

**The National Space Grant Office requires two annual reports, the Annual Performance Data Report (APD – this document) and the Office of Education Performance Measurement System (OEPM) report. The former is primarily narrative and the latter data intensive. Because the reporting timeline cycles are different, data in the two reports may not necessarily agree at the time of report submission. OEPM data are used for official reporting.**

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## **PROGRAM DESCRIPTION**

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The Virginia Space Grant Consortium is a Designated Consortium funded at a level of \$575,000 for fiscal year 2014.

## **PROGRAM GOALS**

**VSGC Goal 1 - Conduct quality scholarship and fellowship programs including a bridge program for freshman and sophomore students, research awards for undergraduate and graduate students, community college STEM scholarships and teacher education STEM scholarships.**

**1.A:** Each academic year, award students in all four categories with scholarships and fellowships. Students will be competitively selected by review panels consisting of representatives from member institutions. Metric: Review panel for each program reports on the process and total number of awards; **1.B:** Award at least the minimum amount required by NASA in scholarship and fellowships to at least 60 students each academic year. Metric: Total amount awarded to total number of students in the five scholarship/fellowship categories; **1.C:** Each academic year, provide a percentage of awards to underrepresented minority and female students that is consistent with the diversity target as established by NASA (currently 24.6%). Metric: Total awards to minority students divided by total awards to all students; **1.D:** At least 90% of students receiving research awards will attend and present at the annual VSGC Student Research

Conference. Metric: Total number of research awardees presenting at conference divided by total number of research awardees; **1.E**: Longitudinally track 100% of all students receiving significant awards to identify their next step in academia or the workforce. Metric: Total number of students longitudinally tracked to next step divided by total awardees; **1.F**: At least 60% of students receiving significant awards will be employed by NASA, an aerospace contractor, higher education or other educational institutions. Metric: Total number of students employed in these categories divided by total number of awards; **1.G**: At least 45% of undergraduate students receiving significant support from VSGC will move on to advanced education in NASA-related disciplines in their next step. Metric: Total number of students in advanced education in these categories divided by total number of awards.

**VSGC Goal 2 - Offer quality higher education programs including internship programs in partnership with our member institutions and partners.**

**2.A**: Each academic year, provide paid internships for at least four students at NASA Centers or with industry partners. Metric: Number of students placed in internships; **2.B**: Conduct at least one annual higher education project in partnership with Virginia's community colleges. Metric: Number of collaborative projects with community colleges or the System office; **2.C**: Each year, conduct at least two higher education projects in partnership with VSGC member institutions. Metric: Number of collaborative projects with members.

**VSGC Goal 3 - Promote diversity in all programs and activities by encouraging participation by underrepresented minority and female students and faculty.**

**3.A**: Each year, conduct at least one outreach event in partnership with Hampton University (HBCU) to promote programs and opportunities to students and faculty. Metric: One Hampton University outreach event; **3.B**: Each year, conduct at least one outreach event in partnership with a non-member minority institution to promote programs and opportunities to students and faculty. Metric: One non-member MSI outreach program; **3.C**: Each academic year, provide a percentage of student awards to underrepresented minority and female students that meets or exceeds the diversity target as established by NASA (currently 24.6% for underrepresented minorities and 40% females). Metric: Total awards to minorities divided by total number of awards; **3.D**: Provide at least one STEM program each year for special needs faculty or students. Metric: Number of programs provided; **3.E**: Undertake at least one collaborative program with a non-member minority serving institution each year. Metric: Number of programs provided.

**VSGC Goal 4 – Undertake programs that foster research capabilities at our member institutions and serve as a catalyst for linking university researchers to NASA and other opportunities.**

**4.A**: Conduct a New Investigator award program each year targeting tenure track faculty who are within the first five years of their academic career. At least five awards will be given annually and the research will have NASA relevance. Metric: Number of awards provided; **4.B**: Disseminate at least 20 research opportunity announcements to statewide networks each year. Metric: Number of announcements disseminated; **4.C**: Facilitate at least five meetings with university researchers and NASA personnel, as appropriate,

resulting in at least two collaborative proposals being submitted. Metric: Number of proposals submitted;. **4.D**: Support at least two experiential student research, mission and design programs each year. Metric: Number of programs supported.

**Goal 5 – Provide quality precollege educational opportunities including professional development for precollege and pre-service educators and student-focused programs for students throughout the precollege pipeline.**

**5.A**: VSGC will provide professional development in STEM and using NASA resources to at least 40 teachers each year. Metric: Total number of teachers participating in professional development activities; **5.B**: VSGC will reach over 100 students by conducting selected student-focused programs and activities promoting participation in STEM and related careers. Metric: Total number of precollege students participating in student-focused programs; **5.C**: At least 75% of precollege educators participating in more than two days of professional development will use NASA resources in their classroom following the workshop. Metric: Total number of educators indicating they will use NASA resources in the classroom on a post-event survey divided by total respondents to survey; **5.D**: At least 60% of precollege educators receiving NASA resources or participating in VSGC-led short duration activities will use NASA resources in their classroom. Metric: Total number of educators indicating they will use NASA resources in the classroom on a post-event survey divided by total respondents to survey; **5.E**: At least 50% of all precollege students participating in VSGC-sponsored programs will express an interest in STEM careers. Metric: Total number of students indicating they have an interest in a STEM career on a post-event survey divided by total respondents to survey.

**Goal 6 - Conduct Informal Science Education programs in partnership with informal education members and partners.**

**6.A**: Sponsor at least one program each year with the Virginia Air and Space Center or the Science Museum of Virginia. VSGC will consider other appropriate informal science education opportunities as funding and partnerships permit with the goal of providing at least one other activity per year if funding and resources permit.

**Goal 7 - Serve as an effective steward of Consortium resources and a strong partner for STEM programs.**

**7.A**: Effectively leverage NASA Space Grant resources. Metric: NASA Space Grant funding will be leveraged by at least three dollars to one NASA Space Grant Dollar as evidenced in Consortium year-end Matching/Contributed Funding Report; **7.B**: Network with other Space Grants and Space Grant organizations. Metric: Evidence of networking and program partnerships; **7.C**: Network with NASA Headquarters and NASA Centers for program implementation. Metric: Evidence of networking and program partnerships; **7.D**: Build and sustain effective strategic partnerships, including relationships with state and federal legislators and officials. Metric: Evidence of state and federal support for VSGC programs and documented attendance by these individuals at select activities and events; **7.E**: Number of program partners working with VSGC each year. Metric: At least 30 non-member partners per year.

**PROGRAM/PROJECT BENEFIT TO OUTCOME (1,2, and 3)**

**Outcome 1, 2, and 3: VSGC received three significant awards recognizing outstanding accomplishments:** VSGC's Virginia Space Coast Scholars Program (VSCS) in partnership with NASA Wallops Flight Facility and VSGC's Engineering Technology Exploratory Saturday Series received Programs That Work Awards from the Virginia Mathematics and Science Coalition in January. This award recognizes innovative, exemplary work in effective education of students or teachers in STEM concepts. Programs that receive this award must display effective innovation and document both the concepts taught and the impacts of the program on the learning of STEM concepts by participants. The Exploratory Saturday program is a partnership between the Greater Peninsula Governor's STEM Academy, VSGC, and local businesses. VSGC won two of the eleven awards given this year. VSGC also received the 2015 GeoTech Center's Distinguished Geospatial Education Partner Award from the National Geospatial Technology Center of Excellence for accomplishments in education and workforce development in the field of geospatial technology. VSGC currently manages the Geospatial Technician Education Through Virginia's Community Colleges (GeoTEd) project.

**Outcome 2: CSIIP Webcasts Being Used by Prominent Afterschool Program:** As a component of the VSGC's Commonwealth STEM Industry Internship Program (CSIIP), VSGC in partnership with the Institute for Advanced Learning and Research (IALR) has produced webcasts, available online to students and the general public. These webcasts cover STEM-related topics as well as topics relative to moving successfully into the workforce. The CSIIP webcasts have also been selected by the Wendell Scott Foundation as the basis for session themes used in their Steer into STEM after-school program. This program is offered to students participating in the Wendell Scott Foundation Legacy Leaders Mentoring Program and students from local high schools in the rural area of Danville, VA. Students are provided with STEM exploration activities. Each session theme is based on a different CSIIP webcast series and is followed up with an activity, field trip, or guest speaker that relates back to the webcast.

**Outcome 2: Demonstrating Excellence in Developing the STEM Pipeline:** The 2015 initial external evaluation report for the Virginia Aerospace Science and Technology Scholars (VASTS) program, which is offered statewide for high school juniors, provides exciting data demonstrating that the precollege pipeline of programs offered by VSGC is having a significant impact on students' interests in STEM. Students were asked to specify their interest level in STEM fields (including aerospace science/technology) after participating in the 2015 VASTS online course. The data show that student interest in learning more about aerospace/ science/technology fields increased for 87.5% of the students after participation. Positive changes of interest were also reported by the students for each of the STEM topics with interest in learning more about engineering increasing for 81.4% of the students, science for 76.5% of the students, technology for 71.2% of the students, and mathematics for 47.4% of the students. This self-reported data indicates a substantive increase of student interest in each STEM field during 2015 as compared with 2013 and 2014 post course feedback.

VSGC also offers the Virginia Space Coast Scholars Program statewide to high school students in their sophomore year. The VASTS evaluation data also shows that a

significantly larger percentage of students who participated in the 2014 VSCS program indicated that the 2015 VASTS online course had a positive impact on their interest in learning more about each of the STEM-related topics than those who didn't participate in VSCS. This same survey indicated that VSCS participants who also participated in VASTS rated their interest in pursuing STEM careers significantly higher than students who did not participate in the Virginia Space Coast Scholars program. Longitudinal survey data indicate that 95% of respondents are either majoring in a STEM field or are employed in a STEM field.

## **PROGRAM ACCOMPLISHMENTS**

VSGC actively works with its members and many external partners to accomplish Consortium goals. NASA's funding investment is heavily leveraged by non-Space Grant funding from federal and state agencies and other nongovernmental sources. This funding enhanced the VSGC's ability to staff and run a wide range of programs in concert with NASA goals.

### **Outcome 1:**

#### **Scholarship/Fellowship/Internships (VSGC Goals 1-3)**

VSGC met all goals and objectives in Goal 1 for conducting the scholarship/fellowship program. For the 2015-16 academic year, VSGC competitively awarded 78 scholarships and fellowships through four different programs to students attending member institutions. VSGC awarded \$312,650 in scholarships and fellowships from NASA Space Grant funds, Consortium funds, and State matching funds (\$170,000) to students attending Virginia universities. The VSGC exceeded the diversity target by awarding 37.1% of all direct awards to minorities and 51.4% to female students. All students awarded are in the longitudinal tracking system and will be tracked to their next step.

A total of \$201,200 went to 34 students for Graduate Research Fellowships; matching funds of \$687,232 to support graduate research awards were also provided by member institutions. In addition, \$76,450 went to 13 students for Undergraduate Research Scholarships. A total of \$27,000 was awarded to 27 sophomore and junior students majoring in STEM through the Undergraduate STEM Bridge scholarship program. A total of \$8,000 was awarded to four community college students majoring in STEM.

During FY14, VSGC held its annual Student Research Conference at which research awardees presented their research. In April 2015, NASA Langley Research Center hosted the conference and Virginia Tech sponsored the luncheon in honor of the awardees. VSGC met the student attendance goal as 92% of research awardees attended and presented their research. Graduate Fellows presented 15-minute oral presentations while Undergraduate Scholars presented posters. The event was also attended by faculty and NASA personnel, industry representatives, and state legislators. Attending and presenting at the Research Conference is a requirement of all awardees receiving research scholarships and fellowships. The Luncheon is held in honor of all awardees and is by invitation only. VSGC invites faculty mentors, selected NASA personnel, and state and

federal legislators among other contacts. Dr. David Bowles, Acting Director of NASA Langley Research Center, served as the keynote speaker.

VSGC also provided Space Grant and Consortium funding to support 4 student internships in FY14.

- \* Two student internships (one spring, one summer) at NASA Langley through the NASA Internship, Fellowship, and Scholarship (NIFS) program.

- \* Two student internships at NASA Goddard Space Flight Center through NIFS.

#### Higher Education (VSGC Goal 2)

All objectives within VSGC's Higher Education Goal 2 were met. VSGC collaborated with several member institutions for higher education projects as described below.

The Commonwealth STEM Industry Internship Program (CSIIP) continues to address the increasing demand for skilled STEM workers in Virginia, by linking undergraduate STEM students to paid internship positions with companies throughout Virginia. CSIIP operates with support from the Commonwealth of Virginia, VSGC, in partnership with Virginia Regional Technology Councils, and in collaboration with Virginia companies, Virginia colleges, and community colleges. CSIIP was launched to place undergrad STEM majors in paid summer internship positions; however, it has been expanded to a year-round program, available to full-time and part-time students, as well as recent graduates. CSIIP works with every community college and every university in Virginia.

A total of 165 companies have registered with CSIIP and posted 476 internships into the online system. More than 1,800 student applicants were pre-screened and ready for internship placement. During FY14, 56 students were placed at 20 different companies, while others are still interviewing candidates and making internship placements. Companies make the selections and employ the interns.

VSGC provided \$6,900 in funding to support a team of Virginia Tech students to participate in the Midwest High-Power Rocketry Competition coordinated by the Minnesota Space Grant Consortium. The student-led team is named INVENTS and includes faculty mentorship and advisement. The VSGC funds are being used to support the purchase of parts for the construction of an I-Motor High Powered Rocket with a boosted dart payload and for team travel to the competition in North Branch, Minnesota. A total of 14 students and four faculty are participating.

VSGC manages the Graduate Research Awards for The Airport Cooperative Research Program (ACRP), a program of the National Academies' Transportation Research Board, offers a national competition for universities that engages students in addressing issues VSGC provided \$20,000 of support for two Virginia students who were selected for the ACRP Graduate Research Awards.

VSGC is a partner in Old Dominion University's (ODU) Engineering Early Advantage Program for Women (EEAPW). EEAPW is a four-week paid summer headstart program for female freshman engineering majors at ODU. The event includes academic and career enhancing activities in a unique engineering setting. Many activities are based at the

Virginia Modeling, Analysis and Simulation Center (VMASC). VSGC provides the student stipend for the 15 female participants.

The VSGC is coordinating and sponsoring a small satellite project (3U) with two member institutions and several institutions including the French Space Agency located in France. VSGC has the administrative lead and ODU and UVA are also participating. The following French institutions are participating: Université Paris-Est Créteil (UPEC); Observatoire de Paris-Meudon (OBSPM); Centre National de la Recherche Scientifique – Institut National des Sciences de L’Univers (CRNS-INSU); Center National d’ Études Spatiales (CNES), Paris.

The project is part of the QB-50 program and demonstrates a new Cavity Ring Down spectrometer that studies material degradation from UV exposure and gas trace analysis of the low earth orbit environment. The State Department has assisted with providing a technical assistance agreement. It is anticipated that the project will launch in Late 2016 or in 2017. Virginia Tech and Old Dominion University will provide ground tracking for the satellite. A technical exchange visit was held in August 2015.

VSGC Director coordinates and leads a statewide small satellite working group to encourage and facilitate partnerships to grow student-led projects. Members of the group include representatives from higher education and NASA partners.

VSGC, in partnership with Colorado Space Grant Consortium, offered a RockOn! workshop in June 2015. RockOn! is a workshop for faculty and students in which participant teams learn to build a small sounding rocket payload from kits and launch it on a sounding rocket at NASA Wallops Flight Facility. VSGC provided \$10,000 to support one student-led team from ODU to participate in the RockSat-C program. VSGC is supporting the half-canister cost, student lodging, and travel expenses.

VSGC provided \$2,000 to support eight ODU undergraduate student members of the Students for the Exploration and Development in Space (SEDS) organization to participate in a rocketry project and competition. The funding helped with rocket building expenses.

#### Research Infrastructure (VSGC Goal 4)

The New Investigator Program (NIP) is designed to strengthen Virginia’s research infrastructure by providing startup funding to Virginia Space Grant university personnel who are conducting research that is directly aligned with NASA’s mission. This opportunity is made available to those who have yet to become established researchers. Five faculty members from VSGC-member institutions received an award of \$10,000 each for their research project. Program guidelines stipulate awardees must be tenure track faculty who are within the first five years of their academic careers, and they must be U.S. Citizens. Faculty may propose research within the full range of NASA missions and activities. Proposals were reviewed by a panel comprised of VSGC Advisory Council members representing the various universities and NASA personnel. The following NIP projects were funded for FY14:

- \* Dr. Joshua J. Choi; Solar Aviation with High-Performance, Low-weight and Flexible Perovskite Solar Cells
- \* Dr. Daniel Foster (ODU); Process Monitoring of Ultrasonic Additive Manufacturing
- \* Dr. Luke Juran; Development and Application of a Multiscalar Water Security Index
- \* Dr. Otilia Popescu (ODU); Software Defined Radios for Small Satellite Communications
- \* Dr. Bhuvana Srinivasan; Theoretical and Numerical Studies of Plasma Separation from Magnetic Nozzles

VSGC disseminated more than 20 research opportunity announcements to statewide networks and member institutions. Opportunities offered by NASA, NSF, NOAA, and other funding sources were disseminated. The VSGC Director coordinates and leads a statewide small satellite working group to encourage and facilitate partnerships to grow student-led projects. Members of the group include representatives from member higher education institutions, NASA Langley Research Center, and NASA Wallops Flight Facility. These meetings have generated ideas and partnerships for future proposals. Other meetings with faculty researchers and NASA personnel were conducted. The Director also serves on the planning committee for NASA Langley Mid-Atlantic Community Small Sat Working Group which engages many NASA, university and industry partners. A total of eleven collaborative proposals with member and non-member intuitions were submitted with seven being funded.

The Mitigation and Adaptation Research Institute (MARI) at ODU engages in research that produces the practice-relevant knowledge needed to cope with the impacts of climate change and sea level rise on the coastal zone and the urban coast in particular. MARI is initiating a state-wide assessment in Virginia of current knowledge on mitigation and adaptation with a focus on the practice-relevant knowledge societal stakeholders in Virginia need to ensure the livelihood of communities under the expected changes in climate and sea level. This assessment will be based on contributions of all relevant academic institutions in Virginia. The assessment process will be led by a team of three to five editors. The assessment will be carried out by chapter author teams, who will prepare draft chapters based on published literature. Contributing authors can provide input to the chapter author teams.

In FY14, VSGC provided \$8,000 of support to assist MARI in organizing an initial kick-off meeting, in which the chapter authors work out the general rules for the compilation of the chapter drafts and on the contents of the individual chapters. MARI will also conduct a midterm meeting that will provide the opportunity to review the state of work and address all contentious issues. In a proposed final meeting, the draft report will be presented and discussed. After this, the complete draft will be made available for review by the academic community in Virginia. Input resulting from this reviewing phase will be taken into account in the compilation of the final report.

VSGC continued to support a collaboration between Virginia Tech and NASA's Johnson Space Center (JSC). The collaboration involved student projects in the area of intelligent textiles and wearable technologies for space flight. Twelve students in two classes worked on four different projects for JSC. The projects included: a garment for test

chamber rescue technicians, a wearable haptic navigation system, a long duration mission astronaut clothing storage and odor absorption system, and a modified cargo transfer bag personal space pod. The students and their two faculty advisors attended the Wearable Technology Symposium on April 20 at JSC. Each team gave a short presentation followed by a poster session with the NASA mentors. They also visited the old mission control center from the Apollo era as part of the JSC tour. The teams continued working on the projects after receiving feedback from the mentors.

## **Outcome 2:**

### Higher Education (VSGC Goal 7)

As indicated by the number and diversity of project activities in the VSGC program portfolio for FY14, the VSGC was a strong partner for STEM programs statewide and throughout the nation. VSGC effectively implemented and leveraged NASA space grant funding exceeding the goal of a match ratio of 3 to 1. NASA space grant funding was leveraged by a ratio of 4.10 to 1 for non-federal match, both cash and in-kind. NASA space grant funding was leveraged by a ratio of 6.85 to 1 for all funding sources.

VSGC hosted the 2014 Mid-Atlantic Space Grant Director's meeting on September 22-24, 2014. The event was held in Colonial Williamsburg at the Woodlands Hotel and Suites. Representatives from seven mid-Atlantic space grant consortia and six other space grant consortia attended. NASA Space Grant Program Manager, Lenell Allen also attended the meeting. Several representatives from NASA Langley, plus personnel from NASA Wallops Flight Facility, and the Mid-Atlantic Regional Space Port also presented. All meeting presentations were posted on the National Space Grant Director website. The meeting included a tour of NASA Langley including several presentations on current research being conducted at Langley. A total of 77 people attended.

The VSGC Director and staff participate in activities such as Aerospace Day at the General Assembly, the Virginia Science Education Leadership Association, Virginia Society for Technology in Education, and the Virginia Association of Science Teachers. State cabinet officials and state legislators have participated in VSGC programs such as the Student Research Conference, the Commonwealth STEM Industry Internship Program, and the Virginia Aerospace Science and Technology Scholars (VASTS) program. Nearly all state legislators have been active in recognizing VASTS Scholars and Virginia Space Coast Scholars from their districts. Members of Virginia's Congressional delegation have done letters of congratulation to VASTS Scholars and Virginia Space Coast Scholars.

The Director and staff annually brief Virginia Congressional and state legislators. VSGC works with state officials and legislators to assist with STEM and aerospace policy advocacy. The Director serves on the Governor's Aerospace Advisory Council and on the General Assembly's Joint Commission on Science and Technology Nanosatellites Advisory Committee. The Director is also a member of, and co-facilitates with the NASA Langley Research Center Director, the Informal Aerospace Working Group of about a dozen aerospace sector leaders in Virginia including the NASA Wallops Flight Facility Director, the Directors of the Mid-Atlantic Regional Spaceport, National Institute of Aerospace, and the Virginia Department of Aviation as well as industry representation.

The goal of the group is collaboration for STEM education and workforce development as well as aerospace advocacy for the Commonwealth including extensive planning for the Commonwealth's annual Aerospace Day and supporting events. VSGC contributes to the aerospace sector messages for the meetings with state policy makers for this event. VSGC is a member of the recently formed Virginia Aerospace Business Association.

#### Precollege Programs (VSGC Goal 5)

Through several programs and sponsorship of a statewide conference, VSGC provided professional development to more than 250 teachers to assist them in becoming better STEM educators and effectively using NASA resources in the classroom. Sponsorship of a statewide conference for science teachers impacted an estimated 600 additional teachers.

VSGC coordinated and hosted a 21st Century Community Learning Center (21CCLC) workshop for 17 teachers and administrators. VSGC Education Program Manager, Rudo Kashiri led the workshop instruction and facilitated the event. VSGC partnered with VDOE to recruit participants from current 21CCLC schools. As the program lead for 21CCLC, NASA Glenn Research Center representatives attended and assisted with workshop coordination. The STEM challenges are based upon real mission data and experiences that occur during human and robotic exploration of the solar system. NASA STEM Challenges included: Spaced Out Sports; Parachuting Onto Mars, and; NASA Exploration Design.

VSGC has an established partnership with the Center for Excellence in Education (CEE) located in McLean, Virginia. In late spring, Deputy Director, Chris Carter attended a legislative reception hosted by CEE and VSGC is currently planning a new teacher professional development event for late 2015. These new Teacher Roundtables events will bring together representatives from industry, academia, and non-profit organizations to talk about STEM careers and programs for teachers and students.

VSGC supported the annual professional development conference hosted by the Virginia Association of Science Teachers (VAST) in fall 2014. This conference is attended by over 600 science teachers and administrators from Virginia. VSGC's support was used to bring renowned speaker, Dr. Carol Tomlinson of UVA to serve as breakfast keynote at the conference. VSGC also exhibited and presented Space Grant programs during a breakout session.

VSGC supported 30 middle and high school teachers from rural southwest Virginia to visit NASA Langley Research Center and the Virginia Air and Space Center (VASC) in June 2015. These teachers were visiting eastern Virginia as part of their Learn Across Virginia project supported with funding from their school divisions. The teachers also visited Consortium members, Virginia Tech and the University of Virginia, as they traveled east. Following their visit to Langley, the teachers also visited Consortium member NASA Wallops Flight Facility. VSGC helped secure the tour with NASA Langley and also provided \$595 to support the teachers visit to the VASC and to view an IMAX film.

VSGC sponsored one teacher from Virginia for a 6-day professional development institute hosted by the Texas Space Grant Consortium. The LIftoff! workshop emphasizes STEM learning experiences through speakers, hands-on activities and field investigations that promote space science and enrichment activities for themselves and others. Program Features include: presentations by NASA scientists and engineers; tours of NASA and Space Center Houston; hands-on, inquiry-based classroom activities aligned to educational standards; and, career exploration.

VSGC partnered with a former professional figure skater who is now a figure skater instructor with a passion for teacher professional development to coordinate and sponsor a workshop for elementary school in-service teachers. The Space Sports in STEM workshop focused on sports as a theme and a context for teaching STEM subjects in grades 3-5. VSGC Education Specialist coordinated the workshop and advised on content and facilitated and evaluated the workshop. Janet Sellars, Head of Office of Education at NASA Langley, provided an overview of NASA education programs for the teachers. A total of 60 teachers participated in the half-day workshop offered twice on the same day.

VSGC is participating in the startup and development of the Virginia STEM Learning Network. The Network is a grass-roots effort to leverage educators, business, and industry to serve as advocates for STEM education and learning statewide. The Network is organized around eight regional hubs of which VSGC is the hub leader for the Hampton Roads Region. As a hub leader, VSGC is responsible for creating a working committee made of various stakeholders that will establish clear goals, purposes, accountability and responsibilities for the success of the hub. VSGC will also meet with the regional executive committee regularly to identify needs and priorities for the region and the state. Some of the functions of hub leaders in the Network include: provide guidance regarding professional development resources related to STEM education; provide professional development opportunities based on the needs of the region and school; and, work with partner hubs to document through action research effective STEM practices. Other goals include helping with procuring grants and relevant to STEM education and serving as a liaison with state and federal governments for STEM education policy. To date, VSGC has attended one statewide meeting, hosted one statewide meeting, and planning to host the first regional hub meeting in summer 2015.

The VSGC reached over 1,000 precollege students through several student-focused programs. The Virginia Aerospace Science and Technology Scholars (VASTS) program is an interactive online STEM learning experience, highlighted by a seven-day residential summer academy at NASA Langley Research Center. High school juniors selected to participate in the program are immersed in NASA-related research through interaction with scientists, engineers and technologists. Top performing students in the online course are selected to attend one of three residential summer academies hosted by Langley. A total of 551 students participated in the online course and 180 attended the summer academies. The program is a partnership between the VSGC and NASA Langley with assistance from the Virginia Department of Education and industry. VASTS is modeled after the NASA-award winning Texas Aerospace Scholars program developed by NASA Johnson Space Center.

VSGC coordinated three engineering technology-themed STEM Exploratory Saturday programs for middle school grade students and parents through the Greater Peninsula Governor's STEM Academy (GPGSA) in partnership with Thomas Nelson Community College (TNCC), NASA Langley Research Center, and Canon Virginia. All three hosted a Saturday event while TNCC help provide a college campus experience for the students. Huntington Ingalls-Newport News Shipbuilding was also a partner and provided instruction for several student sessions. In FY14, VSGC added content and subject matter experts in the field of information technology to greatly enhance the program and better motivate and prepare students for careers in IT along with engineering technology. A total of 238 students and 214 parents attended the four Saturday series.

Building on the excitement around scientific exploration missions launched from NASA Wallops Flight Facility and the Mid Atlantic Regional Spaceport, and with funding from the Commonwealth of Virginia through VSGC-member Old Dominion University, the VSGC established the Virginia Space Coast Scholars (VSCS) program. VSCS is designed to inspire high school sophomores that possess latent science and technical skills to participate in a dynamic online STEM learning experience. VSCS is an informal online learning experience highlighted by a seven-day residential summer academy at NASA Wallops Flight Facility for qualifying students. With a focus on scientific exploration, students are introduced to STEM concepts that are integral to earth and space-based missions launched or conducted from the Virginia Space Coast on the Eastern Shore. Students are introduced to the connection between science and technology and how science drives the engineering and technology designs and decisions for flying payloads on high altitude research balloons, sounding rockets, unmanned aerial systems, aircraft, or medium-class rockets, and STEM careers associated with NASA missions. In FY14, 315 students participated in the online modules and 80 students attended two Academies.

VSGC received funding from the Commonwealth of Virginia through the University of Virginia, a member institution, for Building Leaders for Advancing Science and Technology (BLAST). BLAST is an on-campus, summer STEM experience for rising 9-10 grade high school students. Offered free, BLAST brings STEM alive through a series of innovative experiences led by university faculty and students at the University of Virginia and Virginia Tech. Demonstrations and activities showcase exciting science and engineering topics with the goal of increasing student curiosity and engagement in STEM. In FY14, 240 (122 middle school and 118 high school) students participated in three BLAST sessions.

VSGC provided \$1000 in funding to support the St. Thomas More Cathedral School (STM) in Arlington, Virginia to participate in a CubeSat mission. The STM CubeSat mission objectives include: be the first grade school in the world to place a small spacecraft into low Earth orbit; provide data that expands the scientific understanding of the Earth and the universe; and, inspire the next generation of explorers to pursue a career in the fields of engineering and science Curriculum. The project provided hands-on learning that centered around real world application of math and science including data

driven learning and research. More than 400 elementary students and 30 teachers have participated in the project. The STM CubeSat is set to launch on Orb4 in late 2015.

At least 90% of teachers in all VSGC professional development workshops indicated intent to use the materials received and NASA resources in post workshop surveys. VSGC will continue to survey all teachers during the academic year to measure actual use of materials. Precollege students participating in VSGC programs completed post event surveys to evaluate their experience, and to rate their interest level in STEM courses, majors, and careers. When considering student-self reported data indicating a positive interest in STEM, with at least an interest in any one individual STEM field, 100% of precollege participants expressed an interest in STEM.

### **Outcome 3:**

#### Informal Education Programs (VSGC Goal 6)

The Virginia Space Grant Consortium sponsored the Virginia Air and Space Center (VASC) to offer the Solarium exhibit and educational program. The “Solarium: Harvesting Our Solar Power” program is a VASC project that aims to directly inspire over 1,800 at risk and underrepresented 1st, 3rd, and 5th grade students across Hampton Roads to embrace solar power by exploring the Sun’s features with interactive and hands-on learning programming to stimulate learning about the source of the energy that sustains life on Earth. This program directly supports environmental education and the exploration of energy by utilizing the Sun to teach students in creative ways about renewable energy resources while stressing the importance of utilizing the Sun as an energy source. The project is broken up into two tiers: (1) An educational experience at the VASC with the Solarium; (2) An educational outreach program, titled: Harvesting Our Solar Power, at the schools. Both tiers of the program will equally and uniquely expose the students to the power of the Sun while infusing the appropriate Virginia Standards of Learning and promoting sustainable energy usage.

## PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

- **Diversity:** The VSGC exceeded the diversity target by awarding 37.1% of all direct awards to minorities and 51.4% to female students.

- **Minority-Serving Institution Collaborations:**

VSGC partnered with Hampton University (HBCU) on a successful grant proposal to NASA’s MIRO program. The project titled, Virginia Earth System Science through NASA will allow the VSGC to offer an online course to dual-enrolled high school juniors and community college students statewide. Grant funding allows VSGC to develop and offer the course over a five-year period. VSGC is currently developing the online course and the first course offering will be in spring 2016.

Hampton University has one student participating in the inSTEP program in January 2014. Hampton University, Norfolk State University, and Virginia State University

continue to be partners in the inSTEP program and each have students participating in the pre-service teacher program.

VSGC submitted two proposals in partnerships with Virginia State University that were not funded. One proposal targeted the development of networking technologies for CubeSats and SmallSats. A second proposal was related to big data processing.

- **NASA Education Priorities:**

- VSGC scholarship/fellowship and higher education programs align with all of NASA's educational priorities including authentic, hands-on student experiences in science and engineering disciplines rooted in NASA-related issues, and the incorporation of real-life problem-solving and needs as context for activities. Several student research projects through the scholarship/fellowship program focused on NASA research priorities such as traditional aeronautics disciplines and climate change. Supported projects reflect diversity in institutions, faculty and student participants. Existing partnerships with community colleges are strengthened through projects such as the STEM Saturdays and other outreach to community colleges.
- VSGC partners with Thomas Nelson Community College (TNCC) to offer credit for the VASTS online course and the VASTS Summer Academy. TNCC also hosted one of the Greater Peninsula Governor's STEM Academy (GPGSA) Engineering Technology Exploratory Saturday events. VSGC collaborated with the Virginia Community College System and three community colleges on an NSF-funded project to support geospatial technology pathways. Through this NSF funding, VSGC partnered with NASA Langley to host a service learning project where community college students conducted a tree mapping and assessment project.
- In support of a NASA Space Grant area of emphasis, VSGC provided the New Investigator Program to strengthen Virginia's research infrastructure by providing startup funding to early career faculty from member institutions conducting research that is directly aligned with NASA's mission.
- VSGC's suite of precollege programs includes projects targeting both students and teachers and aligns with NASA's areas of emphasis. Several projects engage middle school students in hands-on activities and exposure to NASA scientific and technical expertise. Follow-up surveys were conducted of all participating teachers. One Space Grant-funded project provided Saturday programs for high school students on a college campus with the objective of increased enrollment in STEM disciplines and interest in STEM careers.

## **IMPROVEMENTS MADE IN THE PAST YEAR**

FY14 was an excellent year for VSGC externally-funded programs with seven proposals awarded out of fifteen submitted with four proposals still pending and four proposal declined. Total amount awarded to VSGC was \$2.02 million. Participation in VSGC

programs by state legislators and members of the Governor's Cabinet continues to grow. VSGC is seen as a state leader for STEM educational programs by state educational agencies, the Governor's office, and the Virginia General Assembly. VSGC added one full-time STEM Education Specialist to the VSGC staff.

## PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

VSGC members and partners play active roles in project development and implementation. In some cases, VSGC provides funding directly to member institutions for projects and the member institution has the lead. In other projects, VSGC staff may take the lead for project coordination working closely with partners for project execution. For competitive opportunities, the VSGC uses a panel of member and sometimes external representatives to make selections of which students or faculty to fund.

**VSGC Affiliate Members include:** College of William and Mary (higher education), Hampton University (higher education), Old Dominion University (higher education), University of Virginia (higher education), Virginia Polytechnic Institute and State University (higher education), NASA Langley Research Center (NASA Center), NASA Goddard Space Flight Center's Wallops Flight Facility (NASA Facility), Science Museum of Virginia (informal education), State Council of High Education for Virginia (state agency for higher education), Virginia Community College System (higher education), Virginia Department of Education (state agency for precollege education), MathScience Innovation Center (informal education), Virginia Air and Space Center (informal education), and Virginia's Center for Innovative Technology (statewide nonprofit that creates technology-based economic development strategies to accelerate innovation and the next generation of technology and technology companies).