

# VIRGINIA SPACELINK

MAY 2016



*Student rocket prior to liftoff.*

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# The Director's Message



Dear Colleagues:

We have good news to share. VSGC has won a NASA Undergraduate Student Instrument Program award that will allow us to work with four of our universities to develop and fly a Virginia CubeSat Constellation. See p. 4 for details. We have also been given the opportunity by NASA to apply for augmentation funding for our Space Grant award for an additional \$185,000 per year which would enable more scholarship, fellowship and internship opportunities as well as other projects.

Two members of our staff are retiring this month – Brenda Neil, Program Manager for several VSGC projects and our Newsletter Editor, and Dr. Mary Jo Leber, who for the past three

years has managed our support efforts for NASA's climate education program, NASA Earth Systems, Technology, and Energy Education for MUREP (ESTEEM). We're pleased that Mary Jo will continue part time for special projects. Both of them have done outstanding jobs and will be much missed by VSGC and our partners.

Brenda is leaving us after 19 years of service. After me, she is our most veteran staff member. She has been a key contributor to many successful programs over the years from the VSGC's creation and management of the NASA Undergraduate Student Research Program to management of the NASA Langley Aerospace Research Scholars Program, BLAST - our university summer residential program for rising ninth and tenth graders, and our New Investigator Program for faculty. A heartfelt thanks to Brenda for being such a great and committed partner over the years and for all she had done to help us grow our program and its impacts.

The summer is upon with eight one-week summer academies at NASA Langley and NASA Wallops tied to our statewide Virginia Aerospace Science and Technology Scholars, Virginia Space Coast Scholars and new Virginia Earth System Science programs. We will also hold four BLAST sessions at UVa, Virginia Tech and ODU this summer. Our precollege pipeline and enrichment programs will impact about 700 students this summer and engage dozens of master educators.

*Mary Sandy*

## VSGC MEMBER INSTITUTIONS

College of William and Mary  
Hampton University  
Old Dominion University  
University of Virginia  
Virginia Polytechnic Institute and State University  
NASA Langley Research Center  
NASA Goddard Space Flight Center's  
NASA Wallops Flight Facility  
MathScience Innovation Center  
Science Museum of Virginia  
Virginia Air and Space Center  
State Council of Higher Education for Virginia  
Virginia Community College System  
Virginia Department of Education  
Center for Innovative Technology

## VIRGINIA SPACE GRANT CONSORTIUM

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# NASA Selects Virginia Students to Develop and Fly a Satellite Constellation in Space

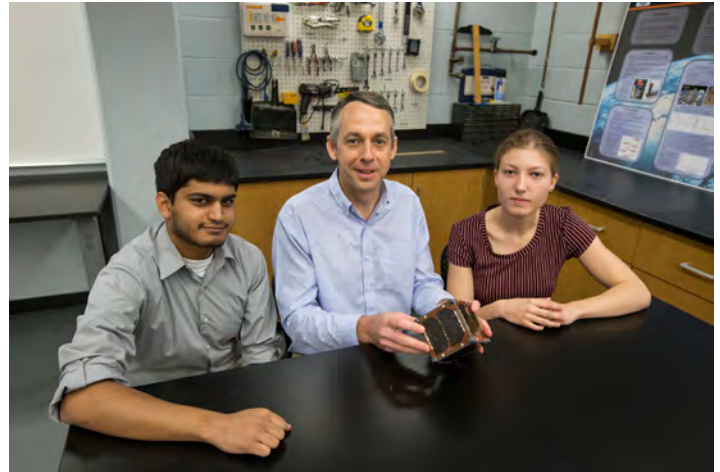
Students from four Virginia universities will develop and fly a constellation of small satellites through a recently announced award from the NASA Undergraduate Student Instrument Program.

The Virginia Cubesat Constellation mission is a collaborative project of the Virginia Space Grant Consortium and four of its member universities: Old Dominion University (ODU), Virginia Tech (VT), University of Virginia (UVa), and Hampton University (HU). Three nano-satellites, each about 4 inches square and weighing approximately 3 pounds, will be developed and instrumented (one each at ODU, VT and UVa) to obtain measurements of the properties of the Earth's atmosphere. As the orbits of the satellites decay due to atmospheric drag, the satellite payloads will quantify atmospheric density. The system will also determine and communicate relative and absolute spacecraft position across the orbiting constellation.

The work will be done by a cross-institutional student team. Student leaders and team members will consist of undergraduate students in the disciplines of physics, electrical engineering, aerospace engineering, mechanical engineering and chemical engineering. A UVa Student will serve as the Team Leader, an ODU Student as Science Principal Investigator and a Virginia Tech Student as the Chief Technologist. The students have 18 months to complete their work and deliver the satellites to NASA for launch.

More than 50 undergraduate students will be involved through nine university courses and two extracurricular independent study topics. The work will be integrated into the undergraduate engineering curricula at ODU, VT and UVa through senior capstone design courses. These engineering students will collaborate with HU students working for the Atmospheric and Planetary Science Department. The team members will be mentored by faculty, staff and graduate students.

The Virginia Space Grant Consortium based in Hampton, Va. is administering the project. Consortium Director Mary Sandy notes, "Our Consortium has been actively sponsoring and coordinating student flight projects for more than 20 years. Engaging students in real-world space missions offers them exciting educational opportunities that provide critical workplace skills. By taking on actual mission roles and going through NASA design and flight readiness reviews, students are learning how space missions



*University of Virginia aerospace engineering professor Chris Goyne, center, and students Chandrakanth "C.K." Venigalla, left, and Robin Leiter, right, are designing a mini satellite for the Virginia Space Grant Consortium Virginia Cubesat Constellation project. Credit: Dan Addison, University of Virginia.*

are done and how to deal with the unique challenges of the space environment." She adds, "Doing technology demonstration and research in space is a great thing for students to have on their resumes."

Many of the students have started preliminary design work. UVa students, for example, worked through the spring semester as part of Professor Chris Goyne's Senior Capstone Design Class. Students have appreciated the valuable real-world experience. "These projects make full use of our training and experience, from the conceptualization to the designing, building and deployment of working payloads," said Fourth-year student, Chandrakanth "C.K." Venigalla. "And we get to work with engineers in government and industry, really learning how industry works and how projects come together."

NASA is providing the launch on a vehicle yet to be specified, but the spacecraft will likely be placed into orbit as part of an International Space Station resupply mission. The three cubesats will be deployed into orbit nearly-simultaneously so they can orbit together and function as a constellation. The satellites will orbit the Earth for about two months, possibly longer, at an altitude of 250 miles before burning up when they re-enter the Earth's atmosphere.

# VSGC Director Honored for 25 Years of Excellence



In December, Mary Sandy was honored for 25 Years of Excellence as the Director of the Virginia Space Grant Consortium. The reception was hosted by the Virginia Air and Space Center in Hampton. Over 100 people attended the event including representatives from NASA Langley and NASA Headquarters, colleagues from several state Space Grant Consortia, industry and academia as well as family and friends. According to VSGC Deputy Director, Chris

Carter, "Mary has touched and impacted many lives and it would be impossible to measure the positive impact or to summarize all the success stories during her 25 years leading Virginia Space Grant." Several colleagues paid tribute to Sandy including Clayton Turner, Deputy Director of NASA Langley Research Center who presented her with a photograph signed by the Center's senior staff marking the 100 year anniversary of the Center.

*Bottom left: Clayton Turner, Deputy Director of NASA Langley Research Center (R) presents Mary Sandy a photograph signed by the senior staff marking the 100 year anniversary of the Center. Bottom right: Current and former VSGC staff gather to pay tribute to Mary Sandy.*

# 2016 Student Research Conference

One of the most rewarding days of the year for the Virginia Space Grant Consortium is the annual Student Research Conference at which research scholarship and fellowship recipients present the results of their VSGC-funded research. The 2016 Conference was hosted by NASA Langley Research Center on April 11 at the Integrated Engineering Services Building. Thirty-one Graduate Research Fellows presented the results of their research in 15-minute oral presentations and thirteen Undergraduate Research Scholars presented posters during the conference. A luncheon, sponsored by the University of Virginia, was held as part of the Conference to honor the 2015-2016 scholars and fellows. ODU President John Broderick, the outgoing Chairman of VSGC's Board of Directors, made remarks and incoming Board Chairman, Dr. Tim Sands, President of Virginia Tech also made remarks and welcomed conference attendees.



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The luncheon keynote address was provided by Dr. Patrick Hopkins, Associate Professor in the Mechanical and Aerospace Engineering Department at the University of Virginia. His presentation highlighted his research in nanoscale heat transfer and the impact prior VSGC support had on his academic and professional career.

*Photos (left to right): 1 - STEM BRIDGE students preparing for a discussion on internship opportunities. 2 - Undergraduate students present posters highlighting their research projects. 3 - A keynote address was given by Dr. Patrick Hopkins, Associate Professor in the Mechanical and Aerospace Engineering Department at the University of Virginia.*

Chris Carter, VSGC's Deputy Director, stated, "This is always one of our favorite days of the year. It is so rewarding to meet the students and hear them present the results of their VSGC-supported research."

Graduate Fellows provided oral presentations during topical sessions of: Aerospace; Applied Science; Structures and Materials; Astrophysics and Planetary Science. Several VSGC alumni, including some who now work at NASA Langley, attended the luncheon and student presentations. Also attending the event were 24 VSGC Undergraduate STEM Bridge Scholars who are sophomores and juniors at VSGC member institutions as well as 16 STEM Takes Flight Bridge scholars and three Community College STEM Scholarship recipients. A separate agenda was provided for Bridge Scholars to help them learn about NASA's mission and STEM career options from those working in STEM fields.

<http://vsgc.odu.edu/src/>

## Virginia Space Grant Consortium Receives Prestigious 2016 Programs That Work Award from Virginia Mathematics & Science Coalition



*Governor Terry McAuliffe presents the Programs That Work award to Virginia Space Grant Consortium BLAST staff and partners. (L-R): Chris Carter, VSGC Deputy Director, Larry Richards, UVA Engineering Faculty, Brenda Neil, VSGC BLAST program manager, Governor Terry McAuliffe, Mary Jo Leber, VSGC staff, Ed Murphy, UVA Astronomy Faculty and Kim Lester, Virginia Tech Center for Enhancement of Engineering Diversity.*

The Virginia Space Grant Consortium's Building Leaders for Advancing Science and Technology (BLAST) program received the 2016 Programs That Work award from the Virginia Mathematics & Science Coalition (VMSC). Governor Terry McAuliffe presented the award on January 19 during a reception held at the Library of Virginia in Richmond. This prestigious award recognizes exemplary science and integrated science, technology, engineering and mathematics (STEM) programs evidencing a positive impact on student or teacher learning. The BLAST award was one of twelve presented by the Governor on behalf of the VMSC.

Since 2013, the BLAST program has offered a free, dynamic, three-day, residential, summer science, technology, engineering and math (STEM) experience for rising 9th and 10th grade Virginia students held at Virginia Tech and the University of Virginia. To date, 632 students representing all areas of the state have engaged in team-based activities designed to solve engineering and scientific challenges under the guidance of university faculty and students. The program, which seeks to motivate and inspire students

for STEM studies and careers, is a partnership between the Virginia Space Grant Consortium, the University of Virginia, Virginia Tech and the Commonwealth of Virginia. Old Dominion University joined the partnership in 2016. Both female and male students participate equally in the program.

When asked, did you learn something about yourself and your interests this week, student comments included:

--"I learned that I actually like building stuff and creating something new. Before, I found myself to be a boring, not creative person but through BLAST I let out many ideas I didn't know I had."

--"I learned that engineers' jobs are to make the world a better place and I really want to help as much as possible, so being able to use what I have learned this week to open doors to possibilities in the future makes me optimistic about what I will be able to achieve."

<http://blast.spacegrant.org>.

# Virginia Community College Students Collect Data for NASA Using Unmanned Aircraft Systems (UAS)



*Photo Credit: Linda Sherman / NASA Wallops: Group picture of the student and faculty participants. (Left to Right) (Seated Front Row) Chris Carter, VSGC Deputy Director, Nicole Knudson, Tidewater Community College (TCC), Carmen Ferraro, TCC, Sarah Lubkin, Northern Virginia Community College (NVCC), Cherie Aukland, TNCC (Co-Faculty Lead). (Standing Back Row) Gabriel Fearing, Rappahannock Community College, Heidi Phillips, Virginia Western Community College (VWCC), Shari Davies, TNCC, Matthew Cox, VWCC, Tim Minich, TNCC, Josh Darnall, TNCC, Jason Sanchez, NVCC, Brian Stemm, TCC, David Nicks, TNCC, Laura Nusz, TNCC, David Webb, VSGC Consultant (Co-Faculty Lead)*

Thirteen students from five Virginia Community Colleges can now add unmanned aircraft systems (UAS) and NASA to their resumes thanks to their work on a sea level rise study for NASA Wallops Flight Facility on Virginia's Eastern Shore. The students recently completed four-days of fieldwork at NASA Wallops in which they planned and conducted UAS missions, analyzed data, and prepared a report for NASA. The fieldwork was completed as part of a new pilot online course, Topics in Service Learning in Geographic Information Systems (GIS), offered by Thomas Nelson Community College in partnership with the Virginia Space Grant Consortium (VSGC) as part of the VSGC's NASA-funded STEM Takes Flight at Virginia's Community Colleges project.

In preparation for the fieldwork, students worked under the guidance of faculty mentors Cherie Aukland and

David Webb to develop knowledge and skills in GIS, remote sensing, UAS, and sea level rise. The goal of the fieldwork was to demonstrate the capability of small UAS to collect imagery and other data about phragmites, an invasive species, and shoreline data to help Wallops assess the impact of sea level rise on the facility. The student-gathered data and technical report will support NASA Wallops' Coastal Resilience Initiative and goals for future similar use of UAS.

"The partnerships were tremendous. Thomas Nelson, VSGC, NASA Wallops, and Sentinel Robotics Solutions (SRS) worked great together to make these groundbreaking missions happen. All of us were thrilled to be part of the first autonomous flight of a UAS in the airspace at NASA Wallops," said Chris Carter, VSGC Deputy Director and project coordinator. "Students demonstrated real strength and ability

to complete the goals of the class despite having just met each other and a mission schedule that was adjusted at the last minute due to the weather," commented Webb.

Matthew Cox, a student participant, stated that this "was a great experience getting to work with actual NASA employees. It was interesting to see the steps and procedures the team had to complete before being able to fly the missions. From the data we collected, we were able to identify the shoreline and phragmites, which was rewarding because that was the ultimate goal."

A DJI Phantom 3 quad-copter flew an autonomous flight over 52 acres on the north end of the island. This mission collected two hundred and eleven high definition true color images to create a high resolution map of the area. A manual flight using a DJI Phantom 2 quad-copter equipped with a payload of a Raspberry Pi-



controlled near-infrared camera was flown over a smaller area on the south end of the island. Students used GIS to analyze the imagery and data about the shoreline and presence of phragmites. “We were able to prove that these relatively low-cost vehicles and sensors can be used to identify phragmites and the shoreline. Now NASA can fly and collect data-on-demand with small UAS. What a great real-world service learning project for these students,” stated Aukland.

Michael Bonsteel, Environmental Scientist at Wallops stated, “These missions allow us to gather data for the exact regions where we have questions about erosion, accretion, and subsidence. Using small UASs for data collection will enhance our ability to gauge the health of our ecosystems and evaluate the success of invasive species management strategies. The use of small UASs results in low-cost, high-value projects, in line with the overall Wallops business model.”

Peter Bale of SRS served as the pilot in command for the UAS missions, and Chase Riley of SRS provided technical and payload support. The project was



*Photo Credit: NASA / Patrick Black: Community college faculty and students along with the pilots observing the DJI Phantom 3 just before take off.*

also supported in part through the VSGC’s National Science Foundation-funded Geospatial Technician Education (GeoTEd) project in partnership Thomas Nelson, Virginia Tech, and the Virginia Community College System. Student participants were from the following community colleges: Northern Virginia Community College, Rappahannock Community College, Thomas Nelson Community College, Tidewater Community College, and Virginia Western Community College.



*The Virginia Aerospace Science and Technology Scholars (VASTS) program recently received a financial contribution from ASRC Federal. Pictured, L-R; Ian Cawthray, VSGC Education Program Coordinator; Rudo Kashiri, VSGC Education Programs Manager; Jeff Jordan, Senior Director, ASRC Federal and Mary Sandy, VSGC Director.*



*The VSGC Director and Deputy Director participated in visits to Capitol Hill during the National Space Grant Director’s Meeting in Washington, D.C., March 2-5. Pictured here, (L-R): Mary Sandy, VSGC Director, Sophia Gull, former VASTS and Virginia Space Coast Scholar; Congressman Randy Forbes, Elizabeth Weech, former VASTS and Virginia Space Coast Scholar and Chris Carter, VSGC Deputy Director.*



# Exploratory STEM Saturday Series

Automation in a factory is a STEM-related activity? There was no doubt about it at the recent Greater Peninsula Governor’s STEM Academy (GPGSA) STEM Saturday Series, hosted at Thomas Nelson Community College, Canon Virginia, and NASA Langley Research Center. Students quickly learned that STEM does not necessarily involve test tubes or telescopes. In this series, which took place from January through March, pennies and popsicle sticks played some significant roles. Ninety-two students and eighty-eight parents attended each of the Saturday programs.

The Exploratory Saturday Series, which Virginia Space Grant Consortium (VSGC) conducts on behalf of the GPGSA for seventh- and eighth-graders, is a regional series of three Saturday events designed to engage and inspire students to pursue careers in engineering technology, information technology and other STEM (science, technology, engineering, and mathematics) fields. Event programs include STEM-themed hands-on activities, interactive problem-solving, guest speakers from local business and education, and informational sessions for students and parents.

Thomas Nelson Community College hosted the first Saturday event on February 20, 2016. This year’s theme, “Designing the Future,” incorporated information technology activities. Students created their own networks with Pack Tracer and learned cutting edge technology through Mechatronics activities.

The second event, “Connecting the Future,” was hosted by Canon Virginia, Inc. on February 27, 2016. Activities for the students included building circuits, manipulating robot arms, and participating in solar car races. Parents were given a tour of the Canon facilities and listened to Ron Jones, Engineering Manager, Newport News Shipbuilding, speak about “The STEM Concept and Workforce Pipeline.”

The final Saturday series event was held on March 19, 2016, at NASA Langley Research Center, with the theme of “Automating the Future.” The first activity was an engineering design challenge using Bristlebots, tiny directional robots. Students were provided the materials necessary to design, build, and test their own Bristlebots against other student designs in a “Bristlebots King of



*Top: Janet Sellars welcomes a room full of students and parents to the STEM Saturday Series at NASA Langley. Bottom: Student participating in NASA’s STEM Saturday Engineering Bristlebot activity.*

the Hill” activity. Students learn soft-skills such as comprise, communication, listening skills, and learning to work as a team as they built and launched model rockets around 3D-printed fin cans. Student teams competed against one another to see which team could launch the greatest number of pennies to the highest altitude for the least amount of cost. In the words of Nathanael Miller, the program host at NASA this year, “I was blown away by this year’s turn out and coordination.” In the words of one of parents, “My daughter thoroughly enjoyed not only the most recent iteration of the program, but also each of the previously held sessions as well. She later enjoyed re-living the day’s events as she energetically recalled for her brothers the building and testing of her Bristlebot and her multiple rocket launches. It’s inspiring to see so many good kids aspiring to go do great things in the world.” Another parent added, “We especially enjoyed doing the projects together with our son at NASA. I know he thoroughly enjoyed every part of this whole experience and we think this is a fantastic opportunity for these young people to see what they can strive towards for a career in the future.”

GPGSA is one of the original six Virginia Governor’s STEM Academies initiated over six years ago designed to expand options for the general student population to acquire STEM literacy and other critical skills, knowledge and credentials that will prepare them for high-demand, high-wage, and high-skill careers in Virginia. The GPGSA is a partnership among school divisions, postsecondary institutions and business and industry. It offers courses of study in two career pathways: Engineering Technology and Information Technology. These are high-growth and high-compensation occupations within Hampton Roads and the Commonwealth of Virginia.

*Right: Student designed rocket launch for NASA’s STEM Saturday. Below: Students observing rocket launch at NASA’s STEM Saturday event.*



# Scholarships and Fellowships Awarded

For the 2016-17 academic year, the Virginia Space Grant Consortium (VSGC) awarded \$316,200 in fellowships and scholarships to 74 students pursuing higher education at VSGC member universities. The awards include 33 Graduate Fellowships totaling \$198,000 and \$85,200 in Undergraduate Research Scholarships to 12 students. “The review team was very impressed with the quality and intellectual merit of the research projects proposed by the students,” stated Mary Sandy, VSGC Director. VSGC also awarded four Community College Scholarships at \$2,000 each and twenty-five STEM Bridge scholarships at \$1,000 each.

The research awards require that students be engaged in a research project of interest to NASA and with a faculty advisor. Awards are based on evaluation of the applicant’s research proposal and relevance to NASA, academic merit and academic potential. Funding for the awards is provided by the Commonwealth of Virginia and NASA.

VSGC has awarded  
**\$6.6 million**  
in scholarships and fellowships to  
**1,583 students**  
since inception in 1989.

## VSGC New Investigator Program Awards

Five faculty members from VSGC member universities have received the New Investigator Program award of \$10,000 each for the 2016-2017 cycle. The award is matched by the faculty member’s university. The New Investigator Program award is designed to strengthen Virginia’s research infrastructure and to provide start-up funding for new faculty members who have yet to become established researchers. Geared to faculty who are conducting research directly aligned with NASA’s mission, the program targets those who are in the first five years of their academic career. Faculty who submit a proposal must be qualified to serve as the principal investigator at their respective institutions. Proposals are reviewed by a panel of VSGC member university representatives and NASA experts.

Since 2009, a total of \$330,000 has been awarded to 33 faculty members!

Awardees for 2016-2017 are:

**James T. Burns**, University of Virginia, Department of Materials Science and Engineering, *Correlating FIB/TEM and HR-EBSD Representations of the Plasticity Condition in the Near-Crack Tip Region of Structural Materials*

**Jermiah Still**, Old Dominion University, Department of Psychology, *Exploring the Influence of Saliency on Visual Search Within Tablet Interfaces*

**Balsa Terzic**, Old Dominion University, Department of Physics, *Feasibility Study of Remote Sensing by “Compton Sources”*

**Shane Davis**, University of Virginia, Department of Astronomy, *Modeling Emission Spectra from Radiation Magnetohydrodynamic Simulations of Black Hole Accretion*

**Cody H. Fleming**, University of Virginia, Department of Systems and Information Engineering, *Towards a Methodology for Safety-Driven Analysis and Integration of Heterogeneous, Autonomous Decision-Makers in the National Airspace*

# Annual Aerospace Day Activities

VSGC was an active participant in the eleventh annual Aerospace Day at the Virginia General Assembly, February 3-4 and served on the planning team. Aerospace – Virginia’s High-Tech Economic and Jobs Engine was the theme for this year’s event, which highlighted the strength of Virginia’s aerospace sector with representation from NASA Langley Research Center, NASA Wallops Flight Facility, the Mid-Atlantic Regional Spaceport, industry and academia. Students from VSGC’s programs, Virginia Aerospace Science and Technology Scholars (VASTS) and Virginia Space Coast Scholars (VSCS) programs participated in Aerospace Day activities to reinforce the impact these programs have on Virginia’s STEM educational and workforce development efforts.



In addition, VSGC Director Mary Sandy and Deputy Director Chris Carter spent the day meeting with Delegates Mason, Helsel, Anderson, Adams, Loupassi, Dudenhefer and Marshall as well as Senators Alexander, Sturtevant, Black and Hanger.

*Top photo: (left to right) Mary Sandy, VSGC Director, Ivana Daniels, a 2015 Virginia Aerospace Science and Technology Scholar (VASTS), and Delegate Betsy Carr. Bottom photo: (left to right) Chris Carter, VSGC Deputy Director, Shane Seaman, current graduate research fellow at Virginia Tech, and Christopher Lore, legislative assistant, in Virginia Senator Richard Black’s office.*

