Project ID: 751

JR - Engineering: Energy, Materials, and Transport

Maliya Montemayor

Honeycombs - Not Just for the Bees: Optimizing Cell Types for Architecture

Biomimicry is the science of learning from nature's models to create designs and processes to solve human problems in a responsible, ecological manner (Benyus 1). This can improve the functionality and aesthetics of designs and make more efficient use of resources. This project aims to mathematically and experimentally compare strengths of honeycombs (inspired by beehives) using rectangular, triangular, and hexagonal cells to determine why hexagonal arrays aren't widely used as support structures in architecture. I designed four sets of honeycombs: Set-A, Set-B, Set-C, Set-D. Each set contains three designs (rectangular, triangular, hexagonal cells), which use the same amount of material to fill the same volume. The difference between the sets are the overall size, cell size, and cell wall thickness. For the larger designs (Set-A and Set-B), I ran compression tests with Professor Boechler's research group at UCSD. For the smaller designs (Set-C and Set-D), I ran compression tests with Professor Youssef's research group at SDSU. Test results showed the relative strengths of the hexagonal structures were much lower than predicted. After studying videos of the tests, I redesigned the boundaries of the hexagonal structures, resulting in relative strengths close to theory. For Set-A and Set-B, the strengths of the triangular and hexagonal structures were about 55% and 18% that of the rectangular structures, as compared to the theoretical predictions of about 72% and 15%, respectively.Â Differences can be attributed to cell wall thickness variations. Theoretical and experimental results show that hexagonal honeycombs aren't well-suited as vertical support structures.

Project ID: 752

JR - Engineering: Energy, Materials, and Transport

William Macinnes

How Chord Length Affects the Efficiency of Propellers

Propellers help planes and helicopters to fly but it also helps to generate clean energy. My interest in propellers started during our trips to lake Tahoe. On our drive up there every year I was intrigued by the big wind turbines. I always wondered if the chord length of these propeller blades affects the efficiency of the energy produced. My hypothesis is that the propeller with the longest chord length, 2.8 cm will produce the highest voltage. My control variables were the time taken to operate the propellers and the DC motor. The independent variable is the different lengths of the propeller and the dependent variable was the voltage it generated.

Procedure: Gather all four different lengthed propellers,1.0 cm, 1.5 cm, 6 cm, 2.2 cm, 2.8cm. Mount the propellers one at a time and start the DC motor. Then I ran the box fan at speed one. I put the propeller in front of the fan and let it spin for 30 seconds. After 30 seconds I record the voltage in millivolts. I did 20 trials for each propeller.

Results and Conclusion: I found that the 2.8 cm propeller was the most efficient. It averaged about 16.311 millivolts. And the least effective was the 1.00 cm propeller averaging about 10.456 millivolts. So this data shows that my hypothesis was correct. The propeller with the shortest chord length was the highest and most efficient the 1.00 cm propeller and the least efficient was the 2.8 cm propeller.

Project ID: 753

JR - Engineering: Energy, Materials, and Transport

Jack Pacente

Improving Compression Strength of Polyethylene Terephthalate Glycol (PETG) through the Process of Annealing

This research is about the compression strength of annealed PETG cylinders. The hypothesis is â€œAnnealing PETG at a temperature of 100ƒ will create the strongest compression strength of a 3D printed part with a higher success rate than other temperaturesâ€. This research annealed 50 cylinders at temperatures 90ºƒ, 95ºƒ, 100ºƒ, and 105ºƒ. The oven we were using only read in Fahrenheit going up and down by increments of 5, so the temperatures were the closest equivalent to those temperatures, which were 90.6ºƒ, 96.1ºƒ, 101.7ºƒ, and 104.4ºƒ and they were annealed for 80 minutes. Then the cylinders were compressed until the first sign of failure and the pressure was recorded in Metric Tons using a hydraulic press. The data was then collected and analyzed. During the annealing process, it was observed that the samples on the upper tray deformed more than the samples placed on the lower tray. The batch with the highest compression strength and an acceptable amount of distortion was batch 4, which was annealed at 101.7ºƒ. This would mean that the hypothesis was proven correct and 101.7ºƒ would be the optimal temperature to anneal PETG.

Project ID: 754

JR - Engineering: Energy, Materials, and Transport

Caleb Raagas

Salinity Levels Effects on Hydroelectricity

Energy is has become a essential part of daily life. There are many ways to create energy like using fossil fuels which will pollute our earth but will benefit the people living on it. We use resources that are non renewable and also pollute the earth. Some of the non renewable energy sources that we use are petroleum which is used for transport fuels, oils that are used for heating and electricity and more. Petroleum will contribute to polluting emissions and increase the carbon footprint. However there are some other types of energy sources that use renewable energy sources. The most common way of hydroelectricity is through a water wheel and using a water wheel will produce about 100 kilowatts or 1,000,000 volts. The easiest way to use a water wheel is to have filtered water which produces the most optimal way to create the energy.

Procedure

The water wheel will produce volts with two different kinds of water salted which represents ocean water and fresh water representing filtered water. The water wheel will turn due to the water pushing it and a voltage measurer will record the amount of data produced. The water will run on a halfpipe connected to a home depot bucket containing the water. A bucket will be at the end of the half pipe to collect the water.

Results

My results had shown that using salt water would make the voltage produced be less but still produce a good amount of energy especially knowing how energy is crucial for daily life. The average for the amount of volts produced for fresh water was 1454.2 and the average for the salted water was 1215 volts showing how it produced a good amount of volts every trial the average for the comparison between freshwater and the salt water was 229.92 volts less. It showed a good amount of volts produced making it a good source to have to produce energy.

Project ID: 755

JR - Engineering: Energy, Materials, and Transport

Rebecca Kalkin

Testing Different Heat and Light Sources to Power a Solar Car

Tons of energy is being used everyday, and it needs to start being conserved more to help our planet. For my project I was initially going to be making a car that would run on a thermoelectric generator. Fast forward a couple days of research, I was not able to use the thermoelectric generator. Once I got the generator and got my materials I was able to produce an electric current with the Peltier/Seebeck effect and measured it with a voltmeter. However, I was not able to charge the rechargeable batteries enough to operate my car. After doing some research, I found that I would need a car with an open flame and something very cold to create an electrical current to power my car. That being the case, I switched to a solar powered car, but I still used my initial experimental protocol and procedure to do my project.

Problem: Can I use different types of heat and light to create electric currents to power a car?

Procedure: Step 1: Gather materials. Step 2: Start putting together materials to build car. Step 3: Put car outside in the sun. Step 4: Wait 3 hours. Step 5: See how far the car moves & mark with chalk. Step 6: Repeat steps with other heat sources (heat lamp & regular lamp)

Results: After recording all my data, I found that when the car was under the sun it had the most movement with an average of 16.833 inches of movement. The heat lamp had the second most movement with an average of 8.685 inches of movement. The regular lamp came last with an average of 3.203 inches of movement.

Project ID: 756

JR - Engineering: Energy, Materials, and Transport

Caroline O'Leary

The Effects of Rotating Solar Panels Vs. Fixed Solar Panels: Which Will Produce More Power Output?

As the amount of people relying on solar energy to power their homes and businesses increases, so does the need for the most effective solar technology. The question I asked in this experiment was, “Will a solar panel that changes angles produce more output than a solar panel that stays at a fixed position? And if so, what angle should this solar panel use to have access to the most amount of sunlight?”

I hypothesized that if a solar panel rotated angles throughout the day, then it would produce more output than if it stayed at a fixed position.
Seven main angles were used: 0°, 20°, 34°, 50°, 130°, 146°, and 160°. At each time of day (9:00 AM, 11:00 AM, 1:00 PM, and 3:00 PM), the output of the solar panel, placed at each angle, was recorded. The averages for each angle were calculated in order to find out which angle produced the most output at which time of day. At 9:00 AM, the angle 34° produced the most output, averaging 2.59 watts. At 11:00 AM, the angle 34° was again the highest performer, averaging 3.95 watts. At 1:00 PM, the angle which produced the most output was 160°, averaging 3.34 watts. At 3:00 PM, the highest performing angle was again 160°, averaging 1.35 watts.

Overall, the the highest producing angle during the AM hours, 9:00 AM and 11:00, was 34°, and the highest producing angle during the PM hours, 1:00 PM and 3:00 PM, was 160°. The daily power output for the rotating panel was 0.022 kilowatt hours. The highest producing output for a stationary angle, 34°, was 0.0019 kilowatt hours, which is 85% of the rotating panel’s daily output, which confirms my hypothesis that the solar panel which switches between the most efficient angles throughout the day would produce more than a solar panel which stays at a fixed angle.

Project ID: 757

JR - Engineering: Energy, Materials, and Transport

Jack Kehrli

The Optimal Surface for Soccer Players

This project examined what is the optimal surface for playing soccer. It is hypothesized that dirt would allow for the 426-gram, size five, with a 9.0 PSI ball to travel at the fastest speed, then turf, followed by 1-inch Bermuda grass “short grass” and ending with 3-inch Bermuda grass “long grass.” This data was collected by building a 44 degree ramp and rolling a soccer ball , thus providing the same amount of force when the ball was released. Time was recorded from the moment the ball was released and traveled one yard after rolling on the surface. The experiment was repeated for 9 more times for each of the surfaces tested. The results indicated that the hypothesis was supported by the data collected, indicating that dirt had the fastest average speed of 1.33 seconds, 23% faster than the slowest surface of long grass with an average speed of 1.64. The dirt surface proved to be the optimal playing surface for soccer. Knowing the optimal playing surface for soccer can help my team pass better and get around defenders and other players a lot quicker than if we did not know this data.

Project ID: 758

JR - Engineering: Energy, Materials, and Transport

Colt Neubrand

What Type of Bat Provides More Distance: Wood or Composite?

This project helped determine the distance a wood bat (control) and a composite bat provided when coming in contact with a baseball. It is hypothesized that the composite bat will hit the ball harder, farther, and faster than the wood bat due to its properties such as strength and pop. Both bats were in a clasp on a swinging device. There, I identified where above, within, and below the sweet spot are located on each bat. I ran 10 trials with each area on each bat which equaled up to 60 trials in total (10 above, 10 within, 10 below=30 x 2=60). I positioned the baseball tee on home plate, 4 inches from the swinging device where it was located in the righty batter's box. I applied enough chalk on a baseball to the point where it would make a mark on where the ball landed after being hit by the selected bat. I put the ball on the tee and cocked the arm for the swinging device and let go. I go and find where the ball made the mark and measure it to the baseball tee. The results for the wood bat varied more than the results for the composite bat ranging from ~4 meters to ~11 meters (above, within, and below). The results for the composite bat were similar throughout the testing ranging from ~9 meters to ~12 meters (above, within, below). The ball was able to travel farther due to the composite bat's properties.

Project ID: 759

JR - Engineering: Energy, Materials, and Transport

Maia Poch
Leilani Schelper

Portable Desalination

Since fresh water is becoming limited to some parts of our population, we wanted to design a device that could filter out the salt from water to make it drinkable, but also be portable and easy to use by those with limited access to fresh water. We created a prototype that should be able to filter out the water using a desalination method called reverse osmosis. In reverse osmosis, the water is forced through a membrane; in this case we used membrane filter discs. We created a wooden base for the device to rest on. The device is also made of a clear tube that is stuffed with membrane filters, the funnel that is attached to the top of the tube is for easy pouring of the water. To test the device, we poured saline water through the device and tested the salinity after each time with a salinity meter. Clarified drinking water must have a salinity of 0.5ppt or less. To test our first prototype, we ran the same water through three times. On average it reduced the salinity by 20.9 ppt but didn't give us complete drinking water. For the second prototype, we ran the same water through 10 times, reducing the salinity of the water by 25.6 ppt on average. We ended up with 4.6ppt saline water. In the end, our filter did not make drinking water but did greatly reduce the salinity. We believe if you were to run water through even more times, eventually, you would end up with safe drinking water.

Project ID: 760

JR - Engineering: Energy, Materials, and Transport

Carter Sparks
Gabe Solomon

Fishing Line Strength Test

As a fisherman you always wonder what type of fishing line is best. One of the worst things that can happen when you are fishing is having your line break when you have that big fish! To prevent this, there are different types of line that each have their own pros and cons, and we wanted to find out which lines performed best under different temperatures. Our hypothesis was, if we test the strength of 10-pound fluorocarbon, braided and monofilament fishing line, then we think braided fishing line will be able to withstand the highest weight withou breaking. We do not think temperature (hot or cold) will affect the breaking weight of the fishing line.

Procedure: Three types of fishing line were tested: fluorocarbon, braided and monofilament. Each line was tested for maximum weight held before breaking at three different temperatures: room temperature, hot temperature (112Â°F) and cold temperature (32Â°F). We performed 25 trials of each fishing line at each temperature.

Results: Braided line was consistently the leader in strength under all temperatures. However, the lines were affected differently, some more than others. Monofilament was affected greatly by any temperature change showing over 40% decrease in strength when heated or cooled. Braided line was affected more by heat than by cold, decreasing in strength by about 17% and 2% respectively. Fluorocarbon was affected least by heat and moderately by cold, decreasing in strength by 4% and 10% respectively.

Conclusion: In conclusion, we found that braided fishing line is the strongest in most realistic fishing temperatures (warm and cold water). If your line has been subjected to extreme heat, it might be best to use fluorocarbon since that line was least affected by the high temperature we tested.

Project ID: 761

JR - Engineering: Energy, Materials, and Transport

Kevin Rhodes

How Color Affects Heat Absorption

This project focuses on heat absorption and colored shirts. More importantly, which colored shirt absorbs the most heat? I hypothesized that the shirt with the highest temperature will be the darkest colored shirt, because the darkest color will absorb more of the light. The way I did this project is by setting six different colored shirts in the sun, three being light colored and 3 being dark colored. I set the shirts out in the sun at noon because that is when it is the hottest in the day, and every half an hour I would take the temperature of all the shirts and see which one was the hottest. The results showed that my hypothesis was rejected. The data shows that the green's highest temperature was the same or even higher than black 2 times out of the three experiments. The first experiment green's highest temperature was 45.5556C while black's was 45C. This shows that green absorbed more heat than black. In the last experiment the highest temperature for green was 37.2222C and black's was also 37.2222C. This shows that on some days it doesn't matter what the color of some of the shirts are, it will still absorb the same amount of heat as a black shirt, while the white shirt always had the lowest temperature. So if it is a hot you should wear a white shirt and to become warm you should wear a black or green shirt because those colors absorb the most heat.

Project ID: 762

JR - Engineering: Energy, Materials, and Transport

Madeline Poulin

Does the Design of a Bridge Affect How Much Weight It Can Hold?

This project deals with bridge engineering, design, and construction. The ideal result of this project was to find the bridge design able to support the most weight. I hope that this project can help future architects and engineers build bridges that are safer and more efficient. I hypothesized that the beam bridge design would support the most weight because it is the oldest and most commonly used bridge design today. I planned to test different bridge designs to discover the strongest design.

To complete this project I first did background research to better understand the topic of bridge design. Then, I designed each of The bridges I planned to test, including a beam bridge, an arch bridge, a truss bridge, and a straight bridge. After I completed the designs for all four of my bridges, I constructed my bridges using popsicle sticks, small wooden sticks, toothpicks, hot glue, wire cutters, scissors, a hand drill, and a cup of hot water. Once all of my bridges were assembled, I used small weights to find the breaking point of each bridge design. Lastly, I put all of my data into a data table and bar graph.

I calculated my means, based on my data, to find that the straight bridge design could support the most weight. The straight bridge models supported about 1000g. Based on the calculations of the means of my data my hypothesis was not supported. This shows that straight bridges are stronger than most other bridge types and should be considered as the new common type of bridge. This project, in conclusion, can help to keep people safer when using bridges for travel.

Project ID: 763

JR - Engineering: Energy, Materials, and Transport

Ahmad Zubaidi

A Solution to Earthquake-Proof Affordable and Sustainable Housing in San Diego

The problem with housing today is that it takes very long, costs too much, and isn't very sustainable. To be specific, it takes around 10-12 months to build a 2-story 4,000 sq foot house. 3d printing houses takes around 330 hours to build that same house which eases the building process by over 1,000 times. It also requires way less construction crew and has way less injuries recorded along the way. After we found this out, the only thing remaining is to find out which concrete is the best and most earthquake resistant. We first created concrete rods mixed with nothing, mixed with flex seal, mixed with fiberglass, and then mixed with fiberglass and flex seal. But after prying the concrete rods off, we found out they were very brittle and easily broke except for the control plain concrete rod. After realizing this, we tested the broken chunks and found out that regular concrete and fiberglass concrete were the 2 best rods. Then we tested different mixes, and included concrete with polymer. After testing the polymer mix, it showed the best resistant and had the best performance. Finally, we came to the conclusion that fiberglass with polymer concrete is the best mix.

Project ID: 764

JR - Engineering: Energy, Materials, and Transport

Keanu Zeller

Tilt Angle Effects on Eddy Current Impacts

In science class we performed an experiment involving eddy currents, and this captured my interest. I researched and came across an article that discussed how eddy currents can be applied to separate metals from other recyclable materials. I began to wonder if changing the angle in an eddy current experiment would impact how long it took a neodymium magnet to travel through a copper tube. I designed an experiment to test the effect of various angles on the time it took for the magnet to exit the tube.
My hypothesis was that it would take longer for the magnet to travel down the tube at angles less than 90°, not from to friction, but also due to the opposing force that was created by the aligning lines of electromagnetic flux.

Six different angles were tested: 90°, 70°, 60°, 45°, 30° and 20°. I built a Lego structure to hold a copper tube at various angles. I installed a release mechanism to provide consistency when dropping the magnet down the tube. I had a friend help me code two switches to time to the nearest millisecond. I tested each experimental angle 25 times with the neodymium magnet versus the control weight. I also tested the magnetic field strength.

At 90°, the magnet took 8.5 times longer on average than the control to travel down the 17.8cm copper tube. At each experimental angle, the magnet took progressively longer. At 20°, the magnet took 27.6 times longer than the control to travel down the tube. The slower rate at which the magnet traveled at various angles did not appear to inhibit the production of eddy currents forming the opposing magnetic field.

In conclusion, the angle at which the copper tube was held in an eddy currents experiment dramatically affected the results. The falling magnet slowed impressively as the tube angle became more acute. The relationship appeared to be nonlinear, likely due to the proximity of the magnet to the copper tube at the more acute angles. Based on my experiment, ramp angles may affect how efficiently metal recyclables are gathered.

Project ID: 765

JR - Engineering: Energy, Materials, and Transport

John Powers

Investigating Optimal Weight Distribution for Stability of a Homemade ROV

The purpose of this project was to find the optimal weight distribution for a homemade remote operated (ROV) boat. I made a boat out of a 15 L plastic storage container and remote control (RC) car parts. An unweighted ROV is at the most risk for capsizing, and even empty large vessels can capsize. The Vice President of Engineering of Grady-White Boats says, â€œIt all depends how weight is distributed, including the longitudinal center of gravity.â€ In this project, I will investigate stability and find the optimal weight distribution for a homemade ROV vessel.

Procedures:

For this project, I used a plastic storage box container, a hobby grade RC system for an RC car; and a jet drive for propulsion. The first boat I built had problems with leaking, and I had to begin again. I used 20 g, 10 g, 5 g, and 1 g plastic test weights. I used an Ohaus Scout Pro Scale to verify the weights to the nearest tenth of a gram, and I used the 1 g weights to make up for the errors in the larger weights. I performed my tests at a local community pool.

Results:

For this experiment, I performed 68 tests in total. I varied the number of weights and positions of the weights that I added. The more weights I added, the less freeboard the ROV boat exhibited. The freeboard results were similar for Positions 1 (low) and Position 2 (high). While testing â€œtiltâ€, which is the amount of freeboard while turning minus freeboard while still, I realized that as weight in Position 1 increased, the boat's stability also increased, but as weight was added in Position 2, the boat was less stable. The lower position with 190 g of weight exhibited less than 3 cm of tilt. Weights in Position 2 had twice the effect on speed as weights in Position 1. This meant that the boat slowed dramatically with weights in Position 2, however, the fastest speed obtained was 0.5 m/s with a 130 g weight in Position 2.

Conclusions:

I successfully designed and built a homemade ROV boat. The freeboard was the same when weight was added in Position 1 (at the bottom of the boat) or Position 2 (at the top of the boat). My homemade ROV was most stable when the weight was in Position 1. Tilt tests with the weights at the bottom of the boat in Position 1 met my goal of less than 3 cm of tilt. The boat traveled fastest when it was carrying the least amount of weight in Position 2.

Project ID: 767

JR - Engineering: Energy, Materials, and Transport

Ben Adler

What Is the Best Spray for Your Football Gloves?

This project examined what the most efficient football spray is to apply to one's football gloves. This project compared two of the most well known football sprays, and a homemade spray. It is hypothesized that the homemade spray will be the most adhesive. To test this, one would place a round tall cylinder as close as possible to a sink, place a plastic bag over the cylinder, spray the bag with the spray that is being tested, and apply the styrofoam cup onto the bag. The time it takes for the cup to fall was measured. In order to create the homemade spray, mix sugar water, Gorilla Glue, and gel based hand sanitizer. If one were to look at the data (15 trials of each condition), they would find that the homemade spray adhered the cup for the smallest amount of time, while the spray assembled by Spin It had the longest average “stick” time, 45.39 seconds. GripBoost, the most expensive spray, held for an average of 37.48 seconds. The homemade spray was the least effective in testing, an average of 10.38 seconds, and may have been the least efficient for many reasons. One reason may be that when the glue dried at the bottom, it took some of the “stick” with it. Another reason could be that there was not enough sugar in the sugar water, leading to the spray being too liquidy. This project proved what the most adhesive spray for football gloves is.

Project ID: 768

JR - Engineering: Energy, Materials, and Transport

Adam Anthony

Testing and Comparing the Strengths of Homemade Bioplastics

This experiment examined different bioplastics' tensile strengths to determine whether or not they would be viable replacements for conventional, petroleum-based plastics. It is hypothesized that the casein protein plastic will prove to be the plastic with the highest tensile strength. Experiments were run on each of the 4 plastics 4 times as they were cut into 4.5cm by 9cm quarters for a more manageable size. The samples were held by 2 high strength clamps and stretched apart by the lower clip which had a basket to hold weight. The amount of weight (in grams) at which each sample broke was then recorded. The Results indicated that the initial hypothesis was incorrect. The Casein plastic performed the absolute worst. It was 1183% weaker than the gelatin plastic with an average of only 163g. This may have been due to the fact that casein, the protein found in milk, does not form the strongest bonds as a polymer. The casein plastic did have the simplest recipe and was by far the least complicated chemical reaction. Perhaps it was that the casein did not dry enough even though it had many hours to dry. The plastic crumbled to pieces and had no flexibility. The strongest plastic proved to be the gelatin foam. It was able to withstand 1928.5 grams of weight on average. Its air bubbles created a lightweight frame whilst at the same time giving the plastic great flexibility. The gelatin plastic proves itself to be the most viable replacement.

Project ID: 769

JR - Engineering: Energy, Materials, and Transport

Michael Ladisa

Which Types of Water Bottles (Plastic, Metal or Insulated) Maintain Water at a Lower Temperature?

My problem for this experiment is â€œWhich type of water bottle maintains water at the lowest temperature?â€. My hypothesis for this question was that the insulated water bottle would maintain the lowest water temperature compared to the stainless steel and plastic water bottles. I chose this project because it looked very straight forward, but I also did this project because it would not only benefit me as an athlete, but all other athletes, hard workers, and all other people that live in hot locations and want cold water. My project would help these people stay cooler. For my procedure, I filled each bottle with water that was six degrees celsius. I then placed them under a heat lamp and recorded the changes in temperature four times over twelve hours for three days. I ended up making one average test run with four average rounds of data of the temperature changes.

Based on my calculations of the means for my data, my hypothesis was not supported. The stainless steel water bottle's water temperature was the coldest ten rounds out of my twelve rounds of data. I think my experimental results were the way they were because the stainless steel insulated water bottle was vacuum insulated, or the heat from the heat lamp was absorbed least by the stainless steel water bottle due to the position it was in from the heat lamp or the stainless steel water bottle's lid was proportionally the largest.

Project ID: 770

JR - Engineering: Energy, Materials, and Transport

Carmina Allende

How Do Different Surfaces of Tennis Courts Affect the Way the Ball Bounces?

The project examined the different surfaces of tennis courts and how they affected the bounce of the ball. It is hypothesized that the hard court (control) will have the outcome of a higher bounce than the clay court surface and grass court surface.
During this experiment, one trial per surface with twenty balls bouncing eight feet away from a piece of cardboard covered with chalk would leave marks against the chalk and will make measurements clear and easy to take.
There was a 13.35 decrease in the height of the bounce on the grass court vs. the control (hard court). For the clay court, the height of the bounce decreased by 6.8 centimeters when tested on the control.
On the grass court, the blades of grass bend and do not provide much upward motion for the ball to bounce in rebound. This causes the ball to have a lower, weaker bounce.
On the hard court, the bounce is fast and predictable. Because the surface doesn't absorb as much energy as a softer surface, it bounces at a consistent height
In conclusion, results indicated that the clay court gave the ball the highest bounce. The surface absorbs the pace of the bounce and gives it more friction, allowing the ball to bounce higher and slower than the grass court and hard court.

Project ID: 771

JR - Engineering: Energy, Materials, and Transport

Jeyanth Narayan Parthasarathy

Effects of Reverse Vertical Stabilizers on Aeroplanes

The idea behind this project is to increase the airtime of an aeroplane, by improving its stability. This project in its present form is the result of adding a second set of vertical stabilizers on an airplane. The initial idea for this project was to find out whether positioning the additional vertical stabilizers somewhere else would benefit more control of an aircraft. Success on this project would mean giving aircraft better stability, leading to a general increase in airtime.

Procedures were used to help determine how efficiently a model plane would undergo airtime in the cruise stage, with a reverse vertical stabilizer positioned under the fuselage or tail. Efficiency was measured by time aloft and distance traveled, on top of plane stability, with the plane measuring about 36 centimeters in width with 43 centimeters in length, weighing just under 10 grams.

Stability in results shows that with balanced weight came greater efficiency during the take-off, cruise, and descent phases. In general, the plane was able to sustain more airtime with some minor trade-offs. After averaging the pieces of data, the average flight time of a plane with a reverse vertical stabilizer was shown to be 1-5% more efficient in all the 3 stages, which contributed to the time aloft. There were a few flaws with this prototype that were later fixed and perfected. Some flights did have significantly less airtime or had little to no benefit.

Test airplanes were able to sustain more airtime with this prototyped part. Averages were generally increasing due to the altering of the center of gravity on the plane. This led to many benefits that outweighed the cons. The way that this project was able to alter the center of gravity by balancing out weight is something that could be later applied to other occasions and ideas. After analyzing the runs, 50-60% of the time the plane with the reverse vertical stabilizer was able to outdo the stock one. Given this, I could claim this project as a success.