

AIAA NCS Selects Area's Top Aerospace Science Fair Projects

Edited by Nils Jespersen, The Aerospace Corporation

This past March, members of the AIAA National Capital Section (NCS) continued their annual tradition of selecting the best aerospace-related projects in the region's various science fairs. Volunteer judges covered eight fairs that were held in Maryland, Virginia and Washington, DC.

Thanks to the generous support from our Corporate sponsors – *U.S. Space & Rocket Center, Booz Allen Hamilton, Honeywell, Lockheed Martin, Ball Aerospace & Technologies and GenCorp Foundation*, 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 14 March 2009. AIAA was represented by Claudio Caprio, Keith Jankowski and Nils Jespersen. Many projects represented technologies with Aerospace applications, and the judges had a difficult time deciding the top candidates. In the end, the judges selected the following projects for special recognition.

First Place



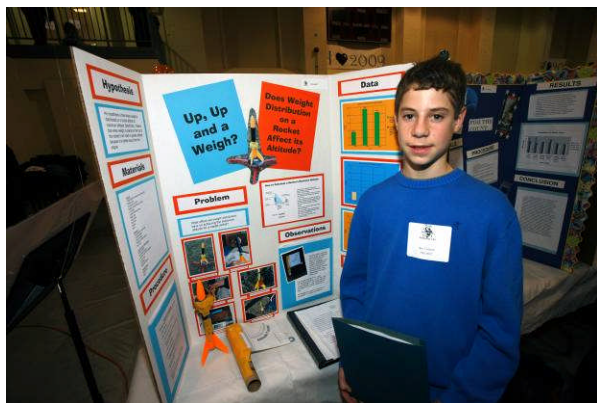
First place went to Max Cooper, 8th grade, of Oyster-Adams Middle School, with his project (ENG-0035) entitled: "It's a bird . . . It's a plane. . . It's a hovercraft". What impressed the judges most was Max's persistence. The judges remembered him from last year. He had a very difficult time with this project (essentially, the design of a hovercraft that was capable of carrying his weight) last year and was unsuccessful in his goal. This year, he spent a lot of time analyzing what went wrong, and systematically addressed each weak point in the design. He isolated each variable (e.g. required energy input, skirt size) and eventually arrived at a workable design. His thought process was clear and methodical, and exhibited the best characteristics of aerospace engineering.

Second Place



Second Place went to Alex Duran, 11th grade, of Washington Math Science Tech Public Charter High School, with his project (PH-0057) entitled “The Aerodynamics of Cars: Shape Problems”. Alex became absorbed with his project such that it no longer became something he was just doing “for a grade”, but it became a quest for him to find an optimum design solution for minimum drag on his subject vehicle (a car). He built a ramp and used a high speed fan to generate controlled wind speed against his trial car body shape designs (constructed from modeling clay). He optimized his experimental setup after making several trial runs. He considered and analyzed the error sources he identified, realizing that weight distribution had a significant influence on his results, beyond drag induced from the shape under consideration. Significantly, Alex, used the results of his measurements to postulate what an optimally shaped car would look like when the objective is to minimize aerodynamic drag, and illustrated his idea with a concept sketch.

Third Place



Third Place went to Ben Carleton, 8th grade, of Stuart Hobson Middle School, with his project (ENG-0027) entitled “Up, Up and a Weigh! Does Weight Distribution on a Rocket Affect its Altitude?”. Ben wanted to find out if a specific quantity of mass made a difference on the attained altitude of a model rocket as a function of axial placement along the length of the vehicle. He constructed a rudimentary, yet very effective, sighting instrument for making the altitude measurement, and made several experimental runs for the configurations he settled upon. Although he encountered some experimental difficulties (e.g. a motor exploded during one of his trials, and severely damaged his test rocket), he collected and analyzed his data very effectively.

Honorable Mentions

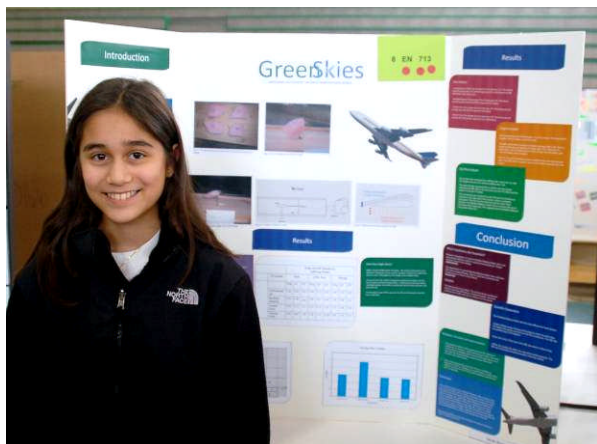
The judges awarded two Honorable Mentions, one of which went to Kierra Green, a 6th grader from HU MS – Math & Science, for her project entitled “The Art of Cryonics”. Although her focus was on freezing effects on biological materials, she understood the broader context of applying cryonics concepts to other materials. Her thought process rivaled that of much older students that participated in this science fair.

The second Honorable Mention went to Sasha Pfeiffer, 8th grade, of Alice Deal Middle School, for her project entitled “The Solar Effects on Earth’s Magnetic Field”. Sasha conducted a significant amount of research and took measurements, with a simple magnetometer, an average of three times a day over the course of several months. The results from the data she took correlated well with solar storm activity that has occurred in recent history.

Northern Virginia Regional Science and Engineering Fair

The Northern Virginia Regional Science & Engineering Fair was held on Saturday March 7, 2009 at Wakefield High School, Arlington, VA. The AIAA NCS judges were Katherine Timpano (Orbital Sciences), Patrick Carrick (Air Force), and Allan Osborn (The Aerospace Corporation).

First Place



First Place was awarded to eighth grader Sarah Khatri of Swanson Middle School for her project entitled "Green Wings: Improving the Efficiency of Flight Through Wing Design." She used a novel arrangement to measure the lift and drag on 4 different wing shapes. She determined that the modified elliptical wing was the most efficient design.

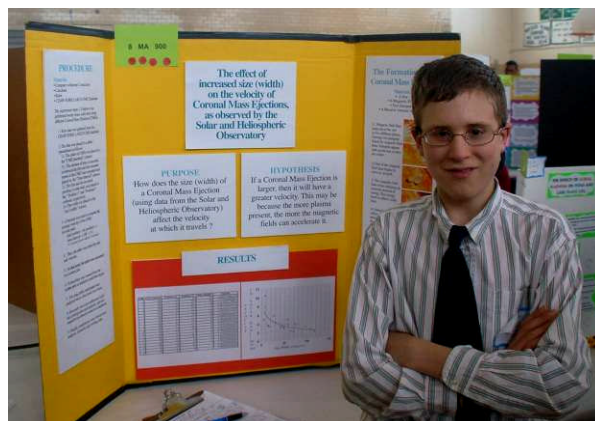
Second Place



Second Place went to Samuel Passaglia of Washington-Lee High School for his project, "Can Any Household Materials Offer Radiation Shielding Against Low Level Gamma Radiation Exposure?" Samuel developed an innovative test procedure placing 7 various household materials in a case and measuring the gamma radiation passing through the materials. He acquired the gamma source from his high school. Samuel determined that most household materials are a

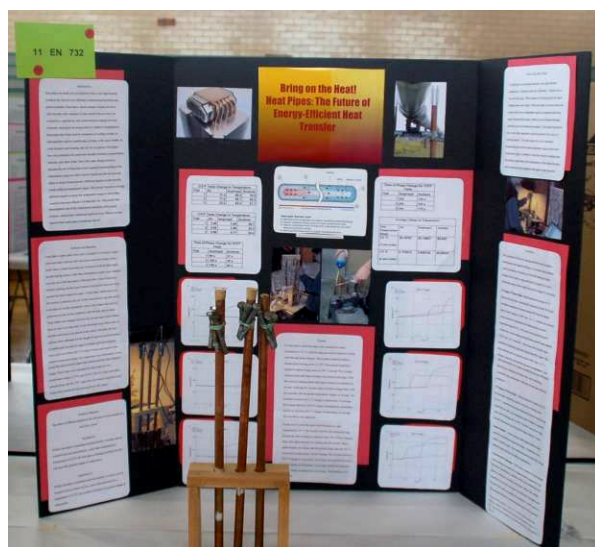
poor source of protection against gamma radiation.

Third Place



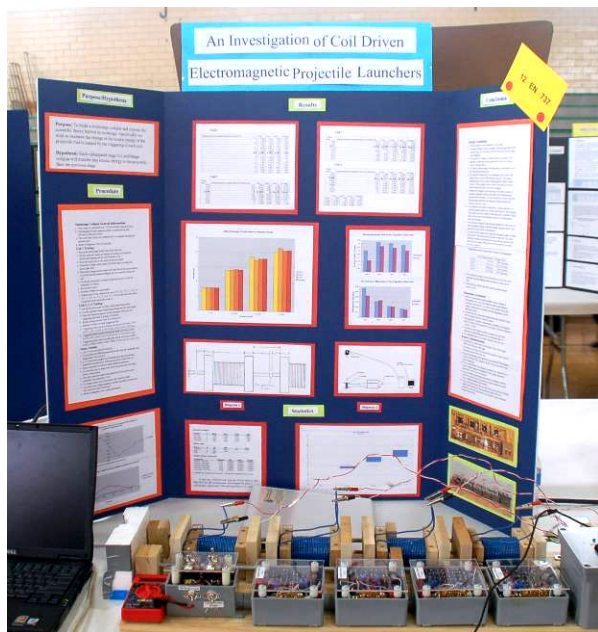
Christopher Gerlach won Third Place for his project, "The Effect of Increased Size (Width) on the Velocity of Coronal Mass Ejections (CMEs) as Observed by the Solar and Heliospheric Observatory (SOHO)." Christopher hypothesized that if the coronal mass ejection is larger then it will travel at a greater velocity. By analyzing NASA data from the SOHO satellite Christopher was not able to support his hypothesis.

Honorable Mentions



The first Honorable Mention was awarded to Matt Newman for "Bring on the Heat, Heat Pipes: The Future of Energy-Efficient Heat Transfer" in which he studied the relationship

between the efficiency of the transfer liquid in the heat pipes and the surrounding environment.



The team of Chris Edwards and Alexander Matta won the second Honorable Mention for "An Investigation of MultiStage Coil Driven Electromagnetic Projectile Launchers."

ScienceMontgomery

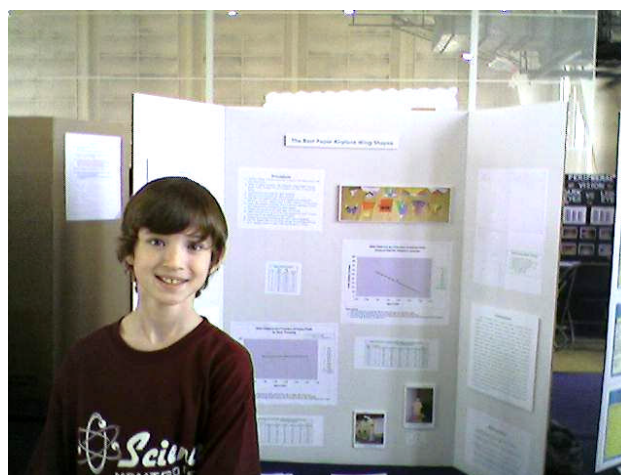
The Montgomery County Science Fair was held on Saturday March 21st on the grounds of the University of Maryland, College Park. The judges were Kevin Leath (The Boeing Company), Jos Galvis (Constellation Power Generation), and Joe Chan (Intelsat).

First Place



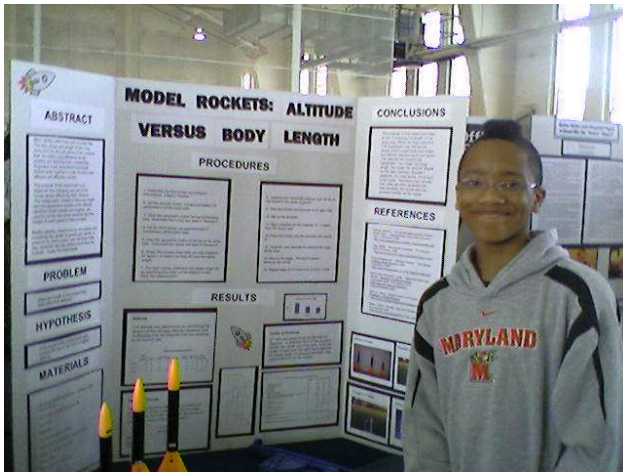
First Place went to Ally Flechsig and Camaryn Kerns, Junior division students from St. Andrew Apostle School. Their project, entitled "A Study of Drag Coefficients and Aerodynamic Car Body Designs," was a well designed investigation into car body designs. Ally and Camaryn displayed clear understanding of both the underlying aerospace equations and the test methods they used in the project. Their discussion of the work was well presented, and they responded thoughtfully when questioned by the judges.

Second Place



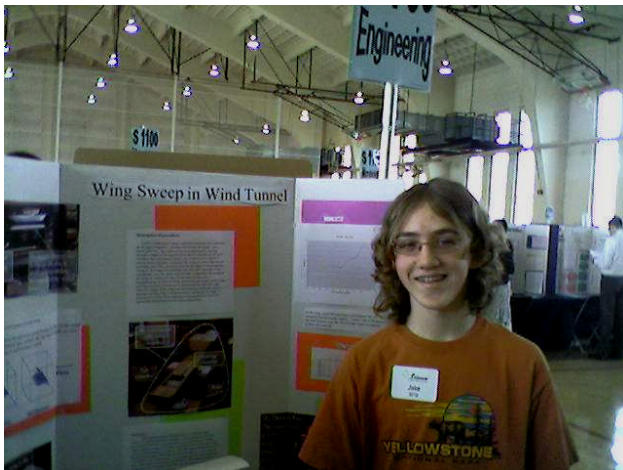
Second Place went to Brandon Sheridan, a Junior division student from Cabin John Middle School. Brandon's project, entitled "The Best Paper Airplane Wing Shapes," compared wing aspect ratios of multiple airplane models to distance travelled in order to find a correlation between wing design and performance. Brandon modified the models to achieve the aspect ratio variations, and used a good technical approach to reduce the effects of unwanted variables such as launch force and weight variation between models.

Third Place



Third Place went to Ollen Douglass, a Junior division student from Cabin John Middle School. His project, entitled "Model Rockets: Altitude vs. Body Length," investigated the effect of rocket body length on flight performance. Ollen demonstrated understanding of the test results and was able to postulate potential explanations for unexpected results.

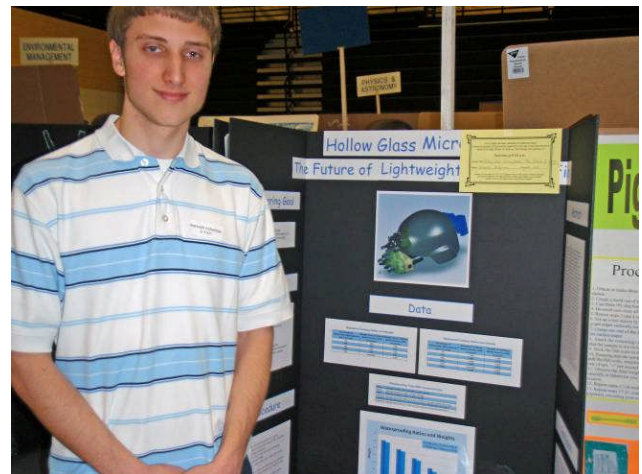
Honorable Mentions



Honorable Mention went to Jake Ullman, a Senior division student from Bethesda-Chevy Chase High School. His project, entitled "Wing Sweep in Wind Tunnel," investigated the relationship between chord length and wing performance.

Charles County Science Fair

First Place



First Place was awarded to Kenneth Aukerman for the project "Hollow Glass Microspheres: the Future of Lightweight Waterproofing". In this project, Kenneth tested the ability of 3M hollow glass microspheres to reduce the density of urethane plastic, while preserving the urethane's waterproofing ability. Urethane plastic is typically sprayed onto electronic circuit boards to waterproof them against environmental moisture, but for some uses (such as night vision goggles) the extra weight is excessive. By testing various concentrations of microspheres, Kenneth determined that a 50% ratio of microspheres was optimum for insulation characteristics.

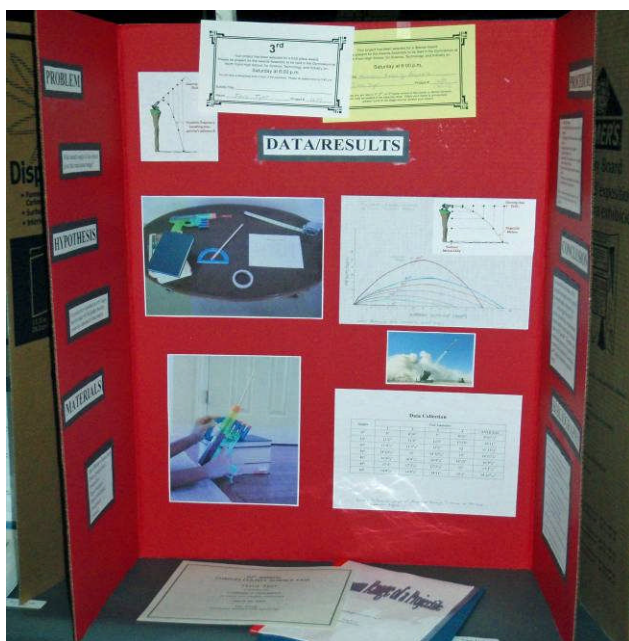
Second Place



Second Place was awarded to Kathleen Clark for the project "Welcome Back to Windmill Town!" Kathleen built a windmill rotor to which a DC

motor was attached, which provided a means to measure the relative efficiencies of various rotor blade shapes. She tested 5 different blade planforms in sets of 2 and 3, and two different angles of attack. A leaf blower provided a constant wind source for all tests. Kathleen found that a 25° angle of attack produced the higher voltage on average for all test sections. Of all configurations, a test setup of 2 blades with a linear planform taper at 25° AOA produced the highest voltage.

Third Place



Third Place was awarded to Tiara Tyer of the Junior Division for her project “Maximum Range of a Projectile.” Tiara used a toy dart launcher to launch darts at various angles to determine the launch angle that provided the greatest range. She hypothesized that a launch at 45 degrees would provide the greatest range, which her data showed to be correct. In addition, her data also showed that darts launched at complementary angles achieved the same range, even though their heights were different.

PRINCE GEORGE’S COUNTY SCIENCE FAIR

On Saturday, March 28, Anand Vyas (self), Mark Shindelman (Missile Defense National Team), and Harriett Hamlin (Francis Scott Key

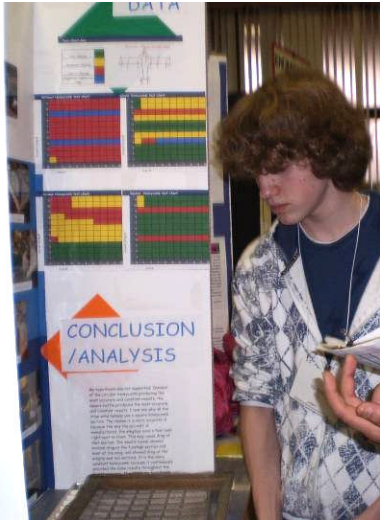
Middle School) judged the Prince George’s County Regional Science and Engineering Fair held at Prince George’s Community College in Largo, Maryland. The Science and Engineering Fair covered the Prince George’s County, the St. Mary’s County and the Calvert County.

First Place



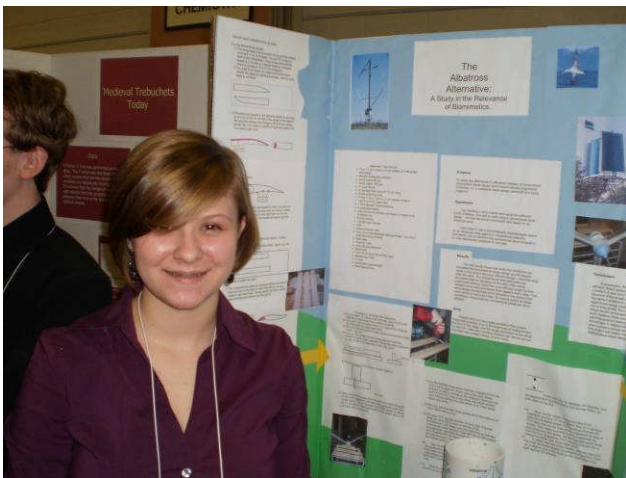
First Place winner was Julie Walker from Leonardtown High School (Leonardtown) for her project, “Look at this Martian Environmental Simulator”. Her project was a continuation of her work initiated in 2007. Using a systems engineering approach, she identified the requirement, design and implementation processes. She then fabricated the various components of the Martian Environmental Simulator. The vacuum chamber, wind subsystem enclosure, power enclosure and transportable enclosure were then integrated per her integration plans. The integration failures were observed and a few feasible solutions were proposed to overcome the failures.

Second Place



Second Place was awarded to Nicholas Ey of Martin Luther King Middle School (Beltsville) for his project, "Honeycomb is Not Just for Bees". The objective of the project was to determine the best grid element geometry for use in the home-built wind tunnel. He built framed grids with three different grid elements for testing. He also designed and built the wind tunnel as part of the project. He measured quality of flow straightening by the deflection of thin paper strips that were attached to the wings of a model airplane and appropriately placed in the wind tunnel.

Third Place



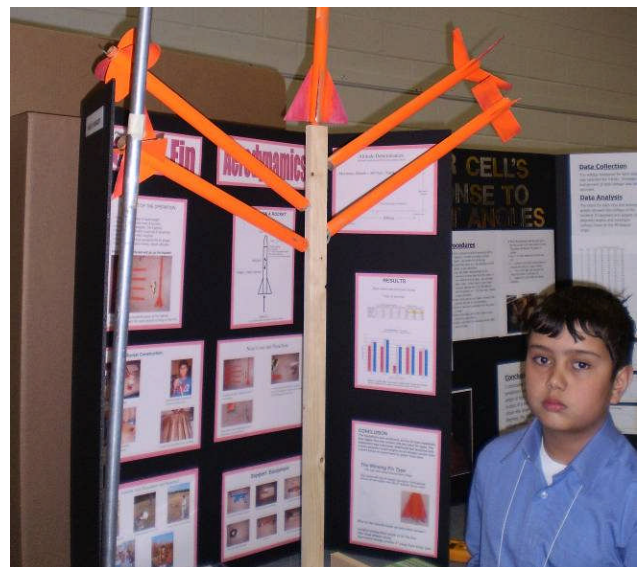
Third Place was awarded to Emma Frank of Great Mills High School STEM Academy (Great Mills) for her project, "The Albatross Alternative". The purpose of the project was to study differences in efficiency of conventional

wind turbine blade design and an alternative blade design based on a wing of the bird (Albatross). The presentation demonstrated remarkable ingenuity in using readily available materials to build the blades, rotor hub and the shaft.

Honorable Mentions



The first Honorable Mention Award was given to Emily Romani of Eleanor Roosevelt High School (Greenbelt) for her project titled, "Alternative Vacuum Sealing Techniques". As part of a NASA internship, she explored alternative methods for providing an effective seal for vacuum pressures of a few micro-torrs magnitude.



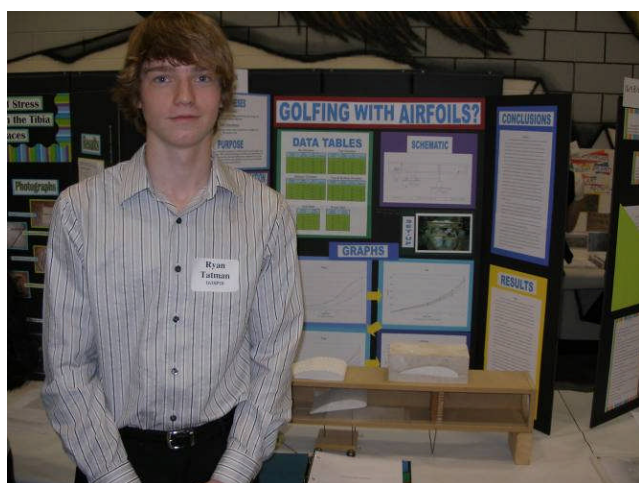
The second Honorable Mention Award was given to Robert Vandegrift, of Spring Ridge Middle School (Lexington Park), for his project

entitled, "Rocket Fin Aerodynamics". The purpose of the project was to determine the best fin shape of a model rocket for achieving highest altitude. As part of the project, he also built a home-made altitude measurement device that uses a simple trigonometric calculation to measure the altitude.

LOUDOUN COUNTY REGIONAL SCIENCE AND ENGINEERING FAIR

The Loudoun County Regional Science and Engineering Fair was held on Thursday, March 19, at Briar Woods School in Ashburn, Virginia. The AIAA NCS judges were Mike McFarland and Tom Lewis, both with Orbital Sciences Corporation.

First Place



First Place was awarded to Ryan Tatman, a sophomore at Potomac Falls High School, for his project entitled "Golfing With Airfoils?" Ryan constructed a wind tunnel using wood, Plexiglas, aviation honeycomb material, a scale, and a leaf blower. He cast several airfoil shapes from plaster, and then drilled dimples like those of a golf ball into the airfoil surfaces. Based on his wind tunnel measurements, Ryan concluded that while dimpling the ventral surface of an airfoil can improve Lift/Drag ratio at very low speeds, the airfoil with no dimples had the best L/D at speeds above 75 kph.

Second Place



Second Place went to William Huffman, a junior at Academy of Science, for his project on "Modeling the Orbits of Dark Matter Particles to Determine the Frequency and Energy of Collisions." William created a dynamic simulation of multiple Earth-orbiting bodies, and computed the relative positions and velocities among the different bodies to observe how the frequency of collisions increases as the number of orbiting bodies is increased. William plans to extend his simulation to model the motion of dark matter particles orbiting a super-massive black hole at relativistic speeds to look for a possible correlation between gamma radiation levels and dark matter particle collisions.

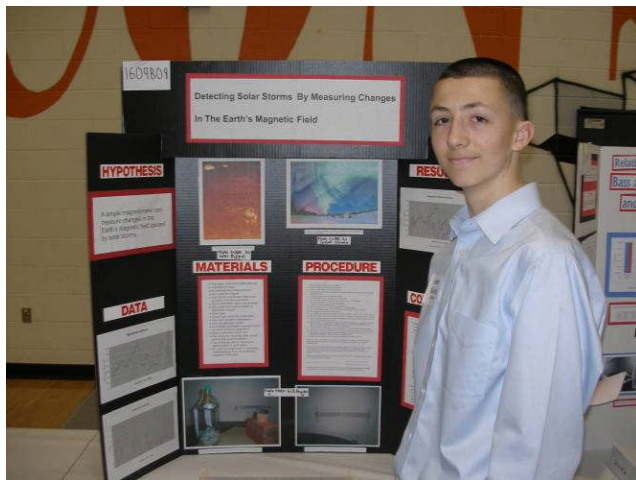
Third Place



Tyler Faley, a sophomore at Heritage High School, won third place for his project titled "The Effect of Notching Windmill Blades Like a

Humpback Whale on the Amount of Voltage Produced." Tyler's project assessed the effectiveness of applying biomimetics to windmill blade design by comparing conventional blades against a unique design with notched trailing edges intended to mimic the features of a whale flipper. By measuring voltage output at varying distances from a wind source, he concluded that the notched blades yielded higher efficiency.

Honorable Mentions



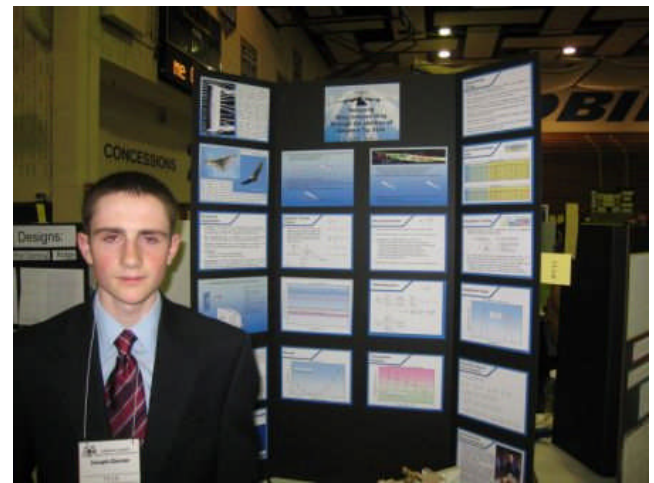
Honorable mentions were awarded to Andrew Hayden of Broad Run High School for "Detecting Solar Storms by Measuring Changes in the Earth's Magnetic Field," in which he built a simple magnetometer and correlated his measurements with K-index data obtained from the National Geological Survey in Fredericksburg, and Benjamin Tutko of Stone Bridge High School for "The Comparison

Between Spinning Aerodynamic and Ballistic Flight."

FAIRFAX COUNTY REGIONAL SCIENCE AND ENGINEERING FAIR

The Fairfax County Regional Science and Engineering Fair was held Saturday, March 28th at Robinson Secondary School in Fairfax, Virginia. The AIAA judges were Tom Marino (US Navy), David Brandt (Lockheed Martin) and Kevin Bollino (US Air Force).

First Place



The AIAA NCS judges awarded First Place to Joe Gerner, a junior at Marshall High School for his project, "Adaptive Tip Sails for Wind Induced Drag Reduction". He borrowed ideas from birds' natural ability to adapt their feathers to wind conditions and, then experimentally measured drag performance on wing-tip designs. Combining his strong physics knowledge with extensive literature research, Joe performed a thorough mathematical analysis of the tests to present comprehensive results.

Second Place



Sara Link, a sophomore at West Potomac High School, earned Second Place for her work entitled, "Effect of Different Wing Camber on Lift Capability", where she examined the effects of camber using a novel homemade test apparatus. Her work showed originality, a theoretical understanding of both the subject and her experimental project.

Third Place



Abby Clarke, a freshman at Woodson High School, conducted a study of lunar albedo and earned Third Place for her work entitled, "Moon Brightness and Surface Area Observed".

Honorable Mentions

The judges awarded two Honorable Mention Awards. The first one went to Mark Schierling, a

sophomore at Paul VI High School, for his "Effect of Diameter on Rocket Altitude" project, in which he measured the effects of diameter on rocket altitude for various model rocket body styles, including an analysis of drag effects using his homemade vertical wind tunnel. The second Honorable Mention went to Jonathan Springfield, a freshman at South Lakes High School, for his project called "Effect of Different Airplane Wing Design on Lift".

Plans for Next Year

In 2010, 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 Marcie Jones at AIAANATLCAPSEC@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.

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Friends of AIAA

- Michael Calabrese
- Brian Dutoi
- Ronald Kolbe
- Joseph Marshall
- Mark Maurice
- Michael Zedd

The judging teams:

- David Brandt, Lockheed Martin
- Kevin Bollino, USAF
- Thomas Marino, Naval Surface Warfare Center
- Claudio A Caprio, BAE Systems
- Patrick G. Carrick, USAF
- Joe Chan, Intelsat.com
- Harriet Hamlin
- James L. Heiertz, Boeing
- Keith Jankowski, Defense Group, Inc.
- Nils V Jespersen, The Aerospace Corporation
- David Kanter, DCS
- Kevin Leath, Boeing
- Thomas Lewis, Orbital
- Jos Luis
- Joe Marshall, BAE Systems
- Mike McFarland, Orbital
- Will Michaux
- Ronald Muller, Perot Systems
- Allan R Osborn, The Aerospace Corporation
- Michael D. Poliszuk, NAVAIR
- Mark Shindelman, GD
- Francis Szalay, Orbital
- Katherine Timpano, Orbital
- Anand B. Vyas

And finally the AIAA NCS Science Fair team:

- Supriya Banerjee, Science Fair Team Lead, CTS
- David Brandt, Lockheed Martin
- Michael Conners, BAH
- Kimberly A. Harris, Lockheed Martin
- Mike Hirschberg, Pre-College Chair, CENTRA Technology, Inc.
- Nils Jespersen, The Aerospace Corporation
- Marcie Jones, AIAA NCS
- Thomas A. Marino, Naval Surface Warfare Center
- Ed Yarbrough, Honeywell