

# AIAA NCS Selects Area's Top Aerospace Science Fair Projects

*Edited by Nils Jespersen, The Aerospace Corporation*

In March and April, 2010, members of the AIAA National Capital Section (NCS) again lent their expertise to selecting the best aerospace-related projects in the region's various science fairs. Volunteer judging teams visited eight regional science fairs that were held in the National Capital area, including Maryland, Virginia and Washington, DC.

Thanks to the generous support from our Corporate sponsors – *U.S. Space & Rocket Center, Lockheed Martin, BAE Systems, Global Science and Technology* – which made it possible for AIAA to cover all of the areas fairs, and enabled us to award tangible prizes to the first, second and third place winners (Scholarship to Space Camp or Aviation Challenge, \$100, and \$75, respectively). Additionally, Honorable Mention certificates were presented to other fair participants that were worthy of special recognition.

## DC Mathematics, Science and Technology Fair

The DC Mathematics, Science and Technology Fair was held at the McKinley Technology High School, in Washington, DC, on 27 March 2010.



Claudio Caprio (BAE Systems), Kenneth Fugate (FAA), and Jay Buckley represented the AIAA

on the judging team. The judges had a great time reviewing the student presentations and, finally, selected the following projects for special recognition.

### ***First Place: "3 2 1 ... Liftoff"***



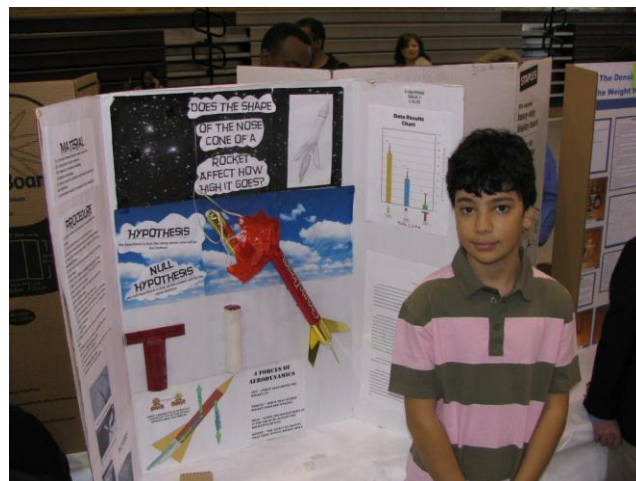
The First Place Award went to a 7<sup>th</sup> Grade budding future rocketeer: Jack Ewart, representing Stuart Hobson Middle School in the Junior Division. Jack received his inspiration from his Dad who, as a young man, also was interested in rocketry. Jack's passion was evident as he discussed the types of nose cone designs that he evaluated to see which designs would provide the maximum height during lift off. With some guidance from an older brother in high school, Jack measured the height of the trajectory using geometry. By measuring the angle at which the apex took place, he was able to calculate the height. He used multiple runs to determine the best overall height for the three nose cone designs in his experiment. The sharp conical design came out the best, with an overall height of greater than 200 feet, followed by a more rounded cone and, lastly, the blunt designed cone. Clearly, Jack has the passion and desire to pursue this curiosity of rocketry into a future in the aerospace field.

***Second Place: “The Effect of Temperature on Hovercraft Performance”***



The Second Place Award went to Nathan Dupree, a 9<sup>th</sup> Grader, representing McKinley Technical High School in the Senior Division. Nathan demonstrated his vast knowledge in the many steps it takes to build a ½-scale hovercraft from drawings he researched on the internet. This endeavor was a challenge on its own. Nathan then built and tested his hovercraft using a hair dryer with three temperature settings. His experiment looked at the effect of temperatures within the hovercraft, as well as its effects on mobility, stability and height. The results were fairly consistent, with the hottest setting performing the best. During his trials, Nathan loaded the hovercraft with books that he normally carries with him to school, varying the weight of the load to almost 22 pounds. That maximum load consisted of his book bag plus a full complement of books. His description was quite informative, and it was clear from his enthusiasm that he truly enjoyed this project.

***Third Place: “Does the Shape of a Rocket’s Nose Cone Affect How High It Goes?”***



The Third Place Award went to Evan Pisani, an 8<sup>th</sup> Grader representing St. Peter’s Interfaith in the Junior Division. Evan considered the effects of different shaped nose cones on the rocket trajectory. Evan provided some creativity to this project in that he himself designed and built two of the three nose cones he evaluated. He made a hammerhead shark shaped nose cone and a rather blunt, slightly rounded, nose cone to evaluate against the standard, fine-pointed nose cone. His launch procedure was to rest the rocket against a pile of snow (yes, this year we did receive our fair share of snow in the DC Area), and to launch it at a 45° angle. Evan’s metric was distance, not height. He noted that the performance of the finely-pointed nose cone was far superior to that of the other two nose cones. He also noticed that the hammer head shark design actually did nothing more than spin out of control for a few feet and, then, drop to the Earth. It was clear, in listening to and discussing his experiment with him, that Evan had a great time with this project, and may someday become a rocketeer. He was already beginning to think of what he could change for next year.



***Honorable Mention: “The Aerodynamics of Cars: Figure Issues”***



Alex Duran, representing WMST Public Charter High School in the Senior Division, received an Honorable Mention. Alex took his passion for cars and design, and expanded the effort he did the year before. This year he focused on designing and building three different auto body shapes: a sleek, sporty one; a rather blunt, SUV-type; and a Minivan-type (which was slightly sleeker than the SUV-type). He built a 45° angled runway on which he slid each car shape, and he included a house fan at the bottom of the runway in order to provide additional air resistance. He timed runs with varied runway starting lengths of two and four feet. Performing multiple runs, he was able to calculate average running times for each and, also, to observe any anomalies. As he postulated, the sleek, sporty design performed the best, but the SUV-type appeared to perform better than the Minivan-type. He postulated that perhaps this result was due to design mass over the wheels, even though each car had the same weight. We look forward someday seeing Alex as a lead car designer for sporty, sleek cars.

**Northern Virginia Regional Science and Engineering Fair**

On Saturday, March 6, Patrick Carrick (Air Force Office of Scientific Research) and James “Mouse” Neumeister (Department of Homeland Security) judged the aerospace projects at the Northern Virginia Regional Science and

Engineering Fair, held at Wakefield High School in Arlington VA.

***First Place: “The Effect of Center of Gravity and Pressure on Rocket Flight”***



First Place went to Henry Tessier, an 8th grader at Swanson Middle School, whose project was entitled “The Effect of Center of Gravity and Pressure on Rocket Flight”. Henry’s project examined the effects of the location of the center of gravity, and center of pressure, on rocket stability and vertical flight. Henry performed 18 trial rocket flights to test his hypothesis.

***Second Place: “The Effect of an Increased International Monthly Sunspot Number on the Number of Coronal Mass Ejections (CMEs) per Month”***



Second Place went to Christopher Gerlach, a 9th grader at T.C. Williams High School Minnie Howard Campus, whose project

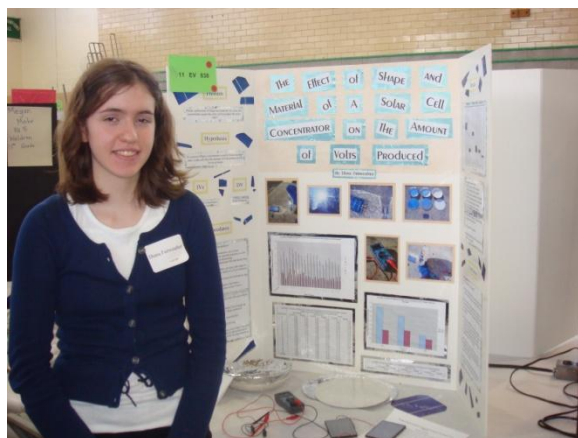
was entitled “The Effect of an Increased International Monthly Sunspot Number on the Number of Coronal Mass Ejections (CMEs) per Month”. Christopher hypothesized that if the number of sunspots increased, then CME activity would increase proportionately. He concluded that his hypothesis was partially accurate in its prediction of a positive trend between the two.

***Third Place: The Effect of the Trajectory Angle of a Rocket on the Distance Traveled***

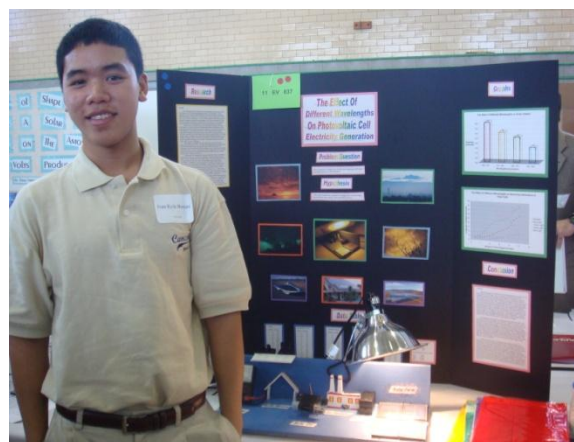


Third Place went to Robert Coleman, an 8th grader at Williamsburg Middle School, whose project was entitled “The Effect of the Trajectory Angle of a Rocket on the Distance Traveled”. The purpose of his experiment was to find the horizontal distance a rocket would travel at different trajectory angles, and to determine which trajectory angle allows the rocket to travel the farthest distance.

***Honorable Mentions***



An Honorable Mention went to Diana Fairweather, an 11th grader at Yorktown High School, for her project entitled “The Effect of Shape and Material of a Solar Cell Concentrator on the Amount of Volts Produced”. She hypothesized that a concave-shaped Mylar concentrator, focusing sunlight onto a solar cell, would produce the greatest voltage of the shapes and material configurations she tested. She found her hypothesis to be correct.



Honorable mention also went to Ivan Kyle Borces, an 11th grader at T.C. Williams High School, for his project entitled “The Effect of the Frequency of Light on Solar Charging”. Ivan hypothesized that if solar cell modules are exposed to red light, they will produce more amperage and, also, provide more battery power than by exposure to yellow, green, or blue light. Ivan found his hypothesis to be true for many different durations of solar cell charging time applied to the battery.



The final Honorable Mention went to Osiel Calzada-Aranda, a 7th grader at Gunston Middle

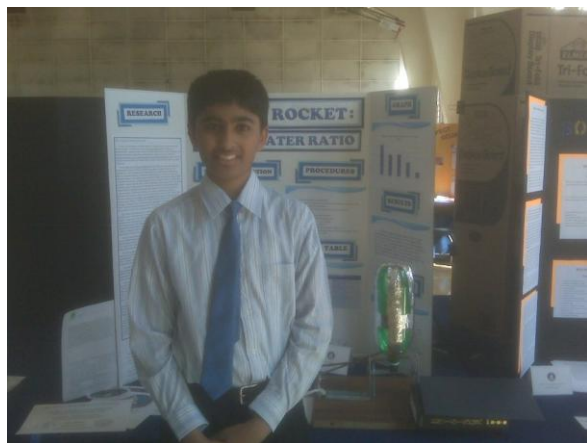


School, for his project entitled “A Comparison of Space Seeds and Earth Seeds”. Osiel received seeds from NASA that had been flown in space, and he compared their growth to control seeds that had not flown in space. He hypothesized that the Earth-seed plants would grow faster and bigger than the space-seed plants.

## ScienceMontgomery

The Montgomery County Science Fair was held on March 20th, 2010, at the Reckord Armory Building of the University of Maryland, College Park, MD. The AIAA judges were Kevin Leath (The Boeing Company), Bob Peters (Satellite Consulting Service), and Joe Chan (Intelsat). Aerospace-related entries were few at this science fair this year, so the judges only awarded First and Second place prizes.

### *First Place: “Bottle Rocket Air 2 Water Ratio”*



First Place went to Umesh Padia. Umesh set out to find the optimal ratio of air-to-water that would result in best rocket performance (in terms of altitude). He inserted different amounts of water into a soda bottle rocket and, then, pressurized the bottle to a predefined value (viz. 35 psi). He then launched the rocket, and by measuring the time from the launch to the time the rocket landed, he was able to determine the height it reached. He showed very careful considerations in both the design of his experiment, and in his understanding of the underlying physics principles.

### *Second Place: “Wind Energy Investigation”*

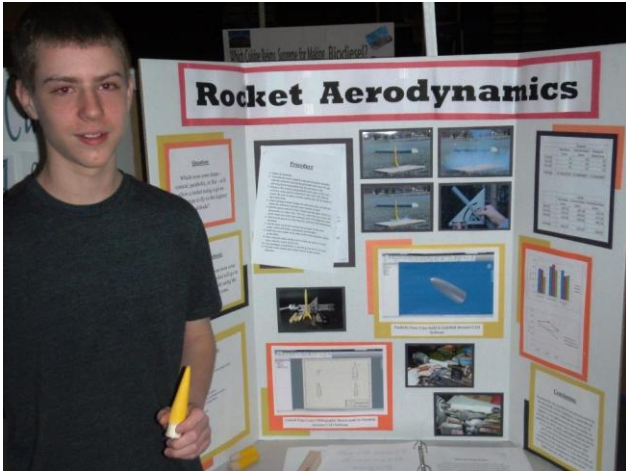


Second Place went to Vinay Sriram. Vinay set out to study different designs for generating optimal power output from an electrical wind turbine. He tested the effect of several variables on turbine performance. These variables included: wind speed, load resistance, driver-to-follower gear ratios, and a variety of blade designs (pitch angles, size, shape, and weight). Vinay worked hard, and was very organized in keeping track of all test combinations and varying parameters. He showed an understanding of the basic principles, and was able to make good engineering conclusions. His continuing goal is to find real-world applications so that his experimental results might lead to engineering standards for electrical wind turbine design.

## Charles County Science Fair

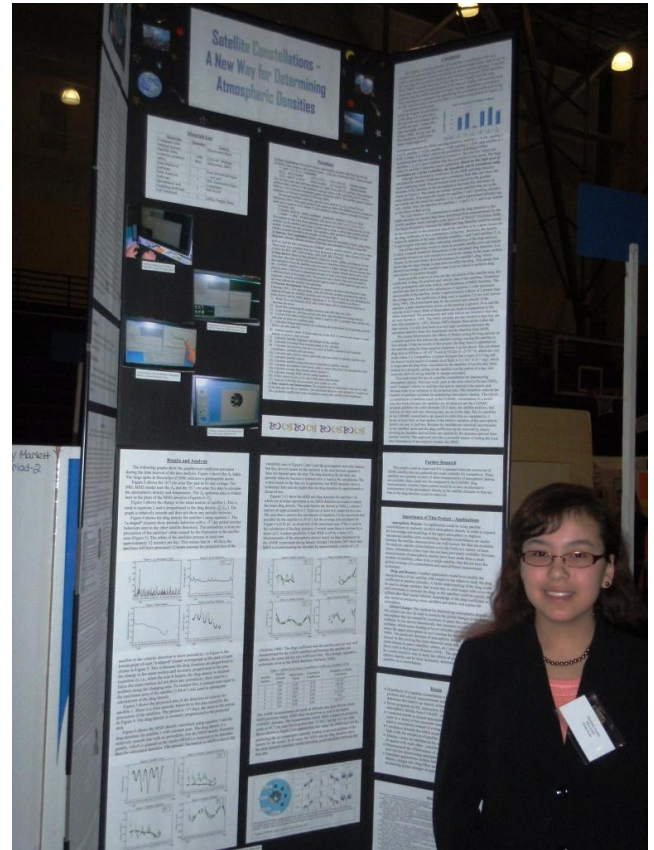
The Charles County Science Fair was held on April 10th, 2010, at North Point High School in Waldorf, MD. The AIAA judges were Michael Poliszuk (Naval Air Systems Command), David Kanter (DCS Corporation), and Ronald Muller (Perot Systems).

### *First Place: "Rocket Aerodynamics"*



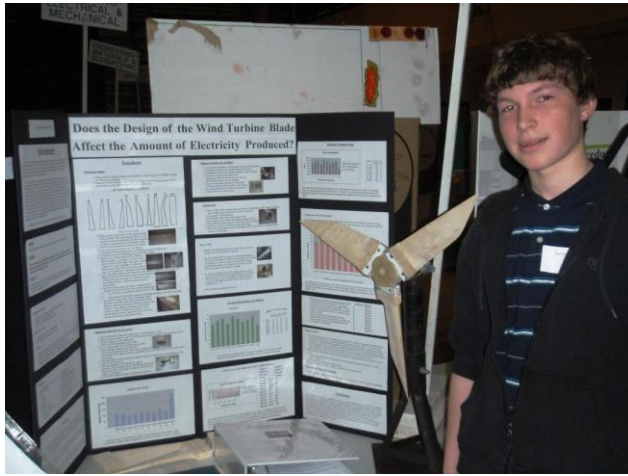
First Place was awarded to Numa Robertson for his studies of the effect of nose cone shape on the maximum height of a rocket's flight. He tested three nose cones: one with a flat front; one with a blunt, rounded nose; and one with a conical nose. He flew each nose cone three times on the same rocket and averaged the data. To ensure that the degradation of his rocket did not affect the data, he flew each cone, in turn, before repeating the experiment.

### *Second Place: "Satellite Constellations - A New Way For Determining Atmospheric Densities"*



Second Place went to Cayley Dymond, of North Point High School, for her project entitled "Satellite Constellations - A New Way For Determining Atmospheric Densities." Cayley developed an innovative computer model to determine atmospheric density by using observed changes in the orbits of several satellites. She included the variable effect of solar array area, as the array maintained orientation to the Sun while the satellite body pointed to the Earth.

***Third Place: “Does the Design of the Wind Turbine Blade Affect the Amount of Electricity Produced?”***



Third Place was awarded to Daniel Diaz delCastillo for his study of the effects of various windmill blade planform shapes on the power and current production of a windmill.

**Prince George's County Science Fair**

The 62<sup>nd</sup> Annual Prince George's Area Science Fair took place March 26-28, 2010 at the Prince George's Community College in Largo, Maryland. The AIAA judges for events on March 27<sup>th</sup> were: Armatha Edwards, George Wilkie (NSWC Dahlgren Division Detachment), and Harriett Hamlin (Francis Scott Key Middle School).

***First Place: “The Effect of Post Burn-In Changes in Voltage and Light Output on Incandescent Lamp Lifetimes”***



First Place was awarded to Benjamin Shaibu, a senior at Eleanor Roosevelt High School (Greenbelt, Maryland). His science project was entitled: “The Effect of Post Burn-In Changes in Voltage, and Light Output on Incandescent Lamp Lifetimes”. The purpose of his experiment was to test how early life factors affect lamp efficiency and lamp lifetime. Incandescent lamps are used on various Earth and space science missions to calibrate infrared instruments. Once installed on satellites, and other spaceborne equipment, the lamps cannot easily be replaced, thus increasing the urgency of identifying lamps that meet mission lifetimes.

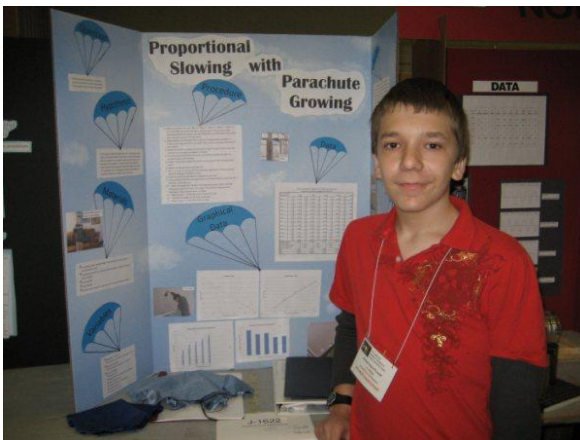


### ***Second Place: “Winded”***



Second Place was awarded to teammates Jasmine Crooks and Nickolas Ewing. Both students are sophomores at Eleanor Roosevelt High School (Greenbelt, Maryland). Their science project was simply entitled “Winded”. The purpose of the project was to experiment with different types of windmill blades in order to determine which blade design produced the most electricity. After adjusting blade angles, and testing many blade configurations, the duo determined that the blade with the most surface area and weight was the most efficient at both capturing wind and producing electricity.

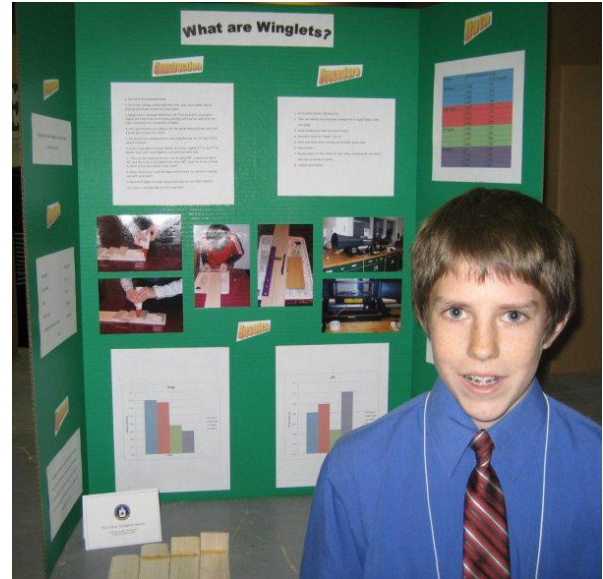
### ***Third Place: “Proportional Slowing with Parachute Growing”***



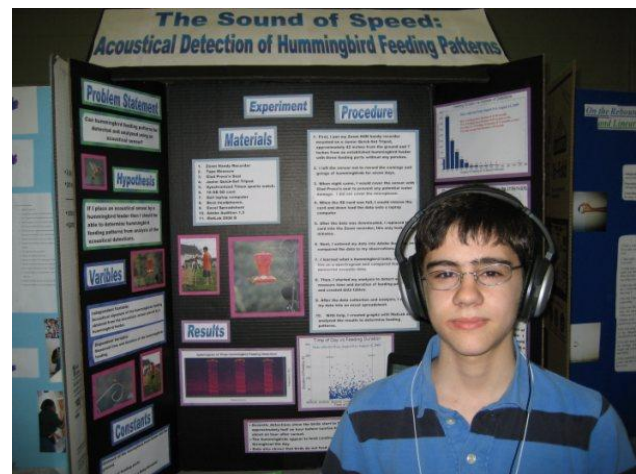
Third Place was awarded to Jonathan Plane, an 8<sup>th</sup> grader at Kenmore Middle School (Landover, Maryland). His science project was creatively entitled “Proportional Slowing with Parachute Growing”. The purpose of his project was to determine if the size of a parachute would be

proportional to its fall time. Jonathan determined that as the size of a parachute is increased, its fall time increased as well.

### ***Honorable Mentions***



The first Honorable Mention Award went to freshman Jeremy Dehn from Great Mills High School (Huntingtown, Maryland). His project was entitled “What Are Winglets”. The purpose of his project was to determine if a plane would have more lift and less drag when a winglet is added to the end of the wing on a plane. He discovered that the winglet design did cause the plane to have less drag more lift.



Also receiving Honorable Mention was 7<sup>th</sup> grader Shamus Gridley from Plum Point Middle School (Huntingtown, Maryland). His project was entitled “Acoustical Detection of Hummingbird Feeding Patterns”. The purpose of his project



was to figure out if hummingbird feeding patterns can be detected and analyzed using an acoustical sensor. After several observations and data analysis, he determined that feeding patterns could be predicted over time.

## **Loudoun County Regional Science and Engineering Fair**

The Loudoun County Science Fair was held on Thursday, March 18th at the Briar Woods High School. The AIAA NCS judges were Mark Pittelkau (Aerospace Control Systems, LLC) and Will Michaux (GeoEye).

### ***First Place: “Star Formation and Luminosity Relation in High-z Galaxies”***

First Place was awarded to Alexandra Wassenberg, a senior at Potomac Falls High School, for her outstanding project titled “Star Formation and Luminosity Relation in High-z Galaxies”. Alexandra investigated the relationship between the period of star formation and luminosity in high red-shift galaxies. She used the ImageJ computer program, with the Polaris plug-in, to analyze images from the NOAA Deep Wide-Field Survey (NDWFS).

### ***Second Place: “The Morphing Wing: A Prototype Wing Utilizing the Shape Memory Properties of Nickel Titanium Alloys to Morph the Control Surfaces, Allowing for More Efficient Flight”***

Second Place went to James Pfohl, a senior at Loudoun Valley High School, for his project “The Morphing Wing: A Prototype Wing Utilizing the Shape Memory Properties of Nickel Titanium Alloys to Morph the Control Surfaces, Allowing for More Efficient Flight”. James used BioMetal, a nickel-titanium artificial muscle fiber, to study how morphing the control surfaces can result in increased aerodynamic efficiency of micro air vehicles. He used a wind tunnel in his investigation.

### ***Third Place: “The Effect of Color of Light on Picture Resolution”***

Third Place went to Anna Frazer, a sophomore at Heritage High School, for her project “The Effect of Color of Light on Picture Resolution”. Anna discovered, through her investigation, that the resolution of hand-held cameras is better for green light than for red or blue light. Further inquiry with manufacturers revealed that this feature is by design.

### ***Honorable Mentions***

Honorable Mention was awarded to John Codde, a sophomore at Loudoun County High School, for his project “The Effects of Camber on Wing Effectiveness”. John made several wings with various camber. He attached them to a wheeled vehicle, with appropriate location of the center of pressure and center of mass, and then evaluated the effectiveness of the wings by observing the distance and stability of the vehicle after exiting a test ramp.

Honorable Mention was also awarded to Heather Quante, a senior at Loudoun Valley High School, for her project “Modeling Populations of Organisms on Titan”. Heather obtained science data on extremophiles, which are organisms that survive in extremely cold conditions on Earth. She obtained environmental data about Titan in order to predict whether such organisms could exist there.

## **Fairfax County Regional Science and Engineering Fair**

The Fairfax County Regional Science and Engineering Fair was held on March 20th at Robinson Secondary School in Fairfax, Virginia. The AIAA judges were Tom Marino (U.S. Navy), David Brandt (Lockheed Martin) and Francis Szalay (Orbital Sciences).

***First Place: "Concept Solution to the Hudson River Plane Crash"***



The NCS judges awarded First Place to Michael R. Collins, a Junior at South County High School, for his project, "Concept Solution to the Hudson River Plane Crash". Michael designed an assortment of scale model protective covers, for a jet engine nacelle, in order to protect against bird strikes. Michael exhibited the thoroughness of a practiced engineer, but he also acknowledged the limitations of his technical designs.

***Second Place: "The Effect of Wing Angle on the Generation of Lift"***



Joshua D. Higbee, a Freshman at McLean High School, showed a very good grasp of the scientific method in his Second Place project, "The Effect of Wing Angle on the Generation of Lift". Josh built a bi-plane test rig and discovered

some operational challenges with this setup, but exhibited perseverance and theoretical understanding.

***Third Place "The Effect of Wing Camber on Lift"***



Dale C. Lescher, a sophomore at West Potomac High School, earned Third Place for her work entitled, "The Effect of Wing Camber on Lift", where she examined the effects of varying wing camber using a homemade test apparatus. Her work exhibited unique workmanship, simplicity and a creative approach.

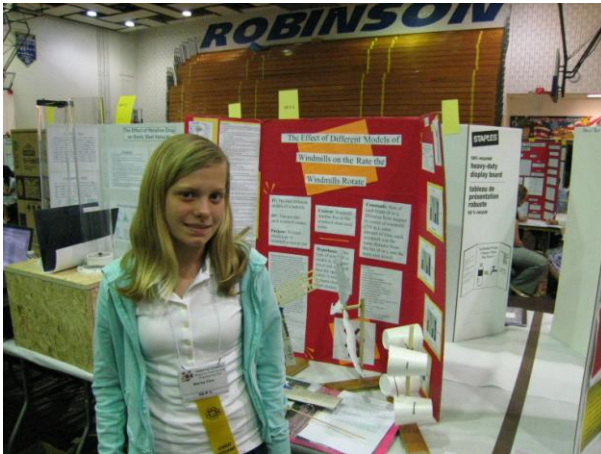
***Honorable Mentions***



The judges awarded two Honorable Mention Awards. The first one went to Alicia Underhill, a sophomore at Langley High School, for her project, "Effect of Pitch of Blades in Windmill



on RPM". Alicia exhibited good scientific reasoning and presented a clear explanation of the purpose for her research.



The second Honorable Mention Award went to Marisa J. Sims, a freshman at Falls Church High School, for her project, "Effect of Windmill Model on Rate of Rotation". Marisa's project exhibited significant workmanship and creative ability, and she looks forward to future iterations of this project.

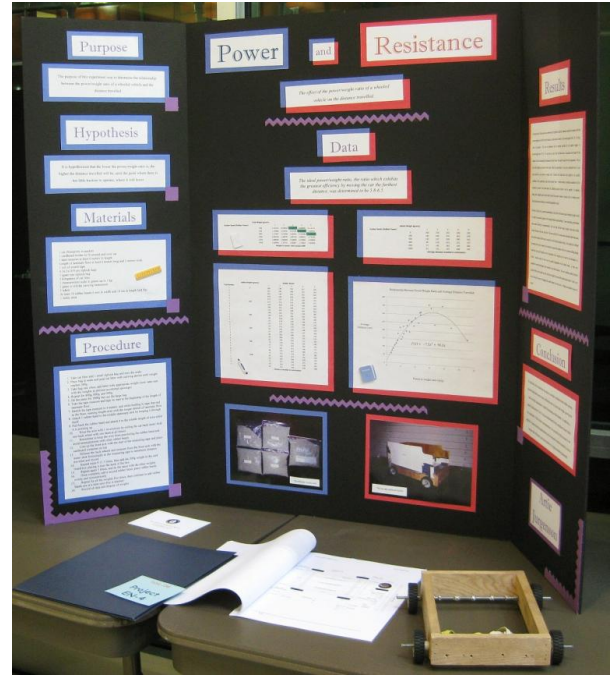
## Prince William - Manassas Regional Science Fair

The Prince William County Science Fair was held on Saturday March 12, 2010 at The Kelly Leadership Center, Manassas, VA.



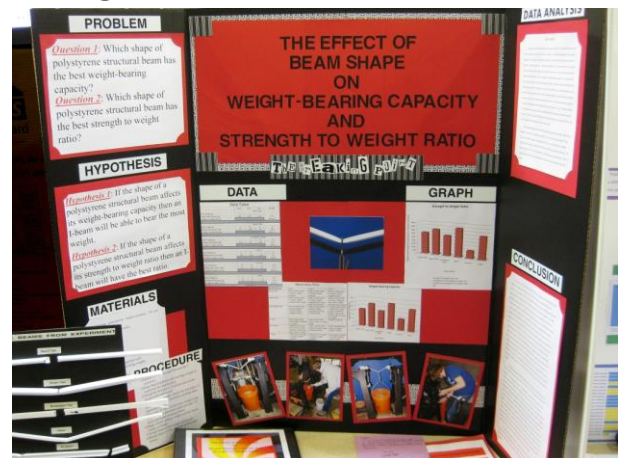
The AIAA NCS judges were Dr. Randall Clendening (The Boeing Company), Joshua Powers (Scitor) and Dr Van B. Le (IEEE).

### *First Place: "Power and Resistance"*



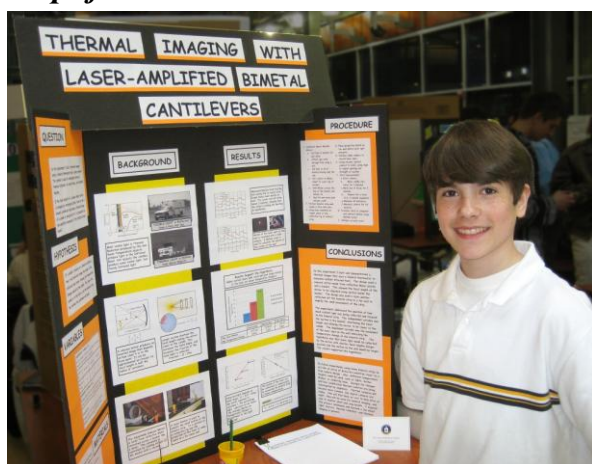
First Place went to Artie Jurgenson, a tenth grader of Battelfield High School, for his project entitled "Power and Resistance". Artie correlated the effect of the power and weight of a wheeled vehicle on the distance traveled. He concluded that the lower the power/weight ratio is, the longer the distance traveled will be, up to the point where traction is insufficient for operation.

### *Second Place: "The Effect of Beam Shape on Weight-Bearing Capacity and Strength to Weight Ratio"*



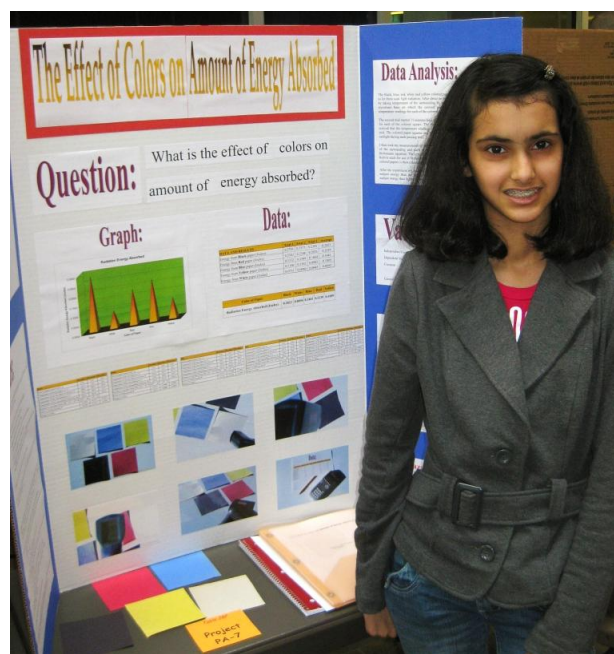
Second Place went to Wyatt Bahm, in seventh grade at Lake Ridge Middle School, for his project: “The Effect of Beam Shape on Weight-Bearing Capacity and Strength to Weight Ratio”. Wyatt postulated that the shape of a polystyrene structural beam affects its weight-bearing capacity as well as its strength-to-weight ratio. Additionally, he postulated that an I-beam would be able to bear the most weight and have the best weight ratio.

***Third Place: "Thermal Imaging with Laser-Amplified Bimetal Cantilevers"***



Aleco Reynolds, a ninth grader at Battelfield High School, won Third Place for his project, "Thermal Imaging with Laser-Amplified Bimetal Cantilevers". Aleco built a concave mirror with a bucket and Mylar, and changed the focal length of that mirror by increasing suction. He then measured the bending of a bimetal cantilever, when the thermal image of a candle was projected upon it, and measured the amplified movement with the use of a reflected laser beam.

***Honorable Mentions***



The first Honorable Mention was awarded to Aishwarya Joshi, in seventh grade at Gainesville Middle School, for “The Effect of Colors on Amount of Energy Absorbed”. Aishwarya measured the energy absorption of patches of different colored construction paper squares. She determined that black construction paper absorbed the most energy, followed by red, blue yellow and white.



The second Honorable Mention was awarded to Mark Lavigne, in tenth grade at Seton School, for “Keeping it Cool: A Comparison of Insulations”. Mark sought the most effective foam insulation for reducing the rate of heat



transfer. He compared cell foam, fiberglass, cellulose and expanded polystyrene.

### **Plans for Next Year**

In 2011, we hope to continue our science fair judging, but we won't be able to do this without continued corporate and volunteer support. If you are interested in getting more involved in National Capital Section educational outreach programs, please contact Michele McMurrer at [aiaancs1@aol.com](mailto:aiaancs1@aol.com).

*Note that even if your favorite student isn't one of our science fair winners, they can still have an out-of-this-world experience at Space Camp or Aviation Challenge. Visit their website at <http://www.spacecamp.com> or call 1-800-63-SPACE (800-637-7223). When registering, please use code "AIAA08". This helps to underwrite the cost of the science fair award scholarships.*

### **Our sincere thanks to:**

#### **Corporate Sponsors:**

- U.S. Space & Rocket Center
- Lockheed Martin
- BAE Systems
- Global Science and Technology

#### **The judging teams:**

- David Brandt, Lockheed Martin
- Thomas Marino, NSWC
- Claudio A. Caprio, BAE Systems
- Patrick G. Carrick, USAF
- Joe Chan, Intelsat
- Harriet Hamlin
- David Kanter, DCS
- Kevin Leath, Boeing
- Will Michaux, GeoEye
- Ronald Muller, Perot Systems
- Michael D. Poliszuk, NAVAIR
- Francis Szalay, Orbital
- Kenneth Fugate, FAA
- Jay Buckley
- James "Mouse" Neumeister, DHS

- Bob Peters, Satellite Consulting Services
- Armatha Edwards
- George Wilkie, NSWC
- Mark Pittelkau, Aerospace Control Systems, LLC
- Randall Clendening, Boeing
- Joshua Powers, Scitor
- Van B. Le, IEEE

#### **And finally the AIAA NCS Science Fair team:**

- Kimberly Harris, Science Fair Team Lead
- Supriya Banerjee, CTS
- Claudio Caprio, BAE Systems
- Mike Hirschberg, CENTRA Technology, Inc.
- Nils Jespersen, The Aerospace Corporation
- Thomas A. Marino, Naval Surface Warfare Center
- Michele McMurrer, AIAA NCS
- Rick Ohlemacher, Northrop Grumman