CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Raffi Attarian; Saro Haroun; Garen Karnikian

Project Number
S0101

Project Title
A Breakthrough in Aerodynamic Technology

Abstract

Objectives/Goals
Finding a method of parasitic drag reduction by altering the flow of aerodynamic boundary layers. The experiment will determine which method will result in the greatest amounts of drag reduction.

Methods/Materials
The experiment was conducted by constructing three identical airplane wings with the use of balsa wood. Different forms of a boundary layer bleed were applied to each individual wing. The first wing did not contain any boundary layer bleed. The second wing contained a boundary layer bleed at the transition. The third wing had a boundary layer bleed constructed at the transition point and every so often until the trailing edge. A boundary layer bleed is a suction method. After each form of boundary layer bleed was constructed on a wing, each wing was placed inside the wind tunnel for testing. Oil was placed on a portion of the trailing edge. The movement of the oil was observed during the testing.

Results
After wind tunnel experimentation, the results showed that Wing A had an transition point of 3.83 cm from the leading edge. Wing B's results, the wing with a boundary layer bleed constructed at the transition point, showed that the transition point had been extended and was now 5.83 cm from the leading edge. Wing C, with the boundary layer bleed at the transition point and every so often until the trailing edge, had a transition point of 7.23 cm from the leading edge, respectively.

Conclusions/Discussion
After successfully completing the experimentation, we found that the best method for drag reduction is by conducting a boundary layer bleed at the transition point and every two centimeters thereafter. This method, theoretically, is the best method to achieve highest amounts of drag reduction. We also conclude that, configuring a boundary layer bleed will always contain less drag then with the wing in motion without any bleed. Although skin friction and parasitic drag are unavoidable, they may be prevented to a certain extent. We found that using a suction method to suck out the boundary layer during a boundary layer bleed, which spans from the transition point and every two centimeters afterwards until the trailing edge, theoretically, contains the greatest amounts of drag reduction. By utilizing our findings much enhancement can be made on aircraft. Recommendation would include to measure the actual drag. We would also strive to find the effects of our findings at different angles of attack.

Summary Statement
Finding a method of parasitic drag reduction by altering the flow of aerodynamic boundary layers

Help Received
We used the lab equipment at Ribet Academy under the supervision of Mr. John Shiradjian.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)

Thuy Cao; Eric Garcia; Oscar Padilla

Project Number

S0102

Project Title

Into the Deep, Again!

Abstract

Objectives/Goals

The concept of ion propulsion was validated by substantial data of prior experiments (i.e. Into the Deep#2002). This experiment is a complex continuation of the previous investigation. However the object of this experimentation is to apply the concept of ion propulsion, which was proven to be true, into actual use. The ultimate aim is to incorporate this concept to produce a source of reliable and visually evident propulsion.

Methods/Materials

· At least 4" of ½" thick PVC piping
· 4 right angle PVC fasteners
· PVC cement
· 1 hot glue gun
· At least 234sq. in. of zinc-galvanized mesh
· 1 10 gallon fish tank (18"x10"x12")
· 1 fountain pump
· At least 1½" of ¼" thick hose
· 8 gallons of distilled water
· 1 pipe cutter
· 1 pair of sheet metal scissors
· 1 1000 ml beaker
· 1 digital scale
· 1 volt meter
· 1 12 V car battery charger
· 1 marker
· 1 tape measure
· 16 zip ties
· 1 500 ml beaker
· 1 stop watch
· 200g of Zinc Chloride (ZnCl2)
· 120" of PVC piping
· 8 3-ringed PVC joints
· 6 T-ringed PVC fasteners

Summary Statement

Application of ion propulsion on an apparatus to create a self-exerted momentum.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Alicia Everetts; Alaina Pidgeon

Project Number
S0103

Project Title
Float O' Fall? An Experiment Designed to Test the Drag Coefficients of Single and Clustered Parachutes

Abstract

Objectives/Goals
The purpose is to test the drag coefficient of one parachute and then compare it to the drag coefficient of clustered parachutes. We wanted to start out with one parachute and work our way up to the clustered parachutes. We would have liked to start from a higher height, but the highest we could find was a little over twelve feet. We believed at the beginning of this project that it was going to be difficult to build a parachute that worked decently enough to make this experiment work.

Methods/Materials
Research began last December. Little did we know that finding information on parachutes would be so difficult. We researched different shapes of parachutes, how to make a parachute, how parachutes work, and several other factors necessary to be able to create a parachute of our own. We will find the drag coefficient by using a set of mathematical formulas. We performed our experiment indoors. We tested different weights on each and every parachute (or cluster of parachutes) we dropped. · 2 boards
· red and blue paint
· sponge
· windbreaker material
· fishing line
· washers
· binders
· calculator
· triple-beam balance
· water
· camera
· string

Results
Our data is displayed on many graphs. Based on our data and research, it is easy to see that the drag coefficients of single and clustered parachutes vary greatly. After many hours of calculating our data, we found that overall our experiment supports our hypothesis. There are a couple instances when our drag coefficients do not decrease steadily; instead, there are little bumps where they rise just a little before they continue to fall.

Conclusions/Discussion
Our first thoughts when discovering this project was that the drag coefficient of a parachute will increase

Summary Statement
An experiment designed to test the drag coefficients of single and clustered parachutes.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Ivan B. Marin

Project Number
S0104

Project Title
Objects of Different Size Fall Rate

Abstract

Objectives/Goals
The purpose of this experiment is to determine if objects of the same weight, but different volumes fall at the same rate in different conditions.

Methods/Materials
Obtain the shapes sphere, cylinder, triangle, square, cone, and rectangle.
Obtain two 100-ml graduated cylinders and one 500-ml graduated cylinder.
Drop the objects into corn syrup, glycerin, and pancake syrup. Use the equation drag x time=constant to find the constant speed of each object and to observe if objects of the same weight, but different volumes fall at the same rate.

Results
Objects of the same weight,but different volumes do not fall at the same rate because the volume affects the descent(if it has more mass it takes up more space). Other factors such as the surface area of the object, mass of the object, and others offset the descent of an object.

Conclusions/Discussion
These results are proven in real life when objects are dropped into a vaccum. The drag, when an object moves through the air, the force of air resistance acts in the opposite direction slowing the descent. If a coin and a feather were dropped from the same height they would drop at a constant velocity until the drag balances the objects. Heavier objects will have to travel at a faster rate because the drag is large enough to balance the object. That is why heavier objects fall first than lighter objects. In fact, the heavier object probably hit the ground before they reached terminal velocity. Terminal velocity is the constant velocity of a falling object on which the forces are balanced.

Summary Statement
The purpose of this experiment is to determine if objects of the same weight, but different volumes fall at the same rate in different conditions.

Help Received
Mother helped make the board; Mr. Corigliano helped find the materials; Mrs. Starika helped with the math; Friend helped type report.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Danielle A. Robinson

Project Number
S0105

Project Title
A Stroke of Propulsion

Abstract

Objectives/Goals
The objective of my project was to determine which of the four competitve swim stroke exerts the most propulsion. I believe the breaststroke will have the most propulsion despite it being the slowest of the competitve swim strokes.

Methods/Materials
Informed consent was obtained from six male and six female competitive swimmers ranging in age from 15 years old to 27 years old with varying heights, weights and abilities. Each swam the competitive strokes on four different days in the same pool. The order of the competitive strokes was rotated on each test day. A stretch cord was secured to the swimmer's waist and tethered to one end of the pool with two 20 Newton Scales attached. A measurement was recorded.

Results
Eleven out of the twelve swimmers tested were found to exert more force while swimming the breaststroke. One male swimmer recorded a higher freestyle measurement. My theory why the one swimmer recorded a higher freestyle measurement is he is new to the sport and is still learning how to swim the other strokes technically correct.

Conclusions/Discussion
Most predicted freestyle would have the most propulsion because it is the fastest stroke. The quicker speed of recovery of the other strokes and less drag compared to the breaststroke help explain why they are faster. However, the breaststroke utilizes the legs to "push" the water while the other strokes used the arms to "pull" the water. This information can help coaches better understand the mechanics of the sport and help swimmers perfect their technique. Also, safety instructors may want to recommend utilizing the breaststroke when informing the public how to efficiently reach shore safely in case of a water accident since the breaststroke will propel them quicker through the water.

Summary Statement
To determine which competitive swim stroke has the most propulsion.

Help Received
My swim coach suggested how to test my hypothesis; Friend helped take pictures as I recorded the data; Friends took data and pictures while I was tested; La Sierra University loaned me the Newton Scales.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Andrew G. Stinson

Project Number
S0106

Project Title
The Effects of Archer's Paradox on an Arrow After Being Shot

Abstract

Objectives/Goals
The objective is to observe the effect of Archer's Paradox on an arrow shot from a properly tuned recurve bow for the first 33 feet of flight.

Methods/Materials
I will perform this experiment using a 42lbs recurve bow and a carbon/aluminum arrow with a slightly stiff tuning set up, as is proper. The first six shots will be at a five foot standing distance from the target and the other groups of six from two foot intervals after five feet to 33 feet. After shooting the arrow, I will measure the horizontal and vertical angles of which the arrow hit the target. I will repeat this many times at varying distances. Then I will be able to take the average horizontal and vertical angle at each distance and be able to plot the path of the arrow. The arrow will be shot at a horizontally and vertically perpendicular target in relationship to the line of which the arrow rest and nockingpoint on the string make.

Results
The arrow appeared to have a fairly stable vertical motion, yet a very unstable horizontal motion in the begging of flight. That unstable horizontal motion seemed to disappear at about 23 feet into the shot and from there after the arrow had a fairly stable and straight horizontal motion in flight.

Conclusions/Discussion
My conclusion is that the effects of Archer's Paradox on an arrow shot from a properly tuned recurve bow can be seen in the horizontal instability of the arrow for the first 23 feet (these qualitative results should apply to any recurve bow, however the quantitative results will only apply to the same bow setup)

Summary Statement
My project is shows the immediate flight of the arrow after being released with fingers from a recurve bow.

Help Received
Used largescale printer in a media office.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Shane M. Suazo

Project Number
S0107

Project Title
Staging vs. Clustering: Which System Will Deliver a Given Payload to a Greater Altitude when Mass and Impulse Are Equal?

Abstract

Objectives/Goals
The object of this project is to compare multi-staging and clustering in terms of maximum altitude in order to determine which is the more efficient system when carrying a given payload. Both theoretical simulation and actual experimentation were used to determine this.

The project compares the sustained, low-thrust profile of a multi-stage flight to the short, high-thrust profile of a cluster, and the outcome with variations in model mass. It explains with mathematical reasoning why clustering is more effective in launching models with large mass relative to the impulses of the individual engines, and why multi-staging is more effective when mass is low relative to the impulses of the individual engines .

Methods/Materials
To test my hypothesis, I designed and scratch-built four rockets: one 2-stage model, one 2-cluster model, one 3-stage model, and one 3 cluster model. In each pair being compared (2-cluster vs. 2-stage, and 3-cluster vs. 3-stage), the two subjects were equal in mass, diameter, and height. The models were first tested in a theoretical numerical simulation. From the simulation, I found that the 2-cluster model out-performed the 2-stage model, and the 3-cluster model out-performed the 3-stage. Actual flight data, however, was inconclusive due to errors in data collection and design flaws.

Results
From the simulation, I found that the 2-cluster model out-performed the 2-stage model, and the 3-cluster model out-performed the 3-stage. Actual flight data, however, was inconclusive due to errors in data collection and design flaws.

Conclusions/Discussion
Clustering is more effective in launching models with large mass relative to the impulses of the individual engines being employed in the model, and multi-staging is more effective when mass is low relative to the impulses of the individual engines. However, due to errors in my experiment, I am in the process of continuing my experimentation.

Summary Statement
I compared staging model rockets to clustering to see which system could carry a given payload to a greater altitude when mass and impulse are equal; this was determined by both theorectical simulation and actual experimentation.

Help Received
Teacher and uncle helped wire electronic launch controller. Teachers gave advice.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Erik R. Van Esselstyn

Project Number
S0108

Project Title
Decreasing Drag Using the Piezoelectric Effect

Abstract

Objectives/Goals
The experiment is testing the effectiveness of piezoelectric transducers, special ceramic disks that produce ultrasonic waves by converting an electric current into mechanical energy, when their effect is applied to the stern of a moving hull.

Methods/Materials
The experiment was set up using a test hull made out of a Tupperware container, which would be tested in a 15ft stretch of a pool. The two piezoelectric disks and their circuit boards were attached inside the container, with a silicone sealed hole that provided the contact between the disks and the water at the stern of the hull. Wires from the circuit boards connected to an extension cord which traveled up through a sealed hole in the top of the container where it connected above the pool to a power support line, eventually gong to the 48 volt end of a transformer. Back at the test hull, a 34ft tow line was attached to the bow which traveled across the pool, through a block at the water level, up to the top of a 15ft extension ladder where there was another block, and finally down to a 2lb weight. When the weight was released from the top of the ladder, the hull would be pulled through the water at a uniform rate for 15ft until the weight hit the ground. The tests were timed.

Results
The average time for the control testing runs was shorter than the average time for the tests with the piezoelectric nebulizers turned on.

Conclusions/Discussion
My hypothesis was that the piezoelectric transducers would have a positive effect in decreasing the amount of drag of the hull through the water, and my hypothesis turned out to be correct because the ultrasonic waves produced by the discs worked to push and break apart the water at the stern of the hull, decreasing the suction effect and the overall drag.

Summary Statement
This project is an insight into the application of piezoelectric technology in the marine environment.

Help Received
APC International donated both piezoelectric nebulizers, dad helped set up testing scheme

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Eric G. Vryheid

Project Number
S0109

Project Title
Wave Attenuation of Floating Breakwaters with Different Numbers of Mooring Lines

Abstract

Objectives/Goals
Floating breakwaters absorb waves to protect the shore. Compared to gravity breakwaters (solid structures resting on the bottom), floating breakwaters are less expensive; do not disturb currents, fish, or sediment movements; are more aesthetic, and transportable. However, floating breakwaters are susceptible to damage by waves and require higher maintenance. This experiment compares the number of lines used to anchor a breakwater to its ability to absorb the energy of approaching waves. It is believed that a floating breakwater with more lines anchoring it to the bottom will absorb more of the wave's energy and result in waves with a smaller height.

Methods/Materials
Waves were made in a rectangular testing tank by dropping a weight into one end of the tank. Wave height was measured behind the breakwater. Styrofoam sphere breakwaters were anchored to the bottom of the tank with one to eight mooring lines. For each number of mooring lines, ten trials were conducted. The data were analyzed with one-factor independent-groups analysis of variances (ANOVA), with number of mooring lines as the categorical independent variable, and wave height as the continuous dependant variable.

Results
The wave heights for each number of mooring lines were statistically significantly different ($F = 2.58$, $p < .025$).

Conclusions/Discussion
However, there was no clear trend showing either higher or lower number of lines resulting in lower wave heights. The lower numbers of mooring lines, however, were more likely to tear free from the anchoring tape. The higher number of lines required more material and labor to construct. It is recommended that further studies be done on the durability and expenses of different numbers of lines.

Summary Statement
I explored the relationship between the number of mooring lines anchoring a floating breakwater to the bottom and its effectiveness in attenuating wave energy.

Help Received
Dad introduced me to ANOVA calculation, supported me financially, and gave advice. Mom helped with backboard design. Mr. Linke helped proofread my project and gave guidance. Mr. Larry Nordell introduced me to floating breakwaters.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Matthew L. Ward

Project Number
S0110

Project Title
Soak Up the Sun

Abstract

Objectives/Goals
In the world we are living in today, there is an enormous need for energy to power our homes, tools, and appliances. The bad thing about this is that it costs money to produce this non-renewable energy. There have been energy crises all across the U.S. in the past few years. Why not have this energy supplied to us in an efficient, virtually cost-free method? This method I'm talking about is solar energy consumption. As solar technology increases, the idea of using the sun as an energy source becomes all the more logical.
The idea of this project came to me when I came across an article about NASA's solar-powered aircraft, Helios. It inspired me to try and build my own version of a solar-powered aircraft. These solar aircraft may be replacing weather and communication satellites one day because they can fly at high altitudes and for as long as the sun is shining. These solar aircraft are not only breaking records, but they are also showing the public that solar technology is a reliable energy-provider.

Methods/Materials
I began by purchasing an ultra-lightweight, remotely controlled aircraft and 2 different solar panels, and 1 type of solar cell, to go with it. I measured the different outputs I could get off of the different panels and their arrangements for a few days. I then measured the output of the aircraft's battery pack and figured out a way that I could produce the voltage and amperage I needed to power both of the aircraft's electric motors. I decided to test which type of panel, or cell, would be able to power the motors and be able to fit on the aircraft's total wing area of 200cm^2.

Results
I discovered that the solar cell measuring 2cm x 4cm would be the only solar panel, or cell, that I possessed that could power the motors and be able to fit on the given wing area. I have found that I would need 24 of these cells to produce the voltage and amperage I needed to power the aircraft. I also discovered that I could charge the aircraft's battery pack using a solar panel and a blocking diode, in case mounting the cells on top of the wings is inconvenient.

Conclusions/Discussion
I have concluded that it would be possible to produce the voltage and amperage needed to power the airplane, as well as staying inside the given wing area. I have also realized that solar energy is a free source of energy, which is easily gathered and already showing signs of being a large energy source in the future.

Summary Statement
My project is about the design and testing of an aircraft that is powered completely by the sun sun using photovoltaic panels or cells.

Help Received