CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Norman Bae

Project Number
S0201

Project Title
Effectiveness of Wing in Ground Effect on High Speed Train Concepts

Abstract

Objectives/Goals
The objective was to find which high speed train concept produced the most lift and least drag and use that to prove effectiveness of the wing in ground effect.

Methods/Materials
Constructed four wing in ground effect models (single wing, double wing, lift wing, and x-wing) from balsa wood and styrofoam. A homemade wind tunnel was used to test each design. Using lift and drag balances, I measured how much lift and drag was produced by each model. Dry ice fog was used to visualize the airflow around each model.

Results
The single wing design produced the most lift of 171 grams and double wing design produced the least drag of 16.5 grams. Further experimentation led to the single wing producing 120 grams of lift at 3.175mm and 87.5 grams of lift at 44.45mm off the ground.

Conclusions/Discussion
The single wing design performed the best overall while the expected best performance design, lift wing, performed the worst. The lift wing design lift was compromised by large aerodynamic drag. Airflow around the lift wing and x-wing models indicated that in addition to the wing surface area, the body surface area of these models also contributed to the overall lift. Further results of the single wing design proved that more lift was produced closer to the ground due to the wing in ground effect. The test data suggest that it is possible to build a train that travels near the inside surface of a u shaped track using wing in ground effect.

Summary Statement
My project is experimenting with different high speed train designs to see which had the best performance using wing in ground effect.

Help Received
Father helped with preparing the materials for the cardboard wind tunnel.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Joshua S. Barram

Project Number
S0202

Project Title
The Differences of Two Propeller Characteristics Affecting Efficiency in Air vs. Water Due to Different Slips

Abstract

Objectives/Goals
The objective of this project was to ascertain different amounts of slip that water and air each respectively have. Also, to determine the effect radius and chord have on the efficiency of propellers in air vs. water.

Methods/Materials
Materials: 10 propellers (2 groups of 5) modified to produce different amounts of chord and radius, propeller and motor assembly and apparatus (to hold and direct propellers), and a stress meter to record thrust of propeller and motor. Methods: the propeller assembly, apparatus, and stress meter were built. The propellers were modified and fitted to the motor shaft. The propellers were tested in water and air, data were recorded from stress meter.

Results
All propellers were more efficient in water than in air. Reducing radius in water increased efficiency, but only up to a point. The most efficient air propeller when tested in water had the shortest radius and longest chord. Overall, altering radius affected propellers more than altering chord.

Conclusions/Discussion
The operational hypothesis for this project was "if water has less "slip" than air, then a longer chord and a shorter radius should make the propeller more efficient in water and a shorter chord and longer radius should make the propeller more efficient in air". This seems to be supported by the data, that water has less slip than air; a longer chord and a shorter radius are more efficient in water, and a shorter chord and longer radius are more efficient in air.

Summary Statement
This project demonstrated that water has less slip than air and altering two propeller characteristics affects efficiency differently in water vs. air.

Help Received
I extend my thanks to my parents for their support, wisdom, and knowledge. I also extend my thanks to Ms. Markson for assigning this project, and for being so patient with me.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Dylan Beatty; Jack Holman; Garrett Morgan

Project Number
S0203

Project Title
Spudgun Ballistics

Abstract

Objectives/Goals
The main objective for our project was to learn about the physics of a potato cannon focusing on angle, barrel length, and the type of hairspray you use.

Methods/Materials
We took a potato cannon to a large field and repeatedly shot it recording how far it went on a data table. Materials:abs pipe, (to build gun) joint glue, latern striker,stand for gun, angle measure, large field, potatoes and hairspray.

Results
We found that at a 15 degree angle with White Rain Hairspray and a 6 foot barrel it went the farthest.

Conclusions/Discussion
We might of had different results if we had found a way to measure from where the potato landed instead of adding the bouce. Besides this we believe that the results we got were accurate. We believe that White Rain worked the best because it had the most dimethyl ether. We also think that the 6 foot barrel worked best because it had the perfect amount of time to exspand.

Summary Statement
Our project was about find the perfect combination of hairspray, barrel length ,and angle to launch as far as we can.

Help Received
partners father helped build gun/stand science teacher helped us learn physics.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Alexander Berry; Katherine Corradini; Bernard Kozacik

Project Number

S0204

Project Title

Shooting for Distance

Abstract

Objectives/Goals

The objective of our project was to find the optimal weight for maximum distance at 100 PSI. We would fire water bottle projectiles out of a pneumatic cannon at different weights and try to find the farthest distance.

Methods/Materials

A pneumatic cannon was filled up to 100 PSI with an air compressor, and a projectile, a water bottle, was filled with birdshot between 99g and 3157g. The cannon was then loaded and fired, and the distance was measured and recorded. This distance was plotted on a scatter plot and fitted to a graph to determine the optimal weight to distance ratio for a projectile.

Results

The results of our projectile fit very closely to our hypothesis. There was a sharp increase in distance as the weight was increased until a certain point, around 1300 grams, after which point the distance steadily decreased.

Conclusions/Discussion

As said before we did not quite get a perfect model of what we thought would happen, however still proved our hypothesis. Our original expectations were that it would look similar to a parabola with a fairly sharp increase and a fairly sharp decrease. While it was evident based on our tests that the sharp increase was realistic, the fluctuation with what we projected was in regards to the decrease of the function. In order to have fully witnessed the relation between weight and distance we would have had to use much larger projectiles with a larger mass. Even though we had a three person group for our project, there was constant work to be done by all three members of the group, whether it be taping water bottles, refilling the chamber with air, or measuring and recording data. Another thing that we would change if we were to do the experiment again would be to let the glue set longer on all the joints and around the valve. This alleviates several issues, first the possibility of air leaking out from the joints, and second the issue of pressure exploding the reservoir. One of our endcaps blew up and caused substantial damage to the wall of the house and broke a window because we did not let the glue set for long enough.

Summary Statement

Our project is about trying to find the greatest distance a water bottle can be shot using a pneumatic cannon.

Help Received

Chemistry and phsyics teacher helped with formulas

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Brandon Pastre; Sandra Boulos

Project Number
S0205

Project Title
The Home Made A.C.V. (Air Cushioned Vehicle)

Abstract

Objectives/Goals
Our goal is to create a hovercraft using house hold materials. Basically things you would find in your home. We got this idea from watching a movie of a man building a space ship in his garage. When we say household materials basically we cant use a special made hovercraft material.

Methods/Materials
Our materials were a Gas Leaf blower to inflate the skirt. a gas weed whacker engine which was one of our failures. an electric scooter motor which powers the fan for acceleration. Two 12ft. rope to steer. PVC piping to even out all of the air in the skirt. A 4x8 platform which is the foundation of the hovercraft. Nylon material or non air leaking material used for the skirt. Duck tape to hold the skirt in place. 24 or a 32 inch fan used to accelerate. Bendable metal which is able to form into a circle so it can force air in the direction we want to go with some help from the flaps. Spray paint which is used for decoration.

Conclusions/Discussion
Our data shows that our hovercraft could be made from household materials. We accept our hypothesis by testing and building our model of an ACV out of household materials. We found our hypothesis to be true because the trapped air makes the skirt inflate and the air pressure causes the plywood to lift. We the group, have learned a lot with doing this project such as the strength of air. The unexpected thing that happened was the ACV needs a skirt that can fit it just right. We didn#t expect to work on the skirt for a long time. It is very important to understand that the air makes this craft hover which is amazing. An ACV that we built can carry 2 people each one being under 180 pounds. Not only that but by testing it we found out that our hovercraft can LIFT UP TO 300 POUNDS!!!

Summary Statement
Our project is to make a homemade hovercraft out of household materials.

Help Received
Parents donated money for materials, Machinery work was done by Mr. Pastre, Teacher guided us

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Terry W. Burke

Project Number
S0206

Project Title
Fore: A Two Year Study of Golf Ball Prices vs. Quality

Abstract

Objectives/Goals
Golf companies design slogans to entice people to buy their product. Slogans like "The #1 brand in golf" and "Distance doesn't have to be hard" are only two of many ways by which golf brands try to attract customers. The goal of this project is to see who is stretching the truth and who is not when it comes to whose golf ball is really better. The purpose of finding this out is to see if golf ball prices are appropriate. The Brand A ball is the most expensive and is used by professional golfers, thus it should have the highest average distance over a series of hits (AD). All other golf ball brands should fall in decreasing order with the largest AD corresponding with the more expensive balls.

Methods/Materials
Four golf balls, all of different brands, were tested. The prices of all four brands were compared on the same website (www.golgalaxy.com). Brand A charges $43.99 per box of golf balls, Brand B charges $15.99 per box, Brand C charges $14.99 per box, and brand D charges $9.99 per box. These balls were tested for their AD using 50 hits. A consistent swing device (CSD) was constructed to ensure an accurate and consistent swing. A putter was attached to the CSD, which was set on a golfing green. A spot was marked using a golf tee to ensure a consistent contact point on the club was made every time it was swung. Each ball was struck 50 times.

Results
The Brand A ball traveled an AD of 231.9 inches per swing (IPS) while the Brand D ball, traveled an AD of 244.4 IPS. Following, was the Brand C ball traveling an AD of 223.4 IPS compared to the Brand B ball which traveled an AD of 210.3 IPS.

Conclusions/Discussion
The data did not completely support the hypothesis. The pricing of golf balls is out of proportion. The ##1 Ball in Golf,# which charged the most per box (Brand A) was, in fact, the ball that went the furthest. The Brand D ball, the least expensive, went the second furthest. Next was Brand C, followed by the Brand B ball.. These results show golf ball quality does not always match the cost. Paying more for a box of balls yields more AD; however, the cheaper balls were inconsistent with their pricing and distances.

Summary Statement
The project was designed to find out whether or not the pricing among golf balls is fair.

Help Received
Father supervised the operation of power tools. Mrs. Lewis, science teacher at Desert High School, helped with grammatical errors in abstract.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Nathan S. Cser

Project Number
S0207

Project Title
A Study into the Consistency in Mass and Accuracy of Airsoft BB's

Abstract

Objectives/Goals
This project was designed to find out which airsoft BB brand is most accurate and also if mass will affect accuracy.

Methods/Materials
CYMA CM.28 airsoft gun, 4 selected BB brands, gun stand, target, scale, paper, and ruler

1. Mass 25 BB's of each brand (store in each order).
2. Shoot them at the target/target paper, 25 feet away.
3. Measure distance from center.
4. Repeat steps 2-3, 2 more times; 3 times at 50 feet and 3 times for 75 feet.

Results
Excell was the lightest BB, 0.1937g average mass, as well as the one with the most accuracy. It's standard deviation from the average distance from center of the target was lowest. It was also the most consistent in mass, +/-0.00196g.

Conclusions/Discussion
Excell was most accurate and had the lowest average density meaning that mass/density affects accuracy.

Summary Statement
This experiment was preformed to find out if mass of the BB affects accuracy.

Help Received
Dad funded; Used scale at Santiago Canyon College under supervision of Mrs. Hale; Neighbor helped base for gun stand.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Andrew D. Durkee

Project Number
S0208

Project Title
Low Aspect Ratio Rotor Blades for Application to Helicopter Noise Reduction

Abstract

Objectives/Goals
The purpose of this project is to determine if the noise produced by helicopter rotor blades can be reduced by using low aspect ratio rotor blades with winglets. It was hypothesized that low aspect ratio rotor blades with winglets would produce less noise than that of high aspect ratio rotor blades. Further it was hypothesized that the 5:1 aspect ratio rotor blade would be the quietest and that a slight upward trend would be observed in the 2:1 aspect ratio rotor blade.

Methods/Materials
In order to test this hypothesis, a test chamber was built that would spin polyurethane foam rotor blades in a circle. The test used a sound level meter to measure the sound level and a photogate to measure the rotational speed of the rotors. A lift equation and several assumptions based on basic wing theory were used to calculate the relative noise level of each rotor size.

Results
After testing, it was shown that the 10:1 aspect ratio rotor was quietest with a source sound level of 46.5 Db. The 2:1 aspect ratio rotor was the loudest with a source sound level of 52.9 Db.

Conclusions/Discussion
It was concluded that the general hypothesis was correct in that low aspect ratio rotor blades can be quieter than high aspect ratio rotor blades, and that as the aspect ratio gets very low the rotor blade starts to get louder. It was also noted that the specific hypothesis was wrong in that the 10:1 aspect ratio rotor blade was quieter, not the 5:1.

Summary Statement
This project investigates the possibility of using low aspect ratio rotor blades with winglets as a means of reducting a helicopters noise signature.

Help Received
Mother proofread report, Father helped in construction of testbed

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Akash Gupta; Neil Kumar; Sameep Tandon

Project Number

S0209

Project Title

An Energy-Efficient, Self-Correcting, Deployable Bridge: Applying the Concept of Tensegrity in Harsh Environments

Abstract

Objectives/Goals

An easily deployable bridge is often required in real life situations. Some examples include emergency relief operations, military operations, or simply reaching inaccessible areas. The challenge is to create a bridge that is easily deployable, energy efficient, cost effective, and is able to withstand harsh environments and unique situations. Our goal was to find innovative methods to create strong structures with few and easily fabricated materials.

Methods/Materials

Our search led us to the physical concept of tensegrity, a natural phenomenon present in the structure of biological cell membranes. Tensegrity structures are essentially amalgamations of sticks and strings that fit together so that the conditions of static equilibrium are always satisfied. Unlike conventional structures, tensegrity structures maintain their rigidity through only axially-loaded forces. By controlling these forces through the tension of the strings, tensegrity structures can easily alter their shape. Using lightweight materials such as aluminum and elastic strings, we were able to assemble a deployable tensegrity bridge. We did this with the use of relatively inexact tools such as readily-available drills and other classroom tools.

Results

The structural concepts are supported empirically by our load tests in which our prototype held up to 29 times its own weight. The spring-like nature of our bridge should make it easy to compact and transport. Our test results showed the bridge structure can be compacted down to approximately 50% of its original size. Finally, we have found that even when the bridge is damaged (i.e. if a tendon were to break or a rod were to be damaged) overall failure of the structure will not occur due to compensating measures in the physical tensegrity design.

Conclusions/Discussion

Other issues in the designing of such a bridge or surface with the use of our tensegrity â#oplatesâ## must be explored further to put our bridge to real world practice. For example, we need to test the bridge with well-established construction techniques such as arches, anchoring methods, material selection, and environmental testing. We believe, though, that our tensegrity bridge demonstrates promise for the future, requiring fewer resources, less technical expertise, and less industrial technology to implement while delivering a product that withstands better the punishment of harsh and unstable environments.

Summary Statement

By using simple materials, we created a deployable tensegrity bridge that maintained its rigidity after placing loads of up to 29x its own weight, making it highly effective in environments where pre-existing infrastructure was destroyed.

Help Received

Mr. Bruce Kawanami helped give direction; Mr. John Alciati helped give direction; Dads helped paste together board

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Matthew P. Hamilton

Project Number
S0210

Project Title
Humane Hunting: Patterning a Shotgun

Abstract

Objectives/Goals
In 1991 the federal government prohibited the use of lead shot because it was poisoning waterfowl. Changing from lead shot to steel shot has a large impact on hunters because steel shot reacts diferently when fired. My project was to determine the best combination of choke tube, shot size, and velocity to have the most effective results when hunting waterfowl. I believe that using a combination of an improved cylinder choke tube with low velocity #2 shotshells will produce the best pattern results and be least likely to superficially wound waterfowl.

Methods/Materials
Data was collected by firing the shotgun at a 30 in. circle on a 35" x 35" piece of butcher paper at a measured 30 and 40 yards with various combinations of coke tube, shot size and velocity. At a later time, I counted each individual target and divided the number of pellets inside the 30 in. circle by the total number in the shotshell, which were also individually counted. 224 test shots were fired using high and low velocity BB, #2, #3, and #4.

Results
Low velocity shotshells consistently had higher pattern percentages compared to high velocity shotshells. Larger shot sizes consistently produced higher pattern percentages.

Conclusions/Discussion
My conclusion is that using a modified choke tube with low velocity BB will produce the best pattern at 40 yards or more. At less than 40 yards, the best pattern was produced using a modified choke tube with low velocity #2. This information is not readily available to hunters and is critical in the effort to conserve our wildlife.

Summary Statement
Effective use of variables to improve waterfowl conservation and hunting outcomes.

Help Received
Mother proofread report; Dad helped assemble target support and assisted with some test shots.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Sarah Herrman; Baillie Sproul

Project Number
S0211

Project Title
How Things Break: Failure Analysis

Abstract

Objectives/Goals
To determine whether a material breaks randomly or in patterns due to their molecular structures and components, and furthermore, to decide whether differences in surface or velocity will affect the breakage patterns and tendencies.

Methods/Materials
Glass sheets, Ceramic tiles, Cardboard Box, PVC Pipe, Steel Rod, Carpet, Wood Flooring, Concrete Flooring, Spray Paint, Safety Goggles, Gloves

We utilized a homemade apparatus consisting of PVC pipe and the aluminum plated steel rod to break ceramic tiles and glass squares on three surfaces: wood, carpet, and concrete an at two heights: 1m and 2m. Before each trial we had to mark the center of the specimen to be broken and align the PVC pipe at exactly a right angle to the center in order to minimize the loss of force due to friction and to increase the level of reproducibility and normalcy within our results.

Results
Overall, the ceramic tiles were very predictable with the most consistent results at one meter. The glass however had significantly more randomized results that were evident on all three surfaces and from both heights. This can probably be attributed to the crystalline structure of the glass compared to the combination crystalline-glassy structure of the ceramic tiles.

Conclusions/Discussion
Our hypothesis was proven to be only partially correct. Both the ceramic tiles and the glass sheets broke in specific patterns due to their molecular structures but were less predictable then we had hoped. Factors that may have altered our data include spray-painting the glass (could have altered the original structure of the material by strengthening its resistance to the breaking force), human errors (such as not aligning the PVC pipe and specimen correctly), variations in the concrete surfaces, and unpredictable flaws in the materials we used.

Summary Statement
We wanted to determine if things broke according to their molecuar structures and componets, or if breakage patterns were completely randomized.

Help Received
Lowes personnel cut glas squares

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Amrita Khoshoo

Project Number
S0212

Project Title
Which Type of Roof Shape Can Withstand a Given Amount of Force with the Least Deflection?

Abstract

Objectives/Goals
The purpose of this project is to test different types of roof shapes through three dimensional and finite element modeling, and report the maximum deflection of each roof shape under a fixed force. This purpose will be met by testing seven various roof shapes through the use of a commercially available Computer-aided design system (CAD/CAE), which has integrated analysis capabilities. The seven roof shapes being tested are high-pitched, medium-pitched, dome, half-cylinder, flat, small curved, and gambrel.

Methods/Materials
Firstly, the NX CAD/CAE system was used to create three dimensional models of the various roof shapes. The roof shapes were then meshed (divided up) into many flat quadrilateral 10 mm elements. The resulting finite element roof meshes were then constrained to simulate the points were the roof is attached to walls. A uniform load of 10 Newtons was applied to the finite element mesh and submitted to the NX Nastran for structural analysis.
The results were post-processed in the NX CAD/CAE system using three dimensional animation of each roof deflection. In addition, the maximum and minimum deflections along with specific nodal deflections of each roof shape were populated onto an excel spread sheet.

Results
The most important finding in this computer simulated experiment was that the dome shape roof had the least defection under the given amount of force. The flat roof however had the maximum deflection, proving to be the weakest shape. The dome shaped roof had less than two percent of the total deflection of the flat roof, less that all other variables used in this project.

Conclusions/Discussion
The results can also be divided in to three main groups: curved shapes, triangular shapes, and flat shapes. Overall the curved shapes were able to deflect the least under the 10N force, and when compared to the flat roof, all three curved shapes were under 10%. The triangular shapes proved to be less efficient than the curved shapes, and when compared to the flat roof all three shapes were in the 6-30 percentage range. This shows inefficiency of triangular roofs as opposed to curved shaped roofs. The weakest of the three categories was the flat shapes. The flat roof was 100%, proving such shapes to be very inefficient roof shape.

Summary Statement
My project was about the use of computer aided finite element modeling and analysis to determine the deflection of various roof shapes under a given load.

Help Received
My father got permission for me to use the NX CAD-CAM CAE software; UGS for providing help and training in learning the tool.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Laurel A. Kroo

Project Number
S0213

Project Title
A Fuel Cell Powered Underwater Glider for Marine Exploration

Abstract

Objectives/Goals
Underwater gliders are used for long-term oceanic studies and missions, such as ship scanning for the navy (invisible to sonar), underwater mapping, and temperature mapping for global warming studies. These gliders are expensive and not very efficient, making them an uncommon tool for ocean researchers. The goal of this project was to build an efficient, low cost underwater glider that recycles energy by using a fuel cell as its method of propulsion. Additionally, I analyzed the glider's performance and demonstrated its feasibility with the simple prototype. More efficient and lower cost gliders could be used more commonly throughout the world#s oceans.

Methods/Materials
A buoyancy engine allows underwater gliders to glide downward under the influence of gravity and upward, propelled by buoyancy. Normal buoyancy engines do this by expanding and compressing gas to change the volume and buoyancy. I have used a fuel cell to produce and consume gas instead of expanding and compressing it. This new buoyancy engine increases the efficiency from 12-15% to 50-75%. The fuel cell for this project was ten times the power of last year#s conceptual buoyancy engine model and has the potential and the ability to power the half-sized glider I#ve built. In this project, I designed, built, and tested a simple underwater glider powered by a fuel cell buoyancy engine. In addition, I wrote a computer simulation to analyze its performance.

Results
The efficiency of this glider is a significant improvement on current underwater gliders being used for ocean research and mapping. This new buoyancy engine powers a glider designed to travel at .25 m/sec while staying trimmed and stable in the water. The design of the glider was done experimentally, virtually and numerically to produce the most simple and reasonable design for aerodynamic performance and construction.

Conclusions/Discussion
The simulation and experimental tests show that this new idea is practical, and could revolutionize methods for some types of marine research. There are other ways to improve energy efficiency, and much more work would be needed for a fully maneuverable and data-collecting vehicle. I have yet to install a control system or sensors in the glider, but this project is the first step toward a powerful tool that would allow researchers to study the ocean in new, exciting ways.

Summary Statement
I designed, built, and tested a simple underwater glider powered by a fuel cell buoyancy engine and wrote a computer simulation to summarize the effects of drag, lift, weight, buoyancy, and pressure on speed, efficiency, and stability.

Help Received
Mother helped paste board, father answered questions about simulation equations, Blake and Sebby from the Gunn Robotics Team helped with welding/construction.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Johnnie Kwok

Project Number
S0214

Project Title
Truss Bridges

Abstract

Objectives/Goals
The project is find out the relationship between difference factor between different types of truss bridge, for example, the longevity of a covered truss bridge and to the truss itself, including the frequency of traffics, loading, maintenance, extent of protection, the different length of each truss, and the difference of the materials.By building model truss bridge with different length and different structure, after finish building the truss bridges, test them on the structure tester with the interface to the computer, finally compare the result.

Methods/Materials
making model out of balsa wood and test the model bridges by using the struture tester di-2000.

Results
the results in the span vs. maxium load has a decreasing rate when the span is increasing. And the H/S ratio vs. maxium load has an increasing ratio when the H/S ratio is increasing.

Conclusions/Discussion
H/S ratio increase because of the span increasing, that's made the Heigh become a less factor of the problem, so most likely the when the span increase, the maxium load will decrease.

Summary Statement
This project is about how the span will affect the truss bridges itself.

Help Received
Used lab equpment at Ribet Academy.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Nitish Lakhanpal

Project Number
S0215

Project Title
Better Stents: Simulating the Effect of Obstructions in Vascular Blood Flow on Coagulation

Abstract

Objectives/Goals
My objective is to develop and implement a model of blood coagulation in the vascular system from which the relative clotting hazards of various obstructions may be predicted. Stents, which have found widespread use in treating arterial blockage, have increasingly been implicated in blood coagulation in the vascular system leading to catastrophic consequences like stroke. I hypothesized that larger or sharp-edged obstructions will lead to quicker clotting while smaller or rounded profile obstructions will lead to slower clotting.

Methods/Materials
2.5 GHz Personal Computer with 512 MB of RAM.
The simulation, using Visual C++, was carried out in 2 steps.
(I) Compute flow field according to Navier-Stokes equations: 1) Establish 200 X 50 grid. 2) Load wall geometry - assign a state (liquid, wall/liquid, inlet/outlet) to each node. 3) Load boundary conditions. 4) Compute velocity and artificial density at next time step. 5) Update grid with new velocity and artificial density values. 6) Repeat 4 & 5 until velocity and artificial density have converged satisfactorily.
(II) Model clot formation: In each time interval, 1) Assign velocity to each platelet per stream velocity. 2) Advance each platelet. 3) If new speed differs from old by more than 40%, activate with probability p_shear. 4) If an active platelet is near a wall and not near a deposited platelet, deposit with probability p_adhere. 5) If an active platelet is near a deposited platelet, deposit with probability P_adhere. 6) If an inactive platelet is near a wall, deposit with probability r. 7) Remove already-deposited platelets with probability q. 8) Add N randomly-distributed platelets at inlet. 9) Assess and repeat 1-8.

Results
The flow calculations were successful. The clotting effects found are qualitatively consistent with general expectations of clot formation. Further, larger or sharp-edged obstructions resulted in more rapid clotting while obstructions that are smaller or have a rounded profile resulted in slower clotting.

Conclusions/Discussion
The results from the simulations performed in this project offer support for our hypothesis. We have produced a faithful account of blood flow around vascular system obstructions. Combining this with a model of clot formation, sharp edges and protrusions toward the center of the vessel appear to be factors promoting clot formation. These results may provide guidance for safer stent design in the future.

Summary Statement
This project used the Navier-Stokes equations of fluid dynamics to simulate the effect of obstruction in vascular blood flow - whether due to imperfections in the vascular walls or the presence of an object such as a stent - on coagulation.

Help Received
Parents drove me to the library.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Christopher K. Lee

Project Number
S0216

Project Title
Mechanical Properties of Cesium Hydrogen Sulfate for Fuel Cell Applications

Abstract

Objectives/Goals
Cesium hydrogen sulfate (CHS) is a solid acid that has been demonstrated as a promising fuel cell electrolyte; however, its poor mechanical strength may undermine fuel cell stability. The mechanical properties of CHS were investigated to characterize plastic deformation, and thus to guide the development of improved composites.

Methods/Materials
Creep deformation was studied under 0.3 MPa-1.0 MPa stress at a temperature range of 120-160 ºC. Three data verification procedures were taken to strengthen results. A homemade ball mill and a thermomechanical analyzer were utilized.

Results
At temperatures above the superprotonic phase transition (SPT), creep activation energy is 200±10 kJ/mol and appears to be limited by cesium ion diffusion. Stress exponents at different temperatures were determined and changed from n ~ 1 to n ~ 2 upon SPT, confirming that the deformation has dependency on SPT. Unique behaviors were also characterized.

Conclusions/Discussion
A complete understanding of these properties resulted in the engineering and identification of a silica nanocomposite material with superior mechanical properties.

Summary Statement
Logical scientific methodology was utilized to engineer a material with superior mechanical properties.

Help Received
Used lab equipment at the California Institute of Technology under the tutelage of Mikhail Kistlitsyn

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Timothy Lui

Project Number
S0217

Project Title
The King of Fling: An Analysis of Counterweight to Projectile Energy Transfer in a Trebuchet

Abstract

Objectives/Goals
Every year, the MESA program hosts a national engineering design competition and this year's competition is the trebuchet. The object of this project is to gain a better understanding on the behavior and mechanics of energy transfer in trebuchets by analyzing the relation between projectile mass and the ratio of projectile kinetic energy to counterweight potential energy.

Methods/Materials
A special type of trebuchet (floating arm trebuchet) was constructed that allowed for a vertical counterweight drop as well as seven copper projectile masses measuring 12.5g, 25g, 50g, 75g, 100g, and 150g. A 50m tape measure was required to measure distance and a stop watch was required to measure time of flight. Each projectile was launched and the time and distance of each flight was recorded. From the given flight distance and time, the original launch vector can be calculated and kinetic energy of the projectile could be measured.

Results
The relation is closely related to a sigmoid curve, with the less massive projectices having a lower KE/PE ratio and more massive projectiles havinga higher KE/PE ratio. In essence, the greater the projectile mass, the greater the energy efficiency (defined as KE(projectile)/PE(counterweight)).

Conclusions/Discussion
The hypothesis that the mass of the projectile affected the energy transfer ratio was supported by the experiments. The less massive the projectile, the less of the counterweight's potential energy was transfered to it and vice versa. The results help trebuchet designers and hobbyists understand the relation between the projectile's mass and the energy efficiency of a trebuchet allowing them to better specialize their designs for specific purposes.

Summary Statement
My project is an analysis of energy transfer from the counterweight of a trebuchet to the projectile.

Help Received
I utilized the school's woodshop and machineshop tools under the supervision of Mrs. Miller. The mathematics involved in calculating the vectors was taught to me by my physics teacher Mr. Schurr - also from whom I borrowed the measuring tape. I also borrowed a miter saw from Mr. Fairbrother

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Anthony J. Neuberger

Project Number
S0218

Project Title
Invention of an Autonomous Navigation System: Design, Development, and Systems Integration

Abstract

Objectives/Goals
The objective of this project was the development of an autonomous navigation system that does not require human input. To achieve this overall goal, additional objectives included development of a test device that could be used to facilitate systems integration, testing, and three-dimensional modeling capabilities to optimize individual subsystems as well as the entire integrated system.

Methods/Materials
A prototype device was built to facilitate the integration and testing of a novel autonomous navigation system. The navigation system is defined as the mechanical structure that houses the steering and propulsion systems, the electronics systems which collect, send and receive data, the computer program which processes the data and the communication systems which establish and maintain two way communication. A microprocessor network collects data from the sensors and sends the information to the AutoNavigator program which processes the data and calculates the appropriate motor settings. Commands are sent to a second microprocessor which translates the information into motor instructions. A communications system was added to facilitate remote monitoring and operation. In addition, Mathematica 6.0 was embedded within the AutoNavigator program to enhance the math computing capabilities of AutoNavigator and provide a modeling capability.

Results
Using a 2 meter test rail system, individual components of the AutoNavigator system were tested and demonstrated to function properly. The test rail was used to perform additional testing of the electrical, mechanical and propulsions systems. Results demonstrated that higher voltage batteries generate more force per engine compared to lower voltage batteries but with a lower overall efficiency. In addition, 6 different propellers with varying combinations of length and pitch were tested. Data obtained from these tests were used to determine the optimal fixed angle propeller. Finally, embedding Mathematica 6.0 into AutoNavigator allowed the AutoNavigation system to be used as a modeling tool. Data collected by the AutoNavigation system was analyzed by Mathematica 6.0 in real time and the forces acting on the system were displayed using vector field diagrams.

Conclusions/Discussion
This work demonstrates the feasibility of autonomous navigation and that the autonomous navigation system described is an excellent model system for future development work.

Summary Statement
A multiuse, autonomous navigation system with 3 dimensional modeling capabilities was designed, built, integrated and shown to be fully funcional.

Help Received
Mr. Regis reviewed plans for the motor housing unit and Mr. Wallace fabricated the motor housing components. A7 Engineering provided BlueTooth units. Wolfram Inc, provided prelease access to Mathematica 6.0.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Darren R. Reis

Project Number
S0219

Project Title
Why Not 50 Miles Per Gallon?

Abstract

Objectives/Goals
I hypothesize Gas mileage can be considerably improved by greatly reducing both the rolling resistance and aerodynamic resistance to a small enough level such that a much more efficient electric motor can intermittently take the place of the highly inefficient, internal combustion engine at highway speeds.

Methods/Materials
My plan was a) to reduce the air resistance by re-shaping the vehicle and then, b) reduce the rolling resistance by cutting down the effective contact area of the tires. The goal was to get the two drag terms low enough so that I could switch off the gas engine at highway speeds and replace it with a much more efficient electric motor. But, when needed, the gas engine could be switched back on to accelerate the car with good performance.
To test my hypothesis, I built a 7-foot wind tunnel, a microcomputer data logger and a 50 MPH radio control car and completed five separate experiments.

Results
After several months of testing, my final design concept for reducing the air resistance was a symmetric airfoil with a Kammback tail. After extensive testing in my wind tunnel, this airfoil has better than half the air resistance of a conventional sedan and would reduce the air resistance drag term from 100 lbs at 60 MPH to less than 50 lbs.
Some of the testing I could do in my 30 MPH wind tunnel, but to really understand whether this concept would work, I had to take it to the field. Courtesy of NASA Ames, I conducted field-testing of my concept car on an R/C platform at one of their taxiways. I ran a control sedan test at 50 MPH and measured the power requirements via my data-logger and then did the same with my concept vehicle. Based on the real time data collected by the microcomputer I programmed, the power savings were the factor three improvement that I expected.

Conclusions/Discussion
So in summary, what we have is a new pioneer in highway transportation. By greatly reducing the air resistance and rolling resistance of a car at highway speeds, I can intermittently replace the very inefficient gas engine with an efficient electric motor. This electric motor efficiently powers the car on the highway such that the gas engine can be switched on and off when needed. The result of my research is that highway speed gas mileage can be increased from the typical 25 MPG today to well over 50 MPG.

Summary Statement
My project proves that by altering the shape and the propulsion of a car, great gas mileage can be achieved without sacrificing great performance.

Help Received
Dad helped wire and taught me BASIC; 2 Neighbors helped with the set up of the real world testing; Charlie Suangka helped improve the R/C car

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Robbi A. Robinson

Project Number
S0220

Project Title
What Affects the Distance of a Hit Ball?

Abstract

Objectives/Goals
My goal was to determine what affects the distance of a hit ball.

Methods/Materials
Materials- wood bat (30 oz.); Composite bat (30 oz.); Aluminum bat (30 0z.); baum swinging machine; jugs pitching machine; Easton batting tee; 15 softballs; Bushnell radar gun; 100 ft measuring tape.
I decided to test three differnt factors of hitting in my experiment.
First I tested three different bat matierials. A wood bat, a Composite bat, and an Aluminum bat. All three weighed 30 0z.I put each bat in the swinging machine and set the swing speed for 28.4 mph and also at 44.3 mph. I recorded all of the distances and averaged them.
Second, I tested Bat wieght vs. Bat speed.To test weight the pitch speed (30 mph), the ball mass, and the swing speed (25 mph) were all kept constant. Only the weight of the bat was changed. With a radar gun, the speed of the ball when it left the bat was measured (15 times with each weight) and then averaged.
For speed, The ball mass, the pitch speed, and the bat weight(30 0z.) were all kept constant. On the bat swing speed was changed. A radar gun was used again to measure the speed of the ball. The speeds were measured (15 times with each swing speed) and averaged.
Third, I tested was the sweet spot vs. the tip or the handle of the bat. The three bats were used again. The bats were all swung at 40 mph. The balls were placed on a tee and were hit with three different regions of the bat: The tip, the handle, and the sweet spot. The speed of the ball coming off the bat was measured and recorded.

Results
In the first experiment with the different types of bats , the composite bat won, the aluminum was second and the wood bat was third.
The second experiment was the speed and weight. I determined that both equally affect the distance of the hit ball.
In the third experiment i tested the sweet spot , the tip, and the handle.
The sweet spot of the bat hit the ball the hardest.

Conclusions/Discussion
In all my experiments the composite bat was the best. The problem I Sawwas that the bat was almost too good. I learned that when they test composite bats they test them brand new. As you use a composite bat small fibers on the inside break apart and ultimately make the bat more flexible. Since they test the bats brand new the results are not right. Since composite bats have been introduced, injuries on the ball field

Summary Statement
My project is about what determines how far and how fast you can hit the ball and the factors that go into it.

Help Received
My father helped me take down data during the experiment and also cut a bat in half for me. The president of the demarini sports bat section helped me by providing the testing materials that i needed.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Christian H. Selby

Project Number
S0221

Project Title
Comparing the Drag Coefficient of Four Popular Sports Cars

Abstract

Objectives/Goals
This experiment was to show the relationship between sports car design and aerodynamic drag coefficient.

Methods/Materials
Four 1/24th scale plastic sports car models were used: Ford GT, Chevrolet Corvette, Ferrari Spider and a Dodge Viper. To eliminate the variable of rolling fiction a free rolling platform was created on which the cars were attached. All the cars were balanced to the common weight,open windows taped closed. Testing was completed in a wind tunnel originally created to test the importance of angle of attack to the flight of an airplane. The tunnels wind speed was 24 mph or 10.73 m/s produced by a single speed motor. A wire lever and electronic balance was used to measure drag force. I tested each car five times disregarding the highest and lowest measurements and then calculated their averages, adjusting each measurement due to the length of the measurement lever.

Results
The aerodynamic drag and drag coefficient were as follows: Ford GT 21.63 gm or .36, Chevrolet Corvette 22.50gm or .36, Ferrari Spider 21.92 gm or .36, and the Dodge Viper 20.80gm or .33.

Conclusions/Discussion
Drag coefficient is a number that is used to compare one cars design to another. It is equal to two times the aerodynamic drag divided by the density of air times the cars frontal area times the square of the velocity of the air. I was surprised to discover that the Viper created the lowest aerodynamic drag of all the cars I tested. I believe the Vipers low roof height as well as smooth body transition from front to back created a more streamline flow over the car. Low drag means better gas mileage, but for sports cars, low aerodynamic drag and high horsepower means a greater top speed. Sixty percent of the horsepower needed to drive at freeway speed is used to overcome aerodynamic drag. Though the wedge shaped design of sports cars makes them appealling, their wedge shape is neccessary to create a down force to keep the wheels on the ground. The wedge shape does not necessarily result in better aerodynamics. As a comparison, the drag coefficient of a Volkswagen Beatle .38 is two tenth better than the famous Lamborghini Countach at .42. This is possible because one of the key variables in the drag coefficient calculation in a cars frontal area (forward area exposed to the oncoming air).

Summary Statement
This experiment showed the relationship between sports car design and aerodynamic drag coefficient.

Help Received
My father helped redesign the windtunnel, mother helped with display board, Dr. Jim Selgrath approved project, Mr. Dan Halbur helped explain conversions and calculations.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Sara Seto

Project Number
S0222

Project Title
Water Velocity: Flowing through Tubes

Abstract

Objectives/Goals
What are the factors that contribute for water velocity in different conditions and circumstances? I added direct mass pressure and created a siphon to conduct this experiment.

Methods/Materials
Materials: Wood (For boxes)- Different Lengths of Hose- Bags of Sand used to measure: 200.0g ,300.0g, 400.0g, 500.0g - (2) 1000ml beaker
Procedure
Experiment 1
-This procedure will be done with the box on a slightly elevated surface 30.0cm at most.1. Prepare Ziploc bag with straw and place into Box A 2. Add water into Ziploc bag and seal shut with no air inside 3. Place Cap A on top of the bag and box and add enough sand to create 200.0g of pressure 4. Hold the 1000ml beaker underneath the straw 5. Measure how much water dispenses in a 30 second time span 6. Record volume of water 7. Conduct 20 trials and record volume of water 8. Carry on steps 1-9 but increase the mass to create 300.0g, 400.0g, and 500.og
9. Conduct steps 1-10 but change to Box B and Cap B
Experiment 2
1. Cover both boxes with cellophane to create a bag within the boxes 2. Cut hose into lengths of 0.85m, 1.35m, 1.85m, 2.35m 3. Place Box A at a height of 0.5m from the ground 4. Place hose from Box A towards the ground into a 1000ml beaker
5. Suck the end of the hose closest to the beaker just enough for water to begin flowing. Hold onto tip of hose.6. Measure how much water dispenses in a 30 second time span 7. Record volume of water 8. Conduct 20 trials and record volume of water 9. Carry on Steps 1-10 but change hose length to 0.85m, 1.35m, and 1.85m. Conduct steps 1-10 but change to Box B

Results
For the mass pressure the 200g experiment went according to my hypothesis, but the other 3 the larger box dispensed more water. For the siphon all but the 0.5m hose dispensed almost the same amount of water. With a siphon equation, they had relatively the same constant.

Conclusions/Discussion
My conclusion is that pressure is directly related to volume. I also know that height is a factor in siphons, increasing the velocity of the water flow.

Summary Statement
I investigated water velocity due to different kinds of pressure.

Help Received
Dad: Cut wood. Mom: helped trials.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Brian M. Smith

Project Number
S0223

Project Title
A Bridge to Safety: Changing Bridge Frequencies to Reduce Resonance

Abstract

Objectives/Goals

Problem Statement:
Will changing the stiffness of steel cables that run through a bridge deck cause the frequency to change, and thus make it more resistant to resonant frequencies prevalent in earthquakes? My objective is to test a scale concrete bridge, measure its displacement with a set amount of weight, and determine if the frequency can be changed by the stiffness of the bridge.

Methods/Materials

Materials:
1Concrete Bridge (70cm x 6cm x 1.4cm); 1 Bridge Stand (75cm high); 2 Turnbuckles 2 lengths of steel cable (95cm minimum)1 Motion Detector; Bucket of Weight
Procedure:
1. Build concrete bridge with tubular holes to run cables through and tensioning device with turnbuckles.
2. Create stand for bridge, leaving enough room for bucket to hang as well as a stand for the motion detector.
3. Set bridge into place on the stand with the bucket hook in the middle of the bridge.
4. Attach necessary equipment to LoggerPro system on computer, and test the bridge displacement with the weight attached.
5. Repeat tests for 20 trials for every tension of the bridge.
6. Record displacement and use in frequency formula to determine changing frequencies of the bridge.
7. Draw conclusions.

Results

It was clear that the changing of the bridge stiffness altered the frequency. At the first stiffness, the bridge had a frequency of 98.3 Hz, while the second stiffness had a frequency of 342.4 Hz. This definitively proves that the frequency can be changed solely based upon the stiffness of a structure

Conclusions/Discussion

In conclusion, when a bridge#s stiffness can be changed through tensioned steel cables, then the frequency of the bridge will also change. I achieve a standard deviation of 0.004, proving that this experiment was not only accurate, but precise. Actual concrete bridges in the world can utilize this technique to prepare against resonance during large earthquakes.

Summary Statement

My project proves that changing the stiffness of the bridge in turns changes its frequency, and it is thus able to activly resist resonance during earthquakes.

Help Received

Father helped cut wood and use Excel; Mother helped on backboard

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Rebecca C. Suzuki

Project Number
S0224

Project Title
The Effect of Building Shape on Its Ability to Resist Hurricane Force Winds

Abstract

Objectives/Goals
The purpose of the experiment was to determine if the shape of a building affected its ability to resist hurricane velocity winds by utilizing a wind tunnel to test different building shapes.

Methods/Materials
A wind tunnel with laminar flow was constructed. A building model was placed on a rolling platform within the testing chamber of the wind tunnel. The air resistance caused the platform to roll back onto a force sensor which read the force of air resistance in Newtons. Ten trials were performed for a control and each of the 6 building models: rectangular tower (narrow face side), square tower (face side), square tower (corner/vertex side), cone, cylinder, and sphere.

Results
The sphere had the least amount of air resistance in proportion to its surface area (0.0006 N/cm^2) and its volume (0.00007 N/cm^3). The cylinder shaped building model had the next least resistance with 0.001 N/cm^2 and 0.0001 N/cm^3 respectively.

Conclusions/Discussion
The spherical and the cylindrical building designs support the initial hypothesis that a symmetrically shaped building with a curved face would best be able to resist high velocity winds.

Summary Statement
The purpose of the experiment was to determine if the shape of a building affected its ability to resist high velocity winds.

Help Received
My father used power saws to cut wood and PVC pipes for the construction of the wind tunnel.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Kaitlyn A. Wakefield

Project Number
S0226

Project Title
Fire and Ice: A Two-Year Study on the Effectiveness of Ice Bullets Fired upon a Drywall Target

Abstract

Objectives/Goals
The purpose of this project was to determine which set of three sets of ice bullets, all containing different amounts of sawdust, is the most effective at penetrating a drywall target. The ice bullets of the 2006 project contained only water. The water-only ice bullets shattered on impact with the drywall target. This ability to break easily is defined as frangibility. By adding sawdust to the ice, the bullets should be less frangible. This project seeks to support the statement that if ice bullets contain sawdust, then they will penetrate the drywall target deeper and more effectively.

Methods/Materials
Three different sets of ice bullets with different ratios of sawdust were tested. Ice bullets were constructed 4 days in advance using an ice mold with sawdust-water mixtures. Each bullet contained 0.3 grains of gunpowder. The first 20 bullets were composed of 25% sawdust and 75% water (Group A). The second 20 were composed of 40% sawdust and 60% water (Group B). The last 20 bullets were composed of 50% sawdust and 50% water (Group C). The bullets were selected at random to reduce variation in the experiment. The ice bullets were fired from a .357 magnum revolver into a drywall target placed 15 feet from the end of the gun barrel. The drywall created a physical record of bullet impacts that were uniquely identified by number. Penetration depth of each impact was measured. A chronograph measured bullet velocity that was used to calculate kinetic energy. A Hunter Safety Class and Certificate was also acquired.

Results
Group A was the most effective at penetrating the target, possessing a 3.100 mm average depth and average kinetic energy of 204.84 joules. This was 0.875 mm deeper than Group C. Group B possessed an average depth of 2.025 mm with an average kinetic energy of 207.26 joules. Group C penetrated on average 2.225 mm with an average kinetic energy of 180.2 joules. Overall, 44 percent of the bullets penetrated fully 2 mm into the target. Group C had the lowest kinetic energy. Group A bullets were the most effective penetrators in all.

Conclusions/Discussion
Overall, the data refuted the hypothesis. Although the use of sawdust improved projectile performance with respect to results of last year's project, the bullets with lesser amounts of sawdust penetrated deeper into the target. The data shows that bullets with a low sawdust to water ratio resulted in deeper target penetration.

Summary Statement
The purpose of this project was to determine which set of three sets of ice bullets, all containing different amounts of sawdust, is the most effective at penetrating a drywall target.

Help Received
Fired ice bullets under parental supervision; parents were data recorders at firing range

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Sarah E. Whipple

Project Number
S0227

Project Title
Adding Turbulence to the Kutta-Joukowski Lift Theorem

Abstract

Objectives/Goals
The objective of this project was to show how well the Kutta-Joukowski Lift Theorem explains Magnus Force on spinning cylinders. This was achieved by comparing theoretical lift to measured lift for various spin frequencies, wind velocities, cylinder diameters, and degrees of turbulence.

Methods/Materials
To achieve my objective, I built a wind tunnel. I used a variable DC power supply to drive the spin motor, a laser tachometer for measuring spin frequency, an anemometer for measuring wind velocity, an electric leaf blower for the wind source, a digital scale for measuring lift, and different cylinder surface materials to vary the turbulence.

Results
I collected and graphed the data. The graphs show that the Kutta-Joukowski Lift Theorem does, in fact, explain the linear relationships between lift and spin frequency, lift and wind velocity, as well as the square relationship between lift and cylinder diameter. I also demonstrated that lift in each case increases as turbulence decreases.

Conclusions/Discussion
My project taught me many math and science skills. I first learned about the origins of Magnus Force and the Kutta-Joukowski Lift Theorem. I learned some basic fluid dynamics, including Bernoulli's Principle, viscosity, laminar air flow, and turbulent air flow.

Summary Statement
I designed and constructed a wind tunnel to measure transverse forces on spinning cylinders, and compared those forces to the predictions of the Kutta-Joukowski Lift Theorem under different conditions of turbulence.

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

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Samantha M. Williams

Project Number
S0228

Project Title
You Guess the Weight

Abstract

Objectives/Goals
The objective of this project is to see that if weight tape is used to measure and thus #weigh# both Caprine & Ovine species, if that #weight# read on the tape is the same as the weight from an accurate livestock scale. Livestock scales cost in excess of $ 1,300.00, where as livestock #weight tape# costs less than $ 10.00. Thus the question is the reliability and accuracy of the low cost weight tape. Animals recorded will be of varying sex and age. Tests will be run on both Caprine and Ovine market species.

Methods/Materials
First thing is to clean and calibrate the certified livestock scale. On paper, create a data table that lists the animal#s identification, sex, and age on the top of the table. Then put the first animal into the scale either Caprine market species or ovine market species. Record the ear tag number, sex, age and the weight from the scale. Remove that same animal from scale and then measure its weight from the Nasco Caprine/Ovine weight tape. Record weight tape reading from the heart girth onto the data table. Repeat for additional Caprine and ovine species.

Results
The results of the project showed that the use of #weight tape# is an acceptable substitute for the weighing of both Caprine and Ovine species under most circumstances. The results did however show that with Ovine species, when the animal#s weight exceeded 100 pounds, results were unreliable at best. Results also show no difference in the sexes.

Conclusions/Discussion
The hypothesis was partially correct. For species Caprine, the tape measurements compared to the actual weight very closely with a R^2 value of .97. For species Ovine, the overall comparisons of measurements taken had an R^2 value of .78. However the R^2 value for the measurements taken on Ovine#s less than 100 pounds was .97 matching that of species Caprine. Therefore, the conclusion is that when using the weight tape for species Ovine, only those animals below 100 pounds can an assurance of confidence of the measurement is believed.

Summary Statement
A comparison of weight tape and a calibrated scale to measure the acutal weight of Caprine or Ovine market species.

Help Received
Dad cut the board.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Jordan R. Young

Project Number
S0229

Project Title
Stay Fly: A Study of the Effects of Both Aspect Ratio and Weight on the Flight of a Glider

Abstract

Objectives/Goals
Throughout the history of aircrafts, there has existed a struggle to provide maximum efficiency while still having the ability to carry heavy loads. It is the goal of this project to determine which combination of Aspect ratio (AR) and weight will provide the most efficiency.

Methods/Materials
This project requires minimal supplies which are not hard to find. The fuselage of a toy glider was used as a constant body for the test glider. Balsa wood was used to construct the wings of the glider. A piece of Rubber Thread was used to launch the glider from a table top. A spring scale was used to insure that there was a consistent force of 10 Newtons of force when it was launched.

Results
The data shows that there is a steady increase in distance traveled as the aspect ratio is increased. The results for Wings 1-5 are as follows (wing #1- 2.751 m, wing #2- 2.908 m, wing #3- 4.747 m, wing #4- 5.165, wing #5- 5.472). There was an average Standard Deviation of .355 m. After a weight of 4.25 grams was added there was a decrease in distance traveled throughout all three of the weighted wings. Wing #1 had an average decrease of .393 m. Wing #3 had an average decrease of 1.327 m. Wing #5 had an average decrease of 1.072 m. Throughout all three of the test sets there was an average decrease of .964 m. There was also an average Standard Deviation of .108 m.

Conclusions/Discussion
In conclusion, the objective of this project was achieved. There results acquired were not the ones expected. It was expected that as the aspect ratio increased that the distance would increase up to a certain point when it was then begin to decrease gradually. However, this did not happen. The distance traveled continued to increase as the aspect ratio was increased. It is possible that this is due to the fact that a longer piece of balsa wood could not be found resulting in material limitations. When the weigh was added to the wings there was an obvious decrease in distance. It is not clear why this occurred. In theory the weight should not have affected the distance traveled by the glider.

Summary Statement
This project#s purpose is to determine the correlation between the effects of Aspect Ratios on distance traveled and weight and distance traveled.

Help Received
The only help received was that of my father. He assisted me in the measuring of the distance traveled.