Abstract: Science and Engineering Fair of Houston

1001

How nozzle geometries effect propulsion efficiencies.

Matthew Baine
Clear Creek ISD /Seabrook Intermediate School

Category

Aerospace Engineering

This project is about evaluating how different nozzle shapes and sizes effect the output exhaust and propulsion efficiency of rocket engines. A rocket engine that is more efficient would put out more power or go longer for the same amount of fuel. This project tested five different nozzles using a common test platform that simulates a rocket engine. The test rig uses water and pressurized air instead of actual rocket combustion to simulate the flow characteristics within the nozzle. For each nozzle, ten measurements were made to record the relative force and spray pattern for each run holding identical initial conditions of air pressure and quantity of water. A pendulum showed the displacement of each run indicating the relative force generated by each nozzle. In addition, the nozzle flow cone angle was measured to understand how well directed the exhaust was. The data was collected using video and rulers to measure and record the various parts to estimate the relative efficiency of the nozzle and therefore a rocket engine. The hypothesis that a De Laval nozzle should be optimum was not shown to be better than a Bell nozzle, however the various conical nozzles were very close and indicate that a future improvement in the test setup could help make a better measurement.

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☐ vertebrate animals ☐ microorganisms ☐ rDNA ☐ tissue

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☐ yes ☒ no

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Abstract: Science and Engineering Fair of Houston

1002

Wings to the sky!

Aariz Vastani
Clear Creek ISD /Westbrook Intermediate School

Category

Aerospace Engineering

This project is about aerospace engineering and specifically about nozzle and wing combination. I wanted to do this because I was fascinated by engineering, and I wanted to learn something I didn't know so I chose aerospace engineering. I believe that that combination of the Elliptical wing and the Bell nozzle would win because the wing had a way of gliding through the air and the nozzle was wider so more fuel could come out. I tested 7 rockets 3 times. Those seven rockets were Ellip and Bell, Triangular and Bell, Trapezoid and Bell, Ellip and Conical, Triangular and Conical, Trapezoid and Conical, and Rectangular and De Laval to be our constant. The results showed that the Elliptical and Conical nozzle had the best time, and this did not support my hypothesis. The reason I believe the Conical nozzle won over the Bell nozzle is because it was shorter, allowing more fuel to get out quicker. The implication of my project in the real world is helping cut spenders' money, having less CO2 in the air, using less time, etc.

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Abstract: Science and Engineering Fair of Houston

1003

How far can a paper airplane go depending on the wing angle

Jon Smithson
Conroe ISD /Knox Junior High

Category

Aerospace Engineering

The purpose of this experiment is to see what wing angle is best for an aircraft that shows the strongest, aerodynamic flight. The hypothesis states that if the plane uses an angle that is more straight and arrow dynamic, then it will fly better because it will cut through the air well and won't have as much air resistance. Lift, drag, thrust, and gravity are the challenges the airplane will face. In this experiment, the paper airplane will go through multiple tests with different wing angles being the variable. The paper will be folded into a certain airplane and different wing angles will be demonstrated for each plane. The wing angles will be 90, 85, 115, and 75 degrees. After the airplane is thrown, the distance will be measured in meters with a tape measure and will be recorded in a graph. In conclusion, the straight, 90 degree angled, airplane performed the best, getting 5.125 meters. The hypothesis has been supported, showing straight angles are the best. This information will be useful in knowing wing angles for future aircrafts in fields like aerospace engineering.

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Abstract: Science and Engineering Fair of Houston

1004

Aerospace engineering

Smrithi Adapa
Conroe ISD /York Junior High

Category

Aerospace Engineering

This experiment includes flying and testing rockets, I have included procedures and materials needed for the Experiment going to be done.

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Abstract: Science and Engineering Fair of Houston

1005

Wings to Fly

Neel Mohan
Conroe ISD /McCullough Junior High

Category

Aerospace Engineering

Wings play a crucial role in aircraft flight. Despite being heavier than air, planes remain airborne due to the combined effect of four forces of flight: Lift, weight, thrust, and drag. An airplane with engines relies on all its forces; gliders without engines only have lift generated by the wings to overcome the force of the weight. If an airplane engine fails midair, it behaves like a glider relying upon the wings to be airborne. While larger wings can generate more lift, they also add to the weight of the flight. The study aimed to determine whether larger wings can produce better gliding time. Three identical planes with different wing sizes were constructed with balsamic wood. The planes were thrown from a height, and the total airborne time was measured. Plane A has a wing span of 10 cms a weight of 0.14 pounds. Plane B had a wingspan of 12 cm and a weight of 0.18 cm, while plane C had a wingspan of 14 cm with a weight of 0.19 pounds. The mean flight time of plane C was 2.1 sec compared to plane B, 1.89 sec, and plane A was 1.75 sec. Our study showed that planes with more enormous wings could glide despite being heavier. This information will be helpful for aeronautics engineers to construct planes with better aerodynamic forces.

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Abstract: Science and Engineering Fair of Houston

1006

What is the Most Efficient Shape for an Electrode of an Electrohydrodynamic Thruster?

Rafaela Rossetto
Conroe ISD /McCullough Junior High

Category

Aerospace Engineering

What is the best geometrical shape for an electrode of an electrohydrodynamic thruster? That question has been in the back of my head since the start of the school year, and I soon realized it was the wrong question. My project wasn't testing which shape works best, but if all shapes work; the project focused not on different possible set ups of the thruster, but which and why only one electrode shape works.I think it is important to understand how a simple set up of an EHD thruster works, so if put on a larger scale, it could be put into a satellite, or a spacesuit. I want to continue working on the lines of an EHD thruster to explore more of the idea of attaching it to future astronaut spacesuits. Working with the thruster was not easy, and it required a lot of trial and error to conduct results. One significant result I found was that a cone(nail) shape is the only cathode shape which works for an electrohydrodynamic thruster as it specifies wind particles to a certain area. This shape partially proved my theory, as I was trying to find an efficient shape to move air particles to a certain spot; so astronauts could aim 180 degrees away from their target to navigate through space. Conducting the experiment was not an easy task, but it taught me a lot of problem solving skills and how to critically analyze a problem to understand what I'm doing incorrectly.

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Abstract: Science and Engineering Fair of Houston

1007

plane aerodynamics

henri souto-marchand
Houston ISD /BCM Academy at James D Ryan - MS

Category

Aerospace Engineering

Aerodynamics is interesting because improving aerodynamics will improve fuel economy , speed , efficiency of aircraft , and airflow. A sleek/smooth airflow will allow for a decrease in drag and in turbulence. I will tested the following different model aircraft: #1 red glider, #2 commercial aircraft and #3 paper airplane. My question is what type of model aircraft will have the most lift. My hypothesis is that the red glider will have the most lift. My supporting evidence is that modern gliders can reach lift-to-drag ratios of up to 60:1. That means that if they begin their glide at a height of one mile, they can travel 60 miles forward. In comparison, a modern commercial airliner has a glide ratio of about 17:1. So, with this information I can conclude that my hypothesis that the glider had the most lift, and flies the best compared to the others was supported. The paper airplane results are not conclusive and we would need another project to test the plane.

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Abstract: Science and Engineering Fair of Houston

1008

Mass Drivers

Adam Al Ghazawi
Conroe ISD /McCullough Junior High

Category

Aerospace Engineering

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Abstract: Science and Engineering Fair of Houston

1009

Astrophysical Implications of Meteoric Events: A Study of Impact Dynamics

Tram Huynh
SST - Champions College Prep - HS

Category

Aerospace Engineering

Meteor showers, while visually stunning, can affect Earth's atmosphere and surface. This project aimed to study these effects using MeteorBright, a machine I invented to detect meteor activity. The machine uses flashing LEDs to indicate meteor entry and a buzzer to alert significant events. During multiple meteor showers, MeteorBright collected data on meteor frequency, size, and behavior. The results showed that while most meteors are small and pose little threat, larger meteors can cause significant damage, as seen with the 2013 Chelyabinsk meteor. The study also suggested that meteorite impacts may have played a role in the early development of life on Earth by creating environments supportive of microbial life. In conclusion, meteor showers present both risks and potential benefits. The research highlights the need for continued monitoring to protect infrastructure from larger meteor impacts and provides insights into how meteorite impacts may have influenced Earth's early conditions. MeteorBright could be applied to improve early warning systems, enhance impact risk assessments, and further our understanding of planetary science.

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Abstract: Science and Engineering Fair of Houston

1010

Crash Landing

Dhanashi Dhriti
Houston ISD /BCM Academy at James D Ryan - MS

Category

Aerospace Engineering

When the Apollo 11 Command Module landed back on earth it was 4 miles off the target. How can I change the landing design on the Apollo 11 Command Module to make it more accurate when landing on a target? My research includes how drag and air resistance prevents an object from landing on a target accurately, and how a rocket is a chamber filled with gas. If I put a magnet on the target and the bottom of my spacecraft, then it will get the most points because it is landing more centered due to the magnetic force of the magnets they will attract. I first make a target, make the three designs, and find a drop zone. Next drop each design three times on the target and record the points on a chart. I concluded that my hypothesis was incorrect. According to my data, I dropped the third design with its "robotic arms" which placed magnets across the center of the target. I was inspired Elon Musk's SpaceX landing. Based on this data, I can conclude that my third design was most accurate because the more points you gain the more center it landed. If I could change anything about this experiment, I would try to find a thicker string to make a better parachute so it could cause more air resistance because I noticed that when I was dropping the designs it made a big clank and I don't think the parachutes provided enough air resistance.

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Abstract: Science and Engineering Fair of Houston

1011

what is the effect of wing sweep angle on amount of drag

Mason Gann
Clear Creek ISD /Brookside Intermediate School

Category

Aerospace Engineering

The purpose of my project is to find out the wing sweep angle with the least amount of drag. To do this, a wind tunnel and 3 different wing sweep angles were 3d modeled, then printed. The wing models slide on a rail made into the wind tunnel connected to a spring scale by string. This design would have been great for getting the data needed, if it had worked. But it didn't. this is mainly due to friction, there was too much friction in the rail system. The wing model never even budged. It would have given data that would be crucial for future engineers, but there was too much friction and a fan not powerful enough, which is ironic because this was supposed to test friction.

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Abstract: Science and Engineering Fair of Houston

1012

What is the Optimal Wing Shape for a Glider's Flight Time?

Tahia Bhuiyan
Ivanna Sanchez
Aldine ISD /Grantham MS

Category

Aerospace Engineering

Gliders and planes have a lot in common but one key difference is that gliders don't have engines to propel them. Their flight time is highly dependent on their wing type and finding the optimal wing shape will improve gliders and give insight on how to better the aerodynamics of any plane. We researched lift and set out to find "what is the optimal wing shape for a glider's flight time?" We built six similar planes all with the same body but different wing shapes. Out of the six, (straight edge, elliptical, pointed tip, tapered, swept front, and swept back), the top three had similar averages. First was the straight edge with an average of 1.884 seconds, Elliptical with an average of 1.846 seconds and Tapered with an average of 1.868 seconds. Their lift-off was smooth and steady along with their landing. We concluded the wings of the top three had the most surface area, in result leading to more lift. Gliders vary from shape to shape with a multitude of factors affecting the flight and hope to pursue those factors in the future.

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Abstract: Science and Engineering Fair of Houston

1013

Turning the screw

jack eisele
Houston ISD /BCM Biotech Academy at Rusk - MS

Category

Aerospace Engineering

I was testing proppellers of different pitch to see what pitch was the most efficient. To see what proppeler was the most efficient I tested 3 things thrust, RMP, and AMPS the thrust and AMPs were the most important because those are the 2 things needed to calculate effeciency and the RPM just showed the affects of the higher pitches drag.When I tested it despite my original expecttations higher pitch props generated slightly less thurst but I predicted correctly that they would pull more amps and that they would spin slower.So in conlusion for the speed I was spinning them at lower pitch is more effiecient.

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Abstract: Science and Engineering Fair of Houston

1014

RocketLaunch: Intelligence Via AI

Akshat Chhokra
Fort Bend ISD /Fort Settlement Middle School

Category

Aerospace Engineering

This AI-powered tool uses advanced Generative AI language models to evaluate critical attributes of rocket designs such as thrust, weight distribution etc. by comparing them against research-based data from previous rocket launches, including their success or failure patterns and underlying factors. By leveraging these insights, the tool provides tailored recommendations for design improvements. This immediate feedback helps scientists make informed decisions more rapidly, significantly reducing research time and enhancing the efficiency of the design process

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Abstract: Science and Engineering Fair of Houston

1015

Flying High

Caroline Erdem
Clear Creek ISD /Seabrook Intermediate School

Category

Aerospace Engineering

Air travel is one of the most popular forms of travel, yet it remains costly. One way of lowering costs is by making the plane more efficient. If one can improve the propellers, it may lead to more efficiency in terms of power use, aerodynamics and thrust. This project tested different propeller styles in four different experiments. To start, 4 different types of propellers were designed and 3-D printed. For each test, the propellers were attached to the plane and results were recorded. For the first test, the plane was attached to a protractor using a string so that forward movement could be recorded. For the second, a watt meter was attached to the engine and the amount of electrical power was recorded. For the third, a smoke machine was turned on to record air flow. For the fourth, an outdoor flight was conducted, and maneuvers were recorded to compare thrust, handling, maneuverability, and aerodynamics. The data showed that in all four tests the toroidal propellers pulled significantly less wattage, created a much narrower flow of air over the plane, had a higher degree of pull, and ranked higher in each recorded area of the flight test. In conclusion, the hypothesis was correct. In each of the 4 tests, the toroidal propellers outperformed the classic propellers. For real world uses, toroidal propellers could be utilized in commercial airplanes to make them more efficient while improving the aerodynamics, maneuverability, and handling. The end result could be lower costs for air travel.

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Abstract: Science and Engineering Fair of Houston

3001

Testing Efficiency For a Magnetoplasmadynamic Thruster

Gregorio Souza Gomes
Conroe ISD /AST: Academy of Science and Technology

Category

Aerospace Engineering

The purpose of this project is to test a simplified model of a type of space propulsion called Magnetoplasmadynamic Propulsion. This propulsion method utilizes an applied magnetic field to confine and control the plasma generated by the ionization of a gas, which in turn generates thrust. A negatively charged cathode emits a stream of electrons that collide with gas particles released within the thruster (this project uses atmospheric gas, however a professional MPDT uses noble gases such as helium) which rips the electrons off of the particles, creating a plasma. The electrons from the cathode travel to the anode, which is positively charged, at the other side of the thruster and take the plasma along. The applied magnetic field inside the thruster is parallel to the travel of the plasma, pushing it outwards. The anode attracts the plasma in a perpendicular direction; this generates a centripetal Lorentz's force, swirling the plasma. When the plasma reaches the end of the thruster, the magnetic field becomes vertical and the Lorentz's force becomes horizontal, propelling the plasma outwards at high speeds, generating thrust. In this project, the student researcher uses copper tubes as the electrodes and an annular permanent magnet for the applied field, along with a low current, 20k volt power source. This project serves to model the magnetoplasmadynamic propulsion system which is used in satellites to make micro-adjustments to maintain their orbit, and will likely someday be used to travel to mars.

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Abstract: Science and Engineering Fair of Houston

3002

Stellar Relay: Optimizing CubeSat Relay Networks for Maximized Communication Range and High-Capacity Transmissions

Zijun Guo
Alina Zhu
Fort Bend ISD /Elkins High School

Category

Aerospace Engineering

Non-line-of-sight Communication between celestial bodies has been a challenge in space exploration. The proposal gives the possibility of utilizing a CubeSat relay network to improve non-line-of-sight communications and the comparisons of the most efficient CubeSat network path. Direct communication technology is insufficient in this case due to the planet itself blocking signals from Earth. The network can enable future back-side exploration missions and also provide a further step for interplanetary missions. To demonstrate the feasibility of CubeSat, the proposal includes a test-case scenario to illustrate how the relay network can provide continuous data transmission without signal obstructions. By comparing network configurations, this project determines the best possible strategy for maximizing coverage and minimizing signal loss. This approach offers significant advantages as CubeSats are more affordable than traditional satellites, and it has a high potential for flexibility and adaptability, making CubeSat relay network ideal for dynamic and evolving exploration missions. The CubeSat relay network represents a critical step toward expanding possible reach in space exploration while improving efficient and reliable communication.

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☒ yes ☐ no

Abstract: Science and Engineering Fair of Houston

3003

NO good this is not good

TEST Peanut Test Butter
Test Profile Test Profile
Zach Homeschool

Category

Aerospace Engineering

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Abstract: Science and Engineering Fair of Houston

3004

The impact of Propeller Blade Design on thrust and Speed in planes.

Janiru Dissanayake
Clear Creek ISD /Clear Lake High School

Category

Aerospace Engineering

Propellers are what make thrusts in planes and there are many different designs of propellers. Propellers rotate and displace air which is pushed back backward and because every action has a reaction the plane starts accelerating. The purpose of this project was to find the ideal propeller specifically when looking at the number of propeller blades in relation to thrust. My original hypothesis was that as the number of blades of a propeller increases, the thrust would decrease as a result of the weight and aerodynamic drag from the extra blade, which would produce less thrust. The first step was to make the plane out to foamboards and electronics needed for flight. Then I tested the thrust by hooking a force gauge to the base of the plane and accelerating the plane and analyzed the data. The simplified result of my experiment is that 2- blade did the worst and 4-blade did the best even though 5-blade had more propellers. This showed that the amount of thrust increases as the amount of blades does until 5-blades. In conclusion, my hypothesis was wrong as we saw that there was a opposite trend and that thrust increases as the number of blades increases. However, this changes when we look at adding a 5th blade because of aerodynamic drag, making the 4-blade propeller the best.

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Abstract: Science and Engineering Fair of Houston

3005

ESPS: An Aerodynamic System for the Cessna 172 Skyhawk to Optimize Lift-Induced Drag Reduction and Improve Stall Prevention Performance through Counteracting Flow Manipulation

Aryan Khandelwal
Conroe ISD /AST: Academy of Science and Technology

Category

Aerospace Engineering

According to the National Transportation Safety Board, there are 18 aviation accidents that occur due to stalling every 10 years. This project was initially designed to mitigate the results of the 2 Boeing accidents that occurred in 2017 due to the failed Maneuverability Characteristics Augmentation System (MCAS) which functions to regulate the airplane pitch in case of an emergency. This project created an autonomous device that would detect the pitch of the aircraft, and adjust it if the pitch goes beyond 15 degrees up or down. The adjusting mechanism consisted of two openings in the aircraft: one being under the aircraft, and the other located on the top surface right before the tail of the aircraft. The openings allowed for air to go into the airplane through the belly opening, and go out of the top opening via an aerodynamic duct designed to redirect airflow. To perform the experiment, two 3D printed models were created and tested via a physical wind tunnel for visual observations, but also tested through a CFD (Computational Fluid Dynamics) simulation. The model was able to balance out the pitch in 5.2 seconds which is an indicator of an efficient emergency system. However, it was evident that the model was relatively effective in producing lift but the value of drag did not have much of a difference between the data of with and without the ESPS system. Overall, the model effectively demonstrated the primary application and purpose of the object.

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Abstract: Science and Engineering Fair of Houston

3006

Electric Ducted Fan Jet

Pierce Crist
Hayden Kramer
ST. JOHN'S SCHOOL

Category

Aerospace Engineering

High-speed jets combust a large amount of fuel in their jet engines, causing large emissions. As the world goes towards electric-powered transportation, so must the aviation industry. The team is designing a small-scale electric aircraft to test the limits of electric application to high speed aircraft. This vehicle will have sufficient carrying capacity to support different tasks including but not exclusive to surveillance, payload delivery, or transportation. The team plans to accomplish these goals by designing and building a lightweight-composite electric ducted fan jet. Throughout the design process, the team focused on a minimum drag design while designing for a high structural strength and the ability for high-speed travel. During this time, the team also designed an intake and thrust tube that optimized for maximum efflux velocity. Using OnShape, the team created multiple iterations of a jet and used Ansys Aero CFD to perform initial tests on the aerodynamics of the jet and further testing was done with a small scale prototype. The team used composite manufacturing at home to create the carbon fiber skin of the plane. The plane's structure is made up of carbon fiber rods along with balsa ribs to provide stability for the carbon fiber skin of the plane. This project represents a viable solution for military and or civilian high-speed drone use. The team can apply this research project to a larger scale attempt at high speed travel with the goal of speeds equivalent to those flown in the commercial aviation industry.

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Abstract: Science and Engineering Fair of Houston

3007

Developing a Nose Cone for Subsonic Speeds

Fox Piperato
Conroe ISD /ACES: Academy for Careers in Engineering and Scien

Category

Aerospace Engineering

A nose cone is the top part of the rocket that aims to reduce the drag force. The purpose of this work was to develop and test a nose cone that reduces the drag force for subsonic speeds. Drag is a force produced by a fluid stream when an object moves through it. Drag can be reduced by increasing the angle and decreasing the surface area of the nose cone. However, data has shown that a conic point induces more drag than a blunted or elliptical nose at subsonic speeds. Therefore, the project developed the nosecone to be conical with an ellipsoid tip to minimize surface area while having a blunted tip. The nosecone's drag was measured in a wind tunnel and compared to a parabolic, power series, conic, ogive, haack series, and ellipsoid nosecone, with a flat face as a control. This design was second-best in mitigating drag, however, the Power Series nosecone induced the least drag. The design could be improved through further iteration and improvement.

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Abstract: Science and Engineering Fair of Houston

3008

Aerocket

Suman Muppavarapu
Asa Gangjee
ST. JOHN'S SCHOOL

Category

Aerospace Engineering

The aerospike rocket engine, developed in the late 1960s, was designed to address a significant limitation of traditional bell rocket engines: inefficient exhaust gas expansion across varying altitudes. Unlike bell engines, which are only optimally efficient at a specific altitude, the aerospike engine maintains consistent efficiency by utilizing atmospheric pressure to shape its exhaust flow. Despite its theoretical advantages, aerospike engines were historically impractical due to challenges related to weight and cooling. The heavy spike and the complexity of cooling its internal structure negated the engine's efficiency gains and hindered its widespread adoption. Recent advancements in additive manufacturing of high-temperature alloys, like Ti64, have enabled the creation of intricate cooling channels within aerospike engines with laser-based 3d printing techniques. Metal 3D printing minimizes material waste and lowers the cost of innovation compared to traditional CNC milling or casting, making it an attractive solution for manufacturing lightweight, high-performance rocket engines. This project aims to leverage these technological advancements to design and fabricate a small-scale aerospike rocket engine with regenerative cooling channels. The process involves using ANSYS to simulate and optimize a nozzle design, then printing it in a high-temperature and strength resin to validate it with real-world testing. The prototype will be tested at a custom-built rocket bed at TRIPOLI Houston's Rocket Launch Site. Data collected from these tests will form the basis of a technical report, which will be submitted to the International Science and Engineering Fair (ISEF). The project aims to demonstrate the feasibility of a novel regenerative cooling solution for aerospike engines optimized for extended-duration applications such as deep space propulsion and reusable SSTO (single stage to orbit) satellite-bearing rockets.

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Abstract: Science and Engineering Fair of Houston

3009

Attenuation of Liquid Propellant Slosh Time via Tank Geometry Optimization.

Rhea Wadhwa
Clear Creek ISD /Clear Lake High School

Category

Aerospace Engineering

This experiment has been conducted to test the effects of altering liquid propellant tank geometry on the slosh time of the fuel within the tank. â€œSlosh timeâ€• is the time it takes for a liquid to settle after being disturbed and it is dependent on factors such as tank geometry, propellent properties, and capillary effects. If a 4-quadrant radial tank is used, then the slosh time of the liquid propellant will be less than that in a pill-shaped baffle-less tank. To test this, CAD software will be used to create each tank and CFD software will be used to simulate the propellent within the designed tank. Within SimFlow, multiple parameters such as microgravity, dimensions of the tank, and propellant properties will be inputted to ensure accurate results from the needed environment. Unfortunately, reliable data was not obtained due to a lack of technical skills in CFD software. However, post-experiment research was conducted to draw a reasonable conclusion: Professional simulations have shown the less space a fluid has to slosh around, the less time it will take to drop to its lowest energy state. Therefore, it is plausible to assume that a 4-quadrant radial tank will decrease the overall slosh time of the propellant while in orbit.

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Abstract: Science and Engineering Fair of Houston

3010
How can camber morphing airfoil(s) affect fuel efficiency and the environment?

Rafael Cantu
Robert Johnson
Conroe ISD /ASHP: Academy for Science and Health Prof

Category

Aerospace Engineering

Aviation has played a pivotal role in global connections for almost the last century, but as rising concerns about carbon emissions grow, so does the increasing carbon footprint of the growing avionic industry. As of 2024, plane emissions contributed nearly 5% of all emitted CO2 in the world with an estimated 800 million metric tons released. An Airbus A320's flight from NY to LA consumes 18,000kg of fuel. For every 1 kg of fuel, 3.15 kg of carbon emissions are produced, totaling 56,700 kg of carbon emissions for the Airbus. Our airfoil on the Airbus A320 would save 47% in fuel consumption and close to 45% in emissions not counting for increased weights of a new system. We achieved this by constructing a seamless morphing airfoil to optimize aerodynamics at each stage of flight. We optimized the wing to a high L/D for lift, allowing a smooth climb. Then the wing would morph into an asymmetric wing such as the 0012. The constructed wind tunnel yielded a constant flow rate of 72g of force, with only an intel funnel of around .3 meters of width and height. The constructed wing was mostly 3D printed with elements coming into around 15 inches long. With a sound and stable PLA-printed skeleton, which houses 8 servos. All of these interact with the TPU-printed and flexible skin which can deform to the arms of the servos to create specific shapes. Such as the described 0012, 4412, and 4415 wings.

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Abstract: Science and Engineering Fair of Houston

3011

Hybrid Winglet Design Analysis for Aerodynamic Efficiency

Arjun Paripelli
Conroe ISD /AST: Academy of Science and Technology

Category

Aerospace Engineering

Winglets play a crucial role in aerodynamics of aircrafts, meaning that the optimal design can create a significant efficiency improvement. In order to test lift properties of 6 winglet models created, 2 of which were designed by the student researcher. A wind tunnel was made and used to evaluate the height achieved by each model winglet inside the test chamber at 3 speeds to replicate conditions of takeoff, landing, and cruising speed. Trials revealed that the Upswept winglet model demonstrated the best lift-generating properties followed by the Blended model in second place and the Arc model in third, based on height achieved within the test chamber. Notably, the Arc winglet model designed by the student researcher ranked just below the 2 models that are currently in use by modern aircraft. Taking into account how much society depends on air travel in developed countries, creating efficiencies in airliner aerodynamics can significantly reduce carbon emissions leading to more sustainable travel, lowered operational costs, and a positive impact on climate goals.

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Abstract: Science and Engineering Fair of Houston

3012

Ionic Thuster vs. Mechanical Thruster

Cooper Standley
Rik van den Berg
Rigel Daniel
Conroe ISD /ASHP: Academy for Science and Health Prof

Category

Aerospace Engineering

How well do Ion thrusters perform within' earth's atmosphere? Ion thrusters have been a growing interest in the field of engineering, recognized for having low thrust yet high fuel efficiency. They have been mainly used in outer space, having limited researches conducted on them within' earth's atmosphere. This purpose of this experiment is to recognize the current gaps in our knowledge with ion thrusters, testing their overall ability to perform under the atmosphere. Two planes were tested, one with ion thrusters and another with mechanical thrusters, and ran twenty different trials testing the distance, time, and speed they traveled. From this data, the results fail to reject the null hypothesis, so there is no statistical difference in the time, distance, and speed, between ion thrusters and mechanical thrusters. In conclusion, further revision in our research is needed to come to a census of this topic.

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