CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Aaron Avazian; Sean Phillips

Project Number
S0201

Project Title
The Gyroscopic Effect of the Speed of a Rotating Flywheel on the Stability of a Turning Vehicle

Abstract

Objectives/Goals
The experiment was conducted in order to test the effect of the speed of a rotating flywheel within a vehicle on the momentum and stability of a turning vehicle. It was hypothesized that the rotating flywheel would increase the momentum of the vehicle thus making the vehicle less stable as it changed direction.

Methods/Materials
A train car with a mounted flywheel was released at different heights on an incline with the flywheel spinning at different speeds. There were three trials for each height, and ten heights for every voltage, testing whether the train car fell off the track or continued through the turn at the bottom of the incline.

Results
The average height where the train car began to fall decreased by voltage until leveling out at 80.00 cm then, as the voltage increased, the average height increased slightly to 81.43 cm then decreased somewhat sharply to 77.50 cm before coming back up to 80.00 cm. Overall, with some exceptions, the average height of falling decreased as the voltage increased.

Conclusions/Discussion
These results supported the hypothesis and the anomalies were most likely caused by human error in the release of the train car or because the flywheel started to create a wind current. Overall this experiment supports the idea that as the speed of the flywheel increased, the resistance to change in orientation increased in the train car.

Summary Statement
The experiment was conducted in order to test the effect of the speed of a rotating flywheel within a vehicle on the momentum and stability of a turning vehicle.

Help Received
Mother helped gather materials, took photographs.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Leo Banuelos; Nicholas Ross

Project Number

S0202

Project Title

Good Vibrations II: A Two Year Study of a New Method of Vibration Suppressino Utilizing Piezoelectric Patches

Abstract

Objectives/Goals

The objective is to determine if the piezoelectric patch will attenuate the vibratory forces by at least half at temperatures between 0 degrees F and 110 degrees F.

Methods/Materials

Materials used were a small scale model of a plane's ventral fin attached to a metal base, three piezoelectric patches attached to the model fin, a Fluke 19xC-2x5C Scopemeter, an 80 MHz Function/Arbitrary Waveform Generator, a Smart Material voltage amplifying device, a portable digital dish heater, a freezer, a Craftsman Digital Multimeter, and a Resistance Temperature Detector (RTD) model Pt 385. One patch acted as an actuator and was used to introduce vibratory forces, created by the Function Generator, onto the mini-fin. The second patch was used as an attenuator by creating a vibration force 180 degrees out of phase of the actuating force. The last patch was the sensor that detected the vibration remaining in the fin from the actuator and the dampening forces. Testing consisted of sine-waves of varied amplitude and frequencies (as shown on the data tables) applied to the actuator patch.

Results

The results of the tests were compiled into average percentages of vibration reduction for the three different categories and the three voltage settings within each category. At room temperature (approx. 68 degrees F), the average was: 100 V - 46.03%; 200 V - 42.06%; and 300 V - 40.65%. At 110 degrees F, the average was: 100 V - 47.85%; 200 V - 36.69%, and 300 V - 46.45%. At 0 degrees F, the average was: 100 V - 50.68%; 200 V - 50.59%; and 300 V - 50.13%.

Conclusions/Discussion

The hypothesis was not entirely supported by the data. While the piezoelectric patch was able to attenuate the vibratory forces by a little more than 50% when it was at 0 degrees F, the most being 50.68%, it failed to do so during the room temperature tests and the heated tests. It was noted the patch performed more effectively when it was colder. The metal is denser and less flexible when colder, so the patch can exert its force and have transmitted along more of the fin and have it distribute more evenly than when it is hotter. When the fin was heated, the metal became more flexible and the first motion of a force from the actuator was probably absorbed and unevenly dispersed throughout the metal.

Summary Statement

Test the effectiveness of the piezo-electric patch's power to dampen vibrations at 0 degrees F, room temperature (67 degrees F), and 100 degrees F.

Help Received

Lionel Banuelos helped with information on project knowledge; AFFTC Test Pilot School provided patch and equipment for testing; Maria Caballero (mother) helped with the data; and Roberta Ross (mother) helped type the data.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Fiona C. Blackburn

Project Number
S0203

Project Title
Floating Cylinders

Abstract

Objectives/Goals
The purpose of this experiment was to determine how the aspect ratio of a floating wooden cylinder affected its tilt angle.

Methods/Materials
To conduct the experiment painted cylinders with different aspect ratios were floated in bleach. Over time a line appeared on the cylinders marking how they floated and then trigonometry was used to calculate their tilt angles.

Conclusions/Discussion
Various unsuccessful approaches were tried to measure the tilt angle before the method used here was devised. With this information gathered it was concluded that smaller aspect ratios of wooden cylinders will float with their circular cross-sections more parallel to the water, however the prediction that cylinders with the same aspect ratio will float the same regardless of their diameter was not proven accurate.

Summary Statement
My experiment explored how the aspect ratio of a floating cylinder affected its tilt angle.

Help Received
My mom helped me to collect and buy the necessary materials for this project. My dad supervised the use of power tools and worked with me to brainstorm alternate ways to obtain the tilt angle after the initial experiment failed.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Forrest D. Csulak

Project Number

S0204

Project Title

H2O & Solar2Go: Using Various Water Temperatures to Determine the Electrical Energy Output of a Solar/Fuel Cell Car

Abstract

Objectives/Goals

The purpose of my experiment was to determine if a correlation exists between the use of various water temperatures in a solar/fuel cell car and the amount of electrical energy it produces as observed by the vehicle's operating duration, distance traveled and speed of the car.

Methods/Materials

To test my experiment, I constructed the car, connected all appropriate wires in parallel and elevated the wheels. I poured 80 ml of near-frozen, distilled water into the tank and siphoned remaining gases from the fuel cell system. The light energy from a 300 W incandescent light bulb burning for 90 seconds 4 cm away from a photovoltaic cell was converted into electrical energy to electrolyze the water. The electrical energy produced by the fusion of the hydrogen and oxygen gases within the fuel cell kept the car's motor operating. The electrical energy was observed through the mechanical energy of the gears. This energy output was measured by the car's operating duration (the length of time the car's motor operated); distance traveled (calculated by measuring the wheel's circumference multiplied by the wheel's revolutions as observed by video); and speed (calculated by distance traveled divided by duration). This was repeated with water at room temp and near-boiling respectively. Each trial was repeated 9 times.

Results

The results show a small difference in the electrical energy output with the differing water temps. The trend shows a very slight increase of these measurements as the water temp increases. The results of the cold, room, and hot water temps showed the room temp water produced the least amount of electrical energy while the hot water produced the greatest.

Conclusions/Discussion

I hypothesized that higher water temps would produce more electrical energy than the lower temps shown by a longer operating duration, a greater distance traveled, and a higher speed of the car's motor. Because higher temps contain more energy than cooler temps, I believed it would take less electrical energy to electrolyze the water using the higher water temps and requiring a shorter time for electrolysis to occur. My hypothesis was correct based on the trend extrapolated from the data; the amount of electrical energy observed increased as the water temperature increased. I believe, though, that further testing is needed to determine the reason for the room temperature water producing the least amount of electrical energy.

Summary Statement

This experiment was conducted to determine if the temperature of water used by a solar/fuel cell vehicle would have effect on the electrical energy as measured by the car's operating duration, distance traveled, and speed.

Help Received

My mom purchased the materials, assisted in the construction of the board, and took pictures during the experiment. My grandma permitted me to utilize her computer for preparing the report and her house for a suitable testing environment.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Samantha Darryanto; Karyne Yakupoglu

Project Number
S0205

Project Title
Going Green: An Innovative Approach to Comfort

Abstract

Objectives/Goals
The objective our project was to create a solar-powered air conditioning system that would cool an enclosed vehicle without using the car's energy source (gasoline).

Methods/Materials
Solar panel, 12v vehicle air conditioning system (compressor, condenser, evaporator, motor still intact), red/ black wiring, dry battery, temperature control system, insulated vehicle.
Connect the solar panel to the dry battery. Connect the dry battery to the temperature control. Connect all components of the air conditioning system to the temperature control system. Input the system into an enclosed vehicle. Take notice the starting temperature of the enclosed vehicle and set temperature control to ten degrees lower than initial temperature and set on "auto". Leave inside of the vehicle and time how long it takes for the air conditioning system to turn on and off (cool 10 degrees). Record data and repeat for 30 more trials.

Results
Our results were very consistent. 50 Primary trials and 30 Secondary trials were taken to prove our system's reliability. The time it took to cool down a vehicle by 10 degrees was approximately 20 minutes with our system. Times varied below and above this average because the volume of the cars were taken into consideration. The ratios of volume of vehicle:time are also available and prove that our system is consistent and reliable.

Conclusions/Discussion
In the end, our project set up proved to be successful. Our air conditioning system was able to receive enough energy from the sun and cool the temperature inside the vehicle by 10 degrees in around 20 minutes. The use of the temperature control system proved to be useful and effective as well, as it turned off once it hit the desired temperature. Overall, it has been proven that an air conditioning system can successfully cool an enclosed vehicle through an alternate energy source (solar).

Summary Statement
A solar-powered air conditioning system was created and implemented into an enclosed vehicle to test the system's efficiency.

Help Received
Rudy Darryanto & Danny E. taught us about the mechanics of our project as well as obtain materials, City of Corona donated the solar panel used in our testing.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Jonathan Deming; Anthony Mosallam

Project Number
S0206

Project Title
The Search for a Cleaner Jet Fuel

Abstract

Objectives/Goals
The purpose of our experiment was to test for the cleanest running jet fuels from a choice of propane and Av-gas, and compare them to the most commonly used jet fuel, Jet-A. We predicted that if we use propane, the jet engine will produce less residue buildup than other common fuels.

Methods/Materials
We used the jet engine as the constant in the test. Our test variables were propane in a fuel bottle, and av-gas (general aviation fuel for internal combustion engines 100 low lead). Jet-A (jet engine fuel and our control) was used as the experimental control since it is the most commonly used fuel in jet engines today. We tested each fuel at three rates of burn, idle: (minimal fuel injected for engine to run), cruise: (medium fuel injected for engine to run, established by finding the median of idle and max power), full power: (the maximum pressure of fuel the engine could handle without flooding). To perform our first test a fuel regulator was installed from the propane tank to the main injector on the engine connected by a 50 foot safety line. Running the av-gas (general aviation fuel) and the Jet-A fuel (commercial jet engine fuel) required an electric fuel pump connected to a 12 volt car battery. Jet A required higher p.s.i. than the previous fuels as they seemed to be thicker and had trouble maintaining operating pressure. We used a laser heat gun to measure the heat give off during the test. After each fuel test we opened the burn can (combustion chamber) and inspected for carbon with a q-tip for buildup recording the results.

Results
We found that propane had run consistently hotter than the other fuels thus theoretically proving it could burn the carbon excess it produces. We know there is no consistency at which the carbon emissions occur between the fuels, so to further stabilize our results.

Conclusions/Discussion
We predicted that propane would run cleanest. It is well established that propane gives off less carbon monoxide and because of this we thought it would perform just as well in running clean. There was a significant increase in temperature from propane to the other fuels in our results. Both Av-gas and Jet-A left significant amounts of residue where propane left little, proving that propane runs hotter and has less carbon buildup. This doesn't prove that propane puts out less carbon emissions, however it can accurately prove that less build up will exist.

Summary Statement
Our project was intended to find another way to reduce carbon emissions in the jet engine by finding a fuel that leaves less residue in the cobustion chamber of our jet engine.

Help Received
Father Mr. Deming, helped build the board, Grandpa Deming helped edit and revise all text. Father Mr. Mosallam helped purchase materials required for building the jet engine and provided his shop for us to build it and test it.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Brandon W. Ferguson

Project Number
S0207

Project Title
The Fighter with the Least Reflectivity

Abstract

Objectives/Goals
It is believed that fighter shape reduces its appearence to radar. An F-22 Raptor will be the least detectable because of all of it's sharp edges.

Methods/Materials
32#x25#x22# cardboard box
7# to 6# diameter reducer
6# x 6# diameter connector
6# to 4# diameter reducer
6# x 4# diameter connecter
4# to 3# diameter reducer
400,000 candlepower spotlight
12 V Solar Panel 18# x 20#
Volt meter
1/72 scale fighter replicas of:
o F-22 Raptor
o F-14 Tomcat
o F-15 Eagle
Black and White Poster boards.

Large testbox is used to test aircraft at 3 different views and gather results. A specially situated solar panel recieves incoming light and detects results in volts.

Results
F-22 wasn't any less detectable than the other fighters. Fighters with camo coating was 61% to 73% less detectable than the fighters with white coating. The 3-D shape was found on average to deflect about half of the light that hits it. The F-14 with retracted wings was the least detectable fighter.

Conclusions/Discussion
The Hypothesis stating that the F-22 would be the least detectable because of its shape was not supported by the data. F-14 Tomcat proved most efficient at scattering light, most likely because of its rough and uneven surfaces. The data had shown that the front views had been the least detectable because more of the light passes by the plane at this view. Standard deviation was consistent usually sticking at around 3%. The outliers never ranged over 12% deviation.

Summary Statement
The project, using the visual spectrum, measures the idea of steath for three jet fighters.

Help Received
My dad had helped me with the necessary trigonometry to put my project

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Zachary A. Johnson

Project Number
S0208

Project Title
The Effect of Differing End Mill Length and Diameter on Dimensional Control While Cutting Steel with an End Mill

Abstract

Objectives/Goals
The purpose of the project was to determine the effect of differing end mill length and diameter on dimensional control while cutting steel with an end mill. It is believed that end mills with a small flute length to end mill diameter aspect ratio will have the least deflection. It is also predicted that the deflection will be directly proportional to the flute length to the third power divided by the diamter to the fourth power.

Methods/Materials
Materials: 2 meter steel bars with dimensions of 19.05 mm x 19.05 mm; End mills of 1.59 mm, 3.18 mm, 4.76 mm, and 6.35 mm diameters with ratios of flute length to diameter of 2.0, 3.0, 3.3, 4.0, and 6.0; CNC End Mill; Band Saw; Safety Goggles; Deburring Paper; Roughing tool of 12.7 mm diameter; Collet (tool holder); Pre-Setter; Micrometer
A computer numerically controlled (CNC) program was created to cut steel blanks into a desired shape through the use of a finishing tool in a CNC Milling Machine. Ten finishing tools with different combinations of end mill diameter and length were chosen to be tested. Three samples w ere cut for each end mill combination of length and diameter. Using a micrometer, the dimensions at the top (closest to tool holder) and bottom (farthest from tool holder) of the machined parts were taken. The difference of these two values was then taken and divided by two in order to determine the deflection for each individual end mill.

Results
With a mean deflection of 0.00 mm, it was found that the five end mills with a length to diameter aspect ratio below 4 to 1 had the lowest deflection. The five end mills with an aspect ratio greater than or equal to4 to 1 had a higher mean deflection of 0.03 mm. For the experiment, the percent deviation ranged from 0.00% to 0.07%, indicating a high repeatability within the project.

Conclusions/Discussion
It was concluded that the hypothesis which stated that end mills with a smaller aspect ratio would have less deflection was supported. Furthermore, it was concluded that the deflection was directly proportional to the flute length to the third power divided by the diameter to the fourth power, with a correlation coefficient of .864, lending validity to the conclusion.

Summary Statement
Accessing the impact of cutting with end mills of differing flute length and diameter on dimensional control.

Help Received
Brother and Parents gave technical support throughout the project.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Laurel A. Kroo

Project Number
S0209

Project Title
Efficient Low-Cost Wind Energy Using Passive Circulation Control

Abstract

Objectives/Goals
Wind turbine blades must change their pitch angle as the wind speed changes to achieve an optimal lift distribution. Circulation control is a way of changing the flow over an airfoil by ducting air through a slot at the trailing edge of the surface. This transforms the shape of the flow, and changes the lift, just as if the airfoil pitch were changed. Conventional variable pitch mechanisms are complex and expensive, but increase the efficiency of wind turbines. This project shows how circulation control can provide the efficiency of pitch mechanisms without their complexity.

A wind turbine can utilize the spanwise pressure gradient along each blade (caused by rotational motion of the rotor), with an inlet near the root of the blade that ducts air to an outlet near the tip, trailing-edge region of the blade. As the wind speed increases, and the RPM increases, so does the centrifugal force, therefore, so does the air coming out of the trailing edge. The flow then passively adapts with the wind speed to decrease the lift at high wind speeds, increasing the turbine's operable range. This project replaces a complex part with a static system that has similar effects but requires no moving parts.

Methods/Materials
I designed, built, and tested a prototype circulation control rotor. I built the blades using stereolithography and CNC foam. To test the rotor, I mounted the turbine to my car, and built an automatic data collection system. I also learned how to run computational fluid dynamics codes to model the effect of trailing-edge blowing on the lift and drag of the blade.

Results
The data taken from the experiment indicates circulation control can significantly affect turbine performance. The new blades increase the range of wind speeds at which the turbine produces power by over 170%. The power distribution at higher wind speeds was lower than expected, perhaps caused by too much trailing edge blowing, or by high drag forces. The CFD cases showed the effect of slot width and jet velocity on lift for this airfoil. Overall, the data from both the prototype and the CFD suggest that passive jet slots could improve the efficiency of wind turbines.

Conclusions/Discussion
The next step is to build a larger prototype to investigate the effects of scaling. This project has the potential to increase the efficiency, reliability, and affordability of wind turbines. Prov. Patent No. 61/306,803 filed Feb. 2010.

Summary Statement
I designed a wind turbine blade with increased efficiency over a range of wind speeds, built a theoretical model using computational fluid dynamics codes, then built and tested a functional prototype,which demonstrated improved performance.

Help Received
David Rodriguez: for teaching me how to run CFD cases. Ilan Kroo: answered conceptual questions and helped with data collection. Tom Muniz: helped with Solidworks. Eric Allison: taught me Xfoil. Colin Johnson/Paul Mendonsa (patent lawyer): helped file patent. Anand Gupta: helped with sensor system.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Jackson T. Lundgren

Project Number
S0210

Project Title
The Effect of Surface Roughness on the Drag of a Rocket

Abstract

Objectives/Goals
The objective of the project was to see how much of a role surface roughness played in the force of drag on an object moving through a fluid (air). I had always heard that rockets must be sanded until their surface is incredibly smooth in order to achieve the maximum altitude. I wanted to test if that was really true.

Methods/Materials
I built three identical rockets, one with a smooth finish, one with a coarse finish, and one with a very coarse finish. I then launched them, using the same type of engine for each launch and recorded the altitude. I found that the smooth rocket went the highest, the coarse rocket the second highest, and the very coarse rocket the least high. I also ran a simulation on a Rocket simulation program, and found that the rougher the surface, the lower the altitude reached by the rocket. The third part of the experiment was in a wind tunnel, where I measured the drag force created by each rocket. I found that the rougher the finish, the greater the drag, and inversely the smoother the finish, the less the force of drag acted upon the rocket.

Results
The hypothesis was supported. The rougher the surface of an object, the greater the force of drag. The smooth rocket went the highest, the coarse rocket the second highest, and the very coarse rocket the least high. I also found in the wind tunnel that the smooth rocket had the least drag, the coarse rocket the second least, and the very coarse rocket the most drag.

Conclusions/Discussion
From my project one can conclude that the rougher the surface of a moving object, the greater the force of drag on said object. One can conclude that the smoother the finish of an object moving through a fluid the less the force of drag on the object.

Summary Statement
finding the effect of surface roughness on drag

Help Received
Uncle helped build wind tunnel components, dad helped fiberglass rockets and supervise launch

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Bradley A. McAskill

Project Number
S0211

Project Title
Common Crash Cushions

Abstract

Objectives/Goals
To build and test different crash barriers that effectively reduce the impact force on the vehicle colliding with them.

Methods/Materials
Construct a very durable "vehicle." Construct a track that the vehicle may travel down. Construct a simple machine that will convert the force 40 lbs falling, to pulling the vehicle down the track. The vehicle is accelerated down the track using this machine until the vehicle impacts a solid wall, the deceleration is then measured using an accelerometer. The accelerometer is also used to determine the speed of the vehicle at the time of impact. A baseline deceleration at the time of impact is established. More tests are conducted with different barriers. One barrier is two 3/4 inch PVC pipes that are 3 feet long and can flex when impacted. Another barrier is two shock absorbers from the suspension of a car. And the third is a one gallon jug filled with water and sealed. The deceleration on impact of the different barriers is then compared to the baseline to determine the barrier's effectiveness at removing energy from the vehicle during impact.

Results
Because the accelerometer could not react fast enough only the time data is useful during impact so the deceleration had to be calculated mathematically using the available data. In all tests the vehicle is traveling approximately 8.8 m/s at the time of impact. The solid wall brought the vehicle to a stop in 0.04 seconds, indicating a maximum deceleration of 222.8 m/s2. The deceleration with the PVC pipe barrier is 162.75 m/s2, the deceleration with gallon jugs was 194.5 m/s2, and the deceleration with the shock absorbers was 170 m/s2.

Conclusions/Discussion
The PVC pipe had the lowest deceleration, however, due to the elastic properties if PVC it was the least effective barrier. After the vehicle impacts and comes to a complete stop, the PVC rebounds and accelerates the vehicle in the opposite direction of impact increasing the total acceleration. The shock absorbers are the most effective barrier. The gallon jugs were the next most effective, then the solid wall, then the PVC pipes. An impact acceleration the same as what was recorded for the baseline tests, 222.8 m/s2, could cause serious injury to a person, thus the importance of developing crash barrier technology. The results of the experiments conducted suggest that using shock absorbers is the best way to reduce the force a person might experience in an accident.

Summary Statement
To design and test different crash barriers to determine which is the most effective at removing energy from a vehicle during a collision.

Help Received
Physics teacher Mr. Mark Grubb supplied the accelerometer and answered occasional questions.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Chakradhar R. Murali

Project Number
S0212

Project Title
The Correlation Between a Propeller's Chord Length and the Electricity It Produces in Voltage

Abstract

Objectives/Goals

The objective of this experiment was to determine a propeller's efficiency when altering the chord length of the propeller. In an airfoil, which is a cross section of a propeller wing, the chord length is basically the entire length of the airfoil. When looked at as an entire wing or blade, it is basically the width of the wing/blade. My objective was to determine which propeller was efficient in producing the most amount of electricity meeting the changes of the chord length. This project shows the efficiency of a simple tool kit propeller against regular home use fan with all other variables constant, such as pitch angle, radius, shape, and airspeed from a fan.

When air moves over a surface of a rotating propeller, like one on an airplane, the air pressure in front of the propeller is reduced and the air pressure behind the propeller is increased. This pressure imbalance is what then pushes the airplane forward. In this project however, instead of a propeller being attached to an airplane, it is stationary and is instead moving to the air being blown at it from a conventional fan. Here the wing is specifically producing induced drag, which is related to how the wing creates lift.

Methods/Materials

The materials used were a simple propeller making tool kit, wood, DC motor, digital multimeter, a simple wire resistor, and small jumper cords. I attached each propeller to a DC motor. This was placed on a wood plank, against the airflow of conventional fan to test for efficiency. The propeller chord lengths were, 37 mm, 35, mm, 31 mm, and 27 mm.

Results

Through this experiment, the average results produced were, 39.63 mV for the 37 mm, 47.97 mV for the 35 mm, 42.78 mV for the 31 mm, and 29.16 mV for 27 mm propeller.

Conclusions/Discussion

In all, the 35 mm propeller produced the most efficient amount of electricity. In regards to the 37 mm propeller, there was a critical point where the propeller was simply to big to spin against the airflow of a conventional fan. On the other hand, because of a shorter chord length, the 35 mm propeller produced less induced drag then the 37 mm and thus had better effect. The 31 mm also had great efficiency. Nevertheless, it was not on par with the 35 mm propeller because the 35 mm propeller deemed to be the best fit for the airflow produced by the conventional fan. The 27 mm propeller was simply too small against the airflow from the fan to generate much electricity.

Summary Statement

I designed a testing station to test the efficiency of a propeller when I altered its chord length and placed it in front of a conventional fan to see how much electricity it would produce.

Help Received

Dad encouraged me and gave input on aerodynamic concepts. Mrs. Lisa Fox, science teacher, guided me through the basics of conducting my experiment and reviewed my lab manual.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Robert K. Olson

Project Number
S0213

Project Title
Synthetic Motor Oil: Is It Worth the Extra Money?

Abstract

Objectives/Goals
Discovering if Synthetic motor oil has less variation in viscosity than regular oil over a range of temperature.

Methods/Materials
3x Cylinderical Containers (Water Bottles)
1x Metal Sphere
1x Glass Marble
3x Different types of Oil
-30W (Oil with no additives)
-15W-40 (Oil with additives)
-5W-30 (Synthetic Oil)
1x Scale for measuring mass
1x Electric Thermometer
1x Stopwatch
1x Pencil
1x Data Sheet for each type of oil
1x Spoon (for getting marble out of the marble)
1x Refrigerator and freezer
1x Stove and pot
Lots of Paper Towels

Results
The Synthetic Oil stays at the same viscocity over a wide range of temperature, while the others change drastically.

Conclusions/Discussion
The Synthetic Motor Oil is the best out of all the oils tested.

Summary Statement
I measure how the Synthetic Oil is different than the other oils

Help Received
Dad helped glue paper onto the board

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Oliver L. Ramin

Project Number
S0214

Project Title
Refractory: The Ideal Proportion

Abstract

Objectives/Goals
The goal of this experiment was to find the most insulating, durable and inexpensive refractory material for utilization in the non-ferrous industry.

Methods/Materials
Two identical groups of samples with varying proportions of the minerals kaolin clay and silica sand were created for consistency purposes. Both materials are extremely inexpensive relative to currently utilized refractors. All samples were measured for weight, and not volumetrically. After the ceramic samples cured, they were measured for weight loss due to cracking. They were also measured by use of a .001 inch caliper for diameter shrinkage. They were then fired to cone 04, or 1900 degrees Fahrenheit. The samples were tested for shrinkage in both weight and size just as they were measured pre-vitrification, after the firing. The sample groups were finally tested for density, indicative of future insulating power.

Results
It was found that a proportion of 65% kaolin and 35% silica in units of weight is ideal for the perfect balance of durability and insulating power. Samples with higher proportions of kaolin shrank and cracked far too much, rendering them impractical for industrial use, while samples with higher proportions of silica would not vitrify correctly. The 65/35 ratio is ideal.

Conclusions/Discussion
The foundry industry is directly or indirectly tied to 95% of manufacturing in the United States. It is, therefore, imperative that the industry is supplied with an inexpensive, durable and insulating material. Refractory is a consumable material, and the less a foundry uses, the more money it will save. The perfect balance of the two inexpensive refractors would prevent countless unnecessary monetary expenditures from the already struggling domestic foundry industry. These data shows that if the eco/bio friendly 65% kaolin and 35% silica proportion were to be utilized, the domestic non-ferrous foundry industry would benefit immensely.

Summary Statement
To find an inexpensive, durable, insulating eco/bio-friendly alternative to refractory currently utilized in the non-ferrous industry.

Help Received
My ceramics instructor, Katherine O'Brien, fired both groups of samples to the exact same temperature, using an electric induction kiln. She also clarified the intricacies of ceramics at the molecular level, pertaining to platelets and vitrification.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Caitlin A. Redak

Project Number
S0215

Project Title
Black Widow Dragline Strength

Abstract

Objectives/Goals
I am interested in spiders because they rely on the strength of their silk for their own support and to capture and hold their prey. Silk is expensive to make, but I thought spiders would need to make extra strength silk so it wouldn't break as easily. This raised the question: is the silk's full capacity being used to hold the spider or is it able to hold more? My hypothesis was that the spider's silk is not being used to full capacity and it can hold more weight for things such as prey, water, or environmental forces like wind.

Methods/Materials
I extracted silk from the spider using larval forceps, attached it to a clamp and attached a hook to the other end using super glue. I put small washers on the hook until the silk broke. I weighed the washers, hooks and calculated the mass that broke the silk. I weighed all weights and spiders on an analytical balance.

Results
I used g/cm to show strength and converted it to tensile strength as well. I compared the average of all four pieces for each spider to the spider's mass. I found that as a spider gets bigger, silk strength increases. I also compared the relative strength (g/cm) to actual length of the silk strands. This data showed that short pieces were stronger than longer pieces. I think this means that a shorter piece will hold more because it is more stable than a long strand. That data showed that across the board a spider's silk can hold more than just the spider.

Conclusions/Discussion
Spider silks can hold a much greater weight than just the spider, so I accepted my hypothesis. Spiders should create webs out of short little strands versus long flowing strands for maximum strength. This is necessary because the spider needs to be able to hold more than just its weight depending on a variance of environmental conditions (wind, water, movement of the prey, etc.). This leads me to question if the dragline is the strongest variety of silk. It seems that it would not be, considering it needs to have the ability to be broken in case of emergency. I would test this in the future.

Summary Statement
I measured and calculated black widow dragline strength to see if it was working to full capacity with a certain amount of weight.

Help Received
Help collecting spiders from Dr. Richard Vetter and Tom Prentice; Used lab equipment at University California, Riverside under the supervision of Dr. Richard Redak; consulted Dr. Kimberly Hammond on statistical analysis.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Adam D. Swirsley

Project Number
S0216

Project Title
Fire Away: A Comparison of Supplemental Fire Protection Methods for Wood Sided and Fiber Cement Sided Homes

Abstract

Objectives/Goals
Since it is not practical or feasible for all homeowners to change their homes' siding materials, what is the most effective temporary method of making these siding materials more fire-resistant?
If we coat a wall with fire-resistant gel, then it will be more fire-resistant than the wall being protected with sprayed water.

Methods/Materials
I will be using lumber, wood siding, Hardie Board, garden sprinkler, fire resistant gel, and a propane torch.
A. Using the lumber, build the frames that the building materials will be attached to. Attach the different siding materials to the frames that were built. Using the propane torch apply fire to each sample for 20 minutes, recording temperature and condition each minute. After 20 minutes remove the torch and record temperature and condition at 1 minute intervals for 5 minutes. B. There are 12 sample, six with wood siding, and 6 with hardie board. 3 of each type will be sprayed with water, and 3 will be coated with fire resistant gel. C. The measurements taken were the temperature of the front and back of the samples in degrees farenheit. A measurement is taken each minute.

Results
Both the wood siding and Hardie board siding withstood the fire when water was sprayed onto the siding during the exposure to fire. When the fire resistant gel was used the samples did not fare as well. Two of the three Hardie board samples resisted the fire with no damage to the inside structure. The third sample had some minor fire damage to the inside structure. The wood sided samples all burned completely through when the gel was used as the protection. The fire on the surface of the wood samples did not spread as much as the control sample tested without water or gel.

Conclusions/Discussion
My hypothesis was not correct. The water actually did a better job of protecting the structure than the fire resistant gel. The water stopped the fire from spreading as well as protecting the back from fire damage, but the fire-resistant gel was unable to stop the fire from penetrating and causing fire damage on the back. This result is most likely the because the water provides a continuing source of cooling for the surface where the gel resists fire well for a few minutes but eventually burns away allowing the fire to penetrate. Both methods of structure protection are superior not protecting the surfaces.

Summary Statement
I am testing to see which method will be most effective in protecting a home with siding that is not fire-resistant.

Help Received
Mother are father helped supervise testing; Father helped transport and purchase required materials.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
William G. Thornbury

Project Number
S0217

Project Title
Passive Solar Air Cooling/Heating Using Geological Insulation

Abstract

Objectives/Goals
My goal for this project was to develop a cost efficient, "green" method for cooling or heating ambient air that could be used to remedy problems our environment faces today and in the future with intensifying climate issues.

Methods/Materials
In this experiment I built two U-shaped PVC pipe apparatuses made of two 7 foot segments of 3 inch and 6 inch PVC pipe that were connected by a 2 foot segment and two elbow-joints. I dug a four foot trench into the soil with an auger and buried the 6 inch apparatus. I attached a solar powered fan to one of the open ends and created an airtight seal. From 12:00-1:00 PM and from 1:30-2:30 PM I measured the temperature of the air flowing into the apparatus, the temperature of the air flowing out of the apparatus, the soil temperature on and 4 feet below the surface, and the humidity.

Results
In both the 12:00-1:00 and the 1:30-2:30 time period there was a significant increase in temperature after circulation (supported by a 2-sample t test). The temperature of the soil 4 feet below the surface remained relatively constant throughout the entire experiment ranging from 11-13 degrees celsius.

Conclusions/Discussion
Consequently, future climate change would have little effect on the soil temperature if I were to dig deeper to where the temperature of the soil is even more stable. Therefore, as our planet's climate intesifies, my research can reduce the percentage of crops lost to extreme weather conditions and mitigate temperature fluctuations in new housing developments while cutting energy costs by cooling or heating the surrounding air.

Summary Statement
My project goal was to see if I could change the temperature of air by circulating it through soil using solar power.

Help Received
My brother helped design the board; My mother taught me how to format the data into excel; My father helped me dig the trench; My uncles drove me to UC Berkeley so that I could do outside research in the libraries.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
David D. Tsao

Project Number
S0218

Project Title
3... 2.. 1... Liftoff!

Abstract

Objectives/Goals
The following report is an attempt to find the relationship between the volume of water and launch altitude for a 2 liter soda bottle rocket under controlled conditions: (1) 1 atm and 25 °C (surroundings to system, the experiment), (2) fixed position of observers and launcher, (3) fixed angle, length, and diameter of launch tube, (4) a pressure of 50 PSI, and (5) water temperature of 25°C for each launch.

Methods/Materials
Under controlled conditions of (1) 1 atm and 25 °C (surroundings to system, the experiment), (2) fixed position of observers and launcher, (3) fixed angle, length, and diameter of launch tube, (4) a pressure of 50 PSI, and (5) water temperature of 25°C for each launch, the experiment carried out consisted of launching a bottle several times, each time with a specific volume of water, in increments of 100mL. The launcher used to launch the bottles was constructed of an air compressor, PVC pipes, a trigger mechanism, a Schrader valve, and a fixed central launch shaft. One person launched the rocket, and another person (observer) measured the angle of the ground to the person to the maximum height of the launched bottle. The person who launched the rocket then measured the perimeter of the imaginary triangle consisting of the points of the launcher to the observer to the final position of the launched bottle. Using trigonometric equations and angle measurement, an approximate altitude is calculated for each test. From the data collected, the relationship between the volume of water and launch altitude is graphed on a plane for the analysis.

Results
The relationship, when graphed on a plane, shows a skewed curve with an elongated end towards the extreme high end of the volume of water. The maximum altitude, 39.49 meters, was achieved with 300 milliliters of water. Before the 300 milliliter mark, there is an increasing trend for the relationship of water added to altitude reached. After the 300 milliliter mark, there is a decreasing trend for the relationship of water added to altitude reached.

Conclusions/Discussion
Within a range of 0-300 milliliters, the altitude reached by the rocket increases with more water added. After 300 milliliters, the altitude reached by the rocket decreases with more water added.

Summary Statement
FInding the Relationship Between the Volume of Water and Launch Altitude for a 2-Liter Soda Bottle Rocket

Help Received
Mother helped with measurements of distances of rocket to launcher to observer; Johnny helped cut PVC pipes and design for construction of the launcher

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Jonathan H. Vu

Project Number
S0219

Project Title
The Precision of Paintball When Shot, Depending on the Brand of Material Characteristics

Abstract

Objectives/Goals
To determine manufacturing factors such as material characteristic of paintball, design of barrels and design of air tanks on whether the paintball will hit or miss. We will measure how the external environments affect the flight of the ball.

Methods/Materials
Manipulated Variables: Material characteristic (brand), design of barrel, design of marker, and design of tank
Responding Variable: Deviation from target
Control: speed of paintballs, height of barrel from floor, size of target board, distance between target board and barrel of markers
Step 1: Paintballs were put into separate bags and subjected to different temperatures: 37.79*C, 23.35*C, and 0*C. Step 2: Target board was put up on wall. Step 3: Markers were set up. Step 4: After 1 hour, paintballs were taken out and for each marker and tank, there were 5 trials.
To ensure barrel was level, a leveling tool was used. To make sure barrel was aimed at bulls eye, a string was stretched between tip of barrel and bulls eye. All five shots were fired, then measured, then wiped off.

Results
Of the Giant paint (with solid, filled level, rigid structure), fired with the Smartparts Ion and LPA tank at normal temp batch, it had the lowest mean out of all brands of paint and markers and tanks
Mean of 4.02cm, avg dev of 1.35, and %dev of 33.55%.
Of the White Box (with solid, filled level, rigid structure), fired with the Smartparts Ion and LPA tank at normal temp batch, it had the second lowest mean
Mean of 5.34cm, avg dev of 1.97, and %dev of 36.97%
Of the Giant (with solid, filled level, rigid structure), fired with the Alpha Black and CO2 at normal temp batch, it had the highest mean
Mean of 44.26cm, avg dev of 1.38, and %dev of 3.11%

Conclusions/Discussion
The study somewhat supported hypothesis, although the overwhelming data was all over the place
The Giant paint hit bulls eye twice
Other shots were close
White box paint hit bulls eye once

Summary Statement
The precision of paintball when shot, depending on the brand of materials characteristic (external environment)

Help Received

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
James Xue

Project Number
S0220

Project Title
Green Concrete for Safer Infrastructure

Abstract

Objectives/Goals

The rubberized concrete has superior damping performance for dissipating seismic energy and protecting structures. At the same time, instead of disposing the waste to a landfill, this technology will enable scrapped tires to be recycled with the best "green" practice.

The objective is to experimentally investigate dynamic performance of rubberized concrete structures.

Methods/Materials

Methods: 1. Preparation of concrete specimens (3 normal and 3 rubberized specimens); 2. Free vibration tests (5 trials); 3. Seismic shaking tests (5 trials).

Material for specimens: 10 kg of cement, 50 kg of sand, 15 kg of recycled rubber crumbs, 12 pieces of 5-mm diameter steel bars, 12 liter of water, 6 pieces of 27 in X 41 inch Styrofoam boards, 2 tubes of superglue.

Material for experiments: 1 shaking table, 4 sets of nuts and bolts, 1 glue gun and 5 glue sticks, 2 seismographs, 1 personal computer, 1 digital camera.

Results

A free vibration test was carried out on each of the six concrete columns. The free vibration test was repeated 5 times for each of the six specimens. Meanwhile the damping ratio was calculated each time. The results show that the rubberized concrete columns have higher damping ratios than the normal concrete columns. This implies that the rubberized concrete columns are more capable in kinetic energy absorption.

In the seismic shaking table tests, the concrete columns were tested in sequence on the shaking table at the selected seismic ground motion. Large movement of the column back and forth was observed. Popping sounds could also be heard. It was observed that cracks appeared in all the six columns, but relatively less cracks appeared in the rubberized columns.

Conclusions/Discussion

Based on the free vibration tests, the average damping ratio of rubberized concrete column is 7.7 while normal concrete columns is only 4.7. Adding rubber crumbs into concrete increases the damping ratio by 70%.

The results of the seismic shaking table tests show that the peak response acceleration of the rubberized

Summary Statement

This study demonstrates the potential for creating a "green" material # rubberized concrete, which possess the superior performance in absorbing kinetic energy during earthquake, protect large structures

Help Received

Mr. Yoshi Fukuda, research assistant at the Center for Advanced Monitoring and Damage Inspection, UC Irvine, provides helps in specimen and experiment preparation

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
David A. Zarrin

Project Number
S0221

Project Title
Less Sweat or Less Fatigue? My SmartBike Does the Rest!

Abstract

Objectives/Goals

I researched the physics of transferring power through moving gears. Unlike the traditional gear system, a Continuous Variable Transmission can provide a near infinite range of gear ratios. However previous attempts to build continuous transmissions have required the use of cones and/or belts, which are inherently less efficient. So, I set out to build and test a better bicycle transmission.

My hypothesis is: The use of a real-time microcomputer and a clever chain-drive CVT can convert more of my energy into bicycle movement than the conventional gear design.

Methods/Materials

My plan is to a) empirically model the inefficiencies of a conventional gear system; b) demonstrate how such mechanical inefficiencies would reduce cyclist road efficiencies; c) build an appropriate simulation model; d) design and then build a new Computer controlled CVT and e) test the hypothesis by comparing the new prototype to the conventional transmission design.

Results

One of my challenges was to maintain the high mechanical efficiency of a chain-drive transmission in a Continuously Variable Transmission. To my knowledge, this has never been accomplished before. Other attempts at CVT [in general] have used belts, which cannot transfer energy as well as the mechanical coupling of a chain on gear. The belt on a cone makes for an easy and continuous change of gear ratio. But, how do you accomplish this continuous ratio with chains?

The simulation results and the prototype showed that it is possible to build energy-efficient CVTs that could deliver up to 15% more power under certain road conditions.

Conclusions/Discussion

The concept of transferring mechanical energy from one point to another is fundamental to many devices and applications. This study shows how to apply computer controlled CVT technology for building energy-efficient vehicles

Summary Statement

Create a computer-controlled Continuous Variable Transmission for bicycles (and vehicles) which delivers more power.

Help Received

My advisor assisted in operating power tools occasionally. Participated in ISEF under the mentorship of Mr. Rob Reis.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Chen (Amy) Zhang

Project Number
S0222

Project Title
What Affects the Speed of a Floating Object?

Abstract

Objectives/Goals
I mainly want to find out if the floating speed of an object depend only on the object volume or also on some other factors when the object is floating across a certain depth in water.

Methods/Materials
1. Use wood material to make floating blocks
2. Cut the wood blocks into different shapes: cubic, rectangular, and triangular prism, with different dimensions and volumes
3. Measure and record the volume and mass of each object
4. Label each objects according to its material, shape, and size in order to keep track of all the data
5. Make sure that the bigger side of the object is facing up at each reference point
6. Push the object into the bottom of the swimming pool at its reference point with a net in order to secure its position
7. the timer starts the stop-watch when the net is being released
8. The timer then time the amount of time it takes for the object to float to the surface of the water
9. Repeat the procedures 6-8 at the other reference point in the swimming pool and with different objects

Results
The measurements from the experiments demonstrate the objects# relationships between their floating time and their sizes and masses. Meanwhile, the paths of the objects floated upward depended greatly upon their shapes and sizes. Larger rectangular blocks floated in almost straight lines and kept same sides (bigger side) facing up until they reach the surface of the water. Smaller rectangular and triangular blocks were not stably moving upward with the same face facing up; instead, they changed their floating orientations, rotated from side to side, or slid in zigzag path while floating in water.

Conclusions/Discussion
The results of this project clearly show that the objects# floating time depends on not only their sizes, but also on their orientations, and their stability. More strictly speaking, the greater the volume of an object, the faster it floats. The more stable movement of an object, the faster it floats. The smaller the side of an object facing the sky, the faster it floats.

Summary Statement
I want to find out the various factors that affect the floating speed of a floating object, while it floats upward.

Help Received
My mom was the second timer during the experiment; my dad was pushing down the blocks toward the bottom of the pool. In addition, both of my parents helped me with building the board.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Ruiqi Zhu

Project Number

S0223

Project Title

The Relationship Between the Number of Blades on Wind Turbines and Power Output

Abstract

Objectives/Goals

Objective: The most of wind turbine generator in California have two blades. So I made an experiment to build a wind turbine with an optimal number of blades that is best suited for generating power. I test the power output in relation with the number of blades, which can be measure by a multimeter.

Methods/Materials

Materials: cardboards, notecards, glue, water bottles, ac generator, multimeter, a piece of wood, a 20x20 inch box fan,glue gun, duct tape

Methods: Make a wind tunnel, make four wind turbines out of note cards, make a removable ac generator. Put a 20 inch by 20 inch fan at the end of windtunnel while the wind turbine is on the other side of the wind tunnel. Measure the Power output from the generator by using a multimeter. Test our all four of the wind turbines.

Results

RESULTS: Unlike what I thought, the wind turbines with fewer blades had a larger output than turbines with more blades. This was very surprising and contradiction with my hypothesis. But power output from wind turbines can be calculated from the equation: P=0.5dAv3. The reason why fewer blades corresponds with higher output can be reasoned from the equation of continuity: d1A1v1=d2A2v2. Since density is lower, velocity is higher. A higher velocity would result in higher power output from P=0.5dAv3.

Conclusions/Discussion

CONCLUSIONS: I was not able to support my thesis from the contradicting data. But I was able to find out reasons why fewer bladed turbines can produce more power than turbines with more blades. As my results pointed out, the turbine with only one blade produced the most output(mW) and output decreased as number of blades increased. I wish to further my research by testing on larger model as well as on different angles of the wind turbines. Larger scales of these wind turbines can be built without an excessive amount of effort. We should commercially build these wind turbines and this will reduce our dependence for extensive wind farms and promote the construction of urbanized wind turbines.

Summary Statement

The Relationship Between the Number of Blades on Wind Turbines and Power Output

Help Received

Mom and dad helped to get materials. Dad helped to cut card board. Friend,Jonathan, helped out.