CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Javi Arango

Project Number
J0101

Project Title
Airworthy Airfoils

Abstract

Objectives/Goals
In my experiment, I tested how modified shapes of airfoils produced lift. I wanted to find the most efficient, lift-producing shape.

Methods/Materials
I used a wind tunnel to test my five airfoils. The five, differently shaped, airfoils were made from styrofoam. I used a sensitive weight measuring device to see how much each airfoil lifted when the wind tunnel was at maximum speed. I recorded each data point three times, to ensure consistency. I repeated the procedure at three different angles of attack (10, 20, 40 degrees). I graphed the resulting lift curves for each airfoil.

Results
As the angle of attack increased in each airfoil, they mostly produced more lift. However above a certain angle, the lift production decreased. Separately, each differently shaped airfoil gave a different amount of lift and a different lift curve.

Conclusions/Discussion
I found that there is no single most efficient airfoil. Depending on what a designer wants (speed, load-carrying, aerobatics...etc.) a different airfoil can be suitable.

Summary Statement
How do different shapes of airfoils affect the lift produced?

Help Received
School's science teacher supervised the experiment and gave suggestions for improvement.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

George R. Caratan

Project Number

J0102

Project Title

A Nose for Altitude

Abstract

Objectives/Goals

My project was to determine if the shape of a model rocket's nose cone would affect the rocket's apogee when keeping the rocket's thrust and weight constant, each time it was launched.

Methods/Materials

Five different shaped nose cones were constructed from balsawood. Each nose cone had a different weight but had the same smooth painted finish. One model rocket was constructed with a cargo bay that contained the altimeter and space for adding or subtracting ballast. The rocket was equipped with a C6-7 motor so it had the same amount of thrust and it was ballasted so it had the same weight each time it was launched. I launched the rocket with the same nose cone three times and recorded the apogee after each flight. I repeated this procedure for each of the five different shaped nose cones.

Results

The rocket, when equipped with the Long nose cone reached the highest apogee, while the same rocket equipped with the Cylinder nose cone reached the lowest apogee.

Conclusions/Discussion

My conclusion is that the shape of the nose cone does have an affect on the model rocket's apogee because of the different amount of aerodynamic drag created by the diffent shaped nose cones. The more pointed shape created the least amount of aerodynamic drag causing the rocket to reach the highest apogee.

Summary Statement

My project demonstrates that the shape of a model rocket's nose cone will affect its apogee.

Help Received

none

Name(s)

Kirsten M.A. Cassidy

Project Number

J0103

Project Title

How Does Fletching Affect the Velocity of Arrows?

Abstract

Objectives/Goals

The goal of this project is to find the fastest arrow out of the four different arrows being tested. The fastest arrow will be the most accurate. Anyone who is involved in the sport of archery can benefit from the results of the experiment by having the fastest and most accurate arrows.

Methods/Materials

Some materials being used are a recurve bow, four differently fletched arrows, a computer with Coach Studio and Quick Time software, a high speed camera, and an archery range. Fist record with the high speed camera all the arrows that were shot. Then download them onto the computer and cut them down so they are not as lengthy. Transfer into Coach Studio and track the arrow. Export the data and record in a data table.

Results

The arrow that was predicted to fly the fastest did in fact fly faster than all the rest after analyzing the data from the videos. The only difference to the hypothesis was that the fastest arrow flew 1.247624 m/s faster than the next fastest arrow. The researcher found that there were some definite differences in the speed of the arrow shot.

Conclusions/Discussion

The hypothesis was very close to the actual arrow. The feather straight fletched arrow did indeed fly the fastest but it was faster than predicted. It flew 1.2476154 meters per second faster than the next fastest arrow which was the plastic helically fletched arrow. The fastest arrow flew 1.6400702 meters per second faster than the third fastest arrow which was the feather helically fletched arrow. What was even more amazing is that it flew 3.9663006 meters per second faster than the slowest arrow. This is almost four whole meters per second faster than the plastic straight fletched arrow. The part of the hypothesis that was correct was which arrow would fly the fastest. This was the feather straight fletched arrow.

Summary Statement

The fastest and most accurate arrow is the straight feather fletched arrow. Now that this information has been found all archers can have the fastest arrow.

Help Received

Help was received from Sabrina Cassidy (mom), Christopher Cassidy (dad), and Gayla Robinson (archery Instructor).

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Giulia M. Castleberg

Project Number

J0104

Project Title

Lift Force of an Airfoil

Abstract

Objectives/Goals

The intention of this project is to establish what shape of wing produces the most lift.

Methods/Materials

In this experiment, five differently shaped foam wings were mounted in a wind tunnel. The different designs are: a flat wing, a wing with a curved upper surface and a concave lower surface, a wing with an upper surface curved down and a convex lower surface, a wing with a curved upper surface and a flat base, and a wing with a flat upper surface and a convex base.

Each wing is mounted onto one end of a balance scale within the wind tunnel. Counter weights are added to the other side to balance the scale. When the fan is turned on, the wing moves up or down based on how the wind interacts with the wing shape. The wing with the most counterweights removed (negative numeric results) will have the best lift.

Results

The wing with a curved upper surface and a flat base had the best lift of -0.37N (negative indicated countering the force of gravity). The second to best wing had a lift of -0.34N; it has a curved upper surface and a concave lower surface. The flat wing's average was -0.11N, while the wing with an upper surface curved down and a convex lower surface had the exact opposite, +0.11N. The wing with the worst results is the wing with a flat upper surface and a convex base; its result average was +0.13N.

Conclusions/Discussion

The data supports my hypothesis that a wing with a flat base and a surface curved upward will generate the best lift force. The shape of a wing can greatly affect and impact the flight of a plane.

Summary Statement

The goal was to establish what airfoil shape produced the most lift, it was discovered that when a wing has a curved upper surface, it will generate a lift force as it moves through the air to counter act the force of gravity.

Help Received

Dad helped build wind tunnel, assisted with testing, and hepled understand the concept of lift; Mom helped review the board.

Name(s)
Daniel R. Cox

Project Number
J0105

Project Title
Aspect Ratio and Its Effect on Sail Efficiency

Abstract

Objectives/Goals
In my project, my goal was to find out if changing the aspect ratio between the sides of a sail without changing surface area changed the amount of force output. I also wanted to find out the ideal aspect ratio for sails.

Methods/Materials
A special wind tunnel, outfitted with a cart tethered to a spring scale to measure force, was built in order to have consistent airflow. Five sails of different aspect ratios, but the same area, were built out of the same materials in exactly the same fashion. Each sail was placed on the cart at the same angle, moving the cart, and therefore pulling on the spring scale tethered to it, measuring force.

Results
The 4:1 (height to width) sail was by far the most efficient. There was an upward trend of force from 1:1 to 4:1, which then dropped off at 5:1.

Conclusions/Discussion
A 4:1 sail is by far the most efficient sail. These results show that when possible, it is best to use a 4:1 sail on ships in order to maximize force generated.

Summary Statement
In my project, I constructed a wind tunnel, vehicle, and various sails, to determine which aspect ratio in sails with equal surface area provided the greatest force output.

Help Received
Father helped with power tools for wind tunnel construction; mother helped with shopping for cart parts.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Alec English; Will Renken

Project Number
J0106

Project Title
Turbulent Torpedoes

Abstract

Objectives/Goals
The purpose of this project was to determine if the shape of a torpedo#s nose affected the speed and amount of drag that torpedo had. It was predicted that the hemisphere-nose torpedo would be the fastest, and therefore, have the least amount of drag.

Methods/Materials
Five torpedoes of different nose shape but identical surface areas were constructed out of Styrofoam cylinders. The five shapes were a hemisphere nose, and long-cone nose, a short-cone nose, a flat nose, and a mushroom nose. The torpedoes were covered with shrink coat to seal their surfaces. The torpedoes had lead placed in their interiors to make their buoyancy neutral in water.

Results
The torpedo with the long cone shaped nose was consistently the fastest torpedo. The mushroom shaped torpedo was consistently the slowest.

Conclusions/Discussion
The conclusion is that nose shape does affect the speed of the torpedo. The hemisphere shaped nose was the third fastest torpedo. Therefore, the hypothesis, that the blue hemisphere shaped nose would be fastest, was proved incorrect. Showing that when traveling short distances long cone shaped noses reach the fastest speeds.

Summary Statement
Our project tested multiple torpedo shapes to see which was most efficient, comparing the effects of surface area, drag coefficients, and cavitation.

Help Received
Father helped obtain equipment and time experimental trials

Name(s)
Jedediah A. Fitzgerald

Project Number
J0107

Project Title
We're Ready for Liftoff: Examining the Effects of Hovering Heights on Produced RPM's

Abstract

Objectives/Goals
My goal for my project is to determine at which hovering height, over which terrain will a helicopter produce the least amount of RPM's.

Methods/Materials
For my experiment I used one (1) Craftsman tape measurer, one (1) Blade XC2 Helicopter, one (1) Blade XC2 remote control, one (1) stroboscope, a 35x25 square of river rock, a 35x25 square of asphalt, and a 35x25 square of grass. I hovered the helicopter at the variable height, over the designated terrain, taking measurements with the stroboscope and recording my results.

Results
My results showed that, on average, the .609 meter hover over grass produced the least amount of RPM's, the 1.22 meter hover over asphalt produced a middle amount, and the 1.83 meter hover over river rock produced the most RPM's.

Conclusions/Discussion
In conclusion, I discovered that to lessen the amount of RPM's produced, you should fly your helicopter low over smooth, level surfaces such as asphalt or grass.

Summary Statement
I chose this project because I wanted to lessen the amount of RPM's produced by a helicopter in order to save fuel.

Help Received
My mother took readings with the stroboscope, Carrie Given and Mrs. Lopez-Lickey, science teachers, helped with papers.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Zachary A. Frontado

Project Number

J0108

Project Title

The Effect of Lift on Angle of Attack

Abstract

Objectives/Goals

My project was to determine if Bernoulli's equation of lift can accurately predict lift by measuring the speed under and over the wing as I change the angle of attack to clarify more accurate results.

Methods/Materials

Ten different wing angles using the same wing were trialed to record various results of lift. Only one wing was used in the testing of this experiment. Each of the different angles of the wing tested, had the same amount of occurring velocity. To measure the speed under and over the wing I stationed the wing in a aquarium of water. I created a make shift propeller out of stainless steel and placed it in the top and bottom of the wing while the water pump; pushed the water against the propeller to create a spin. I video taped the propellor in 10 second time frames and then observed the total rotations. This was then plugged into Bernoulli's equation to find the occuing amount of lift in ounces.

Results

My results conclude that a wing at a positive correlation will result in the most lift until 15 degrees, which is where the most lift occurs. After 15 degrees the lift starts declining to the lower numbers because the wing begins to stall.

Conclusions/Discussion

Based from the results of my data I conclude that the majority of the data supports my hypothesis. The data supports what my hypothesis has stated which was; that more lift will occur once the wing is angled nose upward but will eventually come to a stall and facing downward will result in a restriction of velocity under the wing causing less lift to occur. By looking at these results, a wing at a positive angle will result in positive lift until it reaches a stall.

Summary Statement

My project was to demonstrate the angle of attack and how it affects the lift by using Bernoulli's equation.

Help Received

I would like to thank my grandfather in helping me in the construction of the fluid flow simulator. I would also like to thank Nolan in helping me with excel and Mrs. Miller encouragement.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Noa Garcia-Brown

Project Number

J0109

Project Title

Aerodynamics of the Oblique Wing

Abstract

Objectives/Goals

The purpose of this experiment was to compare how aerodynamic the oblique wing is compared to the swept back wing by measuring the amount of drag each produces.

Methods/Materials

Much of the time spent on this experiment involved a lot of trial and error. Several methods of testing drag were tried but failed. The first failed attempt, involved a dowel going through the middle of the glider and out the top and bottom of the tunnel through little slits to allow the glider to move back and forth. To add resistance, rubber bands were used to attach the ends of the dowel outside the tunnel to a peg in front of the dowel. This method proved to be too stiff to move in response to the wind even with the high-speed carpet-drying fan. The next attempt was to fasten the glider to a trolley placed on a model train track. A weight was attached to the train with a string. The weight rested on the scale place on the floor below the wind tunnel. The thought was that the drag produced by the glider would cause it to pull on the rope lifting the weight and therefore lifting some of the mass on the scale. The difference between the original mass of the weight and the mass of the glider pulling on the weight was supposed to be recorded as the amount of drag the glider produced. No fan found was strong enough to make this method work. After a lot of time spent, the final idea that actually worked was placing the scale horizontally on the track behind the trolley with the gauge facing the window. This method worked best and was decided to be the final one.

Results

In the end, the Oblique wing was the most aerodynamic.

Conclusions/Discussion

The purpose of this experiment was to find out if sweeping the wings on an airplane obliquely would reduce the plane#s drag more than just sweeping the wings back. The hypothesis was that the oblique swept wing glider would have less drag and therefore be more aerodynamic based on much preliminary research. In the end, the results did support the hypothesis. The oblique swept glider applied less pressure on the horizontal scale than the sweptback wing glider did. The data found in this experiment is extremely useful. The oblique swept back wing could make airplane designs much more aerodynamic than conventional wing designs. Oblique wings are also less expensive to build, lighter, require less maintenance, and would use less fuel than the variable swept back wing.

Summary Statement

Testing the aerodynamics of the oblique wing.

Help Received

Mother proof read; Jamshed advised on methods

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Matthew E. Ghilarducci

Project Number
J0110

Project Title
Just Wing It

Abstract

Objectives/Goals
To find out if the wing configuration of an airplane would affect the distance traveled. I predict an airplane with wings set in the neutral position will fly the farthest.

Methods/Materials
First, an airplane launcher was built using three pieces of wood, nails, thumb tacks, a rubber band, and masking tape. Second, a test plane was made to find a launch position on the launcher and this spot was marked. Third, a second plane was made out of construction paper and was stapled at the center of gravity so it would hold its shape. This plane was used for all further testing. Fourth, a ladder was set up outside and the launcher was placed on a step pointing in a slightly upward position. Fifth, the plane was placed on the launcher, pulled back against the rubber band to the marked position, and released. Sixth, the distance traveled was measured with a tape measure and logged. The following wing positions were tested 5 times each: neutral wing position, wings angled downward, wings angled upward, neutral wing position with tips folded up, and neutral wing position with tips folded down.

Results
Listed in order from longest to shortest distance traveled:
(1) Neutral wing position with tips up
(2) Neutral wing position
(3) Neutral wing position with tips down
(4) Wings angled upward
(5) Wings angled downward

Conclusions/Discussion
The wing configuration did affect the distance traveled by the airplane. My prediction that the airplane with the neutral wing position would fly the farthest was wrong. The airplane with the neutral wing position with the tips up went the farthest. I think it went farthest because of the lift and stability created by this wing configuration.

Summary Statement
How does the wing configuration affect the distance traveled by an airplane?

Help Received
Matt's dad helped construct the airplane launcher by hammering the nails. He also assisted with setting up the launcher on the ladder.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Katie P. Gruenhagen

Project Number

J0111

Project Title

Aerodynamics of Pickup Trucks

Abstract

Objectives/Goals

What changes, if any, to the shape of a pickup truck, will change the aerodynamics? I hypothesized that even a small change would affect the aerodynamics, therefore drag, of the pickup truck.

Methods/Materials

I used modeling clay, two toy pickup trucks, machined brass rods, a camera, and a lab at CSU, Fresno to conduct my experiment about the drag of differently modeled pickup trucks. At CSUF, I used their first wind tunnel (smoke tunnel) to visualize the wind flowing over the trucks. Then I calibrated their second wind tunnel (drag coefficient tunnel) and took readings from the manometer and the digital strain gage. My experiment started with readings from the digital microstrain gage and I continued for 5 trials at each RPM. I calculated the drag force and then the drag coefficient for each of the different pickup trucks and compared the drag coefficients among the trials.

Results

I found that the drag coefficients for the control at both 400 RPMS and 600 RPM were consistently the highest drag coefficients for all of the different trucks. In addition, the hood and bed cover and bed cover drag coefficients were not significantly different from each other at 400 RPM; the extended cab and the hood cover also were not significantly different at 600 RPM. Finally, the lowest drag coefficient at 400 RPM was the hood and bed cover and at 600 RPM, the lowest was the bed cover.

Conclusions/Discussion

I found that my hypothesis was supported. I hypothesized that any modification would change the drag. According to my results, the drag coefficients for the modified trucks were significantly different than the control at both 400 RPM and 600 RPM.

Summary Statement

Aerodynamics of Pickup Trucks

Help Received

Used lab equipment at CSUF under the supervision of Dr. Maria Sanchez and Dr. Walter Mizuno; Dr. Elaine Backus helped perform the statistical analysis; Derick Gangbin helped machine the plexiglas roadway; Dr. Ned Gruenhagen helped epoxy the model trucks.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Jack Hewitt; Connor Templeman

Project Number
J0112

Project Title
How Does the Shape of a Sail Affect the Speed of a Boat?

Abstract

Objectives/Goals
Our objective was to learn how the shape of a sail affected the speed of a boat. Our hypothesis was that all of the sails would go the same speed because we made sure that all of the sails had the exact surface area, 156 square centimeters.

Methods/Materials
Our materials were a rain gutter, one wooden boat, sail cloth, a triple beam balance scale, an enclosed room, a hair dryer and a meter stick. We tested our project by attaching a sail to the wooden boat. We then set it down in the rain gutter, which was filled with water. Next, we blew air at the boat with a hair dryer, which was set up at the end of the gutter. We then tested that sail four more times and recorded the speed of the boat as it traveled from one end of the gutter to another. We then switched out the old sail type with a new one and repeated the process.

Results
Our results were that the triangular sail (with the point up) went considerably faster than the other sails.

Conclusions/Discussion
Our research seems to indicate that our hypothesis was incorrect, as the triangular sail (with the point up) went much faster than the three other sail shapes. We believe that this happened because the triangular sail had more surface area at the bottom of the sail, causing it to have more dynamic lift. Dynamic lift is a term in sailing that means that the boat is being pushed up and out of the water. If this occurs, there is less of the boat touching the water, causing less drag, which, in turn, makes the boat go faster. This project helped widen our knowledge on the topic of sailing and could be useful to a sailor.

Summary Statement
In our project we were testing to see how the shape of a sail affects the speed of a boat.

Help Received
Father helped attach sails to boat and helped hold the hair dryer in place. Mother bought sail cloth.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Bobby M. Jones

Project Number

J0113

Project Title

Airplane Wings and the Amount of Lift They Produce

Abstract

Objectives/Goals

I set out to find the wing shape that will provide the most lift that will provide the most lift. My main goal was to find one specific design that outperformed the others when it came to producing lift.

Methods/Materials

First, I need to build a wind tunnel that I will be able to put my wing designs into and test the amount of lift they produce. I need a few pieces of wood, a leaf blower for a wind source, spray paint, and wood screws. Although I have one particular design in mind, I will be able to use different designs for the wind tunnel as I continue with research. I also need to make at least three different wing designs to test. I will make these wings from balsa wood. Last, I will need pennies so I can add weight to the wings. Next, I have to build the wind tunnel. I will gather the materials and then assemble them according to the directions I have found that help you build the wind tunnel. Then, I will build all three of the wing designs that I have chosen to make from balsa wood. Last, I will put each of the designs into the tunnel. Next, I will add a specific weight: both one and three pennies. Then, I will turn the fan on and increasingly turn up the speed at set intervals. When the wing lifts, I will record #takeoff speed.# I will then bring the speed down until the wing drops back down, and then I will record #cruise speed.#

Results

Even without any amount of weight there was a difference between the control wing and the other shaped wings. The shaped wings lifted at lower speeds and cruised at the lowest or second lowest setting. It became obvious that lift was being shown by the tests. However, it was only slightly harder to measure the difference between the shaped experimental wings. For some of them, the difference came down to just a few notches of speed. In the end, my hypothesis was proven to be true and the wing with a slightly curved upper camber and flat lower camber presented the most lift out of any of the wing designs.

Conclusions/Discussion

The best wing shape i created was my second experimental one. This wing would be the most effective wing to use if one is building a cargo plane. It will allow the plane to carry weight without having to use as much fuel. Other planes that are looking to save fuel might also use this wing.

Summary Statement

My project is about finding the wing design that will provide the greatest amount of lift.

Help Received

My dad helped build the wind tunnel because I had a broken arm.

Name(s)

Keshav Kumar; Jonathan Lam

Project Number

J0114

Project Title

Hydraulic Ram Pump

Abstract

Objectives/Goals

Our project was to build a fully automated water pump using no electricity. The water pump mainly ran on water force and pressure. We also tested the efficiency of the pump on three different modes that could be adjusted with the spring tension settings on the main pump itself. We believed that the medium setting on the spring tension would be the most efficient for our situation.

Methods/Materials

A three feet, 1" PVC pipe going downhill and a six feet, 3/4" PVC pipe going uphill was assembled to simulate a downhill/uphill relationship. The main valve consisted of a 1" PVC male pipe plug and adapter as the main components. There was a metal rod that connected all the parts to the pipe plug and adapter. Those parts included the two extension springs, a metal clamp to connect the springs, paper clips, and two pieces of plastic that would act as a piston and support for the springs. We tested the pump by running water into a milk carton (acting as a reservoir of water) that eventually ran downhill and reached the main pump. From that point, the water was pumped uphill. We conducted tests with the three modes set on the spring tension.

Results

The results are Mode 2 (medium speed, medium power) ran 53.2% more efficient and reliable than Mode 1 (low speed, high power). Mode 2 also ran 21% faster than Mode 1 making it the superior mode to choose for our situation (three feet downhill, five feet uphill). Mode 3 (high speed, low power) was not able to reach five feet so Mode 2 was 100% more efficient than Mode 3. Mode 1 ran at 1.893 milliliters per second while Mode 2 ran at 2.395 milliliters per second. Overall Mode 2 ran 53.2% more efficient and 21% faster than Mode 1. Mode 3 was unable to be tested. Other situations may change the efficiency of the modes.

Conclusions/Discussion

The answer shows how great the water pump works at full efficiency. If this project can go into a much larger scale, the world can change one at a time by conserving energy and helping people in need of water. We learned that different modes suit different needs and situations. Other nations without power can find this pump useful and efficient for their needs.

Summary Statement

The project is to build a fully-automated water pump that used hydraulics and physics to pump water rushing downhill to an elevated level uphill.

Help Received

Father helped assemble the main valve together and assemble the pipes together.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Quinten R. Lu

Project Number

J0115

Project Title

Boomerang's Best Bends

Abstract

Objectives/Goals

The purpose of this project was to find the combination of bend location and bend degree for the wings of a cross boomerang that produced a flight as close to parallel to the ground as possible.

Methods/Materials

Nine ponderosa pine cross boomerangs were constructed with equal mass, dimensions, and wing tip twists; however, the cross boomerangs had varying bend locations and degrees of bend. The bends were placed 1/3 or 1/4 of the distance in from the wing tip and were set to 0, 2.5, 5, 7.5, and 10 degrees. Each boomerang was given ten flights, which were timed, and rated on flight quality.

Results

The boomerang with the bend location 1/4 of the way in and a 2.5 degree bend had the shortest and most parallel to the ground flight. The boomerang with the bend location 1/3 of the way in and a 10 degree bend had the longest flight time and the furthest from parallel flight. The boomerang with the 0 degree bend consistently hit the ground before completing its flight.

Conclusions/Discussion

The boomerang that was closest to the objective of this project was the 1/4 of the way in, 2.5 degree bend. In boomerang competitions there are categories such as shortest flight time, longest flight time, and highest flight. The results from this project can help guide boomerang makers as they create boomerangs designed for the different competitive categories.

Summary Statement

I studied the effect of bend location and bend angle on boomerang flight.

Help Received

My parents helped in general ways (proof reading, assisted with testing boomerangs and board layout).

Name(s)

Luca V. Mendoza

Project Number

J0116

Project Title

Which Wing Will Create the Most Lift?

Abstract

Objectives/Goals

The purpose of my experiment was to demonstrate the effects of wing shape on lift.

Methods/Materials

To do so, I designed three different wing shapes with the same area and a wind tunnel. Wing A, when viewed from above, was a triangle, with a height and base of 50cm. Wing B was a rectangle, with a 50cm span and a 25cm chord. Wing C had a 1m span and a 12.50cm chord. The wings were constructed with K#nex frames, crucial in getting the common airfoil shape, and plastic-wrapped. The amount of lift generated was measured by timing how long it took for each wing to travel six inches up the diagonal rods of the wind tunnel.

Results

In the end, Wing A lifted the fastest. It not only lifted six inches in 2 seconds, it immediately traveled all the way to the top which was another 25 inches. Wing B lifted six inches in 3.33 seconds, and Wing C took 7.5 seconds. Although Wing B flew up the rod more quickly than Wing C, Wing C went up farther and steadier.

Conclusions/Discussion

The results did not match my hypothesis, which predicted Wing C would generate the most lift because it created the least induced drag. Perhaps the reason Wing C was slow was the fan only blew at its center and didn#t utilize the full area. However, Wings A and B had more area in the center, Wing A more so than B, providing more lift. In the future, I would be interested in making the wings of balsa because it would render similar weights, and eventually make all the wings lighter so I could measure the amount of lift by adding weights to the wings to see how much they could hold and still fly. Moreover, I would try to find rods that don't bend. Lastly, I would like to have more fans so the wind would be evenly distributed.

Summary Statement

To demonstrate the effects of wing shape on lift, three wings of the same area but different design were tested in a wind tunnel.

Help Received

My mother drilled holes in the wind tunnel frame.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Madison P. Meredith

Project Number

J0117

Project Title

Swim Faster! Salt and Chlorine Pools and the Effect on a Competitive Swimmer's Time

Abstract

Objectives/Goals

In competitive swimming,a second can make the difference. However, there is little research regarding swim speeds between salt and chlorine water pools. This study investigated if the type of water in a pool; salt or chlorine effected a competitive swimmer's time. The question was: Which is better for a competitive swimmer's winning time,a salt-water or chlorine pool?

Methods/Materials

The materials were the pulley machine, timed trials, water samples and research. The machine pulled the swimmer across a fixed pool distance of 10.97 meters. The trial times recorded by stopwatch using two observers. One-liter water samples from the salt and chlorine pools were weighed at a city lab. The density was obtained using the formula: density[d] equals mass[m] per unit volume[v](d=m/v). The research focused on the winning times in the men's 100-meter freestyle event in past Olympics; and the use of salt or chlorine water pools in the Olympics. The materials used were a: salt-pool, chlorine pool, stopwatch, competition swimsuit, goggles, swimcap, snorkel, weights, pulley machine, tape measure and swim buoy.

Results

The hypothesis indicated that a salt-water pool would benefit a competitive swimmer's time because the salt treated water becomes more buoyant. The average swimmer's winning time in a salt-water pool is 11.05 seconds; in a chlorine water is 11.06 seconds. The salt-water sample density is 0.99607 grams/milliliter (g/ml). The chlorine water sample density is 0.992720 g/ml. The salt water sample has a +0.00335 g/ml density that is higher than the density of the chlorine water.

Conclusions/Discussion

It was hypothesized that the swimmer's winning time would benefit from a salt-water pool because of added buoyancy from the salt. The chlorine water indicated a density of 0.992720 g/ml while the salt water indicated a density of 0.99607 g/ml. The trials for the salt-water pool averaged 11.05 seconds; for the chlorine water pool averaged 11.06 seconds or a difference of 0.01 seconds in favor of the salt water pool. The time trial difference could be an issue of pool shape and size, method of timing or the water temperature. With several variables and variation in trials and density of the water samples, it would not allow a solid conclusion. However, there is enough data for a future re-examination of this question.

Summary Statement

My project is about finding if the chemical treatment done to pools makes a difference on a competitive swimmers time.

Help Received

Mother bought supplies; Grandma and Grandpa helped edit research paper; Science teacher helped get supplies for machine.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Alexandra S. Pano

Project Number

J0118

Project Title

The Effect of Geometry and Surface Roughness on Aerodynamic Resistance

Abstract

Objectives/Goals

The objective of this experiment was to investigate the sensitivities of different geometries and surface textures to the amount of aerodynamic drag produced. It was hypothesized that subtle changes in the geometry and surface roughness would have significant effects on the amount of aerodynamic drag.

Methods/Materials

A wind tunnel was built to make drag measurements in four areas: three-dimensional solids, surface roughness, length effects, and two-dimensional plates (edge effects). A leaf blower was used to generate the air flow in the wind tunnel. The drag forces were evaluated by the amount of deflection produced by the air flow resistance pushing against a very soft spring. For each test condition, the test piece was placed in the wind tunnel section and the deflection measurements (drag) was repeated three times. The displacements were measured and recorded in a data table and evaluated.

Results

A total of 15 different test specimens were evaluated. In three-dimensional solid experiments, drag variations differed by almost two orders of magnitude. In the length effect experiments, the amount of drag increase changed significantly less once the cylinder reached a certain length. In the edge effect experiments, it was found that rounding the square edges produced drag forces that were reduced by a factor of 2.5. In the surface roughness evaluation, drag forces were found to increase significantly for irregular surfaces (sponge, bubble-wrap) as compared to relatively smooth Styrofoam surfaces, used as the base line material.

Conclusions/Discussion

From these experiments, it was concluded that minor changes in edge shape, geometry, surface conditions, and length all had significant effects on the amount of aerodynamic drag. This highlights the importance of detail aerodynamic design in many products used today to reduce drag such as airplanes, cars, and bicycle helmets.

Summary Statement

Subtle changes in geometry, surface roughness, and edge shape had significant effect on the amount of aerodynamic drag produced.

Help Received

Father helped cut out wood pieces used to build my wind tunnel apparatus.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

William C. Parks

Project Number

J0119

Project Title

Lift and Drag: A Combination for Flight

Abstract

Objectives/Goals

The purpose of this project was to determine which of the two most popular overseas flight planes was the most aerodynamic. Two planes were purchased online from an online model company. It was made sure that they were both the same scale before buying, and they both were the exact ones felt would be big enough to test and observe. Then, many different arrangements and formulas for testing the airplanes were created and it was realized that there was no way to test the full aerodynamics of the plane, so it was found the next best thing would be to test the lift to drag ratio. With this and the apparatus that was designed and finally chosen, it could be tested very quickly, so it was decided to do more tests than before.

Methods/Materials

The plane was put in front of the fan on the apparatus on top of a postal scale, and then tested at particular speeds. When it started, there were a few problems, but then it started to get the testing right. Finally it was figured out one way to test that does not affect the outcome. The plane was made to stay level by adding minimal weight to the back wings of the plane, so the tip would stay even in the wind. When it was done the weight made it so the plane would stay even and the apparatus could still test the drag correctly.

Results

. The Airbus A-380 had a higher lift to drag ratio on levels 1 and 2 of the air fan, but on level 3, surprisingly, the Boeing 747 won. But I had to dismiss this as useful but not so useful evidence. That speed, at life-size, is 1440 mph. No commercial plane can go that fast.

Conclusions/Discussion

The average cruise speed is around 640 mph. The cruising speed of an Airbus A-380 is 590 mph. That does just prove something though. The Airbus needs less wind speed to lift off, so it must have more lift and less drag (or a higher lift to drag ratio) to be able to cruise at that speed. In this project I learned that testing aerodynamics is much harder than it seems without a wind tunnel. One error that could have occurred was that I built the planes myself. It was hard to build these planes, and they were not by any means perfect. To anyone who is going to try this project, try to find easy planes to build.

Summary Statement

Testing the lift to drag ratios of two different planes.

Help Received

Mentor helped with build apparatus

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Michael B. Patacsil

Project Number

J0120

Project Title

Wingtip Drag Reduction: Spiroid vs. Up-turned Winglets

Abstract

Objectives/Goals

I wanted to test if a wrap-around spiroid winglet design is significantly better at reducing drag by weakening wingtip vortices than traditional upturned winglets.

Methods/Materials

I constructed a homemade open-circuit wind tunnel to test my hypothesis. It was made from wood with clear polycarbonate in the front to show testing. I had an entrance cone made from a veterinary cone used for pets and a diffuser made from foam board. The powerplant of this wind tunnel is a leaf blower. I shaped a wing from a block of balsa wood for the wingtips to slide onto. For my project, I used 3 wingtips, one straight, one upturned, and one spiroid. Each wingtip is made of paper mache, has a mass of 5 grams and is 10 centimeters long. Each wingtip would be tested for drag 30 times each. Strings were attached to hanger wire and a wooden dowel protruding from the wind tunnel. The hanger wire would yaw with the wing on one side and the string on the other. I would then add weight to the center of the string until the hangar wire and wooden dowel are 4 centimeters apart. I would repeat with the next three wingtips.

Results

Test results showed that the spiroid winglets had less drag compared to the straight wingtip and the up-turned winglet. There was an 8%- 12% reduction compared to the upturned winglet and a 15%-20% compared to the control (straight) with a standard deviation of 5%.

Conclusions/Discussion

Based on the results of my testing, I concluded that spiroid winglets show promise in the future by improving aircraft performance and efficiency. Additional experimentation will test for its performance capabilities in order for this concept to become practical and to discover supplementary benefits such as improved lift, reduced noise, and superior stall characteristics.

Summary Statement

My experiment tested the effectiveness and capabilities of wrap-around spiroid winglets in reducing wingtip drag by weakening and eliminating wingtip vorticies as opposed to conventional up-turned winglets.

Help Received

Father bought materials and took photos; Mother helped with display and report; Uncles assisted in the construction of the wind tunnel; Grandfather provided crucial information on the science behind winglets and wind tunnels, as well as plenty of inspiration.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Jeremy A. Rafner

Project Number

J0121

Project Title

Winglets in Wind Tunnels: How Do Winglets Affect Lift and Drag of Aircraft Wings?

Abstract

Objectives/Goals

My science project was to build a wind tunnel in order to create an experiment that tested the efficiency of different winglet designs. Winglets are the physical extension on the end of airplane wings that protrude and stand vertically. I intended to test three different winglet configurations (no winglet, 90 degree winglet, and angled winglet), and measure lift and drag attributes of the different designs.

Methods/Materials

I built a subsonic, open-circuit, closed test chamber wind tunnel from plywood, polycarbonate lexan, an attic fan, and other materials. The wind tunnel was approximately 8 feet from end-to-end, and consisted of a contraction chamber, a test chamber, and a diffusion chamber. I carved test wings and winglets out of balsa. The test rig consisted of brass rods attached on one end to a wing in the test chamber, and on the other end to two multi-force sensors measuring lift and drag. The sensors were linked to a computer running data collection software. For each of three winglet configurations I ran multiple tests and averaged the results. Each test collected data for 10 seconds. I compared and graphed the data results.

Results

The data convincingly showed that winglets increase lift, but angled winglets as opposed to vertical winglets contributed the most lift and actually reduced drag compared to a wing without winglets. The average ratio of lift to drag in the no winglet configuration I measured at 0.85, compared to 1.20 for a 90 degree winglet, and 1.74 for the angled winglet (with the higher value reflecting greater wing efficiency).

Conclusions/Discussion

The evidence from my science project showed that aircraft wings can be made more efficient with the use of winglets, and that angled winglets produced the most beneficial increase in lift with reduced drag. This suggests that through wing designs incorporating angled winglets, aircraft could be more fuel efficient, both lowering costs and reducing environmental impact.

Summary Statement

I built a wind tunnel to test the efficiency of different winglet designs.

Help Received

My father assisted me with some of the wind tunnel construction.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Sankaran Ramanarayanan

Project Number

J0122

Project Title

Shaping Stabilizers for Emergency Landings

Abstract

Objectives/Goals

The objective of this project is to determine which shape of horizontal stabilizers provides a safe, twenty-degree-angled touchdown for an air-plane. I tested seven shapes of horizontal stabilizers using a Balsa-wood Glider and a catapult. I predicted that the "Trapezoid-Backwards" stabilizers would result in the safest angle, for the increase of wind contact from back to front would lift the front of the glider. This experiment would translate in the real world to safer emergency landings.

Methods/Materials

Seven pair-stabilizers were shaped out of Balsa wood. They had equal surface area and mass. The stabilizers were inserted in a slit in the back of the Balsa-wood Glider. The glider was launched using a regular rubber-band catapult. A high-speed camera parallel to the landing site captured the angle of touchdown. There were twenty-five trials performed with each type of horizontal stabilizer in a garage with no wind interference.

Results

The "Trapezoid-Backward" stabilizer constantly reached a touchdown angle of fifteen to twenty-five degrees, while the rectangular, trapezoid-forward, semi-circle, and oval had results nearing the thirty to hundred-degree range. The "Triangular Backwards" stabilizer with similar shape to the winner came close with an average angle of more than thirty, but not close enough.

Conclusions/Discussion

Horizontal Stabilizers have a great impact on angle of touchdown for a jet. Preparing Horizontal Stabilizers with increasing surface area from back to front will help reduce landing-crashes in the world of commercial flights and mass transportation.

Summary Statement

The purpose of this project is to determine which type of Horizontal Stabilizer causes an air-plane to land with a safe angle.

Help Received

Mr.Talsky, my teacher, helped with background research; Father helped with lighting in the garage.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Joana P. Ramirez

Project Number
J0123

Project Title
The Effect of Shape on Parachute Speed

Abstract

Objectives/Goals
The objective was to determine the effect of parachute shape on its descending speed.

Methods/Materials
First, I gathered my materials and found a good spot to drop my parachutes. My materials consisted of plastic grocery bags, ruler, measuring tape, clay, stop watch, and a ladder. Then, I made a parachute with a rounded shape and five more with different shapes. Then, I attached a mass of 10g to each one. After that, I dropped one parachute at a time from a height of ten feet, and I recorded the time it took to land on the ground. I repeated this 100 times for each parachute having the same area and mass.

Results
My results showed that the shape of the parachute did not, in fact, affect the descending speed. My hypothesis was not supported by the data, because the results have shown that the different shaped parachutes did not differ significantly in descending times.

Conclusions/Discussion
My hypothesis was not supported by the data, because the results have shown that the different shaped parachutes did not differ significantly in descending times. My results are useful in everyday life, because people can realize that the shape of the parachute will not affect its descending speed. Thus, it does not matter what parachutes shapes are used in emergencies, military use, or skydiving, the descending speed is relatively the same.

Summary Statement
My project is about the effect of parachute shape on its descending speed.

Help Received
Father helped with timing the descending of the parachute, and my mother helped with making the parachutes.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Reagan A. Risk

Project Number

J0124

Project Title

What a Lift: Force and Fluid Dynamics

Abstract

Objectives/Goals

By simulating greater depth of water, can I create more force to lift greater weight at greater acceleration, as predicted by Newtons 2nd and 3rd laws?

Methods/Materials

Construct a device to simulate greater water depth by suspending a water source (5 gallon bucket which was constantly refilled) attached by flexible 3/8 inch tubing to an elevator (sliding inner sleeve box) which was supported by a 5-gallon water bladder. Test the lift capacity at water source heights of 12 inches, 24 inches, 36 inches, 48 inches, and 60 inches. Each height is tested at four weights: empty elevator (29 pounds), 20 small concrete blocks (74 pounds), 2 cinder blocks (103 pounds), and 4 cinder blocks (177 pounds). Test acceleration and total time it takes to lift these weights to maximum height. Repeat each test three times.

Results

I took a total of 594 timed measurements. Because of the original design flaws in the elevator system, I redesigned and built my elevator mechanism and reran my tests. As I increased the water source height from 12 inches to 36 inches, the acceleration and maximum lift increased. At 48 inches and 60 inches my data had more variations.

Conclusions/Discussion

As the water source was lifted to 36 inches, simulating greater depth, more weight was lifted at greater acceleration. At water source heights above 36 inches some of the increased pressure caused by the increased height was offset by the small diameter of the tubing. However, when this was factored out, my hypothesis was proved correct.

Summary Statement

As I changed the depth of water, the increased pressure created reflects in the increased acceleration of the mass being lifted.

Help Received

Mom helped me with the graphs; explanation of water lateral flow based on diameter obtained from Coachella Valley Water District Engineers Dan Charlton, Mike Shaefer, and Kevin Hemp.

Name(s)

John C. Ryan

Project Number

J0125

Project Title

The Science of Blood Splatter Analysis

Abstract

Objectives/Goals

The purpose of this experiment is to learn whether and how the texture or the angle of a blood splattered surface might affect the interpretation of the evidence found at a crime scene by a crime scene investigator.

Methods/Materials

A syringe was suspended at a fixed position 35 cm directly above the target splatter surface. 1.5 milliliters of simulated blood was ejected from the syringe with each test. The simulated blood was mixed in one batch, covered to minimize evaporation, and testing was done in a single working period to minimize change of viscosity of the blood. A 3.5 kg block was dropped 35 cm on a pulley to strike the syringe plunger with each test in order to maintain consistent speed and pressure on the plunger. The resulting splatter patterns were righted and held flat for drying immediately after the splatter impact to maintain a natural splatter pattern without the effect of gravity (dripping). The smooth surface was tested at 45, 90 (flat to the syringe tip), and 120 degree angles to the tip of the syringe with the middle of the impact zone (also the pivot point of the surface) 35 cm from the tip of the syringe. A cinder block was used for the rough and absorbent surface texture and was only tested flat (at a 90 degree angel to the syringe tip).

Results

My results were that an oblique angle did affect the length of the splatter. On cinder block the divots and absorption of the rough surface decreased the spread of the splatter.

Conclusions/Discussion

The information gathered from this experiment shows that specific conditions at a crime scene can affect the evidence. By documenting these effects we should be able to improve the interpretation of the evidence by investigators and help solve mysteries and crimes.

Summary Statement

Testing and observing different angles of blood splatter onto a surface to determine the effect on the resulting pattern.

Help Received

Father was expert mentor. Mother assisted with visual layout.

Name(s)

Miranda R. Rylee

Project Number

J0126

Project Title

Does the Number of Fins on a Rocket Affect Its Altitude?

Abstract

Objectives/Goals

My project is to determine if the number of fins on a rocket affect its altitude. I believe a rocket with three fins will gain the most altitude.

Methods/Materials

Six rockets were built with identical size and weight. Each rocket had a different number of fins, zero, one, two, three, four and six fins. Each rocket was launched ten times with the same size engines. The zero and one finned rockets were not launched because it was thought to be too dangerous.

Results

The rocket with three fins acheived the highest altitude of the four rockets that were launched.

Conclusions/Discussion

My conclusion is that the number of fins on a rocket plays an important role and rockets with three fins reach the highest altitude.

Summary Statement

My project was about the stability of fins on a model rocket and the drag caused by those fins.

Help Received

My father helped with the construction and launches of the rockets. My mother helped with the board.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

David A. Stanton

Project Number

J0127

Project Title

Boomerangs: Return to Sender

Abstract

Objectives/Goals

The objective is to find out which angle of boomerang will return closest to the starting point.

Methods/Materials

A basic two-arm boomerang shape with eight inch arms was selected. Eight shapes were then cut from ¼ inch plywood varying the angle between the arms from 60 degrees to 125 degrees. An airfoil was selected and boomerangs were sanded to shape. An open field free of turbulence-producing structures was selected as the test area. The direction of the wind was determined. Each boomerang was thrown five times on two separate days and the landings were charted for distance and angle from throwing site.

Results

The boomerang with the 107.5 degree angle came closest to the starting point on average.

Conclusions/Discussion

The boomerang with the 107.5 degree angle returned the closest to me. I am a beginner at throwing a boomerang. The boomerang angle that is supposed to work best for beginners did, in fact, work best for me. Other factors that affected the boomerang performance were the wind and the release technique. Boomerang throwing, just like any other sport, works best when the individual has the equipment appropriate for his or her skill level.

Summary Statement

What angle boomerang will return closest to the thrower?

Help Received

Dad helped with sawing the boomerangs. Mom printed pictures.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Christopher D. Toubia

Project Number

J0128

Project Title

The Study of the Effect of Wing Shapes on Their Drag and Lift Coefficients

Abstract

Objectives/Goals

Through the testing of different cross-sectional airfoil shapes, an ideal wing shape can be found that can be used to optimize the aerodynamic advantage of airplanes today, the new technology being designed to produce more lift while reducing drag.

Methods/Materials

Wind Tunnel: 20x20, 3100 CFM [cubic feet per minute] floor fan with reverse blow; 8x8x16 in. rectangular plastic enclosure; 2 # 16 in. long plastic funnel shape with 8x8 in. squared small end; 1/8 in. thick polycarbonate plastic material; 5 boxes of straws.

Styrofoam, Aluminum Foil, 48 in. long, ¼ in. diameter plastic rod, Any 40 g base, rounded, Spring Scale - increments of 1 oz., Weight measure, Smoke machine, Silicon Adhesive, Scissors, String, Sand Paper.

Results

Drag (N) Lift (N)
Teardrop 0.0588 0.147
Rectangle 0.1078 0.0882
Oval 0.0343 0.1176
Triangle 0.0686 0.0196
Curved Diamond 0.0294 0.0588

Coefficient of Lift
Teardrop 0.0002
Rectangle 0.00009614
Oval 0.00016
Triangle 0.0000267
Curved Diamond 0.00008

Coefficient of Drag
Teardrop 0.004699
Rectangle 0.003204
Oval 0.001869
Triangle 0.00299
Curved Diamond 0.0016

Summary Statement

The study of the effect of the shapes of airfoils on their drag and lift and drag and lift coefficients.

Help Received

Father helped build and perform experiment.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Zack S. Venable

Project Number

J0129

Project Title

Blades of Glory

Abstract

Objectives/Goals

The object of my project is to see which size blades of a wind turbine will produce the most electricity. I had three different blade sizes and tested each set of three.

Methods/Materials

The main materials for my project are balsa wood, DC Volt Meter, Thames and Kosmos Wind Power 2.0 Kit, house fan, and a dremel tool. I constructed the wind turbine which came in the kit. Then I carved my blades, using a dremel tool, out of balsa wood. I had a total of nine blades, three different sizes. I attached the blades to the wind turbine using straws, K'nex pieces, and hot glues. The wind source was a fan which was blown to the wind turbine. The voltage the turbine produced was read on a DC Volt Meter.

Results

In each test, the highest amount of voltage was recorded. There were three test for every trial, three trials in all, and then the three highs for each test were averaged for a trial average. For trial one the small size blades produced the largest average of 0.573 volts. The medium size blades were next at 0.553 volts and the large size blades were at 0.57 volts. For trial two, the small size blades produced an average of 0.633 volts, the medium size blades produced 0.573 volts, and the large size blades produced a low 0.486 volts. Although in Trial Three, the medium size blades produced the largest amount of volts at 0.586 volts. Next, the small size blades produced 0.577 volts and the large size blades produced 0.456 volts. So overall, the small size blades produce the highest average voltage. They were the most efficient.

Conclusions/Discussion

The hypothesis was not supported because in two out of the three trials, the small size blades produced the highest average electricity. It was hypothesized that the medium size blades would produce the most electricity, but they only did in one of the trials, the third. This shows that the blade weight is a bigger factor than blade surface area in producing electricity with wind turbines. It was initially predicted that more electricity would be produced when blade weight and blade surface area were at a balance, as with the, as with the medium size blades.

Summary Statement

Three different size blades on a wind turbine were tested and their results were analyzed.

Help Received

Borrowed fan and dremel tool, mother revised lab report.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Tyler J. Walker

Project Number

J0130

Project Title

Catching Air: Parachutes in Flight

Abstract

Objectives/Goals

The objective of my project was to try and find out which material, between plastic, newspaper and silk, resisted gravity the most therefore making the best parachute.

Methods/Materials

I constructed a release pole using aluminum and PVC pipe and a 45 degree elbow. After designing five different release mechanisms and testing them, I chose the one that worked best and attached it to rope at the top of the pole. I made three 2X2 foot parachutes, one each from plastic, newspaper and silk. The parachutes were attached to a three ounce weight and raised to the top of the pole to be released. I performed five test flights for each different material and also five test flights for my control. The control was the weight without a parachute. The parachutes were launched from a height of 44 feet.

Results

My results show that the plastic material had the greater flight times and made the better parachute. The average flight time for the plastic was 3.938 seconds. It had the longest time in all five test flights. Next was newspaper at 3.582 seconds and the silk had an average of 3.486 seconds.

Conclusions/Discussion

In my hypothesis, I thought the silk would make the best parachute. However, I found that the plastic resisted the force of gravity the most and made the best parachute. In all 5 tests it had the longest flight. Some of the test flights were very close in length. Because of this, I decided to average the numbers so I had one number to look at. Having one number also made it easier to compare it to the test flights of the control.

Summary Statement

My project was to determine if plastic, newspaper or silk, would resist gravity the most and make the best parachute.

Help Received

My mom helped me with some of my typing and with some of my display board. My grandpa let me use his power tools and my grandma took me shopping for supplies to build my mechanisms.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

David C. Weaver

Project Number

J0131

Project Title

Winds of Change: A Wind Turbine's Ability to Power a Car's Electrical Components and Reduce Its Carbon Footprint

Abstract

Objectives/Goals

The objective is to determine whether a turbine mounted on automobile can generate enough electricity to power the cars electrical components and if it can have any affect reducing its carbon footprint.

Methods/Materials

A small sized wind turbine with 35.6 cm plastic blade will need to be purchased as well as an electric meter capable of reading 250 DC volts and 10 amps. Also a car will be needed for testing as well as Noble Wire and Terminal Female blue wire connecters. To test, drive out to a rather empty road and once you have approached the test speed, hold the turbine outside the window while connected to the electric meter. Once you have a stable reading, turn the turbine out of the wind and pull it back inside. Record the data and continue testing.

Results

It was found the at twenty miles an hour, the turbine could not power any electrical components in the car. At thirty miles an hour, the turbine could power the radio, CD player, dashboard display, a single headlight, or a single taillight, all separately. At forty miles an hour, the turbine could power the radio, CD player, dashboard display, both headlights, both taillights, or a portable air conditioner all, once again, separately. At fifty miles an hour, it could power the radio, CD player, dashboard display, both headlights, both taillights, or a portable air conditioner, all separately.

Also it was calculated that if every car in the United States had two turbines attached to it, we as a country could save 6,896,500,000 gallons of gasoline a year which is the equivalent of removing 17,241,250 cars from the road each year.

Conclusions/Discussion

In conclusion, the turbine was capable of powering many electrical components separately at the speeds or forty and fifty miles an hour as opposed to only being able to power some of the items at thirty miles an hour and none of the items at twenty miles an hour. Also, if every car in the United States had two turbines attached to it, America could save 6,896,500,000 gallons of gasoline each year which is the equivalent of removing 17,241,250 cars from the road each year.

Summary Statement

My projects purpose was to capture the excess energy produced by an automobile and see if it was possible to harness and reroute that energy back to the vehicle in order to power its electrical components.

Help Received

My mother drove the car and helped with calculations and my father helped me figure out how the turbine worked.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Matthew Wong

Project Number

J0132

Project Title

Perfect Pitch

Abstract

Objectives/Goals

The objective of my project was to investigate what type of rear horizontal stabilizer would increase the pitch sensitivity of a small, general aviation airplane. I hypothesized that a straight rectangular stabilator would increase the pitch sensitivity of an airplane the most.

Methods/Materials

Four unique horizontal stabilizers were designed and constructed, and each mounted to four identical airplane models that I also built. Each stabilizer was a different shape and type: a straight stabilator, a swept-back stabilator, a straight stabilizer with elevators, and a swept-back stabilizer with elevators. My designs allowed the elevators and stabilators to tilt for each testing procedure. Materials used were balsa wood and paper clips. To test and measure for pitch sensitivity, I developed a testing method to simulate the airplane's ability to pitch-up and pitch-down. For a controlled testing environment, I designed and constructed a wind tunnel using plexiglass. I updated and improved one of my previous wind tunnel designs to suit this project's testing procedures. These unique designs and original testing methods enabled me to gather measurable data. All data was recorded, graphed, and analyzed; conclusions were drawn.

Results

The airplane with the straight stabilator had the most pitch variation for both pitch-up and pitch-down tests. The airplane with the stabilizer with elevators and the airplane with the swept-back stabilator both had less pitch variation than the plane with a straight stabilator. The airplane with the least amount of pitch variation was the plane with a swept-back stabilizer with elevators. For this project, a greater amount of pitch variation indicated increased pitch sensitivity.

Conclusions/Discussion

I concluded that the straight rectangular stabilator was the most pitch sensitive, thus supporting my hypothesis. A factor that could have affected the outcome of my experiments was the difference in surface areas between the straight rectangular designs and the swept-back designs. The straight stabilizers had more surface area, and could have increased pitch variation. The knowledge and experience I gained from this project have allowed me to add to research from previous aeronautic projects and, more importantly, add to my understanding of airplane design and construction for future projects.

Summary Statement

My project was to determine what type of rear horizontal stabilizer increases the pitch sensitivity of a small, general aviation airplane.

Help Received

My parents assisted in driving me to purchase the materials. They also helped me with cutting some materials.