CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Jacob C. Baker

Project Number

J0101

Project Title

Wave Watchers

Abstract

Objectives/Goals

How does increasing the water height of a wave tank affect the speed and height of the wave?

Methods/Materials

Build the wave tank out of Lexan glass, Acrylic Cement, a pulley system with string, a plate made out of Lexan glass, steel, screws to screw in with a screwdriver and tape a ruler onto the side of the tank and set up a high-speed camera in front of it. Set constants for the size of the plate, weight on one end of the pulley, the distance of the drop of the weight, (how high the plate goes) and the angle of the pulley. Add one inch of water into the tank with the plate above water. Drop the weight on the other end of the pulley so that the water comes up and creates a wave. Record the wave with a video camera and then repeat the process nine times. Record waves 10 times, this time with the wave heights two and three inches. Review videos and measure the waves from the water at rest to the crest (top) of the wave. Record how long it takes the wave to travel eight inches to record wave speed.

Results

Some trends in my data are that as an average the water depth of 5.2 had the lowest wave height, the average water depth of 10.2 cm had the second highest wave height. Finally, the highest wave height had the average water depth of 7.8. The data increases on a curve and then starts to go down after peaking in height. The 7.8 cm water depth also seemed to have the most variance in its maximum wave height data. The trends in the speed data seem to be almost the opposite of the water height data. The higher the wave, the slower the wave travels. The 5.2 wave depth had the highest wave speed, the 10.2 wave depth had the second highest wave speed, and the 7.8 water depth had the lowest wave speed. The wave speed decreases on a curve and the wave starts to travel faster after reaching the slowest speed. The water depth of 7.8 cm also seemed to have the most variance in data.

Conclusions/Discussion

When the water height was at 5.08 centimeters the wave height averaged about 2.159 centimeters, when it was at 7.62 centimeters it averaged about 3.62 centimeters, and when it was at 10.16 centimeters it averaged about 3.143 centimeters. It makes sense that the wave that was the biggest was also the slowest because it came up in my research that the bigger the wave, the slower it is.

Summary Statement

I tested how a wave speed and height differs between water depths with bigger waves being the slowest.

Help Received

Mr. Le from ADCO helped me build the wave tank. Dr. Eric Person helped mentor me.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Travis Campbell; Evan Green

Project Number

J0102

Project Title

Just Winging It

Abstract

Objectives/Goals

Our goal for this project was to determine if we could modify the top surface of a foam wing with uneven patterns such as dimples or ridges, and increase its performance at at measurable level.

Methods/Materials

For this project, we used 3" thick insulation foam, one sheet of Plexiglas cut in half lengthwise, and a high RPM fan to construct a wind tunnel. One-inch thick insulation foam was used to construct the wing prototypes. We designed and tested three wing types: dimpled, ridged and control; using a 1/2"drill bit to create the dimples and 40 grit sandpaper for the ridges. A postal scale was used to ensure equal weight of 0.45 oz for each wing. A potentiometer was needed to adjust the speed of the fan, and an Infrared RPM meter to measure the speed. We flew each wing at the lowest possible RPMs to stay aloft, and recorded the RPMs at the stall mark, determined to be 2"(5.08cm) from the floor of the wind tunnel. We ran 20 trials for each wing according to this protocol.

Results

The data from the test flights showed that the control wing averaged 1,032 RPMs to maintain pre-stall. The dimpled wing was the most efficient with an average 873 RPMs to pre-stall, a 15.4% decrease in RPMs compared to the control wing. The ridged wing averaged 1,123 RPMs to maintain pre-stall, an 8.8% increase in RPMs over the control wing.

Conclusions/Discussion

The results partially supported our hypothesis that by modifying the surface of a wing with an uneven dimpled pattern will increase aerodynamic efficiency, due to the fact that the ridged wing showed a decrease in efficiency from the control wing. The significance of this project in terms of real world applications includes design of a wing prototype using dimpling, that results in a lower stall speed, thereby enabling safer and lower speed take-offs and landings. This in turn may lead to decreased fuel cost and shorter runways needed for any aircraft in general. Other variables that could be refined/added to future testing are: additional uneven wing surface designs, conducting flight tests at different times of day, monitoring barometric pressure and temperature, a lower friction rail system, and a higher RPM fan.

Summary Statement

This project is about determining whether dimpling or ridges present on a wing's surface can decrease its stall speed.

Help Received

Cousin loaned tools and oversaw construction of wind tunnel; Father's co-worker assisted with modifying the fan; Mother assisted with double height display board.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Ian A. Canby

Project Number
J0103

Project Title
Unexpected Friction of a Hovercraft

Abstract

Objectives/Goals
My objective was to see which surfaces affected the friction of the hovercraft the most and how airflow could affect my results.

Methods/Materials
I built my hovercraft with plywood, tarp and a jigsaw. I powered it with a leaf blower and measured the friction on four different surfaces on a ramp. I converted the inches it took to elevate the ramp into the co-efficient of static friction because it touched the surfaces, which were grass, wood and two different types of carpet.

Results
Grass had the most friction because it was jagged and air moved over it unevenly. Both carpets had tiny fibers sticking up. The thinner carpet was uneven and the thicker carpet was dense and smoother. The friction on the thinner carpet was higher than on the smoother carpet, but less than the grass. The wood had the least amount of friction because it was flat and sanded smooth, so air was able to move more evenly over it.

Conclusions/Discussion
My hypothesis, that the grass would have the most friction, was correct. My experiment helped me see how the movement of air over different surfaces could make a hovercraft more or less efficient, which is important because hovercraft are often used for uses such as transporting people and equipment over different types of terrain that are relatively flat.

Summary Statement
I built a hovercraft and tested the friction and coefficient of static friction by elevating it on a ramp and using different surfaces so I could see which surfaces are the most difficult for a hovercraft to operate on efficiently.

Help Received
Friend helped me use a jigsaw.

Name(s)

Jaylan C. Catacutan

Project Number

J0104

Project Title

Car Aero: How Aerodynamics Affect a Car

Abstract

Objectives/Goals

My goal is to find how the shape and the edges of a car affect top speed, gas mileage, handling and acceleration.

Methods/Materials

I used hobby boards, fans and acrylic to create a wind tunnel and find how air reacts to a car in motion. I used a variety of model cars ranging from 1:24 scale to 1:18 scale.

Results

After testing, i learned that smooth and subtle edges on a car helps increase gas mileage, acceleration, speed and handling.

Conclusions/Discussion

Overall, I have concluded that smooth and subtle lines helps a car all together, i also learnd that spoilers on the rear end of the car help reduce resistance of air on the car for better speed.

Summary Statement

My project is about the effect of aerodynamics, wind resistance and air odrag on a car

Help Received

Dad helped cut materials for the wind tunnel assembly

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Imelda Ceja; Annika Khan

Project Number
J0105

Project Title
Parachutes: Does Size Matter?

Abstract

Objectives/Goals
Our project was to determine if parachutes with smaller surface areas are quicker to fall to the ground than parachutes with larger surface areas. We believe that if we change the size of the parachutes, then the smaller parachutes will fall quicker to the ground than the larger ones.

Methods/Materials
Three different sized parachutes: 20x20 cm, 30x30 cm, and 50x50 cm were constructed. The parachutes were tested by being timed on how long it takes for them to reach the ground. The parachutes were made out of the same garbage bag material,the strings for the parachutes were 40 cm long, all parachutes had the same amount of washers attached, and the twist ties remained 10 cm long.

Results
The 20x20 cm parachute consistently had the quickest time for falling to the ground. Both the 30x30 cm and the 50x50 cm had slower landing times than the 20x20 cm parachute. The smaller parachutes had faster landing times than the larger ones.

Conclusions/Discussion
Our conclusion was that smaller parachutes are quicker due to the small amount of surface area. We can conclude that because a smaller surface area means a more decreased amount of drag force. Drag force causes a parachute to go downwards.

Summary Statement
Parachutes were built to determine which will descend the slowest.

Help Received
Washers borrowed from teacher. Parents supplied rest of the materials.

Name(s)

Landon R. Creighton

Project Number

J0106

Project Title

Engineering Rocket Science: Can I Make a Small Scale Oxyhydrogen Powered Rocket Launcher?

Abstract

Objectives/Goals

Design criteria:
It needs to launch the rocket. It needs to be safe, not too difficult to build and low cost. It needs to go over twenty feet in the air and be repeatable.

Methods/Materials

I tested four different prototypes using a two liter soda bottle as the rocket and all used the same fuel cell to generate oxyhydrogen. The first prototype used a traffic cone and a plastic bucket. The second used a pvc pipe. The third used a separate combustion chamber and a one way ball and spring valve. The fourth used a separate ABS combustion chamber.

Results

Prototype One: When testing, leaks of water and HHO caused a failure to launch the rocket. Analyzed problems and made a new prototype that would not leak.
Prototype Two: When testing, tried different amounts of HHO in the rocket (2 l soda bottle). Filled 1/4 full resulted in a flash in the bottle and then a crushing of the bottle from the implosion. Filled 1/2 full resulted in a successful launch. The bottle showed signs of deforming from the heat. The bottle launched repeatedly over 20' high. Filled 3/4 full resulted in the top exploding off the bottle. Analyzed problems of overheating and exploding of the rocket, decided to build a new prototype using a separate combustion chamber.
Prototype Three: Tested 10 times that resulted in 5 launches with only one over 20'. Analyzed problems of non launch and low launches. Decided I needed to build a bigger combustion chamber and make the launcher simpler to build.
Prototype Four:Tested 10 times that resulted in 10 launches over 20' high. The bottle was inspected after each launch and only had scratches on it from its landings.

Conclusions/Discussion

After testing my prototypes, analyzing the data, solving the problems and discussing the design with others, brought me to the conclusion that prototype four fit my criteria the best. It always launched safely and always reached heights of over 20'. Although it is the highest cost of the prototypes it is very simple to make. This was a very fun project and I learned a lot about hydrogen and the power of it.

Summary Statement

This engineering project proves from my success that I can make a small scale oxyhydrogen powered rocket launcher.

Help Received

I would like to thank my dad who helped me build the prototypes. I would also like to thank my mom for helping me type, My sister helped to proofread my work.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Johanna E. Dickie

Project Number

J0107

Project Title

How Does Aperture Size Affect the Velocity and Distance of a Mechanically Created Toroidal Vortex Ring?

Abstract

Objectives/Goals

After designing and creating two types of toroidal vortex cannons, I used four different aperture sizes to test for distance and velocity of the created toroidal rings.

Methods/Materials

I constructed two different styles of vortex cannons, firing approximately 0.9 cubic meters of air, and using between 18.1 and 70.3 kilograms of triggering pressure. Four different sizes of apertures were fabricated to test the average distance and velocity of the vortex rings. I used a fog machine, stopwatch, and a 22.86 meters measured area to test each aperture size on each cannon 8 consecutive times.

Results

Two vortex cannons and various sized apertures were created to test distance and velocity of the toroidal vortices generated by each. Results showed that Vortex Cannon 1 shot its farthest reaching ring on average at 16.19 meters using a 30.48 centimeter diameter aperture. Vortex Cannon 2 shot even farther while using a 20.32 centimeter diameter aperture on average at 19.62 meters. Both cannons shot their fastest vortex rings using a 15.24 centimeter diameter aperture with Vortex Cannon 1 having the highest average velocity of 62.73 km/h.

Conclusions/Discussion

My hypothesis that the vortex ring produced would move faster and travel farther when the aperture diameter of a vortex cannon is decreased was only partially supported in my results. Generally, the smaller aperture size caused a vortex ring to increase in velocity, but the rings produced did not travel as far. Possible uses of an accurate vortex cannon could range anywhere from weaponry, assisting firefighters, or animal and crowd control.

Summary Statement

After designing and creating two types of toroidal vortex cannons, I used four different aperture sizes to test for distance and velocity of the created toroidal rings, and compared the efficiency of the cannons.

Help Received

Father helped to build both vortex cannons, and to fire the cannons during testing.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Sebastian J. Figueroa

Project Number

J0108

Project Title

The Effect of Bird Formation on Flight Efficiency

Abstract

Objectives/Goals

The purpose of this study was to find whether a V-formation increases the flight efficiency of birds by taking advantage of wing-tip vortices, and if so, what variation of a V-formation is the most efficient; as a side note, testing was completed to see if it would be more beneficial for birds to fly in a straight line.

Methods/Materials

To begin, a wind tunnel and two model birds were constructed. The first bird was the independent variable, while the second, stationary bird was the dependent variable; using a lever system, its drag was measured by an electronic scale. The experiment involved taking an average reading from the scale for thirty seconds of fan operation with the first bird in a fixed position. This bird was moved around each of the positions on a baseplate. Materials included a large fan, electronic scale, and two poster boards, as well as the scale model birds, lever system, and testing baseplate, which are all constructed of Legos.

Results

On the baseplate, a grid system was used; the columns were 16.25 inches and the rows were 14.375 inches apart (all results and measurements to scale). The column directly in front of the second, stationary bird resulted in the most efficient formation, while the most beneficial position called for the first bird's beak to be 46.25 inches in front of the second's. However, the second column, 16.25 inches to the right, also had benefits while still retaining a V-formation. The most productive position using a V-formation was 71.875 inches in front and 14.375 inches to the right of the the stationary bird.

Conclusions/Discussion

Therefore, it is of greater benefit for birds to fly in a straight line formation. However, a V-formation will still maintain productivity if the birds hold a tightly packed formation. Perhaps, on a larger model, there would be different results, ones where wing-tip vortices (an important aspect in flight efficiency) might have a larger effect. To expand on this project, different size birds could be tested, and perhaps the experiment could be expanded to encompass the aerodynamics of cars and bicycles. These ideas could be applied to a variety of modern day topics and greatly benefit the area of aerodynamics.

Summary Statement

The goal of this experiment was to determine the most efficient flight formation for birds.

Help Received

Mother helped me edit report; father helped construct posterboard.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Aeden P. Gasser-Brennan

Project Number

J0109

Project Title

How Flaps on the Underside of a Wing Affect Its Aerodynamic Efficiency

Abstract

Objectives/Goals

The objective was to determine how the arrangement of flaps on the underside of an wing affects its lift:drag ratio (aerodynamic efficiency). Since I expected that multiple flaps would have more lift than a single flap, but that multiple flaps would not have more drag than a single flap, I hypothesized that wings with more flaps would be more efficient than wings with fewer flaps.

Methods/Materials

A wing with removable flaps and a wind tunnel with air straightener were constructed out of foamboard and cardboard. To measure lift, the weight of the wing was measured in the absence and presence of a fan-generated wind of 12 m.p.h. To measure drag, the backwards force of the wind on the wing was measured using a scale mounted vertically. The lift and drag of 8 wing configurations were measured, including a control wing with no flaps, and 7 wings with 1, 2, or 3 flaps in all possible arrangments. Two measurements of lift and drag were taken for each wing type, and mean lift, mean drag, and lift:drag ratios were calculated.

Results

All wings with flaps had greater lift, drag, and aerodynamic efficiency than the control wing with no flaps. As hypothesized, wings with more flaps generally had more lift than wings with fewer flaps, whereas adding two or three flaps did not increase drag more than adding a single flap. Therefore, a general trend of increasing efficiency in wings with greater flap number was found, although two outliers to this trend were observed.

Conclusions/Discussion

Control surfaces on wings, such as ailerons, flaps, and spoilers, which exploit the Bernoulli effect by manipulating wind speeds above and below the wing, are generally found on the leading and trailing edges of the wing, as well as the upper surface. My experiments suggest that control surfaces on the underside of the wing can also be useful in increasing wing efficiency. Generally, higher flaps numbers are more aerodynamically efficent than fewer, most likely because they increase lift without proportionally increasing drag. The existence of two outliers, however, suggested that the arrangement of flaps is as important as the number for lift generation, and that symmetry may be an important factor.

Summary Statement

I designed and built a wing to test how flaps on the underside of a wing affect lift, drag, and aerodynamic efficiency, and found that more flaps maximize lift without increasing drag proportionally, and so are more efficient.

Help Received

Father helped cut pieces for wind tunnel. Mother helped cut, glue and fit on posterboard.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Sierra G. Gilmore

Project Number
J0110

Project Title
Does the Type of Material Affect How Long a Parachute Floats?

Abstract

Objectives/Goals
My project was to determine if certain materials affect how long a parachute floats. I believe that the type of material does affect how long a parachute floats due to the balance needed between drag and gravity to create a safely landed parachute.

Methods/Materials
Four model parachutes with identical structure, but different masses and weights, were constructed. One parachute had a silk base, the second had a nylon base, the third had a denim base, and the fourth had a tulle base. The parachutes were each given the same amount of weight (4 pennies) to carry when making the flight down from the 7' 7.5" height for 25 trials per parachute, then each given a heavier identical weight (12 pennies) to carry for an identical flight height for another 25 trials. All times were recorded down to the hundredth of a second.

Results
The silk parachute consistently had the longest air time of all four parachutes for trials holding a four penny weight. The nylon parachute consistently had the longest air time of all four parachutes for trials holding a twelve penny weight. The denim parachute had a slightly shorter air time then the silk or nylon parachutes, while the tulle parachute had a significantly shorter air time then all four parachutes.

Conclusions/Discussion
My conclusion is that the type of material does affect how long a parachute floats and that the only reason we don't use silk rather than nylon is most likely due to economic reasons, since nylon costs significantly less than silk.

Summary Statement
The focus of my project was to determine whether the mass and structure of a parachute has significance on how it falls.

Help Received
Mother purchased project supplies and helped with trials.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Alisa Y. Hathaway

Project Number
J0111

Project Title
Improving Aerodynamic Drag by Altering the Shape of a Pickup Truck Tailgate

Abstract

Objectives/Goals
This experiment was conducted to identify the most aerodynamic pickup truck tailgate configuration, to lower drag, increase efficiency, and reduce the amount of hydrocarbon fuel consumed. The hypothesis of this experiment was that a more rounded, smooth tailgate would reduce the aerodynamic drag.

Methods/Materials
In order to conduct aerodynamic testing of various tailgate configurations, a small wind tunnel was constructed using instructions from NASA#s Glenn Research Center. Nine different tailgate configurations were evaluated on five different truck-like vehicles. A supplementary experiment was conducted, using a small digital scale, hairdryer, pulley, and a 50 gram weight to collect objective air drag data, to compare and contrast with the wind tunnel data.

Results
Test results showed that each type of pickup truck performed differently with the various types of tailgates. Overall, the tailgate shaped as an #M# and the trapezoid shaped tailgate worked better in general, reducing the aerodynamic drag (lower Number) of most of the pickup truck models. The #M# shaped tailgate#s Reynolds Numbers were 3.5-1983 Chevy Silverado, 5.5-1987 Toyota, 8.5-1997 Ford F-150, 3.0-2009 Ford F-150, 5.5-Jeep Scrambler; while for the trapezoidal tailgates, the Reynolds Numbers were 4.5-Chevy Silverado, 5.0-Toyota, 3.5-1997 Ford F-150, 2.5-2009 Ford F-150, 10-Jeep Scrambler). The supplemental experiment test data showed that the aerodynamic drag on the trucks varied from a low of 4 grams of force, to a high of 9 grams of force. In general, this data supported the earlier experiment.

Conclusions/Discussion
The Ford F-150s were proven to be the most aerodynamic in their original state (5.0 and 6.0 Reynolds Number, respectively), perhaps due to the smoothness of the front end and transition to the cab. The remainder of the pickup trucks were observed to be very inefficient. The addition of the various tailgate designs improved the aerodynamics of all models; the #M# shaped and trapezoidal tailgates proved to be the best designs overall, with the lowest visual turbulence and measured aerodynamic drag forces. This experiment proved that the aerodynamics of these pickup trucks could be improved significantly by using different types of tailgates.

Summary Statement
My project focus was to identify ways to improve the aerodynamic drag of a pickup truck tailgate by altering its shape.

Help Received
Wind Tunnel design modified from Tom Benson, NASA Glenn Research Center; Father cut Plexiglas and truck tailgates.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Isaiah M. Hessler

Project Number

J0112

Project Title

Gone with the Wind: A Study of the Lift in Certain Airfoils

Abstract

Objectives/Goals

The objective of this project was to determine if a semi-symmetrical airfoil has more lift than a flat-bottom airfoil.

Methods/Materials

Two airfoils were separately tested in a wind tunnel for ten seconds each trial. The airfoils were the same weight and were tested at the same wind speed. A scale was placed under the wind tunnel and connected to a wooden dowel on the airfoil. When the wind tunnel was turned on, the airfoil lifted and showed a negative weight on the scale, measured in grams. The highest lift registered in each trial was recorded in the logbook. There were thirty trials in all for each airfoil.

Results

The mean lift of the flat-bottom airfoil, in grams, was 31.83, while the mean lift of the semi-symmetrical airfoil was 28.17 grams.

Conclusions/Discussion

The hypothesis was proved incorrect because the mean lift of the flat-bottom airfoil was 3.66 grams more than the mean lift of the semi-symmetrical airfoil. This information proves if you have a situation where more lift is needed, it would be better to use flat-bottom airfoils instead of semi-symmetrical airfoils.

Summary Statement

The focus of this project was about determining how changes in airfoil shape effect the amount of lift in each airfoil.

Help Received

Father helped supervise power tool use and helped with building the wind tunnel.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Oliver N. Hill

Project Number

J0113

Project Title

Energy in the Wind

Abstract

Objectives/Goals

My project goal was to experiment with different blade configurations and aerodynamics to produce the most voltage.

Methods/Materials

Horizon WindPitch Education Kit which contains: A wind turbine, a pitch changer device, 3 BP-28 blades, 3 BP-44 blades and 3 BP-63 blades
Horizon Renewable Energy Monitor
Fan
Computer
Measuring Tape
Extra blade kit

My test methods were running experiments with every possible combination of 3 blade profiles, 5 pitch angles, and 3 wind speeds.

Results

My results showed that the lower pitch angles produced the most power. Some of the blade profiles were better at different wind speed than others. The BP-28 blade was the lightest but the BP-44 blade produced more power on an average of 1.5 volts. There was always a steady increase of voltage from the low wind speeds to the high wind speeds for all profiles except for BP-44. The most power generated was 10 volts in the 3 blade tests and 10.61 volts and in the 6 blade tests.

Conclusions/Discussion

The pitch angle of 10 degrees generated the most power of all the pitch angles. I concluded the NACA BP-44 blade with a 10 degree pitch angle is the best combination of profiles and angles I tested. I believe my experiment can help the wind power industry to know that lower pitch angles produce more power. My experiment also shows that at different wind speeds, different blade profiles can produce more power.

Summary Statement

My project experiments with different blade configurations and aerodynamics to produce the most voltage.

Help Received

My parents helped review my work.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Victoria V. Lennon

Project Number

J0114

Project Title

Unplugged

Abstract

Objectives/Goals

My objective was to determine if solids can flow like liquids using granular materials. My hypothesis is that I believe that the smaller the granular material the faster it will flow.

Methods/Materials

Using a funnel I poured 250 grams of granular material, my independent variable, and then proceeded to time how fast all of my material emptied the funnel, this was the mass flow rate, my dependent variable. I repeated this process 3 times with no variations, using 5 different materials which were salt, flour, granola, peanut M&M#s, and Skittles.

Results

Only one of my materials, salt, had a recorded average mass flow rate which was 30.64 seconds. Peanut M&M#s, Skittles, and granola all had the effect of jamming transition. Jamming transition is when the solids become rigid with increasing density as they are being poured into the funnel and/or hopper. As all the material made its way down to the bottom of the funnel(were a stopper was put in place to keep the material from flowing before calculating the mass flow rate) it quickly formed cages within itself leaving no room for the material to flow and causing an arch formation at the bottom of the funnel. All three of these materials were inconclusive in having a mass flow rate because of this physical process. The flour however did not have a case of jamming transition. Flour being a powder is put in a separate class of granular materials from the others. Because of it powdery like characteristics and small particle size, it is more cohesive and easily suspended in gas therefore making it extremely dense and compact when exposed to the moisture in the air. This effect happened when preforming the trials for flour. These factors that I have listed are not the only derivatives that factored into the results of my experiment. The fact that the diameter of the end of the funnel was only 1-inch made it harder for the material to flow and therefore not having mass flow rates. So the diameter of the pipe effected the mass flow rate substantially.

Conclusions/Discussion

My conclusion is that my hypothesis was proved incorrect because my smallest material was flour witch had an average dimension of .005 and did not have a recorded mass flow rate. The characteristics of my materials played a big role in the results as well as the physical process of jamming transition.

Summary Statement

The purpose of this science project is to prove that solids can flow like liquids, and by doing that I test the mass flow rate of granular materials.

Help Received

Sister helped hold a piece of cardboard at the end of my funnel as I was pouring my granular material in the funnel to prevent the material from flowing before I could time the mass flow rate.

Name(s)
Christie P. Lum

Project Number
J0115

Project Title
The Science behind Tsunamis: Studying the Effect of Water Depth on Wave Velocity

Abstract

Objectives/Goals
The purpose of my project is to study the effect of water depth on wave velocity in tsunamis.

Methods/Materials
In my experiment, I simulate waves by dropping a wood block into a water tank filled with 4 different water depths (independent variable) and record their wave velocity (dependent variable). For each depth, I perform 3 trials and 10 tests per trial. In addition to my tsunami simulation experiment, I also calculate the wave velocity as a function of water depth using a math equation - velocity is the square root of the product of the acceleration of gravity (9.8 sec/m2) and the water depth.

Results
Based on my tsunami simulation experiment, the wave velocity for water depths of 0.5, 1, 2, and 3 cm were 45, 53, 62 and 70 cm/seconds respectively. Based on my math equation calculation, the wave velocity for water depths of 50, 100, 200, 500 and 1000 meters were 22, 31, 44, 70 & 99 m/seconds respectively. Both my experimental results and calculated results show similar shaped curves on a graph.

Conclusions/Discussion
The result after 120 tests supported my hypothesis that wave velocity decreases as depth reduces. I hope that by studying the science behind tsunamis, we can understand these killer waves more thus building a better warning system to save more lives.

Summary Statement
My project studies the effect of water depth on wave velocity in tsunamis.

Help Received
Mom helped gather materials; sister helped do the timing and take some pictures; Home Depot donated a wood block.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
David A. Maguina

Project Number
J0116

Project Title
The Effect of Fin Shape on Flight

Abstract

Objectives/Goals
The objective is to determine which of three different fin shapes enable a water-bottle rocket to achieve the greatest altitude.

Methods/Materials
One water-bottle rocket, 3 different fin shapes attached to the removable sleeves, one launch platform, one air compressor.

Results
The fin shape that curved below the rocket consistently achieved higher elevations. The smaller fin shape with right angles consistently achieved the lowest altitudes.

Conclusions/Discussion
My conclusion is that a curved fin shape improves aerodynamics enough to produce greater altitude.

Summary Statement
My project is about discovering the optimal fin design to enable a rocket to achieve the greatest altitude.

Help Received
Mom helped to type this report and display board.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Jared A. Nolen

Project Number

J0117

Project Title

Does Dimpling a Car Affect Its Acceleration?

Abstract

Objectives/Goals

The objective was to find evidence that proved that a car that was dimpled like a golf ball would accelerate faster than a car that is smooth. The acceleration of the car was measured between two photogates that were placed one meter apart on an angled track.

Methods/Materials

A track was set up with two photogates placed one meter apart on an angled track. A cover for a toy car was constructed with floral foam and cut with fishing line to a prefered shape and was smoothed so there would be no sharp edges. Next the car was run down the track 150 times and all the times were recorded onto a spreadsheet. The same car was then dimpled all across its surface (the same car was used so that the mass would stay the same). That car was then run 150 times and the data was recorded onto a spreadsheet. The data was then averaged and compared.

Results

My results showed that the dimpled car accelerated faster than the non dimpled car. The average time for the non dimpled car was 0.6374 seconds and the dimpled car#s averaged time was 0.6371 seconds. I then proceeded to remove The top and bottom 10% of the data in order to remove the outliers. The average for the non dimpled car was 0.6513 seconds and the dimpled car#s averaged time was 0.6511 seconds. The times over 1 meter were small so if i would have increased its length to one kilometer The average time for the non dimpled car would be 637.42 seconds and the dimpled car#s averaged time would be 637.17 seconds.

Conclusions/Discussion

My hypothesis was proved correct, the dimpled car accelerated faster than the non dimpled car. An improvement for further study might have been to increase the distance of the track in order to get more dramatic results. This could apply to the real world because it could be used on cars or other vehicles like planes, boats, etc. It could be used on drag racing cars to increase acceleration over time. It could also be used on planes to lower how much jet engine fuel is used. It could be used on everyday cars to get where you're going faster or to get higher miles to the gallon.

Summary Statement

I tested to see if a car that was dimpled like a golf ball would accelerate faster than a smooth car over a distance of one meter.

Help Received

I borrowed equipment from my science teacher, Mr. Trone.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Portia M. Osuch

Project Number

J0118

Project Title

Kicking It

Abstract

Objectives/Goals

The goal is to measure and identify which of the following three Taekwondo kicks: front snap kick, roundhouse kick, and back kick, generates the most force. The first step is to define the calculation of force. The second step is to understand how to measure the components for the equation. Then translate the recorded measurements into useful data.

Assemble a team of 10 Taekwondo volunteer subjects. The subjects will perform each of the 3 trials per kick type for a total of 9 kicks. The kicks will have no impact and solely performed in the air. The data is input into an Excel spreadsheet for auto calculations with formulas.

This process will help an athlete to identify which kick he or she performs with the greatest amount of force. It will also reveal which kick they can improve upon.

Methods/Materials

Methods:

1.F = M x A; 2.Average % of a foot weight(1.48%); 3.Consult Mr. Collins on formulas, accurate measurements and data collections; 4.Set up a spreadsheet: a.ID#; b.Age, belt rank, weight, type of kick (3 per type), mass of foot, speed, time in 1/100sec, acceleration, force, and #s of force; c.Force=Mass x Acceleration; d.M or Mass of foot = weight in kilograms x 1.48% of the human foot weight; e.Acceleration = Speed/Time; f.Speed=radar device in meters/sec; g.Time=stopwatch in 1/100sec; h.lbÆ#=F x 22.5;

5.Taekwondo session; 6.ID#; 7.Age; 8.Belt rank; 9.Weigh; 10.Perform three kick types; 11.Radar device measure the speed; 12.Stopwatch measure the time; 13.Record the data; 14.Repeat 10-13 until all 9 trials are complete; 15.Repeat step 6 with the 10 subj; 16.Analyze and avg the results.

Materials:

Weight scale, Radar device, Stop Watch, Laptop with Excel spreadsheet, Data book, Pencil, Math equations, At least two helpers, 10 subjects.

Results

My analysis shows that among the 3 kick types, the front snap kick produced the highest overall average lbÆ# at 255 lbs. followed by roundhouse kick at an overall average of 227 lbÆ#, and then back kick at 224 lbÆ#.

Summary Statement

This process will help an athlete to identify which kick he or she performs with the greatest amount of force and it will reveal which kick they can improve upon.

Help Received

Mr. Collins for mathematic formulas; TMAX/Lee's Taekwondo Studeo, Pasadena, CA - volunteer subjects; Mom and Dad to assist me with making sure that the equations were correct.

Name(s)

Alex W. Poonoosamy

Project Number

J0119

Project Title

Frozen Flight: The Aerodynamic Effect of Ice Contamination

Abstract

Objectives/Goals

The objective of this project was to determine what, if any, was the aerodynamic effect of ice on an airfoil. The aim was to specifically determine the differences in lift and drag between a clean airfoil and an airfoil contaminated with simulated ice. The goal was also to determine where on the airfoil the simulated ice had the most effect on lift and drag.

Methods/Materials

A wind tunnel was constructed of Plexiglas, wood, straws and cardboard. A household fan was used to produce the air flow for the wind tunnel with an anemometer to measure the air speed within the tunnel. The airfoil was made from foam board with play dough and sandpaper to simulate the ice shapes. A gram scale was used to measure the differences in lift and drag.

Results

A clean airfoil was first tested for lift and drag measurements to establish control . An simulated ice shape was then placed at three different positions on the airfoil. Sandpaper was then placed on the airfoil to simulate rime ice contamination and lift and drag measurements were taken. It was noted that the ice shape had the greatest negative effect on lift when it was placed on the leading edge. When the simulated ice shape was placed on the trailing edge of the airfoil, there was minimal negative effect on lift. The sandpaper tests also showed minimal effect on lift. When testing drag, it was found that the most drag was produced when the simulated ice shape was placed on the trailing edge. There was less effect on drag when the ice shape was placed on the leading edge or middle of the airfoil. Sandpaper was found to only have a minimal effect on drag.

Conclusions/Discussion

The test results indicate that the most aerodynamic loss in lift was found when the simulated ice shape was placed on the leading edge. However it was also observed that the most drag was produced when the ice shape was placed on the trailing edge. Sandpaper was not observed to have a significant effect on lift or drag. It is also concluded that the simulated ice shapes have an overall negative aerodynamic effect on airfoil performance.

Summary Statement

Testing which position of an simulated ice shape on the airfoil causes the most aerodynamic loss.

Help Received

Mother helped find relevant research, Father helped construct wind tunnel.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Christian Rhodes; Cade Whitaker

Project Number

J0120

Project Title

Does the Design of a Glider Wing Affect the Distance of Flight?

Abstract

Objectives/Goals

The objective in this experiment was to build two types of gliders; one with a dihedral wing design and one with a straight wing design, similarly launch them and determine which one flew farther.

Methods/Materials

The method in this experiment was to construct both a dihedral and straight winged glider and launch them and measure the distance of flight. The materials used to accomplish this were: various lengths and widths and thicknesses of balsa wood, wood glue, sand paper, modeling clay, tape measure or measuring wheel, Exact-o-knife, paper and pencil to record data.

Results

The results of this experiment were that the straight winged designed glider flew further since it flew in a straight path unlike the dihedral angled glider, which would veer off in various directions.

Conclusions/Discussion

The conclusion was that the dihedral angled glider would not fly as far as the straight angled glider, therefore our hypothesis was incorrect.

Summary Statement

This project set to prove which glider wing design would allow the furthest flight.

Help Received

Partners mother help design the board layout and my dad helped construct the gliders.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Tristen M. Snyder

Project Number

J0121

Project Title

Towers of Power

Abstract

Objectives/Goals

The objective is to determine which type of wind turbine, horizontal-axis or vertical axis, produces more power.

Methods/Materials

Two mini wind turbines were constructed using a PVC base and a 7.4V motor. The first turbine used a vertical-axis blade made of a 32 fl. oz. plastic bottle and the second used a horizontal-axis blade made of a 10 x 7 in. three blade propeller. Each turbine was separately tested for power output using a volt meter while running a box fan one foot away from the turbine base, set at the same speed. Ten VDC readings were taken on each turbine.

Results

The horizontal-axis turbine produced an average of 2.30 VDC and the blades functioned better with the wind. When testing the vertical-axis turbine I found that the wind would often hit both sides of the blade and cancel itself out. The vertical-axis method produced an average of 0.60 VDC.

Conclusions/Discussion

My conclusion is that the horizontal-axis wind turbine operated better in the wind and produced more power while a vertical-axis wind turbine was found to have more difficulty using the wind to turn the blade and it produced less power.

Summary Statement

My project will help me understand the power generation difference between horizontal-axis and vertical-axis wind turbines to understand why the horizontal-axis method is more commonly used.

Help Received

My father showed me how to safely use the tools to build my project and supervised the process. He drilled out a section of the PVC to fit the motor and connected the wires to the motor.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Reese A. Swanson

Project Number

J0122

Project Title

How Does the Shape and Weight of the Wing Affect the Lift of the Object?

Abstract

Objectives/Goals

My project's objective was to determine if a wing's shape and size would affect the lift on an object. I hypothesized that a wing design of airfoil with a size 50mmX150mm would be most successful.

Methods/Materials

For this experiment I built a homemade wind tunnel with an air filter and a Boreal Balance scale to test lift. The three designs were used with two different sizes of 50mmX150mm and 75mmX175mm. The designs were airfoil, symmetrical, and reverse-airfoil. This experiment was tested in the same atmosphere and each design was tested 5 times giving a total of 30 trials in all.

Results

In the end, my hypothesis was disproved and proved. The airfoil design was the most successful in receiving lift, however the size that was most successful was the 75mmX175mm size.

Conclusions/Discussion

My conclusion is that the most successful design to receive lift is the airfoil design and that when a plane desires to descend, it should use the reverse-airfoil design.

Summary Statement

My project demonstrates the effect of wing size and design on the lift of the object using Bernoulli's Principle of fluid flow.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

James W. Whiting

Project Number

J0123

Project Title

Falling Out of the Sky in a Plane: The Stalling Characteristics of Aircraft

Abstract

Objectives/Goals

The purpose of this scientific experiment was to answer the following question:

"How do Engine Power, Angle of Attack (AOA) and Wing Shape affect the stalling characteristics of an aircraft?#

Research indicates that if the Engine Power is too low, the AOA is too high and the Wing Shape is not suitable for flight then the wing will stop producing Lift to support the weight of the aircraft and it will STALL.

Methods/Materials

The experiment was conducted in a single engine, propeller-driven aircraft. The aircraft was flown level at 6,000 feet at different Engine Power and wing flap settings and put into a controlled Stall. The speed of the aircraft was reduced and the AOA increased to increase Lift and maintain a constant altitude. The increasing AOA was measured at 10 mph intervals until the aircraft stalled using an AOA protractor built for the experiment. A total of 46 test runs were completed with Engine Power settings of 80%, 60%, 40% (Power ON) and 0% (Power OFF) and wing flaps set Up and Inter.

Results

Overall, the test results indicated that AOA increased in a straight-line as air speed of the aircraft reduced through to the point of Stall to maintain Lift and, therefore, altitude. The effect of Inter flap reduced the starting speed of each test run by approximately 4m/s due to increased Drag. Stall speed also reduced by 1-2m/s with Inter flap due to increased Lift. However, the Stall speed of the aircraft was consistently in the narrow range of 26-28m/s due to the design parameters of the wing. It was also possible to increase the AOA by 1-2 degrees with Inter flap at the point of Stall also due to the increased Lift.

Conclusions/Discussion

The results generally supported the hypothesis # higher AOA was possible at higher Engine Power settings, wing shape was found to affect Lift and higher AOA increased Lift at lower speeds. An error was discovered during the Power Off Stall as the pendulum of the AOA protractor was affected by the rapid deceleration of the aircraft which could be improved by the use of a counterweight. Further improvements in future experiments would be to use lower flap settings to vary wing shape and to try to directly examine airflow over the wing possibly by using an array of pitot tubes.

Summary Statement

To understand how Engine Power, Angle of Attack and Wing shape affect the stalling characteristics of an aircraft.

Help Received

Experiment conducted in Father's aircraft who acted as a safety pilot.

CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Carissa A. Wong

Project Number

J0124

Project Title

Traveling on Thin Air

Abstract

Objectives/Goals

The objective of this project was to determine if the roughness of a surface affects the distance traveled by my model hovercraft. I believe that the model hovercraft will work better on rough surfaces, because the rough parts of the surface will act as barriers and ensure that the air pressured out will not escape as fast.

Methods/Materials

I constructed a model hovercraft with a pushpin, sports bottle cap, balloon, CD disk, and foam tape. I tested with this and ran it down a ramp onto the four surfaces with different roughness. The model hovercraft traveled until the air ran out of the balloon. Then I measured the distance in inches.

Results

The smooth surfaces traveled farthest, and the rough surfaces traveled the least.

Conclusions/Discussion

The smoothness of a surface affected how far my model hovercraft would go. The reason was, on the smooth surfaces, a thinner layer of air was needed. On the rough surfaces, a thicker layer of air was needed because the gaps in the surfaces. Rough surfaces would run out of air faster, therefore, traveling less distance than the smooth surface while using the same amount of air.

Summary Statement

Traveling on Thin Air is a project that uses a simple built model hovercraft to test the friction of surfaces with different roughnesses.

Help Received

Dad helped supply the wood and boards;Participant of the SCSD Science Fair Mentoring Program