AIAA Volunteers Select Area's Top Aerospace Science Fair Projects

Edited by Nils Jespersen, The Aerospace Corporation

In March and April, 2013, members of the AIAA National Capital Section (NCS) applied their expertise in selecting the best aerospace-related projects in the region's various science fairs. Natalia Sizov and Kate Becker coordinated the volunteer judging teams, with Michele McMurrer (NCS Administrator) providing liaison with AIAA management and coordinating logistics for the Awards Banquet. The volunteer judges 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 and Honeywell*** – it was possible for AIAA to provide coverage to all of the areas fairs, and it also enabled us to award tangible prizes to the first, second and third place winners (One week scholarship to Space Camp, $100, and $75, respectively). These top award winners were also invited to attend the AIAA Awards Ceremony in June, 2013. Additionally, Honorable Mention certificates were presented to other fair participants who presented projects that were worthy of special recognition.

DC STEM Fair

Students Discuss Their Projects at the DC STEM Fair

The DC Science, Technology, Engineering, and Mathematics (STEM) Fair was held at the Wilson High School, in Washington, DC, on 23 March 2013.

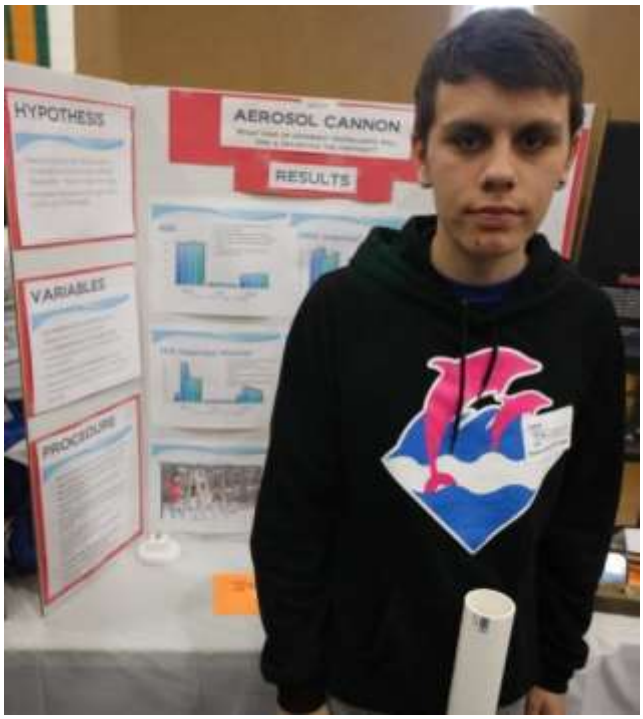
Capt. John Roh (USAF), Joseph Gruber (Wyle), and Nils Jespersen (Aerospace Corp.) represented the AIAA NCS on the judging team. The DC STEM Fair, this year, was surprisingly lacking in projects that were aerospace related and that were available for review. Of the 272 projects scheduled for display, thirteen were selected as having aerospace related content (based on their listed titles) but, of those, only eight were actually exhibited at the fair. As a result, the judges took a fairly broad view of what they included as having aerospace related content. Projects that investigated principles that undergird aerospace engineering were, therefore, included in this evaluation. The judges selected the following projects for special recognition.

First Place: "Creating, Storing, and Measuring Static Electricity"

The First Place Award went to Megan Simeone, a student at Washington Latin Public Charter School (PCS). Megan entered her project: "Creating, Storing, and Measuring Static Electricity", in the Junior Division. As static electricity is a well-known concern to spacecraft and aircraft designers

alike, the judges took an interest in the experiment that Megan conducted. She sought to measure the voltage developed as a function of static charge quantity. Megan had a sheet of Plexiglas© that she charged by rubbing for a fixed amount of time. She then transferred a quantity of charge onto an electrophorus (simply and cleverly constructed from an aluminum pie plate taped to a Styrofoam© cup). Subsequently, she transferred the charge to a Leyden jar that she had constructed from a small film canister (containing a salt water electrolyte) and covered with aluminum foil. She referred to one such transfer of charge as "one charge", and she was able to transfer several quantities of charge into the Leyden jar by repeating the process. Megan then measured the voltage on the Leyden jar by discharging it onto a metal plate and measuring the gap that the resulting spark spanned. She ran several trials and plotted results of voltage versus number of "charges". The judges were impressed by Megan's understanding of the charge principles, the pains she took to be accurate and consistent in her measurements, and the creativity with which she constructed her test setup. Additionally, she had the entire setup on display and demonstrated the actual steps she took to acquire a data point. Megan's display was clearly laid out and she exhibited good understanding of how to quantitatively describe the principles involved.

Second Place: "Aerosol Cannon"



The Second Place Award went to Daniel McDonough, in the Senior Division. Daniel is a 9th grade student at Washington Latin PCS. With his project: "Aerosol Cannon", Daniel wanted to determine the distance that a projectile could be launched as a function of the type of fuel used as a propellant. The launcher was made from PVC© piping, and included a combustion chamber where the propellant was introduced and ignited with a spark generator. The spark generator was typical of those used for lighting barbecue grills. While he wanted to use a potato as a projectile, he realized that the potato might not provide enough consistency from trial to trial, so he opted to use a Nerf© type foam football instead. He mounted the launcher at a fixed angle and quantified the distance traveled by measuring the time of flight. Daniel used an aerosol deodorant (AXE©) and two different concentrations of isopropyl alcohol as his propellant types. In order to control the quantity of propellant, he used an aerosol sprayer and metered the propellant by the number of plunger depressions. By this method, Daniel was able to attain good consistency from trial to trial, and he presented this data in a clear and concise manner. In the end, he determined that the deodorant was the best propellant, and that the finer atomization of that material was likely a contributing factor to his results.

Third Place: "Life Saver"

The Third Place Award went to Anthony Green, in the Senior Division. Anthony is a 12th grade student representing Friendship Collegiate Academy PCS. Anthony did a robotics project that he called: "Life Saver". His project was based on the LEGO Mindstorms NXT© product. Anthony wanted to investigate the effectiveness of different types of sensors (ultrasonic, infrared, and visible light) in recognizing and interacting with two different colored targets (black and white cans) and, then, autonomously grasping and retrieving these targets. He defined "success" as when the robot would locate and retrieve the target a minimum of 9 out of 10 tries. His first attempt did not work at all, and he had to make multiple modifications to his program. In the end, Anthony found that the ultrasonic sensor was the most effective at accomplishing the task. Anthony wants to study electrical engineering and has been granted a full scholarship to the University of Wisconsin.

Honorable Mention: "Watch Out! There Will Be Fireworks"

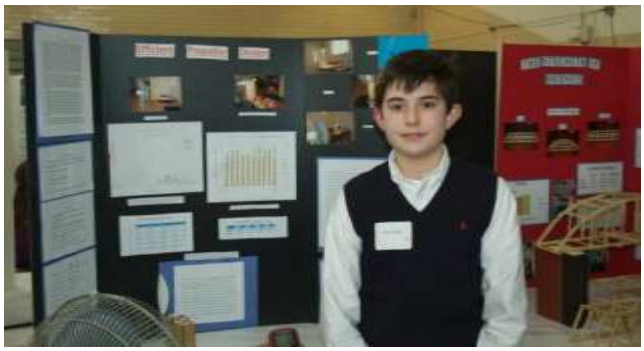
Alassanne Traore, Mychal Sheow, and Stacy Powell, 12th grade students representing Friendship Collegiate Academy PCS in the Senior Division, received an Honorable Mention for the project they did (called: "Watch Out! There Will Be Fireworks") in evaluating the expected trajectory of model rocket payloads. Their objective was to use the physics principles of parabolic flight to determine where the remnants of a presumed fireworks display might land and, by extension, where a safe viewing area might be located. Since they were unable to use actual fireworks, they used two model rockets, with the same motor type (but different masses and lengths) to gather empirical data. Logistically, they were only able to launch each rocket once (constraints at Goddard Space Flight Center, where they were given permission to launch), so the sample size was small. To compensate, they ran several trials with a small catapult in order to validate the equations.

Honorable Mention: "The Power of Force"

Honorable Mention was also awarded to Malik Robertson, Zaki Harris, and Ahmad Fielder, 12th grade students in the Senior Division. These students, with their project called: "The Power of Force", did a qualitative investigation into the effectiveness of a static magnetic field in suspending a variety of objects (differing in shape, size, and mass). They also looked at the effect of introducing various materials between the source magnet and target material. They used paper, wood, glass, and copper, as intervening materials, to compare differences in holding force to the target objects.

Northern Virginia Regional Science and Engineering Fair

First Place: "Efficient Propeller Design"



First place went to Adam Wilkie, an 8th grader from Swanson Middle School, for his project "Efficient Propeller Design". Adam built a propeller test setup attached to a small generator. The goal of the project was to determine the blade angle of incidence that would produce the highest voltage. Adam tested the voltage with blade incidence angles of 10°, 20°, 30°, and 40°, and determined that an angle of 30° was the optimum, based on the voltage produced.

Second Place: "A More Perfect Parachute"

Second place went to Joseph Berger IV, an 8th grader from Kenmore Middle School, for his project "A More Perfect Parachute". Joseph built several recovery sheets to determine what type would perform best by providing the longest elapsed flying time. He demonstrated that the parasheet with a flat surface had the longest recovery time. On the other hand, Joseph found that even though the flat parasheet performed better it, was not a very stable platform and did not make for a good load bearing recovery system.

Third Place: "The Effect of Specialized Adhesives: Fact or Fiction"

The judges awarded Third Place to Matt Hall and Sean Keeley, both 7th graders from Williamsburg Middle School, for their project "The Effect of Specialized Adhesives: Fact or Fiction". Matt and Sean investigated the performance capabilities of

adhesives when applied to surfaces other than those for which they were specifically designed. Their results showed that specialized adhesives might not always create the best adhesive connection on all surfaces. Matt and Sean also demonstrated the failure mechanisms of different adhesives.

Honorable Mention: "Don't Be Thick: Learn About Viscosity!"

Johanna Klein, an 8th grader from Jefferson Middle School, received an Honorable Mention for her project "Don't Be Thick: Learn About Viscosity!" Johanna developed an experiment to explore fluid thickness, focusing on viscosity. She found that it is relatively easy to measure the viscosity of Newtonian fluids, but not so with fluids that have fluctuating viscosities.

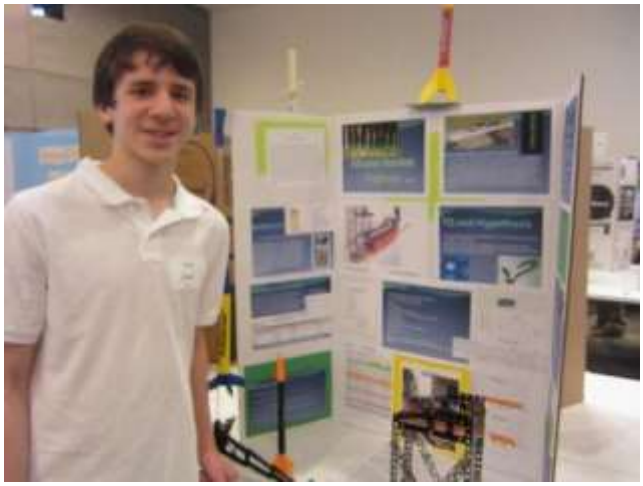
Honorable Mention: "Predicting Severe Convective Wind Gusts Events Using WSR-88D NEXRAD Doppler Radar Data for the Baltimore- Washington Forecast Area"

A second Honorable Mention went to Christopher Gerlach, a senior from T.C. Williams High School, for his project "Predicting Severe Convective Wind Gusts Events Using WSR-88D NEXRAD Doppler Radar Data for the Baltimore-Washington Forecast Area". Christopher analyzed the algorithms, currently used by meteorologists, to determine their accuracy in predicting weather events.

Science Montgomery

Science Montgomery took place on March 17, 2013 at the FDA White Oak Campus in Silver Spring, MD. The AIAA judges selected the following students for special recognition.

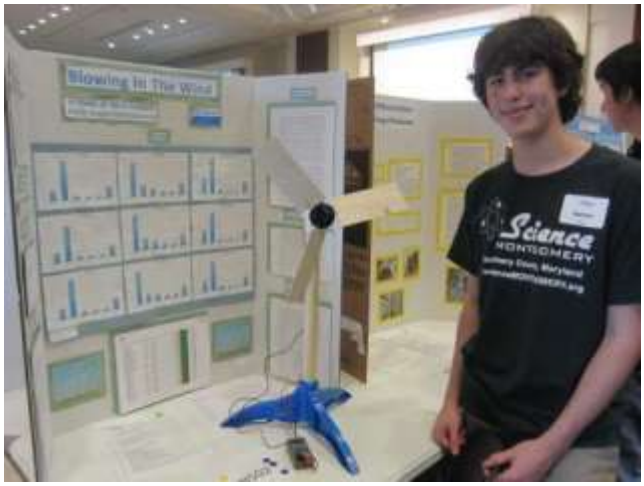
First Place: "Model Rocket Engines"



The First Place Award went to 8th Grade rocket enthusiast, Chris Rose, representing Parkland Magnet Middle School. Chris designed an experiment to test different strengths of model rocket engines. The hypothesis he wanted to test was: "If the amount of propellant in the model rocket is increased, then it will lift the weights higher because the engine provided more thrust for a longer time, pushing the rocket farther and therefore pulling the weights higher". Chris built a weight tower and a rocket sled, on an eight foot track that was connected to the tower with a pulley system, in turn connected to a weight elevator. When the rocket fired, it pulled on a string, attached to the weights, and lifted the weights to a certain height. After running some tests, Chris discovered that the engine with less fuel actually performed better since its average thrust was longer, even though it had less thrust than the engine with more fuel. The judges felt that Chris had a good sense of all the major variables that comprise rocket performance, in addition to which he demonstrated excellent communication skills. Chris has an inquisitive appreciation of rocket

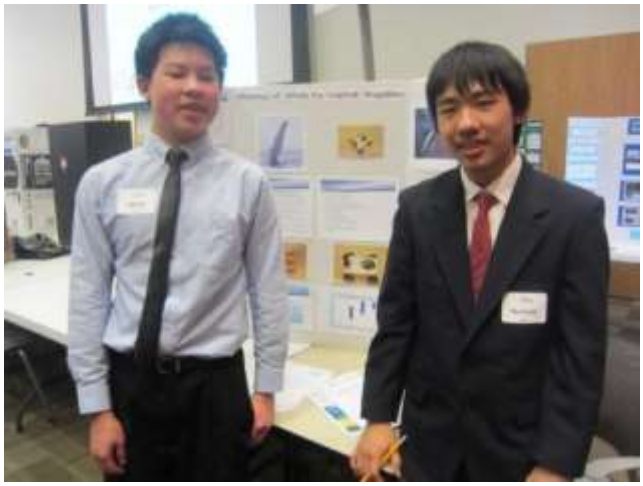
science. Both he and his dad are interested in joining a rocket club.

Second Place: "Blowing in the Wind: a Study in Wind Turbine Pitch Angle Effectiveness"



The Second Place Award went to 11th Grade wind turbine enthusiast, Aaron Renberg, from Winston Churchill High School. Aaron contends that the high cost of wind turbines ($5000) prevents home owners and small businesses from switching to a greener and more efficient energy source and, further, that the complexity of the electronics and control systems, required to maintain optimum direction and turbine blade pitch angle, drives this high cost. Therefore, a simplified, though perhaps a less optimum design, would facilitate greater wind turbine use. Consequently, Aaron designed and built a small wind turbine with blades that could be adjusted for pitch angle. He used two box fans for the wind source, and used that setup to measure turbine speed. His hypothesis was that a pitch angle of 45° would be the most effective over the nine wind conditions he intended to test. These conditions included low, medium and high wind speeds coming from three different directions (head on and ±45°). For each of these conditions, Aaron generated tests for turbine blade pitch angles of 25°, 35°, 45°, 55° and 65°. Aaron did an excellent job of displaying his results, showing all pitch angles and the nine wind conditions. The results showed that lower pitch angles accommodated more wind variations, and to his surprise, the 45° pitch angle was not the most effective after all. He suggested that more tests could be done to focus in on the most effective pitch angle – probably between 25° and 35°. A wind turbine could then be produced that would be effective and inexpensive rather than optimum and very expensive (and probably much easier to maintain). In doing this experiment, Aaron gained a good feel for the aerodynamics of the wind turbine, including drag effects, and was able to hypothesize why performance was different for the different conditions. Aaron is, clearly, an outstanding student. Additionally, he belongs to the Math, Tech and Science Academy which is sponsored by the Winston Churchill High School.

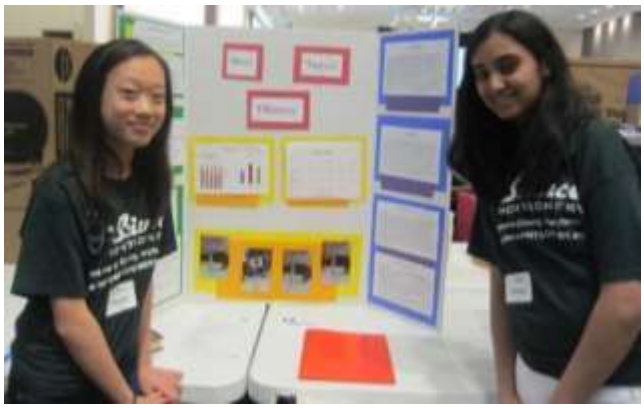
Third Place: "Efficiency of Whale-Fin Inspired Propellers"



The Third Place Award went to 9th Graders Steven Guo and Kenneth Jiang, from Poolesville High School. Steven and Kenneth were doing research on different types of propellers when they encounter a peculiar design in nature: namely, the bumps on the front edges of the fins on a humpback whale. They were curious to find out how this design would perform, so they designed an experiment that would test the performance of a propeller as a function of bump-to-wingspan ratio. Steven and Kenneth believed that the larger the ratio, the more efficient the propeller would be due to the fact that the propeller could grip the air more easily and, thereby, produce additional lift. They purchased three identical model airplane propellers and modified two of them to have designs with varying number of bumps – one with a few bumps and the other with about twice that many. The third, unmodified propeller would be the control article. Tests were set up to measure the propeller's speed for a constant air flow. The results showed that their hypothesis was correct:

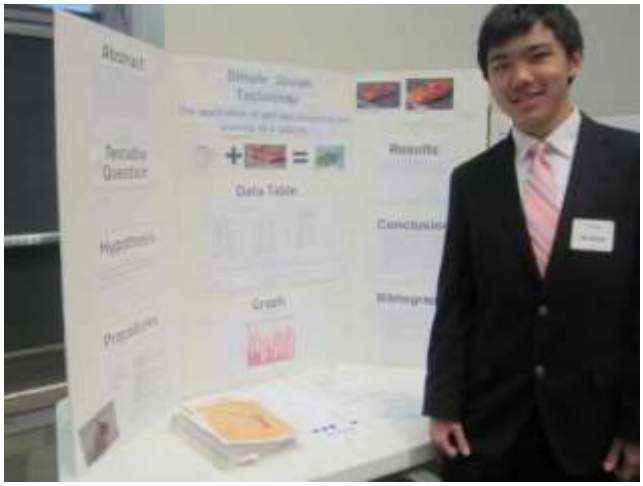
more bumps on the leading edge of a propeller resulted in greater efficiency. Steven and Kenneth are interested in continuing this experiment in the future in order to investigate variations on these results. The judges believed that, in doing a little research and being inquisitive, these students have uncovered a characteristic of propeller design that could prove very beneficial. Steven and Kenneth are in the first year of a Magnet Program which has a STEM focus and is designed for advanced students for Science, Math and Computer Science studies.

Honorable Mention: "Wind Turbine Blade Efficiency"



Shreya Singh and Rachel Qian, 8th Grade students representing Roberto Clemente Middle School, received an Honorable Mention for their investigation into wind turbines. Shreya and Rachel were interested in wind turbines and their role in producing clean energy. They examined a variety of wind turbine designs, with an assortment of blade combinations, in their experimental approach. A fan was used to drive the wind turbine under test, and the turbine, in turn, would raise a bottle filled with water. This method provided an effective way of converting energy from the wind into potential energy. They conducted several trials where they measured the amount of time needed to raise the bottle. In their tests, they found that a two blade system performed the best (as compared to six and three blade systems). Shreya and Rachel were enthusiastic about the project and provided clear explanations.

Honorable Mention: "The Effect of Dimples on a Vehicle's Aerodynamic Efficiency"



Andrew Sebastian, an 11th Grade student representing Richard Montgomery High School, received an Honorable Mention for his demonstration of the effects of a dimple surface structure on a vehicle moving through air. Like the dimple design of golf balls, which use the Magnus effect to gain more lift and therefore more distance, Andrew hypothesized that perhaps a dimple design on the surface of an automobile would allow the automobile to move more efficiently. He set up an experiment where he drove a motorized, undimpled model car, at maximum power, on a 50 foot track. He collected performance data with 15 trails to represent the control case. He then used a drill to put dimples on the car's hood. He then repeated the trials and found that the car had an average of 4% greater velocity than the control trials. Andrew believes this result may open new avenues for prospective automobile designers interested in gaining better performance. He thinks that future experiments should analyze the effects of various dimple distributions and sizes. Additionally, he suggests that the applicability of the technique could be extended to projectiles and other vehicles.

Charles County Science Fair

On March 9, 2013, three representatives of the AIAA-NCS collaborated to identify both the middle and high school projects related to space and flight, at the regional science fair that was held at Theodore Davis Middle School, in Waldorf, MD. From 2012's Charles County Science Fair, rocket scientist David Kanter returned to lead the team. First time AIAA judges

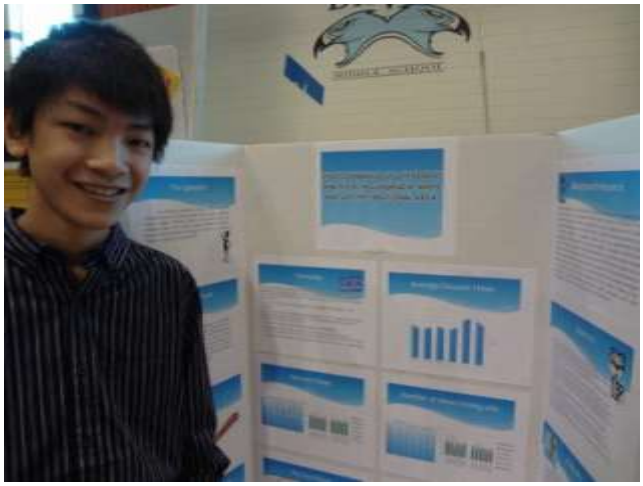
David Benson, of NASA, and Susan Bardenhagen, AIAA Educator Associate, added their expertise. Susan also, personally, presented the awards to the selected winners at the fair's award ceremony.

The judges evaluated projects in a variety of categories - including Earth & Planetary Science, Engineering, Materials & Bioengineering, Environmental Sciences, and Plant Sciences - and interviewed over fifty students. They then narrowed the field to ten for further scrutiny. As a result, the following five projects earned the AIAA awards.

First Place: "Surface Tension in Relation of Temperature"

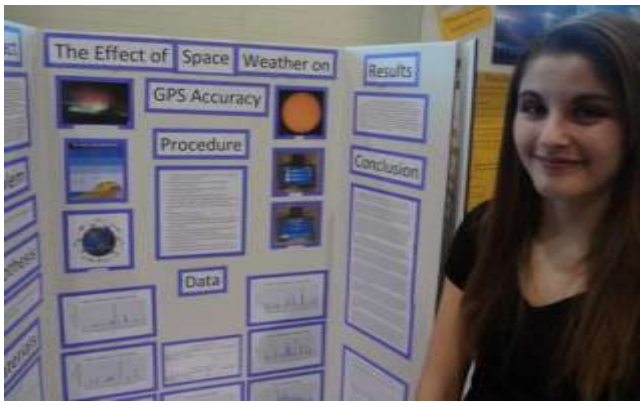
Smallwood Middle School student, Charlotte Craven entered her project called "Surface Tension in Relation of Temperature" in the category of Physics & Astronomy. She enthusiastically related how much she enjoyed working on her experiment. Our Judge Benson had done research in her topic in graduate school and offered the judging team insight into Charlotte's excellent work. "She was right in assuming that temperature affects surface tension, but she really impressed me as we talked about surface tension a little bit more. During our discussion she went above and beyond her initial understanding by noting that the cleanliness of the water affected the surface tension. In practice, cleanliness is the larger concern when surface tension is important to a design. The judges were impressed that she was able to notice a behavior that was outside the original scope of her hypothesis. The category judges at the fair awarded her Honorable Mention.

Second Place: "Hydrodynamics of Different Shapes"



La Plata High School's Matthew Fan entered his project: "Hydrodynamics of Different Shapes" into the Energy & Transportation category of the science fair. When our AIAA team interviewed him, he easily translated his hypotheses and project's applications to aerospace implications- giving support to his inclusion for consideration. He used specially created tubes to control the release of a vehicle's prototype shape. Matthew exhibited excellent knowledge in Physics and is preparing to be a Scientist!

Third Place: "The Effect of Space Weather on GPS Accuracy"



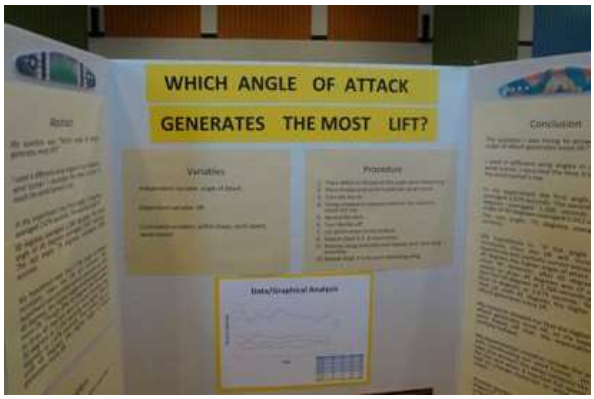
Katie Polk, of North Point High School, with her project: "The Effect of Space Weather on GPS Accuracy", related how her findings could have an impact on communications in both airplanes and spacecraft. She also addressed the military implications of space weather on the operation drone aircrafts. Katie conducted a wide range of research to collate her findings. Katie acknowledged that our location in the middle

latitudes results in a small variance and aspires to travel to northern Canada to retest her hypothesis and gather more data. She placed first in her science fair category and was considered for the Grand Prize award.

Honorable Mention: "The Effect of Wind Resistance on Different Patterns"

Andrew Fan, of Piccowaxxan Middle School, was intrigued by the wind tunnel that his older brother had used for a previous project and, therefore, wanted to investigate the patterns of wing surfaces in relation to their aerodynamic efficiency. His project fit well in the Physics & Astronomy category. Andrew eagerly offered ideas for further scrutiny and spoke scientifically to applications of his findings. Andrew was well-studied in each constant the judges questioned. We hope he continues to analyze and research his questions.

Honorable Mention: "Which Angle of Attack Generates the Most Lift?"



Nicholas Sagun of the fair's hosting school (Theodore Davis Middle School) entered in the fair's Engineering: Electrical and Mechanical category and received first place from the category judges. The AIAA judging team, and other judges (one of whom had previously judged for AIAA), were impressed with the wind tunnel he had constructed to test his independent variable. His data notebooks contained the results of numerous trials, and his display was quite detailed.

Prince George's County Science Fair

The Prince George's Area Science Fair was held on March 9, 2013 at the Prince George's Community College in Largo, MD. Tom Noyes, Ruth Galaviz, and Bo Pollett represented the AIAA in judging the air and space related projects for AIAA science fair awards. The outstanding AIAA student awardees at the 2013 Prince George's County Fair were as follows.

First Place: "Holey Wings"

Sonja is a delightful young woman who built on her success at last year's science fair. As a junior in 2012, she and her father devised a series of airfoils and a wind tunnel, complete with homemade balance, to measure aerodynamic forces. This year she was back with modified airfoils containing holes along the airflow from the upper to lower surfaces. She presented a well devised experiment which measured the lift and drag forces on an airfoil based on angle of attack. Her graphs were well presented and accurately depicted the expected results.

Beyond having an excellent experiment and a commendable scientific process, Sonja had a great attitude and a true passion for science. Her enthusiasm was evident as she described the way

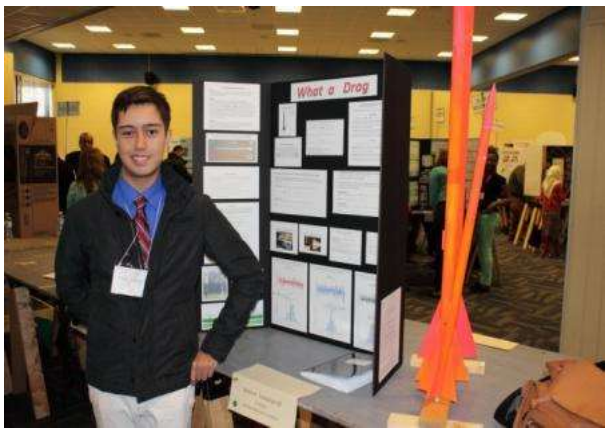
here father helped her by drilling the holes in the airfoils according to her drawings. When asked about her ambitions for the future, she said she had interested in medicine, engineering, and biology. The judges felt that Sonja's project was fully deserving of first place and additionally, she would greatly appreciate the opportunity to explore her interest in engineering and aerospace.

Second Place: "The Rotation Revolution"

The judges awarded Second Place to Alexander Harris, a junior in the Energy and Transportation category. Alexander was a surprise at the end of a long day of judging. This energetic student had a simple, yet well executed project, but it was his eclectic storytelling of his experience building his wind turbine with his family, and turning his kitchen into a laboratory, that was so refreshing. The photos of his father aiming a room fan while he held a clipboard to record data was inspiring. His data was interesting, and he and the judges had a productive discussion as to the factors which caused the trend lines in his energy capture based on fan blade size.

A memorable moment with this young scientist was when he was asked about uncontrolled variables which may have affected his data. He said he had to put the dogs outside because they would run around the kitchen barking at the spinning fan which, in turn, disrupted the airflow. It was clear Alexander had a lot of fun with this project, and we enjoyed hearing about it. The judges were in agreement that a second place finish would commend Alexander's good work as well as encourage his future scientific endeavors.

Third Place: "What a Drag"



Robert Vandegrift, a senior at Great Mills High School, took Third Place for his project, in the Mathematical Sciences category, entitled "What a Drag". Robert has been a perennial winner with the AIAA judges, and has always presented interesting aerospace projects.

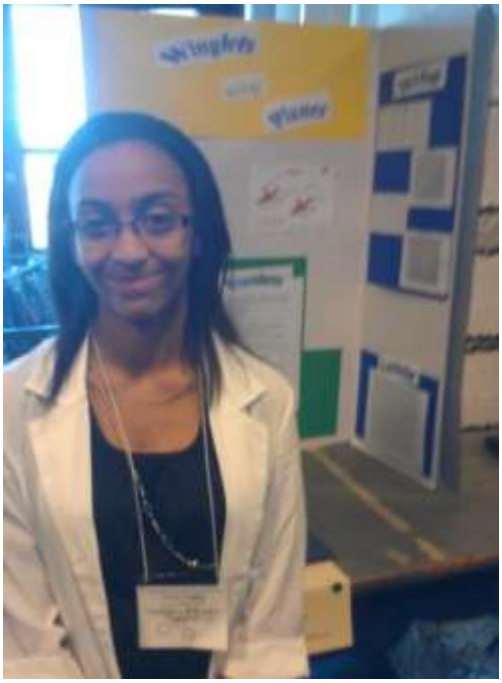
Many projects explored interesting scientific principles, but Robert had the process and mathematics to take his project to the next level. He created multiple rockets of the same design, but with different scale, and evaluated the efficiency by "non-dimensionalizing" the velocity and integrating to determine the thrust and drag. Although not unique, Robert's project was one of the most technically advanced that the judges viewed during the day. The judges selected third place for this project since it was well executed and raised the standard for the level of analysis applied to scientific thought.

Honorable Mention: "Prototyping a Low Cost Star Tracker"

Christopher Chornay, a senior in the Computer Science category, received an Honorable Mention. Christopher's project was a unique hybrid of a research project, his after-school job, creative mechanical tinkering, and application of advanced space and computer sciences. Christopher built a homemade star tracker from scratch using a simple camera, a pair of stepper motors, original software, and a set of NASA star charts. The purpose of the device was to make a low cost machine that could take pictures of the sky, determine the orientation of its field-of-view, and begin following a specified position in space. This objective was made more complex by the integration of an algorithm that cached the location of recent searches in order to reduce the time required to reinitialize orientation.

Christopher's work was started as a joint venture with a local NASA outreach program. Through this work, he taught himself many of the skills required for this project, including electrical engineering to set up the wiring for the stepper motors and computer programming to make the motors talk to the software. There appeared to be a bit more work to be done to complete this project, but the progress so far was very impressive, and the judges wanted to recognize Christopher's skills and hard work.

Honorable Mention: "Winglets and Planes"



Tiffany Reecks, a senior with a project in the Engineering and Mathematics category, also received an Honorable Mention. Tiffany was an excellent example of the value of this science fair. She was enthusiastic and ambitious about her project. She had built a model and created a complex test rig. It was evident that she spent a majority of her time building and testing, but ran out of time to properly analyze her results. Through discussions with the judges, it was clear that Tiffany learned a lot about the scientific process during this project. She spoke about how she had not realized how important the data collection process was, and how easily a test could become burdened by unforeseen factors. Her original test variable, winglet efficiency, ended up turning into an entire matrix of variables to test.

It was clear that Tiffany has a lot to learn about the scientific process, but she has plenty of enthusiasm and curiosity. She showed a lot of promise as an aspiring engineer, and the judges felt that encouraging her ambition would help to inspire her to follow her passion and continue her education in the field of science and aerospace.

Loudoun County Regional Science and Engineering Fair

The Loudoun County Regional Science and Engineering Fair was held on Thursday, March 14, 2013 at Tuscarora High School in Leesburg, Virginia.

The Busy Display Floor at the Loudoun County Science Fair

The AIAA NCS judges were Luis Bermudez, Mike McFarland and Carlos Niederstrasser from Orbital Sciences Corporation and Mark Pittelkau from Aerospace Control Systems, LLC.

First Place: "The Effect of Different Fin Configurations on the Altitude Achieved during Flight"

First Place was awarded to David Fackler, a sophomore at Broad Run High School, for his project entitled "The Effect of Different Fin Configurations on the Altitude Achieved during Flight." David constructed three model rockets, each with a different number of stabilizing tail fins. After ensuring that the rockets were identical with respect to weight and fin area, and that all three were sufficiently aerodynamically stable, David used an altimeter to measure the altitude achieved in repeated launches. His results showed, decisively, that fewer fins resulted in a higher altitude. This result was most likely caused by reduced aerodynamic drag due to decreased frontal fin area and/or reduced aerodynamic interference between fins.

Second Place: "The Effect of Temperature on the Flight of Baseballs"

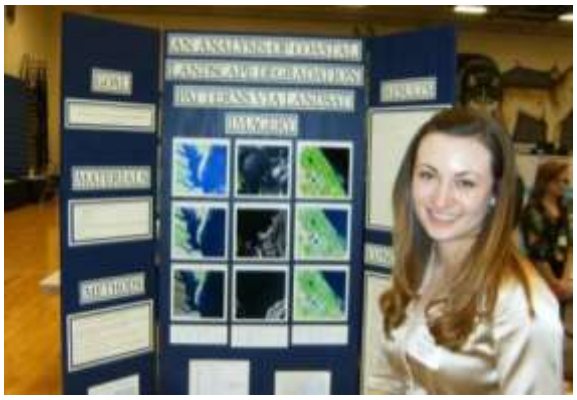
Second Place went to Tyler Curran, a freshman at Stone Bridge High School, for his project on "The Effect of Temperature on the Flight of Baseballs." Tyler constructed a tension-driven mechanism to hit baseballs off of a stationary fixture. He then used this fixture to test baseballs that had been thermally conditioned to temperatures ranging from 0°C to 100°C. His results showed a small, but statistically significant, positive correlation between distances traveled and the soak temperatures of the baseballs. Tyler showed creativity by focusing on material, rather than aerodynamic, properties of the baseballs, and his experimental methodology was exceptionally thorough.

Third Place: "The Effect of Ocean Temperature on Hurricane Intensity"

Chloe Knox, a sophomore at Loudoun County High School, won Third Place for her project

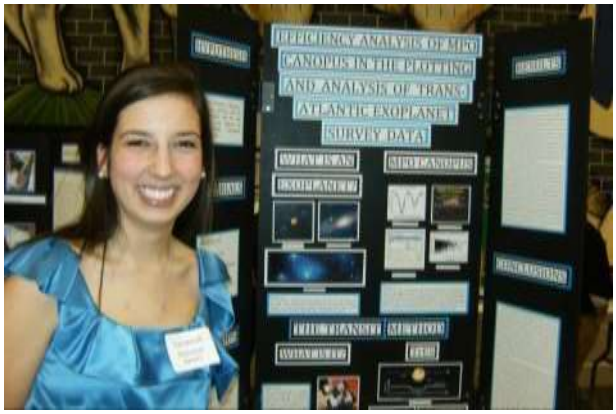
entitled: "The Effect of Ocean Temperature on Hurricane Intensity." Chloe's project compared data on the number of Atlantic hurricanes, over the last thirty years, with ocean temperature measurements collected over the same time period. Her results, which were computed using a variety of metrics, showed significant correlations between ocean temperatures and hurricane activity.

Honorable Mention:" An Analysis of Coastal Landscape Degradation Patterns via LANDSAT Imagery"



Honorable Mention was awarded to Miranda Bellamah, of Dominion High School, for "An Analysis of Coastal Landscape Degradation Patterns via LANDSAT Imagery." In her project she used LANDSAT imagery, published by the United States Geological Survey, to characterize variations in coastal land area caused by weather as well as coastal land reclamation activities.

Honorable Mention: "Efficiency Analysis of MPO Canopus in the Plotting and Analysis of Trans-Atlantic Exoplanet Survey Data"



Savannah Hummer, of Dominion High School, similarly earned Honorable Mention for "Efficiency Analysis of MPO Canopus in the Plotting and Analysis of Trans-Atlantic Exoplanet Survey Data." Savannah investigated the effectiveness of software that is made available to amateur researchers for processing astronomical data in the search for exoplanets.

Fairfax County Regional Science and Engineering Fair

The Fairfax County Regional Science and Engineering Fair was held at Robinson Secondary School, in Fairfax, VA, on March 16, 2013.

The Volunteer AIAA NCS Judges for the Fairfax Fair

Michael Moore (Retired NASA), Natalia Sizov (FAA), and Cary Huang (US Navy) represented the AIAA judging team, comprising industry experience ranging from satellites and planetary sciences, to aviation, and to rockets and reentry vehicles.

There were over 400 projects at this fair with categories ranging from biological, chemical, and behavioral sciences, to engineering, energy and transportation, and planetary sciences. The judges met the challenge of narrowing down the field to aerospace related projects, and selected the following for special recognition.

First Place: "The Effect of Solar Activity on Earth's Magnetic Field at Different Altitudes"

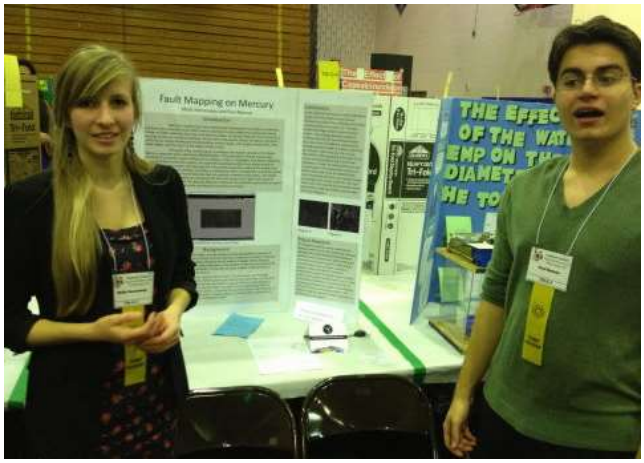
The First Place Award went to Yekaterina Gilbo, a 12th grader from George C. Marshall High School. Yekaterina investigated the influence of solar activity on the Earth's magnetic field, with the goal of understanding magnetosphere phenomena and, thereby, determine how solar storms might affect spacecraft. She analyzed magnetic field data from NASA THEMIS satellites and, also, geomagnetic storm activity data from NOAA's Disturbance Storm Time (DST) index to build a relationship between magnetic field strength as a function of altitude and solar activity. Her utilization of the THEMIS data took advantage of the very specific set of alignment characteristics built into the design of this constellation, and the results of her independent analysis fit well with historical results.

Yekaterina's initiative and enthusiasm for the subject, and her resourcefulness in using multiple data sources, was outstanding. This project, overall, was very advanced for a high school student, and the judges were impressed with the quality of her research, analysis approach, and understanding of the subject matter.

Second Place: "The Effect of a Morphing Wing on Lift and Drag"

The Second Place Award went to Patrick Silsby, an 11th grader from Chantilly High School. Patrick constructed a variable sweep angle wing from Styrofoam and tested it in a university wind tunnel. He designed the wind tunnel measurement instrumentation to gather lift and drag data, using scales and moment arms, and designed the test configuration plan to make measurements at specific forward and back sweep angles and, also, at specific airspeeds. He recognized that he was unable to test at higher airspeeds due to the structural limitations of the Styrofoam which, in turn, could possibly influence his conclusion. Patrick's experimental design, control of variables, and conveyance of the experimental data were top notch.

Third Place: "Mapping Lobate Scarps on Mercury"



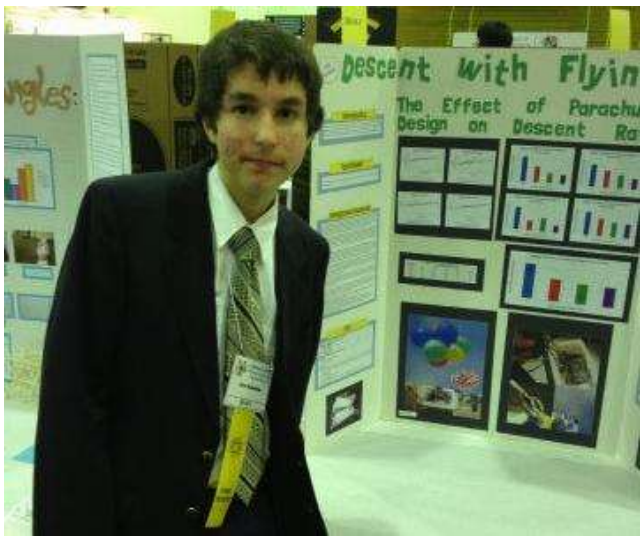
The Third Place Award went to Molly Hemenway and Paul Naanou, 12th graders from Thomas Jefferson High School. Their project aimed at understanding the formation of Mercury lobate scarps, which are cliffs varying between tens to thousands of kilometers in length and from 100 meters to 3 kilometers in height. They utilized data from the MErcury Surface Space ENvironment GEochemistry and Ranging (MESSENGER) satellite to identify patterns in scarp formation. Molly and Paul focused on the Southwestern region of Mercury, created a Microsoft Excel database to log the location and length of these landforms, and then searched for correlations between these landforms and intersecting basins. They seemed genuinely puzzled that their hypothesis was not supported by the data they accessed to date, and were looking forward to further releases from the MESSENGER Project in order to extend their research and to determine if the initial results are regionally consistent.

The judges were impressed with both the originality of the question posed and the clarity of the team's presentation. Their presentation clearly delineated the area being studied with the supporting rationale, the process for analyzing the data, and the results. Their oral presentation was very well scripted and featured seamless hand-offs at logical points in the discussion.

Honorable Mention: "Stalling is Not an Option: The Effect of Angle of Incidence on Efficiency of Lightweight Aircraft"

The judges awarded Honorable Mention to Hussain Jaffery and Peter Steele, 11th graders from McLean High School. Based on a scaled-down version of the "Lit'l Sweep" competition glider model, Hussain and Peter constructed four balsa wood gliders, of varying wing incidence angles, and tested the gliders' efficiency with respect to altitude increase and glide performance. Their experiments consisted of a custom-built wind tunnel and a catapult launch system that was used to find the most optimal configuration for glider efficiency. Peter and Hussain built and won a Science Olympiad using what they learned from their experiments.

Honorable Mention: "The Effect of Parachute Design on Descent Rate"



The judges awarded another Honorable Mention to Alon Bendelac, a 9th grader from Chantilly High School. Alon studied the deceleration of a

specific payload subject as a function of varying hexagonal parachute sizes. He used an innovative release mechanism design and camera footage to calculate drop rate. He recognized the potential for further studies by extending the experiment to test other parachute shapes, materials, and lengths of suspension lines.

Prince William - Manassas Regional Science Fair

On Saturday March 17, 2013, Nick Keller, Kristine Ferrone, and Richard Bibb judged the 2013 Prince William-Manassas Regional Science Fair, at the Kelly Leadership Center, in Manassas, VA. The judges selected the following projects as particularly worthy of awards.

First Place: "Airflow on Wing Surfaces"

Tim McGraw, a 10th grade student from Seton School in Manassas, VA, completed a project entitled "Airflow on Wing Surfaces". For his research, Tim analyzed the effect various wing shapes have on the turbulence they produce. He had five different wing shapes with pieces of yarn attached at pre-defined locations. He subjectively determined the level of turbulence produced by each surface by visually inspecting the movement of the yarn. For his control, he used a rectangular prism, assuming that it would produce the most turbulence. He eventually confirmed this assumption by experiment. Tim also tested a triangular prism, as well as three different wing shapes with varying cambers. He concluded that the wing with the lowest camber had the lowest drag. What set Tim apart from his peers was the fact he built his own wind tunnel for this research out of a box fan and some cardboard boxes.

Second Place: "Near Earth Object Discovery"

Nader Maharmeh and Mohammad Hassain, 11th grade students at The Governor's School, completed a project entitled "Near Earth Object Discovery". With the aid of a software package called "Astrometrica", these two young researches compared successive images of the night sky looking for "fast" moving objects. They further applied the tools, within the package, to compute the orbital elements of the "fast" objects they found, and compared those elements (especially Right Ascension of the Ascending Node and Inclination) to known bodies. Their procedure has the potential of application to discovery of new near earth objects.

Third Place: "Investigating Energy Production in Wind Turbines"

Trevor Hittinger, a 10th grade student from Osbourn High School, completed a project entitled "Investigating Energy Production in Wind Turbines". To do this investigation, Trevor established a multi-variable optimization problem

to analyze the effects of length, number, angle, and shape of turbine blades. He used output current as a measure of turbine efficiency. After multiple iterations, he eventually concluded that, at his scale, six relatively short, moderately angled, triangular blades produced the most output power.

Plans for Next Year

In 2014, we hope to continue our science fair support, but we won't be able to do this without continued corporate sponsorship and volunteer judging participation. If you are interested in getting more involved in National Capital Section educational outreach programs, please contact Michele McMurrer at aiaancs1@aol.com.

Our sincere thanks to:

Our Corporate Sponsors:

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The Science Fair Judges:

- Susan Bardenhagen
- David Benson
- Luis Bermudez
- Richard Bibb
- Sandra Cauffman
- Kristine Ferrone
- Ruth Galaviz
- Joseph Gruber
- Mike Helton
- Cary Huang
- Nils Jespersen
- Adonay Jiminez
- David Kanter
- Nick Keller
- Mike McFarland
- Michael Moore
- Tom Noyes
- Mark Pittelkau
- Mike Poliszuk
- Bo Pollett
- Ashish Purekar
- Capt. John Roh
- Natalia Sizov

And finally, the AIAA NCS Science Fair team:

For 2013, the following AIAA Science Fair Committee members worked very hard to make this year's AIAA science fair coverage a success:

- Natalia Sizov, AIAA NCS Lead Science Fair Coordinator
- Kate Becker, AIAA NCS Council Member
- Nils Jespersen, The Aerospace Corporation
- Michele McMurrer, AIAA NCS Administrator
- Robert Thomas, Fund Raiser
- Kimberly Harris, AIAA NCS Council Member
- Michael Santos, Intelligent Automation, Inc, AIAA NCS Treasurer
- Bruce Milam, NASA, AIAA NCS Chair