

# 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, ably lead by AIAA's Science Fair Coordinator Kimberly Harris, 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 – *Lockheed Martin, BAE Systems, and National Space Club* – it was possible for AIAA to cover all of the areas fairs, and also enabled us to award tangible prizes to the first, second and third place winners (\$600 Scholarship to a STEM program, \$100, and \$75, respectively). These top award winners were also invited to attend the AIAA Awards Ceremony in June, 2011. Additionally, Honorable Mention certificates were presented to other fair participants that were worthy of special recognition.

## DC Science and Engineering Fair

The DC Science and Engineering Fair was held at the DC Armory, in Washington, DC, on April 2, 2011.

Michael Caudill (Lockheed Martin), Keith Jankowski (Defense Group, Inc.), and Nils Jespersen (Aerospace Corp) represented the AIAA on the judging team. Student participation was extensive, and the judges enjoyed talking with the students and reviewing their presentations. Evaluating the presentations for best aerospace engineering content was challenging, indeed. Eventually, the following projects were selected for special recognition.

### *First Place: "Are Winglets Winging It?"*



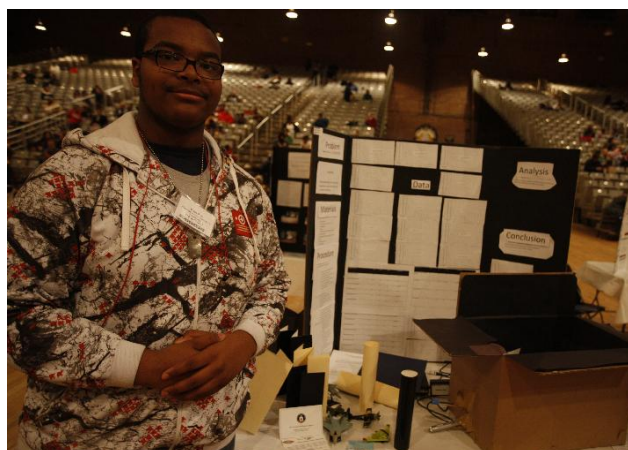
The First Place Award went to an 8<sup>th</sup> Grade aspiring aerospace engineer, Evelyn MacPherson, representing Stuart Hobson Middle School. Evelyn wanted to assess the effects of winglets on aircraft flight efficiency. She started gathering data by way of interviewing personnel who work for the FAA. She then constructed several balsa wood gliders, all with the same wing aspect ratio, one without winglets and three with differing sizes of winglets. Because she had difficulty developing a usable launch mechanism, she opted to hand launch the models. She found that she could repeat the launches fairly consistently, and compensated for the random errors by conducting many trials (40+) and confirming the reasonableness of the statistics. In the end, she concluded that her medium sized winglet produced the best performance. The project was cleanly done and well presented.

### ***Second Place: “Projectiles – The Science of Shooting”***



The Second Place Award went to Alistair Andrulis, a 9<sup>th</sup> grade student at Washington Latin High School. Alistair fashioned three different projectile shapes, from the same diameter of pine dowel material, in order to investigate the impact of the projectile shape on aerodynamics as measured by the speed of the projectile. He used a paintball marker as the launcher, firing the projectile into beam breaking timing apparatus. He took efforts to account for error sources and to explain anomalous results. He would like to continue this research, possibly using a wind tunnel the next time.

### ***Third Place: “Stealth”***



The Third Place Award went to Evan Polk, a 10<sup>th</sup> Grader representing Washington Math & Science High School. Evan considered the effects of different shaped, colored and textured objects on their reflectivity to a light source. He set up a

matte black chamber that was configured with an LED flashlight, as light source, and a light intensity sensor. He then placed the test objects, at controlled distances, in the chamber and measured the amount of light each one reflected. One surprising result was that a sharp, glossy object reflected the least amount of light. He was very enthusiastic about this project and wants to extend the experiment to reflectivity to radio waves next.

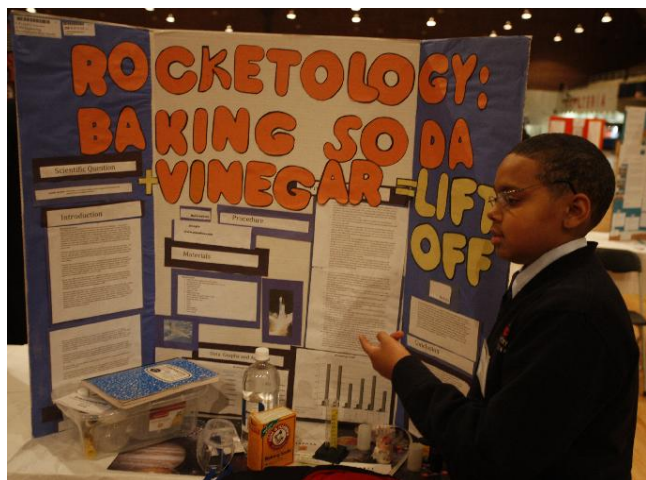
### ***Honorable Mention: “The Fastest Pinwheel in DC”***



Margaret Goletiani, a 3<sup>rd</sup> grade student representing Shepherd Elementary School, received an Honorable Mention for the project she did experimenting with different types of pinwheels. Margaret set up an experiment where she mounted the target pinwheel on a fixture and then directed the air from a hair dryer toward the pinwheel. She then moved the hair dryer farther away from the pinwheel and noted the distance at which it stopped spinning. She was clearly proud of the work she did and wanted to explain the details. She was thrilled to get information on possible careers in aerospace.



### **Honorable Mention: “Rocketology”**

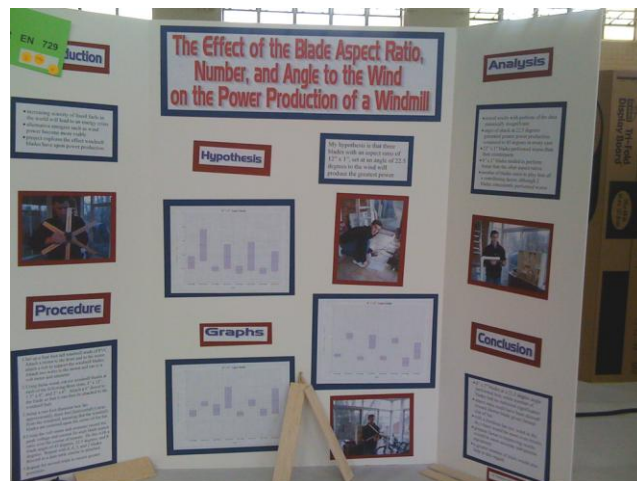


Another Honorable Mention went to Gary McIarty, a 7<sup>th</sup> grade student at the Center City Bright Wood Campus. Gary built several baking soda and vinegar powered rockets from film canisters. He outfitted the canisters with a variety of coverings and leading edge shapes. Using controlled amounts of fuel, he measured the maximum height each rocket attained. It surprised him that smaller amounts of fuel actually resulted in better performance. He realized that more fuel means more mass which, in turn, impacts the maximum height the rocket will fly.

### **Northern Virginia Regional Science and Engineering Fair**

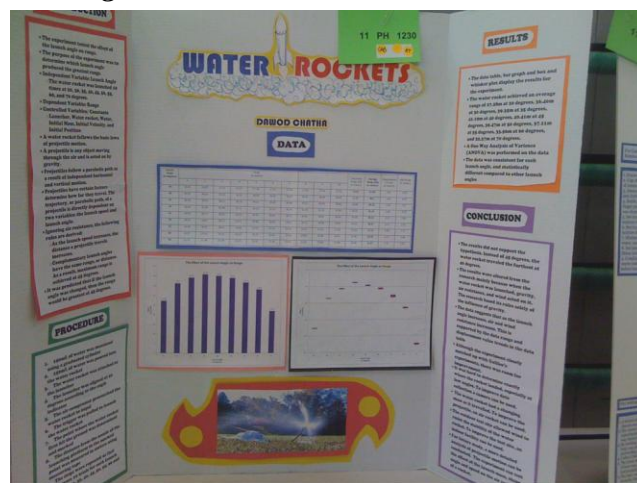
The Northern Virginia Regional Science and Engineering fair was held on March 5, 2011. We saw many excellent projects, and talked to many enthusiastic, motivated, well-spoken students. Michael Poliszuk, Kenneth Fugate and Josh Powers made up the AIAA judging team.

### **First Place: “The Effect of Blade Aspect Ratio, Number, and Angle to the Wind on the Power Production of a Windmill”**



Our First Place went to Matthew Fahrenkrug, a 12<sup>th</sup> grader from Yorktown HS, for his project “The Effect of Blade Aspect Ratio, Number, and Angle to the Wind on the Power Production of a Windmill”. Focusing on power production, not simply voltage produced, Matthew’s experiment demonstrated how the several parameters, when varied, changed the power produced.

### **Second Place: “The Effect of Launch Angle on Range”**



Second Place went to Dawod Chatha, an 11<sup>th</sup> grader from Yorktown HS, for “The Effect of Launch Angle on Range” of a rocket. Dawod launched several trials of a pressurized-water powered rocket at various launch angles up to 90°. His pre-test calculations indicated that a 45° angle would result in the longest flight, but his

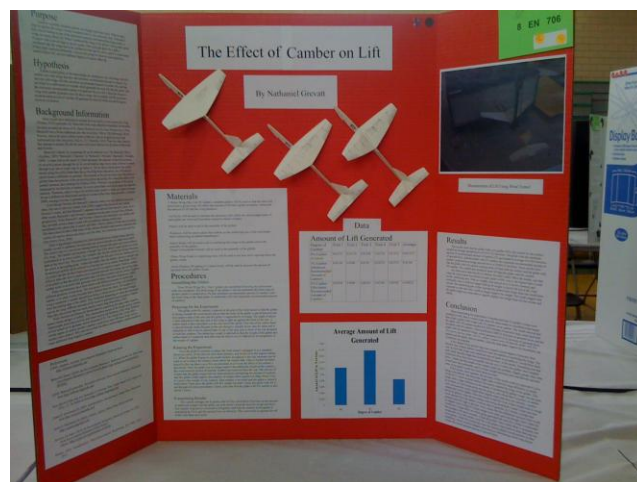
tests showed that 40° was the longest. When asked to explain the difference Dawod speculated that the continued decrease in mass of the rocket as water was expelled, combined with air drag on the lightweight rocket, were factors.

### ***Third Place: “Reducing Peak Acceleration in Helmet Collisions”***



Juliana Bain, a 7<sup>th</sup> grader from Swanson MS, earned Third Place for “*Reducing Peak Acceleration in Helmet Collisions*”. In her project she placed melons inside 2 football helmets, with an accelerometer inside one. She attached that helmet to a rope that allowed it to swing in an arc into the other helmet, which was held stationary. The purpose was to test various thin configurations of shock-absorbing materials installed on the *outside* of the helmets to determine how much the impact forces were attenuated. She found a material that reduced impact acceleration by about half over bare helmets. The shock absorbing configuration has the benefit that it doesn’t change the outside shape of the helmet excessively; Juliana was so pleased with her results that she is applying for a patent for her design.

### ***Honorable Mentions***



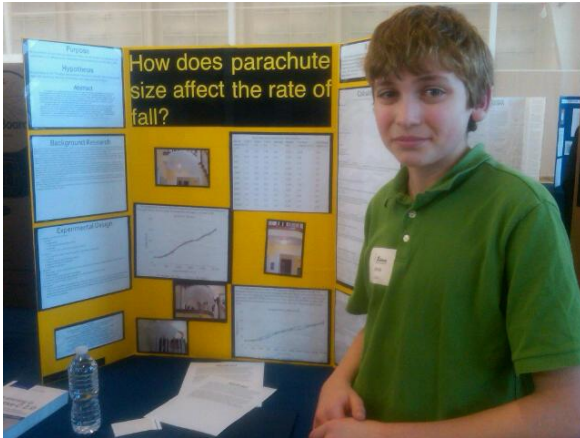
Honorable mentions went to Andrew Schlicht, for his study of the drag of various boat shapes, and Nathaniel Grevatt, for studying the effects of camber on the amount of lift generated by a wing.

### **Science Montgomery**

Science Montgomery took place on March 19, 2011, and the AIAA judges were Bob Peters (Satellite Consulting Service), Joe Chan (Intelsat) and Cynthia Carr.

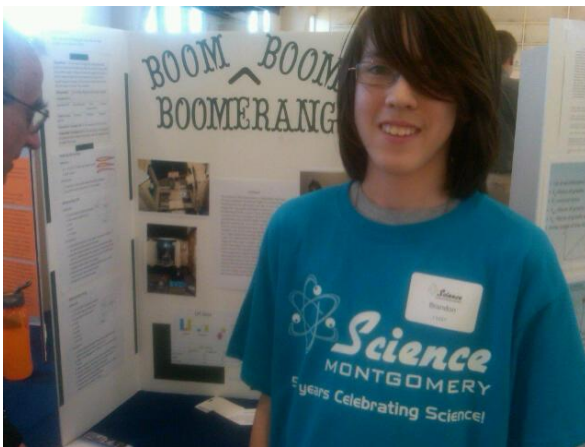


***First Place: “How Does Parachute Size Affect the Rate of Fall?”***



Jacob Glueck is an 8<sup>th</sup> grade student from Charles E. Smith Jewish Day School. He took First Prize with his Junior Fair experiment that attempted to determine the relationship between parachute size and falling time. He designed and conducted his experiment with minimal support. Jacob stated his inspiration for this investigation came from his interest in terminal velocity. When asked about his future aspirations, he simply stated, “That’s a great question, I think I would like to be a physicist.”

***Second Place: “Boom! Boom! Boomerangs!”***



Brandon Grinkemeyer is an 8<sup>th</sup> grade student from Roberto Clemente Middle School. With his teammate, Andrew Lehnus, his experiment tested the shape of a wing and angle of attack to determine lift. Brandon’s father is a computer scientist who helped him build the wind tunnel used to conduct the investigation. While his dad’s aspirations for Brandon involve the

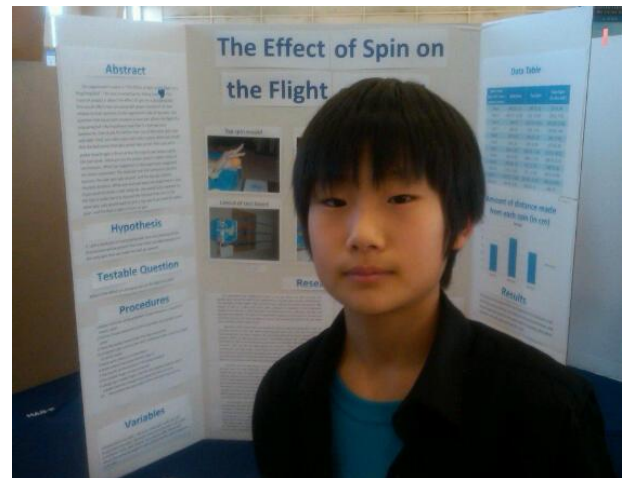
computer sciences, Brandon wants to study physics. He designed and executed the experiment to include incorporating geometric principles learned in a recent math lesson.

***Third Place: “Obstacle Detection Robot”***



Adithya Girish is an impressive 8<sup>th</sup> grader from Roberto Clemente Middle School. His obstacle detection robot took third place for its creative design and real world application. Adithya has quite an extensive knowledge of circuits, he claimed came from his parents who are also Robotic Engineers. He used the scientific method with a number of trials to get the circuit to respond the way he intended. Like his parents, he aspires to be an MIT graduate in Robotic Engineering.

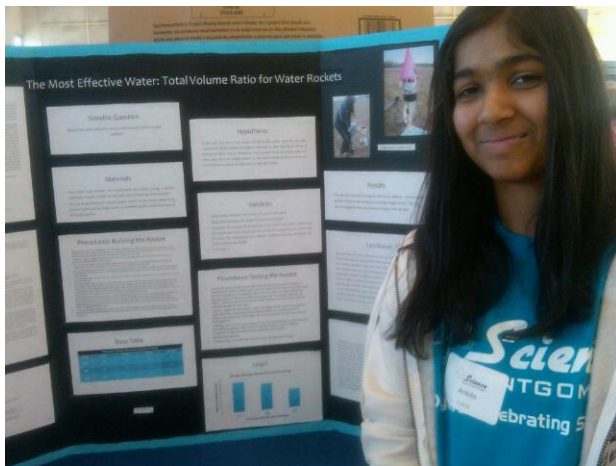
***Honorable Mention: “The Effect of Spin on the Flight of a Ball”***



Seong Joon Yoo from Roberto Clemente Middle School received Honorable Mention for his

interesting experiment using a ping pong ball and creative experiential design. When asked about the theory behind his unique investigation, Seong Joon explained clearly about the changing air pressure around the ball in the instance of each of the three types of spin. Seong Joon was able to answer coherently and completely with a diagram when the judges prodded for a more in-depth explanation.

***Honorable Mention: “The Most Effective Water: Total Volume Ratio for Water Rockets”***

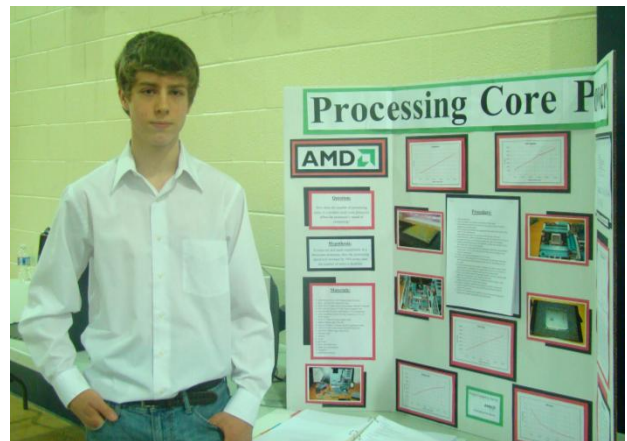


Roberto Clemente Middle School students made quite a showing at the Montgomery County Science Fair this year, and Ankita Sharma is no exception. As one of our most soft-spoken young budding scientists, she spoke eloquently on the topic of her physics investigation. Ankita submitted an interesting take on the old Bottle Rocket experiment where she tried to determine the most ideal water:air ratio for bottle rocket propulsion. It was clear to the science fair judges that she had done her research!

**Charles County Science Fair**

The Charles County Science Fair was held on March 5, 2011, at North Point High School in Waldorf, MD. The AIAA judges were David Kanter (DCS Corporation), and Ronald Muller (Perot Systems).

***First Place: “Processing Core Power”***



First place went to Numa Robertson of McDonough High School. Numa’s project investigated the impact of adding processors to a motherboard’s resident processor. His research yielded a (near?) linear relationship between the number of processors and the resulting processing speed. This contradicted what he had been told, which was that processing speed increases with the number of processors, but only in a limited manner. Numa had to build his own computer in order to perform this experiment.

***Second Place: “Drag Racing”***

Second place went to Anthony Teleky of North Point HS. Anthony built two wind tunnels for this project; the second one was more appropriate, as it was driven by a leaf blower. He measured drag on various shapes; his target effort was automotive aerodynamics. Anthony’s measuring instrument was a Newton scale, which he also built. The interesting result he found was that dimpled shapes yielded considerably lower drag than smooth shapes.

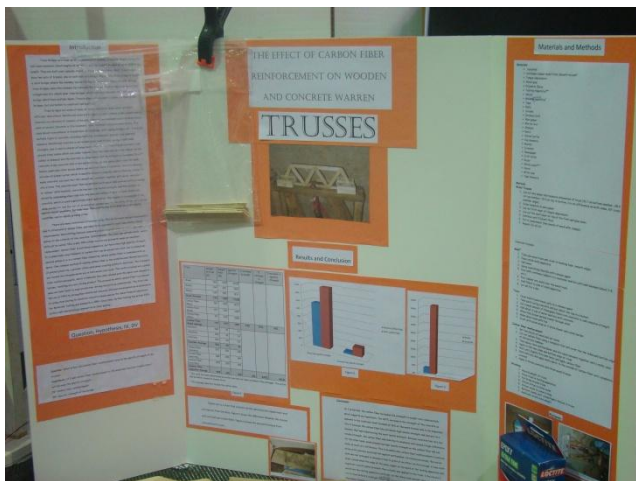


***Third Place: “Mysteries of Wind Turbine Blade Design: Effect of Blade, Pitch and Twist on the Electricity Produced”***



Daniel Diazdelcastillo, of North Point HS, won third place. Daniel performed a similar project in 2010, but this year's project was much better defined. He worked with people who were able to provide speed vs. pitch code for helicopters. His results correlated wind speed to best turbine blade pitch and best blade twist for given scenarios.

***Honorable Mention: “The Effect of Carbon Fiber Reinforcement on the Strength of Trusses”***



The judges awarded an Honorable Mention Nathanael Crispell of LaPlata HS. Once Nathanael saw the problem of low tensile strength of concrete, he reinforced it with homemade rebar for baseline truss strength measurements. He then added carbon fiber for strength improvement and obtained excellent results.

***Honorable Mention: “It Might Get LOUD”***



A second Honorable Mention went to Aaron LeBeau of Henry E Lackey HS. Aaron's project was to determine how guitar pickups were affected by the number of turns on the pickup coil. His greatest number of turns (48AWG wire) was 5,000. He learned that more turns yields more signal output. He also learned that there exists a maximum preferred number of usable turns, due to back-EMF limitations.

**Prince George's County Science Fair**

More than 350 science projects were exhibited by students from Calvert, Prince George's, and St. Mary's counties during the 2011 Prince George's Area Science Fair, which was held at the Prince George's Community College over the weekend of March 25-27, 2011. The student exhibitors were winners in various science, technology, engineering and mathematics categories from many science fairs hosted by public, private, and parochial middle schools and high schools.

The AIAA team, for the 2011 Prince George's Area Science Fair, included judging of the student projects by Ms. Veronica Leonard of

Lockheed Martin and Dr. John Day of NASA Goddard Space Flight Center.

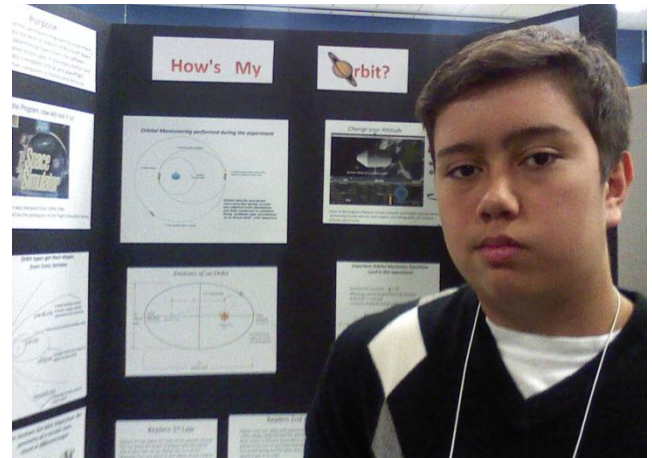
Approximately 15 exhibits were identified as aerospace science projects and were evaluated by the AIAA NCS judges during the science fair. The top projects were presented with the AIAA award certificate at the ceremony for the 2011 Prince George's Area Science Fair winners on March 27, 2011. The 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> Place AIAA Awardees were also invited to an additional award ceremony, where they will be presented a monetary award by the AIAA NCS.

***First Place: “Determining Lift and Drag Coefficients of Small-Scale Airfoil Configurations”***



“Determining Lift and Drag Coefficients of Small-Scale Airfoil Configurations” by 11<sup>TH</sup> grader Joseph Vandegrift was selected for the 1<sup>st</sup> Place AIAA Aerospace Award. Using a homemade wind tunnel and plane model, Joseph measured wind speed, lift, and deflection for various configurations to determine both lift and drag coefficients.

***Second Place: “How’s My Orbit”***



“How’s My Orbit” by 8<sup>th</sup> grader Robert Vandegrift was selected for the 2<sup>nd</sup> Place AIAA Aerospace Award. Robert used Microsoft Space Simulator to calculate the orbital parameters of Earth and other planets; and compared the results to the actual parameters from orbital mechanics equations.

***Third Place: “Aircraft Survivability and Biofuels”***



“Aircraft Survivability and Biofuels” by 12<sup>th</sup> grader Jennifer Lyons was selected for the 3<sup>rd</sup> Place AIAA Aerospace Award. Jennifer subjected aircraft fuel liner material to samples of different aircraft fuel types to determine the ability to self seal a damaged fuel tank.



## ***Honorable Mentions***



“Safety of Parachutes”, by 10<sup>th</sup> graders Anne Doyle and Clayton Roush, and “The Soaring Airplanes”, by 6<sup>th</sup> grader Shawn Samuels, Jr. were selected for AIAA Honorable Mention. Clayton and Anne evaluated the fall speed and impact damage for various parachute configurations; and Shawn measured the flight length for different glider plane configurations.

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

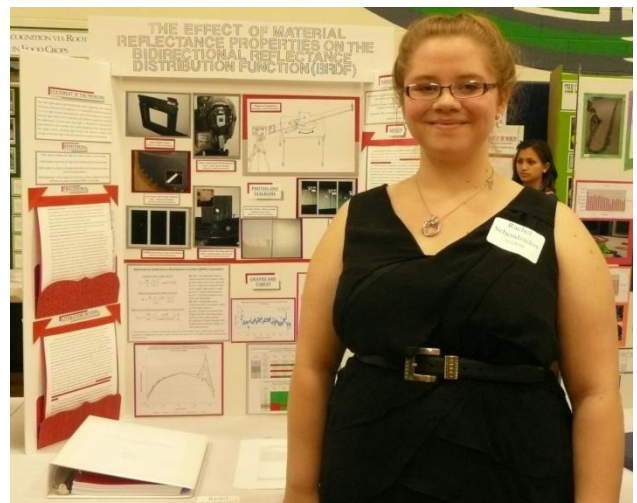
The Loudoun County Regional Science and Engineering Fair was held on Thursday, March 17, 2011, at Woodgrove High School in Purcellville, Virginia. The AIAA NCS judges were Mark Fraser from EADS North America, Mike McFarland from Orbital Sciences Corporation and Mark Pittelkau, consultant and owner of Aerospace Control Systems, LLC.

## ***First Place: “The Effects of Dimples on a Fuselage”***



First Place was awarded to Ryan Tatman, a senior at Potomac Falls High School, for his project entitled "The Effects of Dimples on a Fuselage." Ryan built a wind tunnel using wood, clear plastic, aviation honeycomb material, and a leaf blower. He used ball bearings, string, a weight and a scale to construct a simple, single-axis force balance. Ryan cast fuselage shapes from plaster, and drilled dimples like those of a golf ball into the fuselage surfaces. Based on his wind tunnel measurements, Ryan concluded that adding dimples doubled the fuselage drag. This effect may be attributable to an increase in skin friction associated with the dimples.

## ***Second Place: “The Effect of Material Reflectance Properties on the Bidirectional Reflectance Distribution Function (BRDF)”***



Second Place went to Rachel Schendzielos, a freshman at Freedom High School, for her project on "The Effect of Material Reflectance Properties on the Bidirectional Reflectance Distribution Function (BRDF)." Rachel used a 1064 nm laser to measure the BRDF of various materials, similar to the way in which spacecraft payloads measure the properties of terrestrial vegetation. Rachel's material samples were ceramic tiles, each with different surface roughness, mounted on a turntable of her own design. Rachel's data showed that high-gloss tile produced Lambertian reflections while matte tile produced specular reflections.

***Third Place: "The Analysis of the Effect of Nano Particles on Solar Panels"***



Adithya Saikumar, a sophomore at Briar Woods High School, won third place for his project titled "The Analysis of the Effect of Nano Particles on Solar Panels." Adithya applied silver nano-particles, sandwiched between two layers of thin film laminate, onto a photovoltaic solar cell. Comparing cells with and without the silver nano-particles showed that the particles produced a 26% increase in cell current production.

***Honorable Mention: "Ballista Angle Shoot-Off"***



An Honorable Mention was awarded to Zachery Thomas of Loudoun Valley High School for "Ballista Angle Shoot-Off," in which he built a working scale model of a medieval crossbow and measured the sensitivity of projectile range to launcher elevation angle.

***Honorable Mention: "The Effect of Magnet Spacing on Launch Velocity"***



Another Honorable Mention was awarded to Nicholas Blackley of Heritage High School for "The Effect of Magnet Spacing on Launch Velocity," in which a metal projectile was propelled by a series of permanent magnets and the measured range was used to determine the sensitivity of projectile velocity to magnet spacing.



## Fairfax County Regional Science and Engineering Fair

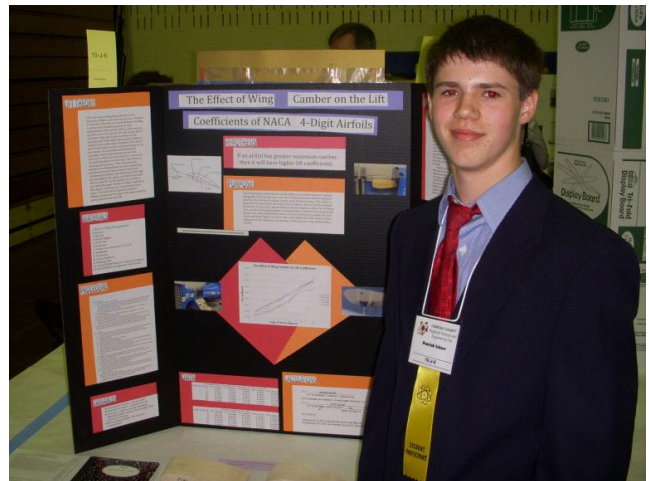
The Fairfax County Regional Science and Engineering Fair was held on March 19, 2011 at Robinson Secondary School in Fairfax, VA. The AIAA NCS judges were Francis Szalay (Orbital Sciences), Patrick Carrick (AFOSR) and Thomas Marino (NSWCCD).

### *First Place: “The Effect of Wing Shape on Lift”*



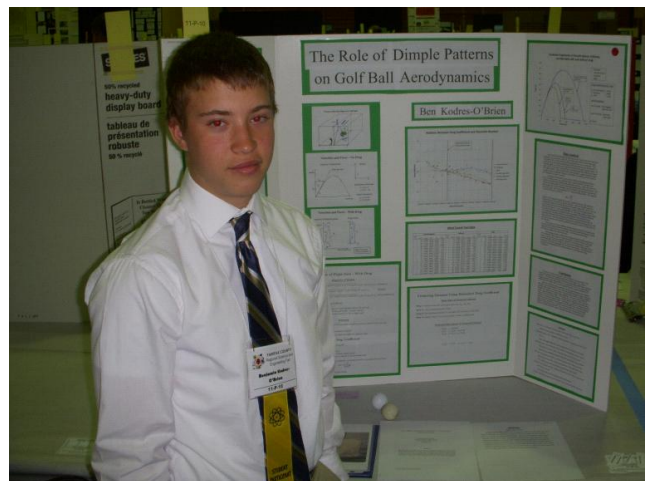
First Place went to Patrick Silsby, a freshman from Chantilly High School, for his project “The Effect of Wing Shape on Lift.” Patrick displayed a solid understanding of the basic underlying principles behind his experiment, and the judges were impressed by both his homemade testing apparatus and his excellent use of statistics and control groups in his project.

### *Second Place: “Effect of Wing Camber on Lift”*



Second Place went to sophomore Patrick Schurr from West Potomac High School for his project, “Effect of Wing Camber on Lift.” Patrick used a NACA airfoil generator and created a series of airfoils which he then tested in a wind tunnel. Patrick exhibited an impressive knowledge of airfoil design theory and history, which he had acquired while working on his project.

### *Third Place: “Aerodynamics of a Golf Ball”*



Third Place went to Benjamin Kodres-O'Brien, a junior from Madison High School. Benjamin's project, “Aerodynamics of a Golf Ball” investigated the effect of dimples of varying shapes on the flight of golf balls. Benjamin showcased a comprehensive understanding of aerodynamics as well as advanced mathematics, and tested his hypothesis in an impressive, homemade wind tunnel.

### ***Honorable Mentions***

Honorable mentions were also presented to Christopher Keihl of Robinson Secondary School and Dale Lescher of West Potomac High School. Christopher's project was "Maximizing Distance of Water Bottle Rockets", and he impressed the judges with his uncertainty analysis. Dale's project, "The Effect of Wing Design on Wing Vortices," was a continuation of her project from last year's fair. The judges felt her CAD modeling work and understanding of aerodynamics deserved a special mention.

### **Prince William - Manassas Regional Science Fair**

On Saturday March 19, 2011, Saul Volansky (Retired) and Minh Truong (USPTO) judged the 2011 Prince William-Manassas Regional Science Fair held at the Kelly Leadership Center. The awards were presented to students in both the Middle (grades 7-8) and Senior (grades 9-12) Division.

### ***First Place: "Electromagnetic Pulse Accelerator"***



The First Place was awarded to Manuel Barbara (Senior Division) for his project: "Electromagnetic Pulse Accelerator." Manuel experimented with electricity and coil lengths to eject objects from a tube. He proposed that his experiment could be used help project a spacecraft into outer space.

### ***Second Place: "Plant Life on Mars"***



The Second Place went to Natalie Holmes (Senior Division) for her project "Plant Life on Mars." Natalie experimented with Mars-like soil to test the germination of several vegetable plants. She stressed the importance of being able to grow plants on Mars for future human space exploration.

### ***Third Place: "The Effect of Extreme Temperature on Battery Life"***



Third Place was awarded to Elizabeth Mau Finnan (Middle Division) for her project "The Effect of Extreme Temperature on Battery Life." Elizabeth experimented with a variety of temperatures ( $-70^{\circ}\text{C}$ ,  $0^{\circ}\text{C}$ ,  $21^{\circ}\text{C}$ , and  $57^{\circ}\text{C}$ ) to test how these conditions affect the duration of a battery's output.

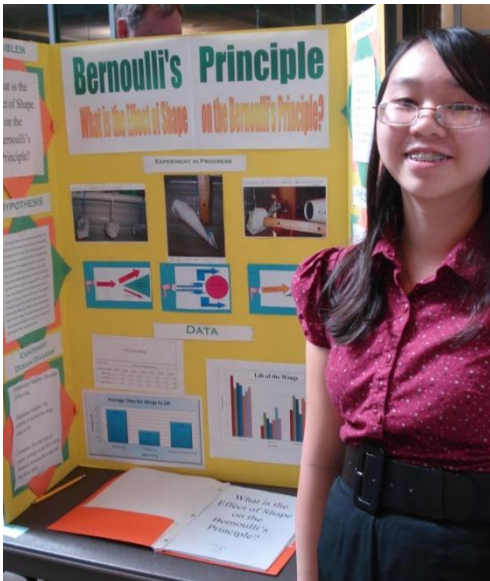


***Honorable Mention: “Measuring the Earth’s Magnetic Field”***



An Honorable Mention Award was given to Noshin Tabassum (Middle Division) for her project “Measuring the Earth’s Magnetic Field.” Noshin used a magnetometer, a laser, and computer software in her experiment to measure the Earth’s magnetic field at various orientations.

***Honorable Mention: “Bernoulli’s Principle”***



An Honorable Mention Award was given to Nancy Trang (Middle Division) for her project “Bernoulli’s Principle.” Nancy used three

different airfoils to determine which shape would create the best lifts.

**Plans for Next Year**

In 2012, 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).

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- Patrick G. Carrick, USAF
- Joe Chan, Intelsat
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- Veronica Leonard, Lockheed Martin
- John Day, NASA Goddard SFC
- Saul Volansky
- Minh Truong, USPTO
- Mark Fraser, EADS North America
- Mike McFarland, Orbital Sciences

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

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