CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Blake H. Bainou

Project Number

J0101

Project Title

How High Can She Fly?

Abstract

Objectives/Goals

My science project, "How High Can She Fly?",involves testing,reengineered and more aerodynamic fin designs of a model rocket. The purpose of this project is to determine which fin shape would help propel its rocket altitude higher into the air, increase its speed and conserve on fuel. When N.A.S.A. launches its space shuttle, thousands of gallons of fuel needed to achieve space flight. I hypothesized, if a rocket is more aerodynamic, it will fly faster, taking less time to get into space. The faster the rocket flies, the less fuel the rocket will consume. Because rocket propulsion is by no means inexpensive, the less fuel the rocket consumes the less money N.A.S.A.will need to spend. With this information, I believe, that the experiment I developed is worth exploring further to improve the economy of scale for future space flights, speed to cover further distances into the heavens and to reduce fuel consumption.

Methods/Materials

Partial list of self-constructed items:
·2 Nova Payloader Model Rockets·Nova Payloader Reengineered Fin Design·Science Project DVD Video·Display Board·Securing Unit for Altimeter in Payload Compartment·Data Tables and Graphs·All Contents of Report and Display

Results

From my data, I concluded that Rocket A, flew to an average peak altitude of 143.49968 meters. Rocket B, with its manipulated fin variable, flew to an average peak altitidue of 297.72864 meters. Analyzing this, Rocket B flew 154.22896 meters higher than Rocket A, approximately 207.47 % higher. Think of this experiment on a larger scale. Imagine if this experiment were replicated, except with a 200 foot long rocket headed for the moon. Think how much higher and faster this rocket would go compared to Rocket A; not to mention how much propellant would be saved. This just goes to show you how aerodynamics can really make a difference.

Conclusions/Discussion

Analyzing my data, I found that my hypothesis was proven correct. The reengineered fin design propelled its rocket more than twice the height of the conventional fin shape. If I had the opportunity to expand upon my project, I would take it to the next level and make my project's significance a reality.

Summary Statement

How High Can She Fly? is a project that involves testing reengineered and more aerodynamic fin designs of a model rocket, to determine which fin shape would help propel its rocket higher into the air.

Help Received

Aside from my parents taking me to Kinkos numerous times, 100% of my project I typed, wrote, cut, constructed, paid-for, scanned, glued, printed, collected data for, etc.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Emily J. Biagini-Lee

Project Number

J0102

Project Title

It Doesn't Take a Rocket Scientist

Abstract

Objectives/Goals

I wanted to see how weight, length and fin size affected the flight distance of home-made rockets. My hypothesis was that the medium body lenghth, with the medium fin and tip weight would fly the farthest.

Methods/Materials

I built three body lengths out of cardstock, and three sizes of fins for each body, also out of cardstock. I attached one of three weights to the tip using pennies. The rockets were each launched using a store-bought launcher, in random order, 5 times each.

Results

The small rocket body with the small fin size and the least amount of weight yielded the best results. The small rockets averaged 70 feet. The medium-sized rocket with the medium fin size and the medium weight averaged 60 feet. The large-sized rockets with the large fin size and the heavy weight averaged 40 feet.

Conclusions/Discussion

I found that the smallest rocket, fin sizes, and tip-weight tended to fly the farthest. This is not what I predicted. I think NASA can use this information to build rockets that fly farther.

Summary Statement

This project determines whether and how three variables affect the distance that a rocket will launch - body length, fin size, and tip weight.

Help Received

While I launched the rockets, my neighbor and parents helped to measure their landing, since sometimes they bounced forward or backward. My family helped tape some of my rockets.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Sunil C. Bodapati

Project Number
J0103

Project Title
Effect of Varying Air Outlets on the Stability of a Hovercraft

Abstract

Objectives/Goals
To determine whether the number of outlets of air on the bottom of a hovercraft will affect the stability of the hovercraft. Stability will be determined by measuring the number of degrees the hovercraft veers from a horizontal grid line and the distance it travels from an origin.

Methods/Materials
Materials: 3 sheets of foam board 3ft by 2ft, plastic nuts, washers and bolts 2 1/2 inches and 4 M4 size, duct tape, plastic Trash bag, a lift fan 4 inches in diameter, 7.2-volt battery, protractor, hand tools and tape measure.

Construction Methods: Take the foam board and cut two sheets so the bottom sheet is two inches smaller than the top one all round. Drill 4 holes 2 inches from the corner of the smallest sheet, which is then placed in the bigger sheet. Cut a hole in the center of both sheets a little bigger than the diameter of the fan. Drill four holes to fix the fan to the outside of the top sheet (biggest sheet) using M4 bolts. Take a black plastic trash bag and cut into 8-inch wide strips. Tape the strips together, wrapping these around the hovercraft perimeter and taping them to the top and bottom foam boards.

Testing Methods: Using hand tools, foam board panels were cut so that each had a different number of holes. The panels were then secured onto the bottom of the hovercraft. The hovercraft is then placed on a horizontal grid line and turned on for 5 seconds. Conduct the same test with the same panel three times. The distance from where the hovercraft starts (the origin on the grid line) to where it ends is measured using a tape measure and recorded. Measure the angle in degrees it veers by drawing a line parallel to the hovercraft and making sure that the line parallel from where the hovercraft ended intersected each other. Use a protractor to measure the angles.

Results
The hovercraft moved less when there were more holes on the panels at the bottom of the hovercraft. It also veered less with a panel with more holes.

Conclusions/Discussion
My hypothesis was supported in saying that with more holes, the hovercraft moved and also veered less, because the distribution of air was more even and would not cause an imbalance as easily as it would be caused by an uneven distribution of air.

Summary Statement
My project investigates whether varying the amount of air outlets on the bottom of a hovercraft affects its stability.

Help Received
Ms.Belinda Lowe-Schmahl mentored me thoughout the project. My dad helped me conduct the experiment and my mom helped me create the display board.

Name(s)
Mark A. Chodas

Project Number
J0104

Project Title
Landing Humans on Mars

Abstract

Objectives/Goals
The objective of my project was to find out if humans can land on Mars and return to Earth using existing rocket technology. I hypothesize that this can be accomplished although it will take many launches.

Methods/Materials
First, I designed a theoretical Mars mission and calculated its mass. Then, I figured out how much propellant it would take to get it to Mars and back. Next, I added the propellant mass to the mass of the vehicle and found the total launch mass of the spacecraft. Finally, I divided this number by the amount of mass an existing heavy-lift rocket can carry to Low Earth Orbit to find the number of launches necessary.

Results
I concluded that the mission would have a total mass of about 1,218,000 kg. It would take 49 launches of a Delta IV Heavy rocket to get this mass to Low Earth Orbit. This proves my hypothesis correct.

Conclusions/Discussion
My hypothesis was correct: humans can get to Mars but it is not feasible with current technology. Forty-nine launches would require too much in-orbit assembly. The mass can be reduced, however, by employing mass saving techniques such as aerobraking into Mars orbit and in-situ resource utilization on Mars. For comparison, if the old Saturn V rocket were used, it would only take 10 launches to carry the spacecraft into Low Earth Orbit because the Saturn V was a more powerful rocket.

Summary Statement
My project is about finding the launch mass of a manned spacecraft to Mars and calculating the required number of launches using an existing rocket.

Help Received
My dad, Dr. Paul Chodas, helped me understand some of the math required for this project.

Name(s)

Ashkan D. Farida

Project Number

J0105

Project Title

How Does the Pitch of the Blades on a Helicopter Affect How Much Power Is Produced?

Abstract

Objectives/Goals

I tested how the pitch of the blades on a helicopter effect how much power is produced. I hypothesized that as the pitch increases, so will the amount of power produced.

Methods/Materials

A wind tunnel was built to accurately measure the information. When the wind tunnel was built and ready for experimenting, the pitch of the blades was changed to either 0°(control), 10°, 20°, 30° and 40°. When the motor was turned on, the wind speed was measured by a wind meter, then the speed of the wind was recorded.

Results

After the trials were done, the average wind speed produced was; 6.52 kph at 0°, 29.52 kph at 10°, 22.88 kph at 20°, 14.93 kph at 30°, and 11.97 kph at 40°.

Conclusions/Discussion

I concluded that my hypothesis is incorrect. A change of pitch does affect how much power is produced.

Summary Statement

My project is about how the pitch of the blades on a helicopter effects how much power the helicopter produces.

Help Received

Dad helped drill holes into air duct.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

David K. Fleming

Project Number

J0106

Project Title

What a Drag

Abstract

Objectives/Goals

The objective of my project was to test and compare the aerodynamic drag of five different shapes to determine which shape produced the least drag and which produced the most drag using two different wind speeds.

Methods/Materials

My method was to test, using a small homemade wind tunnel and an oscillating fan with 2 different speeds, the drag of five different shapes cut from balsa wood. Each shape was attached, individually, to a platform mounted on wheels, which was placed in the wind tunnel. Attached to this platform was a string on a small pulley that held a 2-gram weight which rested on a postal scale, displaying weight in grams. In my data book I recorded how much lift each shape produced as I observed the weight decrease on the scale. The higher the 2-gram weight was lifted off the scale, the greater the drag. I tested each shape 45 times at each of two wind speeds and then averaged the tests to obtain my data.

Results

My results indicated that at medium speed, the round shape created the least drag because it lifted less than 1 gram, while the diamond shape had the most drag because it lifted more than 1.6 grams. At high speed, the sharp teardrop A showed the least drag because it lifted less than 1.3 grams while the diamond shape had the most drag because it lifted the 2-gram weight completely off the scale. The more drag that the particular shape generated, the more the grams decreased on the scale.

Conclusions/Discussion

I discovered that my hypothesis was not accurate as stated because I had thought that sharp teardrop A would be the most aerodynamic at both medium and high speeds. However, this was only true at high speed while the round shape proved to be most aerodynamic at medium speed, displaying the least amount of drag. I had also thought the block shape would be least aerodynamic at both wind speeds. Instead, the diamond shape displayed the highest drag at both speeds. This surprised me until I realized that the diamond shape had a greater frontal area than the other shapes, thus creating more drag.

Summary Statement

My project is the study of drag on various shapes to compare which shape would be the most and least aerodynamic.

Help Received

All of my help came from my family. My dad helped build the wind tunnel and helped to cut the platform and shapes. My older sister and younger brother helped me with the testing. My older brother helped me create the graphs using Excel. My mom helped me edit the writing and cut paper for the display board.

Name(s)

Christopher A. Hinds

Project Number

J0107

Project Title

Do Different Fin Designs Affect a Rocket's Maximum Altitude?

Abstract

Objectives/Goals

The point of this project is to see if different fin designs affect a rocket's maximum altitude and the stability of the flight, and if so, which fin design makes the rocket go the highest. This was done was by designing five different fins and launching them each 3 times then comparing how high the rocket went and how stable the flight was.

Methods/Materials

4# by 3# sheet of Balsa wood
3 Polaris Estes Model Rocket Kits
1 Estes Altitude Tracker/theodelite
Estes Launch Equipment (Igniter, Launch pad)
5 packs of C-6-5 Engines.

1. Put together all 3 Estes model rocket kit
2. Spray paint the rockets red so you can see them in flight
3. Design and cut out 4 different fins
4. Go to your launch site, prepare rockets and launch equipment
5. Launch rockets and have someone record the altitude and flight stability.
6. Repeat three times for each design. Change fins as required to complete flights.

Results

The low drag clipped-delta fin design went the highest and was the most stable flight. This fin design was #2 and went 99 meters and was graded a 9.8 on a scale of 1-10, ten as the most stable. The lowest altitude was 24.5 meters made by the rocket with no fins.

Conclusions/Discussion

The hypothesis that a low drag clipped-delta fin would make the altitude the highest and would be the most stable flight was supported by the findings of the experiment. The fins that came with the rocket did not perform as well as the clipped delta fin design. Other people may be able to use the information in this report to design new and better fins for their model rockets.

Summary Statement

The point of this project was to launch rockets with five different fin designs and see how the designs affected the rocket's altitude and stability.

Help Received

My Dad recorded the flights and bought the rockets. My Mom launched the rockets. My sister retrieved the rockets. Bill Lyon, my Dad's business partner, developed an electronic launch system. Ms. Gunn, my advisor from Lewis, guided me thru the process.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Brian P. Hoover

Project Number

J0108

Project Title

The Shapes of Boat Hulls Matter

Abstract

Objectives/Goals

In this experiment I proved that the shape of a boat hull affects the friction or resistance between it and the water.

Methods/Materials

A water trough was constructed out of a plastic gutter 5 feet by 4 1/2 inches. Four boats were made of wood from a 2 by 4. Each one was 6 inches long and had a different shaped bow. They were a flat bow(front of the boat), flat bottom(Boat 1); pointed bow, flat bottom (Boat 2); flat bow, rounded bottom (Boat 3); pointed bow, rounded bottom (Boat 4). A piece of twine was attached to to a screw located 1 inch from the bow. A scale was created to measure the amount of resistance each of the boats displayed in a constant flow of water from a garden hose. A cap was placed on the end of the trough with a small weir to control the depth of the water in the trough. A boat was placed in the trough facing into the current with the string attached to the scale. The amount of resistance was recorded on a scale between 0 and 16 mm. This procedure was repeated 3 times with each hull. The average was calculated for each hull.

Results

Boat #3 had the least amount of resistance. Repeating the process three times provided results of 2 mm, 0 mm, and 1 mm of resistance. An average of 1 mm was recorded for Boat # 3 with the flat front rounded bottom. The other boats averaged; 4 mm(Boat #1), 2.3 mm (Boat #2), and 2.6 mm (Boat #4). Boat #3 clearly had less resistance in the constant flow of water in this experiment.

Conclusions/Discussion

In my project, I discovered that the shape of a boat hull makes a big difference in the way it travels through the water. I had some unexpected obstacles. The first obstacle was that the original boats that I made, one inch by one inch, were not big enough to show any difference in efficiency and they did not move straight through the channel of water. The next problem that I encountered was that the spring scale I borrowed from school was not sensitive enough to measure resistance on three of the four boats. Because of this, I had to design and build my own tool to measure resistance.

My hypothesis in this study was that the boat with the triangular bow would have the least resistance when flowing through water. I was not correct. The experiment proved that the boat with the flat front and rounded bottom had the least amount of resistance. Without further study, I cannot explain why this occurred.

Summary Statement

I did this project to find if the shape of a boat hull affects the efficency of it traveling through water.

Help Received

I had no help with this project.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

H. Aidan Jolliff

Project Number

J0109

Project Title

The Effects of Magnetic Fields on Water Flow

Abstract

Objectives/Goals

This experiment measures the affects of a strong stationary magnetic field on water running through a confined space.

Methods/Materials

A plastic champagne glass was placed in a wooden fixture between two sets of cobalt magnets that produced a 200 (+/- 10) gauss magnetic field around and through the stem. A stopwatch was used to time the flow of measured amounts of distilled water, tap water and saltwater through the stem. The experiment was then repeated for each manipulated (water) variable with no magnetic field present. The flow rate was measured seven times for each test solution and each test condition on three different days.

Results

The raw data for each manipulated variable was plotted using a scatter gram. After discarding the two outlying data points for each variable, the five remaining closest data points were averaged to produce a smoothed data set for each variable.

The smoothed data showed the saturated saltwater solution in the presence of the 200 gauss magnetic field had the slowest rate of flow. The distilled water with no magnetic field present had the fastest flow, which confirmed the original hypothesis that a strong magnetic field would affect the flow rate.

Conclusions/Discussion

Electrical measurements of the solutions showed the saturated salt solution would conduct a current in excess of 500 milliamps. The distilled water showed no measurable current flow, confirming the conclusion that the more ions and salts in the water, the greater the effects of the magnetic field.

The underlying physics of the observed water flow phenomena are still under investigation.

Summary Statement

This experiment investigates the affects of a strong magnetic field on the flow of water in a confined space.

Help Received

My grandmother got me interested in magnetic fields, bought materials, helped me design the holding fixture, and showed me how to use a spread sheet to record and plot the data. Dr. James Clemmons of the Aerospace Corp. measured the magnetic gauss across the stem of the glass as it was held in the test

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Thomas C. Judge

Project Number

J0110

Project Title

Testing Turbines for Maximum Power

Abstract

Objectives/Goals

The objective is to compare different styles of wind turbine propellers to see if the style of the propeller effects the amount of energy it produces. My hypothesis was that the style of the turbine does effect the amount of energy produced.

Methods/Materials

I designed four different styles of propellers to test. Turbine #1 was a two-blade model with straight blades attached at 80 degree angles. Turbine #2 was a four-blade model with straight blades attached at 80 degree angles. Turbine #3 was a two-blade model with the blades slightly bent in the middle of each blade. Turbine #4 was a four-blade model with straight blades that were angled forward from the hub. All turbines were made from balsa wood and attached to their own DC motor with leads.

Each turbine was placed in front of a household fan. At the fan's highest setting for one minute, the wind generated registered an average of 3.0 meters per second (M/S) on my anemometer. Each turbine was mounted to the tower I built out of K#nex. The turbines leads were connected to the resistor on the voltmeter. Each propeller was tested ten times for one minute. I recorded the highest reading on the voltmeter for each test in my logbook.

Results

I calculated the average volts for each turbine by adding the ten test results and then dividing that sum by ten. Turbine #4, with the four, straight blades that were angled forward from the hub produced the highest voltage at 12.0 volts. Turbine #3, with two-blades slightly bent in the middle of each blade produced 9.8 volts. Turbine #1 with the two, straight blades attached at 80 degree angles produced 8.0 volts. Turbine #2 with the four-blades attached at 80 degree angles produced the lowest voltage at 6.45 volts.

Conclusions/Discussion

My hypothesis was correct. The style of the turbine does effect the amount of energy produced. The use of wind could be our answer for a future energy source. We need to find the best turbine design for maximum power. Wind energy doesn#t pollute and it is renewable, unlike the fossil fuels we use today. If I were to do this experiment again, I would create and test more turbines to further my search for the turbine that produces maximum power.

Summary Statement

My project is about comparing four different styles of propellers for a wind turbine to see if one style would produce more volts of electricity than another.

Help Received

For my project, my father helped me build the tower and my mother helped me type the report.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Laurel A. Kroo

Project Number

J0111

Project Title

Drag Reduction of a Mini Cooper

Abstract

Objectives/Goals

The objective of this project is to reduce the drag or the air resistance on a Mini Cooper (a type of car). From my references, I read that 2/3 of the power used by a car (and the fuel required) is caused by aerodynamic drag. By reducing the drag on the Mini Cooper, I hope to raise the efficiency (miles per gallon), and therefore be conservative with car gas, and precious nonrenewable resources like oil.

Methods/Materials

One of the main problems I came across was how to measure drag, and came up with a set up, that with sensitive enough equipment, would work. A small model of a Mini Cooper was placed on top of a car, and in a wind tunnel. A string was tied to the front of the car, and the string was threaded over a pulley. At the end of the string was a weight, so when the car was pulled back from wind, the weight lifted a certain amount. The weight rested on a scale, so by subtracting the original weight from the drag-impacted weight, the drag was measured. This worked but I had to make sure that variations between each test could be avoided. This setup was tested in a wind tunnel and also mounted on top of my dads car.

Results

From research, I found that most of the drag on the car is related to how the air comes off the back of the car. This separated flow creates a partial vacuum that is responsible for most of the drag. By creating attachments, I found I could make that area of separated flow smaller. A good visualization of this is the process of narrowing the wake of a boat. My first attachment design consisted of two vertical wings attached at the back sides of the car and curved inward, which narrowed the flow. My second design was one wing down the center. This resulted in increasing the drag instead of lowering it. Several other designs were tested, but they had little effect on the drag. The results I collected in the wind tunnel supported the results I got from testing the set up on the car. My first attachment design was the most successful and it reduced the total drag by 12.5%.

Conclusions/Discussion

This project is interesting because it can save money for people if applied to full sized cars, and it can help our environment. It can keep the air clean, and the ground still full of oils that are taken to make car gas.

Summary Statement

By adding attachments to the back of a Mini Cooper, I reduced the drag by 12.5% and therefore substantially increased the miles per gallon.

Help Received

My dad helped me with many of the equations in measuring drag, such as Drag coefficients, and explained a few concepts to me such as Reynolds numbers. I used lab equipment (wind tunnel) under supervision of Professor Bradshaw at Stanford University.

Name(s)

Seth G. McFarland

Project Number

J0112

Project Title

The Effect of Wind on Bridges

Abstract

Objectives/Goals

To determine the effect of wind on different bridge structures.

Methods/Materials

I built four bridges; one bridge with no sides, one bridge with solid sides, one bridge with 17% of material removed from its# sides and one bridge with 30% of side material removed. I also built a wind tunnel where I tested all my bridges three times. I tested the bridges under wind speeds of low, medium, and high. The bridges were allowed to turn on an axis and the angle they turned was measured in degrees. I also tested the bridges horizontal motion under the same wind speeds. I measured this movement in millimeters.

Results

The bridge with no sides rotated the least, but the bridge with 30% of its side material removed from its sides rotated just a little less. The bridge with 17% of its side material removed turned more than the bridge with 30% of the side material removed but less than the bridge with solid sides, which turned the most. I threw out the data for the horizontal motion tests because the results were invalid.

Conclusions/Discussion

I have concluded that the surface area of the side of a bridge makes a big difference in wind resistance. The more surface area there is for the wind to hit, the more force is put on the bridge. This has to be taken into consideration when engineers design a bridge.

Summary Statement

In my experiment I tested four different bridge designs in a wind tunnel to further understand the importance of the aerodynamics of bridge sides.

Help Received

Name(s)

Robert W. McRae, Jr.

Project Number

J0113

Project Title

How the Adding of Weight Affects the Speed of the Hovercraft

Abstract

Objectives/Goals

After constructing a hovercraft, my experiment will test how weight added affects the speed of the hovercraft.

Methods/Materials

First I constructed a hovercraft using supplies purchased at local retail shops. After construction I tested the amount of time it takes the hovercraft to travel the distance of 15 meters. The weights used for the testing were from my gym set and each weight weighed 4.5 kg (10 lbs). The measurement of time was in seconds using a stop watch and the results were documented on data sheets that I developed prior to testing.

Results

The control tests established the amount of time it took to travel 15 meters with no extra weight just my weight of 40.5 kg (90 lbs). As weight was added the results varied due to different factors, however there did appear to be an increase in time once the hovercrafts weight-distribution / level-balance point was established. The factors that affected testing the most were driver error and the plywood used to construct the hovercraft#s platform. Navigating the hovercraft was difficult because of the drift of the craft causing me (the driver) to assist the craft with my feet.

Conclusions/Discussion

The hovercraft constructed made it through a tremendous amount of tests. It did carry my weight plus an extra 81kg (180lbs) for a total of 121.5kg (270lbs) and still had the ability to travel 15 meters.

Summary Statement

I constructed a hovercraft using a leaf blower, a 55 cm propeller blade, a scooter engine and supplies out of my garage; then tested to see how it performed when different amounts of weights were added to it.

Help Received

Science teacher, Mrs Debbie Beckett, for encouragement; My father, for taking me for supplies and guiding me in construction and timing the trials while I drove; My mother, for taking pictures and filming the trials; My sister for the use of her scooter engine and for proofing some of my papers.

Name(s)

Preston D. Neal

Project Number

J0114

Project Title

Which Automobile Shapes Have the Least Wind Resistance?

Abstract

Objectives/Goals

My project is to determine which shaped car has the least wind resistance. My goal is to figure out which car shape has the least wind resistance.

Methods/Materials

Materials used to make the wind tunnel included a hairdryer (to create the wind), wood, wire, and Legos (to build auto chassis]. The car bodies were carved with florists foam. A postal scale was used for measuring the force produced. I carved six cars out of foam. One with box shape, one with truck style, another with a dome shape and two that had the lowest profile. When that was done I turned on the hairdryer and when the wind blew the car back, the scale pointer would show the force pulled in grams.

Results

The results are that a car with a rounded shape and more aerodynamic will have the least wind resistance and a car with a greater frontal area like a truck will have more resistance.

Conclusions/Discussion

During the time I was testing I saw that the aerodynamics of a car and frontal area does matter. I think that the cars that have a greater frontal area will have an effect on the amount of gas that would be used because a car with a bigger frontal area will need the power to go through the wind. I also think that a car with a less aerodynamic shape will also have to use more gas and power.

Summary Statement

My project is to determine which shaped car has the least wind resistance.

Help Received

My mom helped me organize the board and my mom and dad helped with some typing. My dad also helped build the wind tunnel.

Name(s)

Erika K. Oblea

Project Number

J0115

Project Title

Does the Weight Distribution on a Glider Affect Its Flight Path?

Abstract

Objectives/Goals

The purpose of this experiment is to determine if the weight distribution on a glider affects its flight path. This experiment was designed to predict where the glider will land with different weight positions.

Methods/Materials

The right wing and the target are mapped to an x-y grid coordinate. The weight was placed on different positions on the right wing of the glider. The glider was launched ten times on the launcher for each weight position on the right wing, and the point where the glider first touched the ground was recorded. The target was 28 feet and 3 inches forward and 28 feet and 3 inches to the right from the launching point making it 40.02 feet away from the launching point.

Results

After launching ten different weight positions, the coordinates on the right wing, (11.20 in, 1.60 in) produced a measurement that was closest to the target (0.31 feet away). As the weight was moved closer towards the tip of the right wing in the increasing x-axis, the glider landed in increasing x-axis in the target#s coordinates. While as the weight was moved towards the trailing edge in the decreasing y-axis, the glider landed in the increasing y-axis in the target#s coordinates.

Conclusions/Discussion

The experiment proved that by controlling the weight distribution on the glider, the landing point can be approximated and predicted with reasonable accuracy. The independent variable in this experiment is the weight distribution on the glider, and the dependent variable is the glider#s landing point from the target. Several factors, such as the type of plane, the force of the thrust of the launcher, the weight of the metal piece, and the wind conditions, were kept constant during the experiment.

Summary Statement

This experiment is designed to test if the weight distribution on a glider affects its flight path?

Help Received

Teacher helped to build launcher; Father supervised launching in the park

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Billy Paris

Project Number

J0116

Project Title

The Falling Rate of Small Spheres

Abstract

Objectives/Goals

An experiment was designed to test the falling rates of small plastic spheres ranging in diameter from 1-6 mm.

Methods/Materials

Six spheres were fashioned from hardenable modeling compound within the above diameter range. A testing apparatus was designed and built which included a four meter endless belt moving horizontally at a constant speed. A tripping device attached to the belt caused the graphite coated sphere to be released two meters above a zero point on the belt. The distance the belt moved between the zero point and the graphite mark left by the falling sphere was used to calculate the falling speed of that sphere. Each sphere was tested four times and the calculated speeds were averaged.

Results

The largest sphere (5.14 mm in diameter) fell at an average rate of 4,302 mm/sec., while the smallest sphere (1.6 mm in diameter) fell at an average rate of 2,369 mm/sec. When the average speeds of six spheres were plotted the result approximates a straight line.

Conclusions/Discussion

Larger spheres fall faster than smaller spheres of the same density. It is possible that the difference in falling speed between the larger and smaller spheres is greater than was measured if the larger spheres did not have enough height to reach their terminal velocity.

The hypothesis was based upon the increasing ratio of the volume to area of a sphere with increasing sphere diameter, and the data supports this. This relationship between size and speed of falling objects would account for insects falling from great heights uninjured and increasing amounts of damage from larger hailstones.

Summary Statement

This experiment was designed to determine the relationship of falling speed to size for small (1-6 mm in diameter) spheres.

Help Received

Suggestions from Dr. Richard Stepp , Ph.D. and mr. Bill Alexander both of Humbolt State University Physics Dept. helped with apparatus design. Mr. John Palmer, M.A., my science teacher helped with design and construction of apparatus. Mr. Kenny Norman on Green Point Staff, helped with math.

Name(s)

Lillian M. Perry

Project Number

J0117

Project Title

Wow! The Wonders of Winglets!

Abstract

Objectives/Goals

Does adding winglets to a Boeing 757 reduce it's wake vortex? I think that adding winglets will reduce the wake vortex of the 757.

Methods/Materials

Materials: Dry ice, cooler, paper, 6in diameter, 3ft long plastic tube, styrofoam, assortment of wood files, styrofoam putty, fan, ruler, writing utensils, digital camera, tuna can, hot water, turkey baster, black paper, screen, duct tape, light, container for cold water, clock, tongs, and gloves. Building a Wind Tunnel: Obtain a six-inch diameter plastic tube three feet long; make a base for the tube by hollowing out Styrofoam; place screen inside of tube; get measuring tape or paper with cm marked on it and tape it to the outside; tape large piece of black paper to the outside of one side of the wind tunnel; place your fan 41 cm away from the tunnel. Get a piece of Styrofoam; draw your wing design on it; use design in Image A. Cut out the design not on your lines but make your design a little larger than you want it to be. Use wood files to file the Styrofoam to the shape in Image B. After shaping the wing, cover the wing with putty to make Styrofoam not porous. Testing: Place the wing inside of the wind tunnel using double sided tape. Place dry ice in tuna can full of hot water so that it starts to vaporize. Continually remove the cold water from the tin with a turkey baster and replace it with hot water. Turn on wind tunnel and observe. Count the number of visible vortices (swirls) during 30-second intervals. Repeat six times without and with the winglet.

Results

With Winglet: Once turbulence starts the winglet breaks apart the disturbance creating a less turbulent air stream. No noticeable vortex. Airflow was more laminar after the wing. Noticeable breaking of turbulence. Winglet cut disturbances, waves became flat and air was much less turbulent after wing remained smooth for 23 cm or until end of tunnel. observations Without Winglet: Vortex is noticeable in short bursts, some are larger than others are. Without Winglet: Turbulence was slightly increased after wing for 5 cm. Without Winglet: End was less laminar than with winglet. Edge of wing swirled and was turbulent. Near the tip there is more vortex.

Conclusions/Discussion

Winglets reduce the drag and wake vortex of a Boeing 757 wing. Without the winglet there were as many as 14 vortices per minute any of these could be fatal.

Summary Statement

Does adding winglets to a Boeing 757 reduce it's wake vortex?

Help Received

Eric Fujishin helped with dry ice, Janice Rourke helped with photos, karen perry helped with cutting pictures.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Brian W. Peterson

Project Number

J0118

Project Title

Surf's Up

Abstract

Objectives/Goals

My project was to determine if the amount of surfboard rocker affects a surfboard#s speed in the water. I believe that increasing the rocker will decrease a surfboard#s speed.

Methods/Materials

Three different 1/6 scale model surfboards were designed out of balsa wood, each with its own specific amount of rocker. A tank was constructed that would circulate water at a constant velocity. Each board was tested five times with four different amounts of weight to simulate a, #surfer.# Each weighted board was tested at three different velocities of water. The speed of the water in the tank was changed by lowering or raising the water level.

Results

The board with the most rocker had the largest amount of drag, making it the slowest. The fastest board was the one with the smallest rocker and the least amount of drag. Adding weight caused the board#s drag to increase, and so did increasing the water velocity.

Conclusions/Discussion

My conclusion is that a board with little of no rocker will be faster than a board with greater rocker. Also, the heavier the person standing on the board, the slower the board will be traveling.

Summary Statement

The amount of rocker on a surfboard greatly affects the speed of the board when in motion.

Help Received

Teacher helped check my work to see if it was understandable. Dad helped with recorging data on prepared graphs as I conducted the experiment.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Gregory J. Pinto

Project Number

J0119

Project Title

How Does the Chord Length of a Propeller Affect the Amount of Force It Makes?

Abstract

Objectives/Goals

The purpose of this project was to investigate a possible connection between the chord length of propeller blades and the amount of force the propeller produces.

Methods/Materials

I taped extensions onto 4 propellers so that they extended the chord lenght 0.3 cm., 0.6 cm., 0.9 cm., and 1.2 cm. I attached the propellers to a 7.6 cm. long rod and inserted it into a chuck of a cordless drill. I made a jig to keep the drill steady. I pulled the trigger all the way in with the RPMs of the drill set at the lowest setting and in reverse mode. I made sure that the propeller stayed perpendicular to the 0.01 g. accuracy scale. I took six reading for each propeller.

Results

The propeller with the 1.2 cm. extension consistently got the highest reading. The propeller with the 0.3 cm. extension consistently got the second highest reading. The propeller with the 0.6 cm. and 0.9 cm extension consistently got the lowest readings.

Conclusions/Discussion

My results contradicted my hypothesis in the fact that I was expecting a steady increase in the readings as the chord lengths got bigger. I encountered several problems:

The scale reading oscillated too much to get a correct reading. I tried to compensate by counting to 5 and taking down what I saw at that moment.

When I started, the self-ratcheting drill caused the first sample to break. I had to change to a different drill.

The test results were not what was expected and there was no scientific explanation for these results. I believe that the test or propellers were flawed in some way.

Weighing the force does not seem to be the best way to measure the force the propeller creates. Using a car or boat would probably be a better way to prove/disprove my hypothesis.

Summary Statement

My project is about the link between cord length and generated force.

Help Received

Used lab equipment at Bellarmine College Preparatory under the supervision of Dr. Richard Nevle. My mom helped a little with the display board. Mr. Dan Kalcic steered me towards a very helpful website. My science teacher, Mr. Dolan, made sure I was showing progress.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Kelsey A. Procter

Project Number

J0120

Project Title

What a Drag!

Abstract

Objectives/Goals

The objective of this project was to determine how different types of surface materials covering an object affect drag as water moves past the object. It was hypothesized that the smoother the surface material covering an object, the lower the drag will be as water moves past the object.

Methods/Materials

The five experimental groups and one control group tested how different types of surface materials covering an object affected drag as a stream of water flowed past the object. The object covered was a plastic egg with a diameter of 5cm. The independent variables for the five experimental groups were the following five different surface coverings: 1) tight-fitting 80% nylon / 20% lycra fabric, 2) Speedo Fast Skin fabric, 3) 100% polyester synthetic hair, 4) loose-fitting cotton fabric, and 5) Vaseline. The control group was the uncovered plastic egg. The dependent variable measured for each of the five experimental groups and the control was the resistance in grams, as measured by a spring scale, while a constant stream of water was pumped past the covered or uncovered plastic egg. There were 20 trials for each experimental group and control.

Results

The average resistance measured for each of the experimental groups and control group was as follows: the uncovered plastic egg (control) - 7.06g, Vaseline - 8.3g, Fast Skin - 9.31g, 80% nylon / 20% lycra - 10.93g, loose-fitting cotton - 13.39g, and 100% polyester synthetic hair - 16.19g.

Conclusions/Discussion

The differences in resistance measured in this experiment were due to differences in surface friction, or drag. The results indicate that the hypothesis was true and that choice of swimwear could make significant improvements in a swimmer's speed. The Fast Skin, shark skin mimic, would seem to be the best choice since it produced even less drag than the 80% nylon / 20% lycra covering which is the fabric found in traditional racing suits. If swimming a fraction of a second faster is important, this fabric which is supposed to mimic the dermal dentacles on a shark's skin may provide the extra speed by reducing drag. The loose-fitting cotton suit would be the poorest choice in swimwear since it produced greater drag. Swimmers have debated whether head and body shaving can increase a swimmer's speed. Since the synthetic hair covering in this experiment produced the greatest drag, it suggests that shaving may be helpful in increasing speed.

Summary Statement

The project tested how different types of coverings, which might be found on swimmers in racing situations, affect drag in water.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Christian H. Selby

Project Number

J0121

Project Title

Aerodynamic Lift: It's Not a Drag. Which Wing Design Will Create the Greatest Lift?

Abstract

Objectives/Goals

This project was done to discover which wing (airfoil) design would create the greatest aerodynamic lift.

Methods/Materials

Six wing (airfoil) designs were created to be of equal length. Three designs were conventional and three were experimental. Thin wooden supports of equal weight and length were created for each side of each wing and attatched to allow the wing to pivot on the side supports. A wind tunnel was created with a one speed motor. Within the tunnel a grid was created to produce a more smooth (laminar) air flow. Each wing was flown at both a level postion and at a 30 degree angle from a level position. Equal amounts of weight were added progressively to each side of the wing being tested until the wing could no longer hold a level or 30 degree above level position. After failure, the last successful amount lifted (wing, supports and weights were weighed) was recorded as grams.

Results

Wing number two with a high upper camber and a flat lower camber out-lifted all other designs with a lift at 30 degrees from a level position of 330.2 grams and at a level position of 257.8 grams. This exceeded all other designs by at least 37.4 grams for tests at 30 degrees and 75.6 grams for tests at a level position.

Conclusions/Discussion

I thought wings #3 #4 with the concaved underside (deep lower camber) would produce the greatest lift but they accually produced the least. The deep concaved surfaces must have created rough air flow (turbulence)under the wing which increased drag and reduced the wings' lift. Wing design number two proved to create the greatest lift. Now I can see why airplanes with this wing design are used for cargo and passenger planes. These planes need to carry extremely heavy loads.

Summary Statement

My project is about testing the aerodynamic lift of six different wing designs.

Help Received

My Father helped me design and build the wind tunnel used to test the six different wing designs. My mother helped me glue down materials to my presentation board.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Max M. Shulaker

Project Number

J0122

Project Title

Oh Chute! Does Parachute Internal Volume Affect Rate of Fall, Assuming Constant Leading Surface Area?

Abstract

Objectives/Goals

This experiment tested the hypothesis:
If rigid pyramidal parachutes of different volumes, but with identical cross-sectional areas of their openings, are dropped from a given height,
then
the larger the internal volume of the parachute, the slower it will fall.

Methods/Materials

I constructed six rigid pyramidal parachutes from poster board.
Each parachute had the same square opening of 10cm x 10cm, but they differed in the height of the apex, therefore their volumes differed.
Each parachute was dropped five times from the same test height. Discarding the highest and lowest times, the average time for each was calculated. The results were graphed as "drop time vs. parachute volume".

Results

All the parachutes had the same drop times. The internal volume had no effect.
However, from my observations during the experiment, I saw that the size (therefore volume) of the parachute does affect its stability - the smaller ones were more likely to spin and topple.
I also built an extra parachute with a 15cm x 15cm opening - this fell significantly slower than the 10cm x 10cm parachutes.

Conclusions/Discussion

With parachutes having the same cross-sectional area of their open side (the "lead side" as they fall); varying the internal volume has no effect on the drop time of the parachutes.
However, from my observations during the experiment, I saw that the size of the parachute does affect its stability - the smaller ones were more likely to spin and topple. This was due to turbulence as air 'spilled' around the edges.
The parachute with a 15cm x 15cm opening fell significantly slower than the 10cm x 10cm parachutes.
This indicates that the cross-sectional area is a main factor in the descent speed of a parachute, rather than the volume.
In the future I would like to investigate the effect of different openings (area and shape), materials, and parachute shapes.

Summary Statement

This project investigates how parachute internal volume affects rate of fall - assuming a constant cross-sectional area of the opening.

Help Received

Minimal help - father dropped parachutes while I did the timing.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Brandon A. Smith

Project Number
J0123

Project Title
Can the Design of a Paper Airplane Make It Fly Faster and Farther?

Abstract

Objectives/Goals
To find out which design of a paper airplane determines how fast or how far it can fly. Can the design also determine the flight accuracy and the airplane's ability to perform stunts?

Methods/Materials
paper airplane book, sturdy white paper 8 1/2" x 11", tape measure, stop watch, log book, paper clips, bull's eye target, and launcher

Results
The larger wing area of both the Stealth and the Slice performed better in distance. In the speed test, the Stealth was the fastest. The Slice and the Blue Angel were equally as fast, and the Aerobat was the slowest. For accuracy, the Slice and the Blue Angel hit the target the most. The Aerobat and the Stealth hit the target half the time. For stunt performance, the Aerobat was able to complete all four stunts attempted. The Blue Angel also performed well, but the Stealth and the Slice were more awkward during the stunts.

Conclusions/Discussion
I conclude that the design of the paper airplane determines its ability for speed, distance, accuracy, and stunt performance. The airplane models with the larger wing area flew greater distances. The longer based and larger wing designs flew fastest. The Aerobat was able to perform all of the stunts perfectly. Finally, the two larger based models were the most accurate at hitting targets.

Summary Statement
My project is about which paper airplane model is best for distance, speed, accuracy, and stunt performance.

Help Received
My parents helped with the test trials and assembly of the display. My sister helped me type and proofread my report.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Sarah E. Whipple

Project Number

J0124

Project Title

Magnus Force on Spinning Spheres

Abstract

Objectives/Goals

The objective of my project was to explain how well the Kutta-Joukowski Lift Theorem explains Magnus Force on spinning spheres by comparing theoretical lift to measured lift for various spin frequencies, wind velocities, and diameters.

Methods/Materials

I built my wind tunnel using various materials, including wood pieces for the frame, electronic components for the motor control switchbox, a tachometer kit for measuring spin frequency, a homemade anemometer for measuring wind velocity, an electric leaf blower for the wind source, and a dietetic scale for measuring lift.

Results

I demonstrated that the Kutta-Joukowski Lift Theorem does, in fact, explain the linear relationships between lift and spin frequency, as well as lift and wind velocity. This theorem also explains the cubic relationship between lift and sphere diameter.

Conclusions/Discussion

My project taught me many math and science skills. I first learned about the origins of Magnus Force and the Kutta-Joukowski Lift Theorem. I learned some basic fluid dynamics, including Bernoulli's Principle, viscosity, laminar air flow, and turbulent air flow. I also learned about various linear and cubic mathematical relationships. I learned about Ohm's Law and how motor speed changes with current. Lastly, I learned soldering and other construction skills.

Summary Statement

I designed and constructed a wind tunnel to measure transverse forces on spinning spheres, and compared those forces to the predictions of the Kutta-Joukowski Lift Theorem.

Help Received

My parents supported, guided, and encouraged me when working on my science project. My father helped me in the construction of my wind tunnel, and my mother helped me in the design of my board.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Nick J. Bertero

Project Number
J0199

Project Title
The Effects of Wing Angle and Angle of Attack on Flight Duration

Abstract

Objectives/Goals
The goals for this experiment were to find out which wing angle produced the most amount of lift when launched from 3 different angles of attack, 0, 5 and 10 degrees. There were 3 different wing angles, 3, 20 and 50 degrees.

Methods/Materials
After the planes were modified they were launched from the launch board 12 times from 3 different angles, 0, 5, and 10 degrees, representing different angle of attacks. Every time the planes were launched, they were timed to the hundredth of a second and measured to the nearest 0 or 5 hundredths.

Results
Alpha, the 3-degree plane, generated the most amount of lift in the shortest amount of time. Alpha created enough lift to start a loop, but did not generate enough speed to finish the loop.
The 20-degree plane, Bravo, generated enough lift and speed to complete loops. After the loop was completed, enough speed would be left so Bravo could glide for several more seconds.
Delta, the 50-degree plane, generated the least amount of lift but created the greatest amount of speed. The launch board occassionally snagged Delta, indicating that Delta was on the board all the way until the board ended. It was able to usually fly straight because it never did a loop or glide so the wind could not affect it.

Conclusions/Discussion
The smaller the wing angle, the more lift is generated, and the greater the wing angle, the more speed will be generated, though some amount of lift will be lost.
Alpha created the most amount of lift in the shortest amount of time, even though not enough speed was created to complete the loop. The wing angle for Alpha is best used on small planes because it can generate enough lift with a smaller engine.
Bravo created a balance of lift and speed. It was generally able to complete one loop, and glided for several seconds after the loop was completed. Because of the balance of lift and speed, Bravo is best used for commercial airline flights.
Delta was the fastest plane and always traveled in a straight line. Since it generated the least lift, it needs to have high speeds in order to fly. This wing angle is perfect for fighters in the air force because those planes can generate the speed needed to keep them aloft.

Summary Statement
I timed how long a different wing angle would stay in the air when launched at three different angles.

Help Received
Professor Drela from MIT told me that I should focus on flight duration. Grandfather helped cut and shave the wings, and helped to conduct the experiment. Father timed the flight duration and measure the distance the planes had flown