tunnel using their wing (airfoil) designs. I believe that some of the toy airplanes would be able to create lift because their wings are at respectable angles to create lift.

Methods/Materials

Five toy airplanes, modeled after five different planes, of roughly the same size were used. A wind tunnel was built using basic ideas from the internet to conduct the tests. The toy airplanes were put in the wind tunnel and held in place in the airstream by a clamp on their rear horizontal wing (stabilizer). The vertical and horizontal deflection of the wind from the wings was recorded for three different airspeeds.

Results

The airplane with the greatest angle of incidence created the most lift, which was measured by the greatest vertical wind deflection. It was found that the planes that I thought would have the greatest lift actually appeared to, according to my data.

Conclusions/Discussion

The planes that had the largest vertical deflection of air were the ones that I determined to have the greatest lift generated by their airfoil designs. The higher the vertical deflection the faster the air going over the wing has to travel, meaning that there is lower air pressure on the top of the wing than on the bottom. The combination of lower air pressure on the top of the wing and higher air pressure underneath the wing creates the lift.

Summary Statement

Could my toy airplanes create lift in a wind tunnel using their wing (airfoil) designs?

Help Received

My uncle and father helped me built the wind tunnel and monitored my data collection.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Peter N. Fettis

Project Number

J0107

Project Title

Pythagoras, Power, and Pennies

Abstract

Objectives/Goals

My objective is to prove the lateral components of force and the Pythagorean Theory by using common items such as a fan and a skateboard. My hypothesis is the following: that when the fan is at 90 degrees it will be exerting the most force and pounds of pressure, when it is at 45 degrees it will be exerting .707 times the force at 90 degrees because the Pythagorean Theory is in effect, and when the fan is at 0 degrees it will not be exerting any force or pounds of pressure.

Methods/Materials

I made the skateboard-fan apparatus first. Then I attached fishing wire to the back of the skateboard and tied the other end of the wire to a plastic water bottle cut in half that was filled with pennies which was hung over the edge of a table. When I turned on the fan and it did not go forwards or backwards then I weighed that wire, half bottle, and pennies. That provided the pounds of pressure at 90 degrees and I did the math from those figures.

Results

The results were superior. They worked just as planned. At 90 degrees, the skateboard lifted 3 ounces, or 33 pennies, at 60 degrees it lifted 2.6 ounces or 28 pennies, at 30 degrees it lifted 1.5 ounces or 16 pennies, and at 45 degrees it lifted 2.12 ounces, or 23 pennies. The multiplication is as follows, 3 x .707 =2.12 and 33 x .707 =c. 23, 3 x .866=2.6 and 33 x .866= c. 28, and 3 x .5=1.5 and 33 x .5=c. 16.

Conclusions/Discussion

My experiment worked out how I thought it would and it also proved the Pythagorean Theory. My data supports my hypothesis because everything in my hypothesis corresponds to everything that turned out to be the results of the experiment. I can understand everything, except for that I still do not fully understand how at 45 degrees it can be .707 times 90 degrees, but since I proved it with math and in the actual experiment, it worked. To better my understanding, I could use the same skateboard-fan, but have a spring tied to the back of the skateboard and a wall, and do a very complicated math problem to figure out the force exerted.

Summary Statement

My summary is to prove the Pythagorean Theory and the lateral components of force by using common items such as a skateboard and a fan.

Help Received

My father helped me build the skateboard-fan; Dr. CDR Hamilton reminded me of the Pythagorean Theory.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Ian K. Flagstad

Project Number

J0108

Project Title

Downforce on a Stock Car

Abstract

Objectives/Goals

The goal of this aerodynamic science fair project, "Downforce on a Stock Car," is to test the amount of added weight to a stock car during movement. The variables used in this test were: angle of air flow, temperature of the air flow, and speed of the air flow. It is hypothesized that the amount of force on the car will be stronger with low temperature and high speed air. The angle of air is not expected to cause a significant force on the car.

Methods/Materials

For this testing I used a model stock car, postal scale (weight in grams), blow dryer with a concentrator nozzle attachment, a plexiglass box. The car was attached inside the plexiglass box and a hole was made for the blow dryer to point at the nose of the car. I performed 10 trials each of different combinations of speed (high & low), temperature (high, medium, & low), and angle of air flow (none, 45 degrees, 90 degrees, and 180 degrees. I recorded each of these results in my log book and later converted these results to equivalent force on a life-sized stock car.

Results

My findings proved that the faster air speed and lower temperature had the most downforce on the stock car. Surprisingly, the 45-degree angle showed the most change in downforce. The high temperature and low speed air flow with 90-degree or 180-degree angles resulted in the least amount of change to the car's weight.

Conclusions/Discussion

I conclude that studying the air flow over a stock car is important because it can affect the results of a race. To my surprise the 45-degree angle showed the most amount of downforce on the car, in a real race, this would only happen when the car was banked in a steep turn. This could be one of the reasons why oval race tracks are slanted on the turns. My recommendation for the future would be to use a stronger source of air to test the effects. My converted results did not meet the actual force on a car in a race.

Summary Statement

The amount of downforce on a stock car with speed, temperature, and angle of air flow as variables.

Help Received

My father helped with convertion of data, Mother helped with graphs and typing, Uncle Chuck helped build my box, and my teachers guided me through the testing and report.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Keith C. Gordon

Project Number

J0109

Project Title

Foam Takes Flight

Abstract

Objectives/Goals

My project was to determine what effect the shape of a wing has on lift generated. I believe that a wing that rises to its maximum camber early, but not too early will do the best.

Methods/Materials

Seven wings with different shapes, but identical sizes were constructed. Each wing reached its maximum camber at a different point, but only centimeters apart. Five tests were done for each wing, and then five grams of weight were added, and this continued until the wing could not produce enough lift to rise at all.

Results

The wing which reached its camber line at three centimeters generated the most lift out of all seven wings, while the last plane that reached its camber line at seven centimeters generated the least amount of lift.

Conclusions/Discussion

My conclusion is that the shape of the wing plays an impotant role, and wings that reach their maximum camber early but not too early will generate the most lift.

Summary Statement

This project is designed to test what shape of a wing will generate the most lift.

Help Received

Science Fair teacher Thomas Smith let me use wood workshop and helped with unsafe cutting.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Tyler Hansen

Project Number

J0110

Project Title

A Further Cut

Abstract

Objectives/Goals

Objective: The objective of my project is to determine which model car will travel the furthest when released from a ramp, based on its aerodynamic design. My hypothesis was that the teardrop shaped car, due to its highly streamlined design, would be the most aerodynamic model and travel the furthest.

Methods/Materials

Materials and Methods: Four Styrofoam blocks, all the same size, were cut and shaped into four different body styles: a block (the control), a wedge, a standard sedan, and a futuristic teardrop designed car. Each model was weighed on a postal scale and washers added to the lighter models in order for them to weigh the same. They were then sent down a ramp, ten times each. Their distances were then charted.

Results

Results: The wedge car went further on average than the other models, while the unshaped block traveled the shortest average distance.

Conclusions/Discussion

Conclusion: My conclusion is that aerodynamics is an important factor in the distance a model car can travel and that compromises between downforce and drag must be met to design an efficient chassis.

Summary Statement

My project involves seeing what effects aerodynamic shaping has on the travel distance of a model car.

Help Received

My dad helped me when using the table saw to cut, and my mom helped me glue my board.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Paul W. Howard Mullan

Project Number

J0111

Project Title

Center of Gravity and Paper Airplanes

Abstract

Objectives/Goals

The objective is to determine the effects of aft weight and nose weight on paper airplanes.

Methods/Materials

I conducted five preliminary trials with eight different models of planes before discovering how to control many variables and redesigning my project. In phase 2, I weighted two new models with small paper clips. Both F42 and F2Tiger were new airplane designs that were not used in the first five trials. F42 and F2Tiger without paperclips served as my controls. I measured both their distances from the point of origin on the launch line and their distances off the centerline.

Results

Adding weight to the rear of F42 caused it to fly a shorter distance than the control in 97% of 30 trials. Adding weight to the nose of F42 did not significantly increase flight distance until 3 paperclips were added, although the results varied. Adding weight to the rear of F2Tiger caused it to fly a greater distance than the control in 73% of 30 trials. Nose weight in F2Tiger decreased the distance it traveled. The average distance flown off course was reduced by weighting the aft of the F42, or weighting the front of the F2Tiger.

Conclusions/Discussion

My hypothesis was incorrect because although the center of gravity affected the distance the planes flew; the size and shape of a plane's wings was more important. Part of my hypothesis was that when a plane was weighted in the back it would fly farther. This was only true for the F2Tiger. My results were inconsistent.

My project shows that the aerodynamics of aft heaviness and nose heaviness affect the distance a glider travels, although not in the way my hypothesis stated, and not as much as wing design. Aspect ratio is important.

I really thought the nose weighted F42 flights looked better. But the nose weight did not increase the average distance until I used three paperclips. However, since I was measuring the closest point of the plane after landing to the centerline, the planes bouncing backwards was an error in my experimental design, bringing down the averages. Projects on optimal center of gravity could help glider designers create gliders that are more efficient such as motorless aircraft used by the military to land infantrymen behind enemy lines. Center of gravity research might also benefit remote controlled gliders that are used to monitor ocean temperatures.

Summary Statement

My project is about the effects of aft weight and nose weight on how far a paper airplane travels and how far off course the plane travels.

Help Received

My mom helped type the report, my dad read numbers aloud while I double checked my spreadsheet, he also showed me some planes he made when he was young, the school librarian helped me with the bibliography format, my Mom, Dad and Ms. French made suggestions for clarifying my writing.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Matthew R. Johnson

Project Number

J0112

Project Title

Flow Dynamics of the Salt Oscillator

Abstract

Objectives/Goals

The objective of my project was to determine if the salt density and the size of the hole connecting the two fluid layers affected the period of the flow oscillations in the salt oscillator.

Methods/Materials

I built my salt oscillator using two cups, table salt, dye so that the fluid flow could be seen, and fresh water. The experimental setup consisted of a cup of salt water with a small hole in the bottom immersed in a larger cup of fresh water. I ran a series of trials with hole sizes varying between 1 mm - 10 mm and with a range of salt densities, and measured the resulting oscillation periods. I used a micrometer to measure the size of the hole, a stopwatch to measure the oscillation period, scales, measuring spoons, and measuring cups. I used a digital camera to take pictures of the flow.

Results

The results showed that the oscillation period does depend on the salt density and hole size. The oscillation periods were in the range of 1.0 sec - 4.0 sec. During each trial the salt solution initially flowed down in a narrow stream and settled on the bottom of the fresh water cup. After a period of time, the salt water stream narrowed even further and then stopped. Shortly thereafter, the up flow and down flow oscillations started, sometimes continuing for several hours. Oscillations did not occur during the trial with the larger hole size of 9.9 mm.

Conclusions/Discussion

The oscillation period of the salt oscillator was more sensitive to the hole diameter than to changes in the salt density. Also, oscillations did not occur if the hole size got too large. I learned some things about layers of fluids with different densities, pressure in fluids at different depths, laminar fluid flow and flow of fluids with different densities through each other, diffusion, unstable systems and oscillators. I also learned how to use a micrometer.

Summary Statement

The project tested the behavior of flow oscillations in a salt oscillator made with salt water overlying fresh water.

Help Received

I would like to thank my mom and dad for supporting me with this experiment.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Brian T. Kim

Project Number

J0113

Project Title

The Effect of the Blade's Pitch Angle on Wind Power

Abstract

Objectives/Goals

This study examined the effects of different blade pitch angles on the rotor speed (RPM) and the generator power.

Methods/Materials

First, a wind tunnel was made with cardboard and placed on a fan, achieving sufficient wind speed (5 m/s or 10 mph) to turn the propellers. Then, the rotor blades and hub were made with balsa and poplar wood, respectively. Among four different combinations of gearboxes and generators, the 5:1 gearbox and the RE 260 motor combination was selected. The number of blades experiment showed wider blades performed slightly better, but the 2.54 cm wide two-blade propeller was selected for easier manufacturing and structural strength. A laser tachometer was used to measure the rotor speed (RPM). Two experiments were performed. In the pitch angle experiment, flat blades of different pitch angles were compared, while the twisted, flat and curved blades were compared in the aerodynamic blades experiment.

Results

In the flat-blade pitch angle experiment, the 10° blades turned fastest at 1820 RPM with no load. However, when blades were attached to the generator, the 15° blades produced the most power (0.113 Watts) at 1180 RPM. In the aerodynamic blades experiment, the twisted blades with varying pitch angles of 10° at the tip increasing to 20° at the hub produced the most power (0.192 Watts) at 1390 RPM. The output power increased by 41% compared to the 15° flat blades.

Conclusions/Discussion

The twisted blades, when the flatter surface was facing the wind, produced the most power. There are two reasons. First, the twisted blade is curved, producing more lift because it is more aerodynamic. Second, the blade's pitch angle increases from 10° at the tip to 20° at the hub. Since the blade speed is lower near the hub, the higher pitch angle is needed there.

Summary Statement

This study examined the effects of different blade pitch angles on wind power.

Help Received

Mom helped make the board, while Dad helped make the propellers and understand some aerodynamics concepts.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Matthew K. Kurihara

Project Number

J0114

Project Title

Going Up

Abstract

Objectives/Goals

The objective of my project was to see the effect of upper cambers, distances from the wing to the wind source, different wing lengths and different wing spans affected how much lift the wing would create. I predicted that as the upper camber, distance between the wing to the wind source, wing span and wing lengths increased, the lift created would increase as well.

Methods/Materials

The experiment consisted of thirteen wings constructed from manila folders. One of the wings was used in each of the four experiments as a control. Four of the thirteen wings had the same wing spans and lengths, but different upper cambers. Another four had the same wing spans and upper cambers, but different lengths. The last four had the same upper cambers and lengths, but different wing spans. I tested each wing on a frame that allowed the wing to move up and down without flying away. Each wing was tested ten times.

Results

I found that as the upper camber increased, the amount of lift decreased to a point and then started to increase. For the experiment testing different lengths between the wing to the wind source, I found that as the length increased, the lift increased to a point and then decreased. The experiment which tested the length of the wing showed that as the length increased, the lift increased to a point and then decreased. For the last experiment, I found that as the wing span increased, the lift increased to a point and then decreased altogether.

Conclusions/Discussion

I believe that wings with bigger upper cambers lifted higher, with the exception of the zero degree camber, because the larger camber created a bigger low pressure area which allowed the wing to lift easier. With the different distances between the wing and wind source, I believe that the wing lifted the way it did because the wind got to a point where it would hit the wing with the most momentum which would have allowed the maximum lift on the wing. For the experiment testing wing length, I believe that the wings that were longer created a bigger low pressure area length wise allowing the wing to lift easier and higher. For the last experiment which tested wing spans, I believe that the wings with bigger wing spans created a bigger low pressure area width wise which also allowed the wings to lift higher easier.

Summary Statement

The purpose of my project was to see how different variables would affect how a basic wing would lift.

Help Received

got a few suggestions from the LA county judges for correct terminology on certain variables

Name(s)
Jason A. Lee

Project Number
J0115

Project Title
The Effect of Ball Diameter on the Time It Takes to Fall

Abstract

Objectives/Goals
The purpose of this experiment is to investigate the effect of ball size on dropping speed in viscous liquids.

Methods/Materials
Basically, all that is needed is an assorted number of balls, a stopwatch, glycerin, and a cylindrical container. The container is filled with glycerin, the ball is dropped into the cylindrical container and the speed is timed. The results were then recorded on a table and graph.

Results
The average falling time of the 1.6 millimeter ball was 37.075 seconds, the average falling time of the 3.2 millimeter ball was 10.15 seconds, the average falling time of the 4.8 millimeter ball was 5.335 seconds, the average falling time of the 6.4 millimeter ball was 36.275 seconds, the average falling time of the 7.9 millimeter ball was 2.9375 seconds, the average falling time of the 9.5 millimeter ball was 2.345 seconds, the average falling time of the 12.7 millimeter ball was 2.96 seconds, and the average falling time of the 19.1 millimeter ball was 8.355 seconds. While the balls were being dropped, I found out that small balls left touching the glycerin will sit on its surface tension, allowing more precision on the timing. The results that came out were almost perfect, and were ripe for analysis.

Conclusions/Discussion
My original hypothesis was that the balls falling speed would increase with its diameter. The gain in seconds per 1.6 millimeters would be estimated to be not in definite intervals, but to be somewhat exponential. With the given results, my hypothesis was fairly correct; the larger the ball, the faster it falls, but the hypothesis of how much? was not exactly identical to the results.

Summary Statement
The project is about dropping balls of different diameter to record effect in their dropping speeds.

Help Received
Father programmed a prescise stopwatch in computer to help time dropping speed of the ball; Lawrence Camilletti, a mentor from Ask-A-Scientist, assisted in picking this topic.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Nicholas A. Manning

Project Number

J0116

Project Title

Go With The Flow: The Hydrodynamics of Boat Hulls

Abstract

Objectives/Goals

The objective is to determine which boat design is most hydrodynamic.

Methods/Materials

Eight wood blocks served as boats. With them I did three different tests: bow testing, stern testing (I used the same boat I used for bow testing but turned them around), and weight testing. In bow and stern tests, I adjusted the weighting of the boats so that they all had the same weight.

I used four - eight foot half pipes filled with water for my boats to float down. I attached a string to the eye screw at the bow or stern of each boat. The string was connected to a washer used as a weight to pull the boats down the trough. The weights were dropped off a crossbar at the end of the troughs. The troughs were nine feet off the ground so I could use gravity to pull the weights that pulled the boats.

Results

In the bow test, the overall fastest boat was boat #2 which had a rounded design. In the stern testing, boat # 1 was the fastest. It had a square stern design. In weight testing, boat # 1 was the fastest. It was the lightest of the weighted boats.

Conclusions/Discussion

During my bow and stern testing I discovered that density became a variable in my experiment and caused the boats that had more area cut away when they were shaped, to sink lower in the water and one to drag on the bottom. This proved my hypothesis incorrect. In weight testing though, my hypothesis was proved correct and the lightest boat moved the fastest.

Summary Statement

My project was to determine the fastest boat hull design and whether weight effected boat speed.

Help Received

My mother edited my report. My father helped use heavy machinery to construct my testing apparatus. My father helped in the testing and my mother took pictures of the testing. My science teacher suggested materials.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Andrew T. Murray

Project Number

J0117

Project Title

What Is the Best Nozzle Angle for My Airplane?

Abstract

Objectives/Goals

Over the past several years, I have been thinking about different ways of using wind as a source of power. I wondered if a lot of wind could be directed so that more power could be produced.
Applications of nozzles can be used to increase the efficiency of various forms of transportation. I wanted to find if there is an optimum nozzle angle that will produce a maximum amount of thrust (force) when air is passed through.

Methods/Materials

I measured the takeoff thrust by using a rubber band attached to the back wheel of my remote-controlled airplane. I measured the thrust by recording how far the rubber band stretched. I constructed a nozzle made from an embroidery hoop, construction paper and tape, and attached it to my electric powered airplane. I changed the nozzle angle and measured the resulting thrust (distance traveled). I repeated the experiment eight times for each nozzle angle and recorded the results. I decreased the nozzle angle by about 2 degrees for each experiment. I analyzed the data by first averaging the results from each run and then plotted the averaged amounts onto a line graph.

Conclusions/Discussion

The data showed the best nozzle angle to produce maximum amount of thrust was no nozzle at all (open configuration). After applying the nozzle apparatus, the optimum nozzle angle was 176-degrees. Further development of this experiment would focus on the 176-degrees nozzle angle using different materials. I hope that this type of research would lead us to future improvements in methods of transportation.

Summary Statement

To find if there is an optimum nozzle angle that will produce a maximum amount of thrust (force) when air is passed through.

Help Received

My dad helped me with the engineering of my project, including understanding of some basic triganometry (how to use the tangent to find the measurements of angles).

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Gregory H. Okawachi

Project Number

J0118

Project Title

Faster Is Not Always Better

Abstract

Objectives/Goals

To determine what shape parachute (circle, square, rectangle, triangle or ellipse) will slow your fall down the best. I hypothesize that the circle shaped parachute will fall the slowest because there are no sharp angles or straight edges in the shape.

Methods/Materials

Materials: 6 sq. yds. rip stop nylon, 18 yd. drapery cord, (6) 1/2 ounce fishing weights, velcro adhesive squares, ruler, pencil, tape measure, scissors, ladder, stopwatch, calculator.

Methods: 1. Construct the 5 different shaped parachutes all with the same surface area and attach a 1/2 ounce fishing weight to each using drapery cord and velcro. 2. Perform the experiment indoors to eliminate wind as a variable. 3. Drop each of the 5 different shape parachutes and a 1/2 ounce weight alone as the control from a height of 18 ft. and time their fall. Do this 25 times and average the times. 4. Calculate the rate of fall by dividing 18 ft. by the average drop time and compare the results.

Results

The calculation of 18 ft/ave. drop time results were as follows: Square shape parachute dropped at 4.63 ft/sec; Rectangle at 4.70 ft/sec; Triangle at 5.36 ft/sec; Circle at 5.70 ft/sec; Ellipse at 6.00 ft/sec; Control weight alone at 21.18 ft/sec. The results show that the Square shaped parachute decreased the rate of fall of the weight the best and the ellipse parachute the worst.

Conclusions/Discussion

My experiment proved that the square shaped parachute decreased the rate of fall the best. My hypothesis that the circle shape parachute would fall the slowest was wrong. I believe the square shape was slowest because it has sharp corners and straight edges. This is probably a less aerodynamic shape and so it did not travel through the air as quickly.

Summary Statement

My project is about comparing 5 different shaped parachutes of equal surface area and their affect on the rate of fall.

Help Received

Dad helped calculate parachute sizes, Mother helped with poster board, Sister & Brother helped with testing.

Name(s)

Lynne R. Qiu

Project Number

J0119

Project Title

Forensic Crime Unit: Blood Spatter

Abstract

Objectives/Goals

In forensic science, blood spatter is often used to interpret what has happened at the crime scene. This experiment focuses on whether the materials used or the heights from which the blood is dropped affects the diameter of the resulting spatter more.

Methods/Materials

A simple, adjustable fixture was used to hold an eyedropper filled with cosmetic stage blood. The eyedropper was gently squeezed so the stage blood falls freely, without any force except gravity acting on it, to three different testing materials, ceramic, vinyl, and carpet. The test was repeated for six different heights. For each height, four samples were taken and averaged to reduce human error. The diameter of each sample was measured and recorded. The data was then processed and analyzed.

Results

The blood spatter on ceramic was consistently larger than the other two, due to hardness and smoothness. Vinyl#s spatter tended to shrink, because vinyl has a positive charge, and there is an ingredient in the cosmetic blood which reproduces this, and the two repel. Carpet#s results were the easiest to predict, as it has many tightly-bunched fibers that absorb liquids almost instantaneously.

Conclusions/Discussion

My hypothesis stated that the materials would affect the diameter of the blood spatter more than the height. This hypothesis was correct. Interestingly, the diameters of the spatter, when graphed, did not increase linearly. This is because the force of acceleration due to gravity on the blood is being balanced by the force of air friction. When the graph of Diameter vs. Materials is placed next to the graph of Diameter vs. Heights, the Diameter vs. Materials graph has a larger spread of data, leading me to the conclusion that the materials used affect the resulting spatter#s size more than the heights do.

Summary Statement

If the materials or the heights from which the blood is dropped affect the diameter of blood spatter more.

Help Received

Mother helped set up display board, Father helped with experiment fixture.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Justin R. Riordan

Project Number

J0120

Project Title

The Shape of a Glider: How Far It Flies

Abstract

Objectives/Goals

The purpose of this experiment was to help airplane/glider builders know which design flies the furthest

Methods/Materials

12 Pieces of Graph Paper, 12 Pieces of wax paper, Old thin cardboard box, Pencil, Ruler, exacto-knife, Tissue paper, Thin wooden sticks, Long measuring tape, Open space to throw airplanes, Hot glue gun and glue.

Method:
i built 12 difrent shape winged gliders of basswood and covered with tissue paper. i trough each one 5 times then adveraged them to find witch one flew the futhest.

Results

the glider with small airfoils, and large turned up wings went the futhest

Conclusions/Discussion

In project I discover that plane five, which had large airfoil, big turned up wings, instead of plane three (airfoil, small turned up wings). For some planes followed a pattern, for example plane three which went far then shorter than longer than shorter, but for plane 12 it went all sots of different lengths.

Through the whole experiment I fought with the wind, example: one time I throw a plane it and it pulled a prefect u-turn and landed three feet short of were it turned. Another time the wind caught the plane and it flew the farthest of all the planes. The best shape for a glider to flight the farthest is to have larger, turned up wings with larger airfoils. On average the planes with turned up wings flew farther than their counter part with not turned up wings. On top of that, comparing the average distance, the planes with larger airfoils did better that their opposites. Lastly the larger wings worked better for the distance.

For all these reason I declare that part of my hypothesis is in correct because I thought that the plane with airfoils and smaller turned up wing would fly the farthest. I was correct that airfoils and turned up wings, but I still guessed the wrong plane.

Summary Statement

my project told me which wing shap for basswood gilder would go the furthest

Help Received

Mr. Armstrong (teacher) helped me with write up; mom help build planes; friend help record plane distance

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Christian H. Selby

Project Number

J0121

Project Title

The Importance of Angle of Attack to Flight

Abstract

Objectives/Goals

This experiment shows Bernoulli#s Principle is too simple an explaination and doesn't consider Newton#s Laws of Motion or the Coanda Effect, nor does it give enough credit to the angle of attack of the wing.

Methods/Materials

I built a wind tunnel. A balsa wood wing with an upper camber 15% longer than the lower camber was made. I attached the wing to the side supports with rear pegs and adjustable front pegs. I drilled 8 holes at 0° through 21°. During the 3 trials I pulled the wing to a level position for each angle-of-attack. Average lifting force was recorded for each. Wind speed & wing shape were kept the same. Calculations of lift were made for a Cessna 150 flying: at a normal airspeed; with an upper wing camber long enough; and airspeed great enough to produce the lifting force to keep the Cessna 150 flying.

Results

The results showed that the greatest angle-of-attack (21°) produced the greatest amount of lift, at 2.4 Newtons and the smallest angle-of-attack (0°) produced the least, at .1 Newtons. The amount of lift increased proportionally with the angle-of-attack. The calculations showed that Bernoulli#s Principle was only 3% responsible for the force needed to keep the Cessna 150 flying at a normal airspeed. Increasing the upper camber 50% longer than the lower camber or increasing the airspeed to 727 ft/sec (350 mph) would produce enough lift.

Conclusions/Discussion

Lift is not possible unless a force acts on the air and that air reacts by lifting the airplane (Newton#s 1st and 3rd Laws). The action on the air bending it downward is a result of the viscosity of the air and its attachment to the upper wing surface. This is called the Coanda Effect. From my calculation of the Cessna 150, Bernoulli#s Principle was responsible for less than 3% of the total lift needed to keep the airplane in flight. In my calculated results, I have outlined which changes in wing shape and air speed would create enough lift to keep the Cessna 150 in the air. Neither increasing the upper camber by 50% or flying at over 727 ft/sec (350 mph) would be possible. I think the remaining lift must be a result of the angle of attack. In my study of angle of attack I found that lift increases proportionally as angle of attack increases. Pilots know that if the weight of their airplane increases, they will need to fly faster or fly at a greater angle of attack, and redirect more air downward to counteract the force of gravity.

Summary Statement

My project was to show that the primary cause of aerodynamic lift is the redirection of air over the upper camber (Coanda Effect), as a result of a wing's angle of attack and is not the traditionally accepted Bernoulli's Principle.

Help Received

I received help form my father in building the wind tunnel. My mother helped me with the display board. Mr Dan Halbur (physics teacher at Foothill High School) provided the pulley and spring scale, and helped explain the calculation of lift.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Katie C. Tanner

Project Number

J0122

Project Title

What's Up? Solving the Mystery of Water Towers and Their Purpose

Abstract

Objectives/Goals

Why are water tanks located up on top of towers or on top of hills? I hypothesized it has something to do with creating pressure for better flow of water and decided to create an experiment to test my hypothesis.

Methods/Materials

I created a homemade water tank using a five-gallon bucket and various parts. I created a water pressure measuring device that included a low pressure gauge. I connected my tank to my gauge via a garden hose. I filled the water tank with water and I conducted experiments measuring water pressure by elevating my tank on a ladder to 3 ft., 5 ft., 7ft., 10 ft., and 20 ft. heights. I measured the pressure with my gauge at each elevation and found that as the tank was lifted higher, the water pressure became greater.

I conducted expanded research within my own neighborhood. By using a G.P.S. device, I was able to find the elevation of the water tanks that service my home. I found the elevation of my home. By using a mathematical equation (Tank elevation minus home elevation divided by two) I determined the water pressure at my home. I tested my finding by connecting a high water pressure gauge to my home faucet. The reading was the same.

Results

My results: At 3 feet-A little under 1 1/2 pounds of pressure. At 5 feet-Approx. 2 1/2 pounds of pressure. At 7 feet-Approx. 3 1/4 pounds of pressure. At 10 feet-Approx. 5 pounds of pressure. At 20 feet-Approx. 10 pounds of pressure. In my expanded research, the water tanks (T) servicing my home are at 809 feet and my home (H) is at approx. 700 feet. When I use the equation T minus H divided by 2, I came up with approx. 55 pounds, which I verified by placing a high pressure gauge on my home faucet and turning on the water. The read-out was approx. 55 pounds.

Conclusions/Discussion

My hypothesis was correct. The higher a water source, the higher the water pressure. This is because of GRAVITY. Gravity pushes down. Water tanks that sit up high will have gravity to assist in creating water pressure to the homes below it. This means when you go to turn on a faucet in your home, you will get a nice steady stream. On the other hand, if you have a house on a hill with a water tank below it, you will not have gravity helping to push water up hill, you would need a man-made pump to create this pressure. Without this pressure, the water would be nothing but a trickle. This project helped me to solve the mystery of the water tower and its purpose.

Summary Statement

How elevating a water source affects water pressure.

Help Received

Mother helped type report. Father gave directions for using power tools and making tank, and assisted with lifiting water filled tank.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Wolf I. Thielmann

Project Number

J0123

Project Title

Smoothing the Surface: The Coefficient of Lift and Drag as a Function of Texture

Abstract

Objectives/Goals

I investigated this project in order to determine how different wings and their surfaces affected their efficiency.

Methods/Materials

In a wind tunnel, I placed four wings, two were control subjects with smooth surfaces and two were experimental subjects with a surface smoothness that varied from the control wings. I placed them individually in the wind tunnel and using a force probe, measured the lift and drag each wing produced.

Results

I found that a wing with a smooth surface is more efficient than a wing with an unsmooth surface.

Conclusions/Discussion

Further extensions of this investigation include finding effective control surfaces for aircraft that create drag and deplete much of the wing#s lift in order to make landings safer. Other possible research applications include finding an airfoil that is more efficient for manned gliders or solar powered aircraft.

Summary Statement

I attempted to discover if and how the surface texture of a wing affects a wing's performance

Help Received

Recieved Vernier Instruments force probe from school and father assisted in cutting out large wood pieces for wind tunnel using router and skilsaw.

Name(s)

Calvin H. Witt

Project Number

J0124

Project Title

Breaking the Splash Barrier: Developing an Economical Underwater ROV

Abstract

Objectives/Goals

My goal is to design, create and develop an Underwater ROV (Remotely Operated Vehicle) that will function and be maneuverable in and under water. It will be built from parts commonly available at hardware and surplus stores (this is NOT an Internet "kit" project). The ROV must descend to the bottom of a pool and ascend to the surface, move in both forward and backwards directions, and turn sharply in and under the water using power interruption to one of the motors. The controller I design and build will have two functions: one for "cruise" and the other for "finite" control.

Methods/Materials

1. Decided on size, hexagonal shape. 2. Tested propellers with various motors, designed and constructed watertight PVC "power pod" to contain motors. 3. Designed, created, and tested various seals for motor shaft. 4. Designed and constructed multifunction ROV power controller for propulsion and steering. 5. Performed preliminary tests, Ascend/Descend, Forward/Reverse, Turning tests and made changes. 6. Performed final testing (10 tests each).

Results

Testing proved the ROV to descend, ascend and be quite maneuverable (steer) on the surface and underwater. It performed every function I had designed it to.

Conclusions/Discussion

Yes, I was able to design, create and develop an ROV that functioned and maneuvered in and under water using common and surplus materials. This was confirmed with consistent test results. The total cost was $35.24 which is far less than a manufactured ROV. I found the low RPM, high torque motors and small propellers to efficiently move the ROV on the surface and underwater. I found it interesting that the ascend time was shorter than the descend time. Also interesting was, though the motors ran slightly slower in forward than reverse, the ROV was faster moving forward. This appears to be because the propeller force is hitting the power pod housing. Though the seals did prevent the motor power pods from quickly flooding, small amounts of water did leak past.

Summary Statement

I designed, created, and developed an Underwater ROV (Remotely Operated Vehicle) at a very reasonable cost that functions and is maneuverable in and under water after extensive testing and modifications.

Help Received

The Elhardt#s for using their pool for testing; Peter Elhardt and Audrey Witt (my sister) for being my "third hand" as the stop watch operator during timing tests; my dad who supervised my work on this project and made me think problems through.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Meaghan Yolles

Project Number

J0125

Project Title

Wing It! The Effects of Airplane Wing Design on Aerodynamics

Abstract

Objectives/Goals

My objective was to see what the effect of the degree of camber, or curvature, in each of the three wing designs I constructed, would have on the ability of the craft to become (and stay)airborne. In the terms of aerodynamics, my objective was to see which design had the greatest lift.

Methods/Materials

My three airplanes were constructed out of bolsa wood. To the underside of each craft I attached a small length of fishing line. At the end of the line was a small hook. I constructed a wind tunnel out of cut plexiglass. I positioned a motorized electric fan at one end of the tunnel. For testing,I would then place one of my models within the tunnel, and turn on the fan. I would then observe the ability of the wind force exerted to create lift, both with the plane by itself, and with small amounts of weight, in the form of metal bolts and washers, attached to the hooks.

Results

The plane with medium camber and flat lower camber had the greatest lift.

Conclusions/Discussion

My hypothesis was partially wrong. I had thought that a wing with a high upper camber and flat lower camber would have the greatest lift. The results of my project are important in that they can aid aeronautic engineers in designing airplane wings.

Summary Statement

My project is about how wing design of an aircraft effects lift.

Help Received

Assistance from neighbor in constructing models.