

West Virginia Space Grant Consortium
West Virginia University
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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 West Virginia Space Grant Consortium is a Designated Consortium funded at a level of \$575,000 for fiscal year 2012.

PROGRAM GOALS

Our overarching goal is to extend the benefits of NASA's research and education to all citizens of West Virginia and to promote and support STEM education in the state. Specifically, the goals that were outlined in our five-year plan are:

- (1) To contribute to, and advance NASA's vision and strategies as outlined in various NASA and other documents (such as the Strategy for American Innovation, and the Federal Science, Technology, Engineering, and Mathematics (STEM) Education Portfolio report), specifically in terms of workforce development.
- (2) To contribute to the state of West Virginia's efforts in research infrastructure development, particularly in the high-technology sector, and improving the quality of science and math in K-12 education and teacher preparedness.
- (3) To increase the participation of under-represented groups in our programs for students and faculty.

SMART Goals for Higher Education Programs

Goals: The goal of WVSGC's Higher Education Program is to enhance higher education capabilities in STEM in West Virginia. WVSGC is in a unique position to initiate and support innovative programs that enable WV students to engage in hands-on experiences

that will better prepare them for careers at NASA, its contractors, and other high-technology companies in the US.

SMART objectives:

- To initiate and support programs such as the Balloon Satellite Project, Microgravity Research Program and to participate in programs such as RockOn that have been made available through other Consortia;
- To insure sustainability by securing at least 1:1 cost share from participating affiliates for the above higher education programs; and
- To provide partial support to special projects of student organizations such as AIAA, SWE, NSBE, Astronomy Club, and Student Partnership for the Advancement of Cosmic Exploration (S.P.A.C.E.).

Goals and SMART Objectives for Fellowship/Scholarship Programs

Goal: To contribute to, and advance NASA's vision and strategies as outlined in various NASA documents, specifically in terms of workforce development.

SMART objectives:

- To maintain the minimum number of Space Grant fellowships/scholarships at 120 per year.
- To place at least ten summer interns at NASA field centers (including the Academies) and high tech companies in West Virginia; and
- To increase the number of students who benefit from our Fellowship/Scholarship and summer internship programs by 5% per year in the next five years (assuming the availability of at least the same level of funding).

Goals and SMART Objectives for Research Infrastructure Programs

Goal: To contribute to NASA's and the state of West Virginia's efforts at research infrastructure development (particularly in the high-technology sector).

SMART objectives:

- To support new faculty members at our academic affiliates through seed grants and assistance in building collaborative efforts with a NASA scientist. We will make at least 20 seed grant awards per year.
- To support at least at least two new STEM courses per year at undergraduate and graduate levels at WVSGC academic affiliates; and
- To help and support all faculty members at our academic affiliates to initiate collaborative research with the high tech sector in West Virginia. We will support at least two such projects per year.

Our goals and SMART objectives for Outcome 2 are listed below.

Goal: The goal of WVSGC is to support the development of innovative STEM related courses/activities and participation in professional development opportunities at the pre-college level.

SMART objectives:

- To support programs that enhance the use of NASA-developed training programs at the secondary education level for teachers in WV. We will fund at least two such projects that would support STEM teachers to attend professional development opportunities (at least 10 teachers per year); and
- To support in-service and pre-service teachers to implement programs that would stimulate the interest of pre-college students in STEM areas. We would like to support at least two teachers (or teams of teachers) to implement such programs to cover a minimum of 50 students per year.

Our goals and SMART objectives for Outcome 3 are shown below.

Goal: The goal of WVSGC is to support the development of new and innovative extension and outreach programs such as conferences that promote the understanding, education, development, and utilization of space; seminars that encourage interdisciplinary training and informal education activities for the general public in West Virginia.

SMART objectives:

- To support and fund at least two projects in public extension and outreach per year;
- To be proactive in conducting collaborative public extension programs with our partners and various entities in the state; and

To reach as many members of the public in West Virginia as possible and enhance their understanding of the importance of STEM education, as well as the positive role NASA plays in high-tech workforce development. We aim to outreach to at least 1,000 members of the public in West Virginia.

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

Outcome 1: (*Employ and Educate*)

In 2012 WVSGC provided numerous opportunities for students at its academic affiliates as well as the opportunity to participate in summer internships at NASA centers and high tech companies in West Virginia. Overall 20 students (6 female, 14 male; 1 Hispanic, 4 African American, and 15 Caucasian) interned at various NASA centers or high tech companies in the summer of 2012. They represented eleven academic departments and four institutions of higher education in West Virginia.

- Percentage of students who have taken their next step and have been successfully tracked through their next step vs. last year of SG support.
 - 33% for 2006
 - 57% for 2007
 - 79% for 2008
 - 96% for 2009
 - 92% for 2010
 - 100% for 2011
 - n/a for 2012 – all participants still enrolled
 - 60% for 2006-2012
- 83% of students significantly supported by WVSGC went onto next steps in STEM disciplines

As previously defined in our SMART objectives for Higher Education programs, we continued to provide partial support to special projects of student organizations. As an example of the usefulness of such support, Amanda Thorp, President of the Society of Women Engineers (SWE) at West Virginia University, wrote: “I just wanted to let you know that the support we received from WVSGC helped with our trip to Houston (National SWE Meeting). I know all the girls had a wonderful time...the informational sessions and networking opportunities were unparalleled. Also, on a more personal note, because of my attendance at the massive career fair in Houston, I was offered a job (which I accepted) at BP for Health and Safety/Process Engineering. Considering this is an unbelievable opportunity (and my dream job), I cannot personally thank WVSGC enough.”

The following comments of note were recently submitted to the National Space Grant Foundation (NSGF) as part of its longitudinal tracking program. The comments are from students who were supported during FY12.

Question: How did participation in these programs impact your education and life?

Participation in the Space Grant program opened up doors to opportunities in undergraduate research I otherwise would not have had. I was able to work throughout the summer in a research lab and become even more involved in projects with graduate students and faculty. I was even able to present at the WV Undergraduate Research Day at the Capitol with the project that I worked on through the Space Grant. Having this opportunity to be a part of undergraduate research has greatly enhanced my education already, with the hands on knowledge unavailable in a lecture hall setting and has allowed me to develop and sharpen my critical thinking skills in a way that only open ended research can. (Erin Fankhanel - on 03/11/13, 2012 Undergraduate Research Fellowship)

The program allowed for fundamental research to be performed at an undergraduate level. The caliber of research was on par with one in pursuit of a Master's Degree in a science field. Such an opportunity paved a genuine intrigue to continue education through my PhD, and into industry, where an immediate

impact can be made through applied science. (Brett Allen - on 08/27/12, 2005 West Virginia Space Grant Scholar, Reaxis Inc. - Laboratory Services Manager)

Outcome 2: (*Educate and Engage*)

WVSGC sponsored several education projects that benefited the Consortium students directly and prepared them for a STEM career in the future.

- 1) WVSGC sponsored the annual West Virginia FIRST LEGO® League state championship on the campus of Fairmont State University. The event took place on the main campus of Pierpont Community and Technical College on December 8, 2012. There were 56 teams registered for this year's tournament. Fifty four teams competed. This is a jump of almost twenty teams over last year's event. The theme of this year's tournament was Senior Solutions. Teams, made up of students ages 9-14, presented research and programmed their robots in a series of challenges based on improving the quality of life for seniors by helping them continue to be independent, engaged, and connected in their communities. The program introduces elementary and middle school students to real-world engineering challenges and helps them learn critical thinking, team-building and presentation skills.
- 2) The 2012 Summer Aviation Camp, which was co-sponsored by WVSGC and the Mid-Atlantic Aerospace Complex, provided exciting hands-on, aviation focused, experience to 45 pre-college students during a three day in-residence camp on the campus of West Virginia University. Astronaut Jon McBride inspired the campers with his presentation and participation on the last day of the camp.
- 3) College level robot competition: The Lunabotics team, which included students from a variety of disciplines in the Benjamin M. Statler College of Engineering and Mineral Resources along with cadets from WVU's United States Air Force ROTC, traveled first to the Kennedy Space Center for the Lunabotics Mining Competition, held May 21-26, 2012. The following week, they were off to the Revolutionary Aerospace Systems Concepts Academic Linkage (RASC-AL) Exploration RoboOps or Mars Rover Competition, held at the Johnson Space Center, in Houston, Texas. The Lunabotics event featured 58 international teams of students, which were challenged to design and build a remote controlled or autonomous excavator called a lunabot, to determine which could collect the most regolith (simulated lunar soil) within 10 minutes. The complexities of the challenge included the abrasive characteristics of the simulant, the weight and size limitations of the lunabot and the ability to control the lunabot from a remote control center. WVU finished third in the Joe Kosmo Award for Excellence or grand prize competition, which goes to the team with the most points from all categories; finished second in the slide presentation and demonstration award category; and 10th in the on-site mining award competition. At JSC, WVU was in excellent company, joining teams from Cal Tech, University of Maryland, University of Pennsylvania, University of Texas, SUNY Buffalo, University of Utah and Worcester Polytechnic Institute. The rover, which featured carbon-fiber composite construction, six-wheel independent drive, four-wheel steering, and rocker-bogie suspension, was controlled remotely during the competition by students on WVU's campus in Morgantown.

Outcome 3: (*Engage and Inspire*)

WVSGC sponsored several public extension and outreach projects last year. A couple of those projects are highlighted below.

- 1) Thirty-five years ago two scientists, J.R. Fisher at the NRAO in Green Bank, WV, and R.B. Tully of the University of Hawaii, discovered a correlation between the brightness of a spiral galaxy and the maximum velocity of its rotation. The key data for the project were measurements of neutral hydrogen made with the Green Bank radio telescopes. The correlation, subsequently called the “Tully-Fisher relationship” is among the most important and puzzling in modern astrophysics, as it relates the material content of a galaxy to the dark matter content. To celebrate this anniversary the NRAO in Green Bank, WV hosted a workshop "Global Properties of HI in Galaxies" on April 1-3, 2012. More than 50 researchers attended from all over the US and abroad. There were presentations about galaxies ranging from our own Milky Way to objects that we observe when the Universe was a fraction of its current age. The workshop was characterized by intense discussion and new lines of research were opened up. Many of the presentations are now posted on the workshop website <https://science.nrao.edu/science/event/tf35/> where they will remain available as a resource to researchers.
- 2) WVSGC and Robert C. Byrd Institute (RCBI) for Advanced Flexible Manufacturing sponsored the first NASA’s Museum in a Box pilot activity providing hands-on/minds-on lessons with an aeronautics theme. Approximately 40 current and soon to be teachers from throughout the state attended the workshop, Composite Technology in the Classroom — Museum in a Box, Saturday, March 9, from 10 a.m. to 4 p.m. at the RCBI Bridgeport Advanced Manufacturing Technology Center. There they toured the National Center of Excellence and received training from Todd Ensign, NASA IV&V Facility, NASA Educational Center, on introducing composite technology in the classroom. The lesson allows students to examine materials used in the field of aerospace. Through demonstration and experimentation, students will learn how modern technologies have allowed us to fly faster and travel deeper into our solar system. The NASA Education Center will provide 2-3 teaching kits free of charge for teachers to use. Lessons are tied to STEM topics, and geared toward students from kindergarten through the 12th grade.

PROGRAM ACCOMPLISHMENTS

Outcome 1: *Contribute to the development of the STEM workforce in disciplines needed to achieve NASA’s strategic goals (Employ and Educate)*

Achievements and progress related to the NASA WV SGC Fellowship/ Scholarship, Higher Education and Research Infrastructure program are listed below.

Fellowships/Scholarships: We made 133 fellowship/scholarship awards (\$1,000 to \$3,000 each) as well as eleven (11) Undergraduate Research Fellowships (up to \$5,000 each) and six (6) Graduate Fellowships (\$24,000 each). Also, seven (7) additional students were funded as part of research grants awarded to faculty.

Of the 133 fellowship/scholarship awards at the affiliate level, 60 (45%) went to female students and 17 (13%) went to students from underrepresented groups. Our goals, as stated in our 2010 Five-Year proposal, were 30% for women and 10% for underrepresented groups. We are proud that in FY 2012 we have exceeded our stated goals. We also awarded one (1) scholarship to a student with a disability.

Statistics for students who have taken their next step and have been successfully tracked through their next step vs. last year of SG support are shown below.

- 102 students took next step in FY12 (SG participation supported from FY06-FY12 funds)
 - 23 are pursuing advanced degrees in STEM disciplines
 - 50 accepted STEM positions in industry
 - 1 accepted a position at NASA
 - 1 accepted a STEM position in academia
 - 27 went on to positions in non-STEM disciplines

We sponsored several higher education projects that benefited our STEM students directly and helped them to get ready for a future in STEM career.

Undergraduate Research Fellowships (up to \$5,000 each) are competed for at the Consortium level. Eleven (11) such fellowships were awarded last year to students from the following Consortium affiliates:

Marshall University: 6 awards, 2 male, 4 female.

West Virginia University: 4 awards, 4 male, 0 female.

West Virginia Wesleyan College: 1 award, 1 male, 0 female.

Graduate Research Fellowships (up to \$12,000 plus cost share of at least 1:1) are also competed for at the Consortium level. Six (6) such fellowships were awarded last year to students from the following Consortium affiliates:

Marshall University: 3 awards, 1 female, 2 male.

West Virginia University: 3 awards, 2 female, 1 male.

Students participating in Research Infrastructure projects with guidance from faculty (>160 contact hours and/ or at least \$3,500 in support received): There were seven (7) students that benefited from this program and they are enrolled at the following Consortium affiliates:

West Virginia University: 3 participants, 3 males, two graduate and one undergraduate

Bluefield State College (HBCU): 4 participants, 4 female African Americans, all undergraduates.

Breakdown of the number of students who have received direct support during the FY2012 reporting period by affiliate was as follows:

Bethany College	11
Bluefield (HBCU)	8
Fairmont State University	5
Glenville State College	7
Marshall University	38
Shepherd University	18
West Liberty University	9
Wheeling Jesuit University	14
WV State University (HBCU)	7
WV Wesleyan College	12
West Virginia University	28
Total	157

Some of the comments that were submitted to the NASA WVSGC office in response to the question: “How did participation in these programs impact your education and life?” are shown below.

I believe that learning brings me the greatest happiness in life. I have thought this way since I was very little. When I was in college, I wished to do research and gain as much interesting knowledge as possible. I was able to get scholarships and grants to pursue my interest in physics. The West Virginia Space Grant particularly stands out for me as an important grant. It allowed me to participate in research that included multiple sciences and meet many other students in research. Although I have ultimately decided a medical path for my career, I hope at some point in the future I can do other research that can help NASA. My life was definitely improved by the grant because it allowed me to spend time learning rather than working a non STEM related job to pay for living expenses. I particularly appreciate that the grant program exists for so many students and I hope it continues to encourage others; especially women in science. (Brooke Adams - on 04/12/12, 2009 West Virginia Space Grant Scholar, 2009 West Virginia Space Grant Scholar, Ohio Medical Physics Consulting - Medical Physicist)

I was just accepted into a summer REU program at Johns Hopkins where I will be working at the Institute of Nano BioTechnology. After graduating next year with a B.S. in Chemistry, I plan to attend graduate school to receive my Ph.D. in molecular biology and cell biology. When applying to the REU at Johns Hopkins, I mentioned that I would be completing research through the NASA program. I believe that it really helped my chances of getting a spot; thank you very much for this opportunity! (Daniel McClelland - on 03/20/12, 2011 Space Grant Fellowship, 2012 West Virginia Space Grant Affiliate Scholarship)

The Space Grant program has opened so many doors for my academic and professional career. The program allowed me to conduct research that I enjoy and made me a better candidate for national scholarships, which resulted in receiving a competitive national scholarship. (Byron Patterson - on 08/21/10, 2009 West Virginia Space Grant Scholar, 2010 NASA/WVSG Undergraduate Research Fellowship Program,

2011 Undergraduate Research Fellowship, 2011 Space Grant Fellowship, 2012 NASA Academy, NASA - Internship)

Other “Higher Education” programs supported by WVSGC include:

Support for AIAA; support for one student to attend the NASA Connecticut Space Grant Consortium Helicopter Training Experience in New Britain, Connecticut; support for Career Fairs (College of Engineering at WVU, EMR, NASA LARSS, High Tech Companies, and NASA IV&V Facility) which were attended by over 100 employers and over 2,500 students; and support for NASA Scholars to attend conferences to present their research papers.

Research Infrastructure Programs: WVSGC supports two programs in this category

- Research Initiation Grants (RIG) are competed for at the Consortium level. These grants are awarded in the amount of (up to) \$20,000 of NASA funds augmented by \$10,000 in cost share. Three RIG’s were awarded last year.
- Research Enhancement Awards are competed for at the academic affiliate level. West Virginia University, the lead institution, does not participate in this program. Per an annual subcontract, each affiliate receives \$6,000 in NASA funds which they augment by an additional \$6,000 from non-federal sources. Issuing the RFP, deciding on review criteria, and making the award decisions are accomplished by the NASA Committee at each affiliate independently.

The breakdown of the number of Research Enhancement Awards (REA) awarded to the faculty at the time of this report during the FY2012 reporting period by affiliate is as follows:

Bethany College	1
Fairmont State University	3
Glenville State College	6
Marshall University	6
Shepherd University	4
West Liberty University	5
WV State University (HBCU)	5
WV Wesleyan College	4
Wheeling Jesuit University	3
Total REA awards:	37

Thirty seven faculty awards: 14 Female; 23 Male; 1 African American; 1 Hispanic, 3 Asian, 32 Caucasian.

The following “Research Initiation Grant” awards were made during FY 2012 reporting period.

Dr. Bin Wang, Marshall University, research entitled “An Investigation of Iron-IRE Interactions in the mRNAs of Ferritin, APP, and ASN”. Dr. Wang indicated that one

peer reviewed publication has been accepted and soon to be published. Presentation will be made at the American Chemical Society (ACS) National Meeting & Exposition in New Orleans.

Dr. Ashish Nimbarte, West Virginia University, research entitled “Biomechanics of suited ingress and egress” Dr. Nimbarte reports that the results of this study are expected to produce several peer reviewed journal articles and conference papers. Furthermore, the data generated from this proposal will be used by the PI to submit full proposals for ASA NRA funding mechanism in collaboration with Dr. Sudhakar Rajulu’s research group at Johnson Space Center. In addition, the findings of this study will also facilitate development of proposals targeting funding opportunities with NIOSH and DOD, as workers in many occupational groups as well as army soldiers usually work in confined spaces under various conditions using protective suits and/or coveralls.

Dr. Feng Yang, West Virginia University, research entitled “A Statistical Procedure for Multivariate Calibration of Sensor Arrays”. Jing Li of NASA Ames Research Center stated “the proposed research on multivariate calibration of sensor arrays is of substantial interest to NASA. Dr. Yang indicates that sensor research is also of great interest to WV, NSF, DOE, and NIH, and has strong funding potential. Sensor research is an important thrust for the WVNano Initiative, and will contribute to the WVU Energy Initiative Program and to the Industry of the Future of West Virginia (IOFWV). Furthermore, sensor technology plays a key part in the combustion control systems in the Fossil Energy Program at the National Energy Technology Laboratory (NETL). The PI is a participant in the NETL Regional University Alliance (NETL-RUA) that combines the NETL’s fossil energy expertise with the broad capabilities of five regional universities including WVU. The proposed research will help the PI to make contributions to the WVU sensor research, establish partnerships via the above-mentioned mechanisms, and accelerate the development and deployment of the sensor technology.

The total value of the RIG programs was \$69,999 (\$40,000 NASA; \$19,900 cost share)

Outcome 2: *Attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers, and faculty (Educate and Engage)*

WVSGC has supported and implemented two competitive programs in direct support of Outcome 2: the College Course Development program and the K–12 Professional and Curriculum Development Program.

1. The College Course Development Grant Program is intended to assist faculty in developing new and innovative courses at the institutions of higher education affiliated with the Consortium. Applicants must present a clear and feasible plan for designing and offering a new course in the STEM fields.

The following College Course Development projects were funded during the FY2012 reporting period:

Jeff Groff, Shepherd University, “Physical Computing: An Introductory Course in Electronics and Microcontroller Programming.” Ten students have enrolled in the course for the spring 2013 semester. An aim of this project was to recruit students from underrepresented populations including women. Two women are enrolled in the course (one of which is mathematics major and the other an environmental science major). Another aim of the project was to recruit students from outside of STEM disciplines. Professor Groff writes: “I am excited to have two art majors and an art faculty member enrolled in the course. This faculty member teaches sculpture and is excited to move his program in a direction that includes more science and mathematics courses.”

Robin Hensel, West Virginia University, “Promoting Retention of High-Risk Engineering Students.” Twenty two students have enrolled in this program. Other WVU organizations that participated in this project include: Career Services Center, Financial Aid, Office of Social Justice, Well WVU, Academic Affairs, and Adventure WV.

Rana Jisr, West Virginia University Institute of Technology, “Introduction to Nanoscience and Nanotechnology.” The course was not offered this spring due to low enrollment, it will be offered in fall 2013 instead.

Trevor Stevens, West Virginia Wesleyan College, “Computational Astrophysics.” The course will be an introduction to numerical and computational methods for solving complex problems in physics, and will use a series of complex problems in astrophysics to illustrate these methods. We anticipate the course will be offered fall 2013 to juniors and seniors at WVWC; we expect that the majority of these students would be physics and engineering majors, but the class will also be cross-listed as a mathematics course and would be open to juniors and seniors in mathematics and computer science. No previous knowledge of astronomy will be required, but students will be expected to have had some brief introduction to differential equations. Relevant concepts in physics will be covered in the course and presented in a mathematical fashion which would be understandable by mathematics and computer science students.

The total value of the College Course programs was \$36,600 (\$18,300 NASA; \$18,300 cost share).

2. To enhance the interests and enthusiasm of K-12 students and teachers in science, math, and engineering, the WVSGC implemented the K-12 Professional and Curriculum Development program. Intended for teachers, schools, or non-profit organizations to design and implement K-12 professional development projects or new curricula for the academic year. The main emphasis is on teacher development, not class activities

Projects supported in this category during the FY 2012 reporting period were:

Elizabeth Strong, Near Earth Object Foundation, “Science Misconceptions Workshop.” This project comprised of a three day summer workshop and two fall follow-up sessions led by members of the Near Earth Object Foundation, SMART-Center staff, and the WT-

Handle on Science Project Director. The workshop focused on clarifying science content misconceptions in physical, life, earth and space sciences through various activities that may be used in K-8 science classrooms. When asked about the evaluation mechanisms, Sr. Strong indicated that in addition to the pre and post test tests that were administered during the summer session, conversation regarding the questions still missed on the post test occurred during the required fall follow up session. Additional activities that addressed misconceptions also were the focus of the follow-up. Science content knowledge was gained based on the results of the pre vs. post tests, with many of the participants. Lesson plans were shared at the fall follow-up and several teachers shared the student misconceptions and the correction of the misconceptions through the lessons they designed.

Earl Scime, West Virginia University, “Mountaineer Area Robotics.” The Mountaineer Area Robotics (MARS) program reaches over 400 middle school students and their teachers in twenty-three counties and over 50 high school students from three West Virginia Counties (including one in southern West Virginia) with robotics-based educational programs. The program also includes outreach activities to elementary, middle, and high school classes throughout West Virginia. When asked to describe the involvement of Higher Education Students and Faculty in the conduct of Precollege project, Dr. Scime reported that the MARS robotics program includes seven WVU faculty and staff as mentors and twelve college students as mentors. These faculty, staff, and college students work weekly in the summer and fall with the pre-college students and 3-4 times a week during the winter and spring.

Aniketa Shinde, West Virginia University, “Making Science Accessible.” Teachers have applied for the program and 10 participants were chosen out of 23 applicants. Our criteria was to give first priority to teachers of students with visual impairments within the state, then seek middle school math and/or science teachers from different counties. The goal of this project is to train teachers to use a new technology and exciting new computer software applications (apps). These apps will make science content accessible to all students, particularly students with low vision or who are blind. The project will train teachers to utilize new tools for the classroom, the Novint Falcon Haptic Device and eTouchSciences Apps1, which provide an exciting way to make science content accessible to all students. The target audience for the project is West Virginia middle school teachers. The audience consists of science teachers, special education teachers, and vision specialists for school districts.

Afrin Naz, Virginia University Institute of Technology, “Collaboration for student success in STEM fields.” In this project, Dr. Naz introduced an innovative project designed by the Department of Computer Science and Information Systems and the Department of Mathematics at West Virginia University Institute of Technology with the help of local high school teachers to place a strong emphasis on addressing the current and anticipated shortfall of STEM professions. Thirteen in-service educators and three college faculty participated in this program.

The total value of the K-12 Outreach programs was \$61,338 (\$29,900 NASA; \$31,438 cost share)

A new initiative by the NASA IV&V Facility in partnership with the NASA WVSGC is called the “Space Flight Design Challenge.” This is an initiative where teams from academic institutions across the state develop knowledge and gain practical experience designing, building, launching and operating space-based vehicles. The Space Flight Design Challenge serves to remove obstacles posed by the complexities inherent in developing critical systems by making the knowledge required and practices utilized for such endeavors commonly understood topics. This initiative will serve to advance IV&V approaches and provide practical test beds for IV&V engineers to maintain their domain expertise and rapidly mature innovative solutions for the application of IV&V on NASA’s missions.

- Academic institutions across WV develop knowledge and gain practical experience in designing, building, launching, and operating space-based vehicles.
- The Space Flight Design Challenge is a multi-year program.
- Each year builds upon previous years as well as opens up the competition to larger audiences (dedicated teams from colleges across the state, colleges + high schools + etc.)
- Goals for each year to basically remove the obstacles inherent in knowing how to build a space-based vehicle.

Academic institutions will receive:

- Spacecraft kits (solar cells, batteries, microcontrollers, transceivers, structures, etc.)
- A launch (rocket will place spacecraft in polar LEO at 300km for about 3 months)
- Mentors from NASA IV & V Program
- Tools for developing requirements, designs, conducting tests.

Academic institutions that have been incorporated into the program include: Shepherd University, West Virginia Wesleyan College, Marshall University, and West Virginia Institute of Technology. At these institutions, S.P.A.C.E. chapters have been established as well.

Outcome 3: *Build strategic partnerships and linkages between STEM formal and informal education providers that promote STEM literacy and awareness of NASA’s mission (Engage and Inspire)*

NASA WV Space Grant Consortium implemented a competitive program entitled “West Virginia Space Grant Consortium Extension and Public Outreach (EPO) Grant” program. A brief description of activities and projects supported in 2012 is provided below.

Tom Minnich, Marshall University, “Composite Materials Technology: RCBI West Virginia Outreach Campaign.” The primary goal of this program was to increase the awareness of composites materials technology and illustrate the enormous impact it has already had and will have in the future of the aerospace and other leading industries. RCBI will accomplish the goals of this program through four separate events: 1) conduct a composites technology conference and demonstration; 2) facilitate composites technology webinars; 3) assist in the development of composites technology workshops and professional

development for K-12 STEM educators; and 4) initiate a K-12 outreach campaign using composites technology centered lesson plans, learning materials and hands-on experiments.

Total number of professional development workshops for informal educators: 1

Total number of exhibits supported/developed: 1

Direct participants in-service educator completed: 20

Charlie Waters, Mountain Institute, "Tectonics in the Solar System." A one week residential professional development workshop focused on developing a conceptual understanding of geologic processes that occur on the Earth and throughout the solar system. Three credits of graduate college credit for recertification or salary enhancements will be an option for all participants at a reduced rate. The successful partnership between Fairmont State University, The Mountain Institute, and the NASA IV&V Facility Educator Resource Center (ERC) in providing this workshop reflects a common interest in supporting education that serves to broaden awareness and appreciation for our mountain environment that leads to individual and community engagement in land stewardship.

Richard Pollack, Near Earth Object Foundation, "SolarMax 2012 Project." SolarMax2012 is a solar astronomy project of the Near Earth Object Foundation with support from the NASA West Virginia Space Grant Consortium. A main feature will be a dedicated solar observatory set in an urban environment.

See: <https://www.facebook.com/SolarMax2012>

Robert Strong, Near Earth Object Foundation, "Bringing Rural Skies Downtown Project." The major goal of the project is to enhance knowledge and increase interest in space and sky science for as many individuals as possible through a series of urban based twenty-one (21) Star Watches

Direct Participants In-service Educators: 51

Direct Participants Pre-service Educators: 5

Direct Participants Informal Educators/Museum Staff: 93

Direct Participants Precollege Students: 322

Direct Participants Administrators: 3

Direct Participants Parents/ Guardians: 209

Direct Participants Higher Education Students (non Pre-service): 9

Direct Participants Higher Education Faculty: 11

Direct Participants Public At Large: 69

Direct Participants Other Adult: 0

Direct Participants Other: 500+ (Listeners to Radio Science News)

John Ford, National Radio Astronomy Observatory- Green Bank, "Collaboration for Astronomical Signal Processing and Electronics Research."

Felix Lockman, National Radio Astronomy Observatory- Green Bank, "Global Properties of Neutral Hydrogen in Galaxies." Conference at the National Radio Astronomy Observatory in Green Bank, WV. This conference is aligned with NASA/WVSC goals to promote the understanding of space, and to support seminars that encourage research in aerospace-related fields. This brought together more than 50 researchers to the Green Bank

Observatory in Pocahontas County for the three-day intensive workshop to discuss recent research in this and related fields and to map strategies for future discovery.

The total value of the EPO programs was \$95,709 (\$46,936 NASA; \$48,773 cost share) Additional projects sponsored by WVSGC included the following:

- “Plastics Day at West Virginia University”. The purpose of the one-day event was to promote awareness among students of the importance of plastics in every aspect of modern-day life. This was the first time ever that this concept has been introduced on the campus of WVU. Jim Griffing, President of the Society of Plastics Engineers, opened the ceremony and was the keynote speaker. Plastics Day featured technical talks, lab tours and opportunities for students to interact with representatives from all facets of the industry. Companies that attended include Bayer Material Science, The Dow Chemical Company, DuPont, Pickering Associates and SABIC Innovative Plastics. There was also a poster competition for students, on such research topics as polymers and materials, energy, biomedical engineering and catalysis. Representative from the attending companies and sponsors, including the Director of WVSGC, acted as judges and prizes were awarded to the top three posters in both the undergraduate and graduate categories.
- WV State Fair held August 9-18, 2012: In collaboration with WVSGC, NASA Langley, NASA IV&V Facility and WVU Freshman Engineering staffed an interactive exhibit during the course of the fair. Gate attendance: 187,000-190,000. Over 6,500 people visited WVSGC’s booth. We met with elementary and middle school students who were just starting to get interested in the STEM fields; high school students who were starting their college searches; and alums who just wanted to say hi and see how things were going. Outside of the typical outreach that we normally do, we also really felt like we were educating the public on engineering and technology, and most seemed very interested and could be heard talking about it throughout the fair.
- Annual Undergraduate Research Day (URDC) at the Capitol took place at the Capitol Rotunda, Charleston, WV. URDC allows students to present their discoveries in poster format and talk to legislators about their findings.
- Eight Grade Career Day at Mylan Park in Morgantown, WV. On April 19, 2012, over 820 eighth grade students from five middle schools in Monongalia County participated in the event. Student workbooks with occupational information and salary range were provided for each vocation attending the event. Because of the attraction of robots and college students in astronaut suites, WVSGC’s booth was the most popular exhibition at this event.

The total value of the additional EPO programs was \$6,200 (\$4,900 NASA; \$1,300 cost share)

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

- **Student Data and Longitudinal Tracking**

Total awards = 77; Fellowship/Scholarship = 41, Higher Education/Research Infrastructure = 36; 8 of the total award represent underrepresented minority F/S funding.

During the FY12 program year 23 students are pursuing advanced degrees in STEM disciplines, 50 accepted STEM positions in industry, 1 accepted a position at NASA, 1 accepted a STEM position in academia, and 27 went on to positions in non-STEM disciplines. The remaining students have not yet received the degree that they were pursuing while they received their Space Grant award.

- **Minority-Serving Institution Collaborations**

Both of the only two HBCUs in West Virginia are members of the WVSGC. Bluefield State College is represented by Dr. Felica Wooten Williams and WV State University is represented by Dr. Naveed Zaman. In 2012, both institutions were active in the Consortium and participated in a number of programs sponsored by WVSGC. Seven (7) NASA fellowships were awarded at West Virginia State University and four (4) (including students from the Emerging Leaders Institute) were awarded at Bluefield State College.

WVSGC continued its support of the Emerging Leaders Institute (ELI) at Bluefield State College. The goal of this program is to recruit and train minority college students in STEM fields to be mentored by a faculty member. These students visit area high schools and talk to minority students to encourage them to attend college and serve as a role model for them. ELI was established at Bluefield State College several years ago to provide African-American students majoring in STEM fields with opportunities for leadership development through a comprehensive program based in leadership theory and practice. The program stresses civic service and academic productivity, while stressing ethical responsibilities of individuals and organizations.

Two of the ELI students, Sasha Richmond and Mardochee Isme, presented their research work at the Mid-Atlantic Space Grant Consortium Regional meeting in Philadelphia, PA. Sasha and Mardochee also experienced “weightlessness” at the National AeroSpace Training And Research (NASTAR) Center.

Three female students from the ELI were awarded summer internship to conduct undergraduate research under the supervision of Dr. Tesfaye Belay at Bluefield State. In FY 2012 we provided \$9,000 to support these summer student internships and a stipend of \$5,000 to Dr. Belay.

Five students from WV State University were awarded a Summer Undergraduate Research Experience. In FY 2012 we provided \$15,000 to support these summer experiences. Two students will present their research experience at the Spring 2013 WVSGC Board of Directors meeting in Charleston, WV.

- **NASA Education Priorities**

- Authentic, hands-on student experiences in science and engineering disciplines: WVSGC initiated and sponsored several programs that provided hands-on student experiences. Examples of these programs include:

- AIAA Design Build Fly, West Virginia University/ Department of Mechanical and Aerospace Engineering. The West Virginia University Unmanned Aerial Vehicle Team sponsored by the NASA WVSGC participated in the annual AIAA Design, Build, Fly competition sponsored by the American Institute of Aeronautics and Astronautics (AIAA) Cessna Aircraft, and Raytheon Missile Systems. The 2012 competition was held in Wichita, Kansas from April 13-15, 2012. . The WVU team consisted of 12 students ranging in class rank from sophomores to seniors all full time students at the Statler College of Engineering and Mineral Resources. The contest provided a real-world aircraft design experience for engineering students by giving them the opportunity to validate their analytic studies.
- RockSat: WVSGC sponsored a team of six students to participate in the RockSat program. The research and education project is providing a space-based platform for payloads built by WVU students with a variety of backgrounds and levels of expertise. The project is targeted to STEM majors from the Eberly College of Arts and Science and the College of Engineering and Mineral Resources. The 2012-3 experiments will focus on autonomous measurements of the space environment and advance some of the earlier projects. In addition a new experiment will be open for students to propose in coordination with the PI and specialist advisors. All payload components are designed, assembled, and tested by the students. The payload design phase is part of an SPTP course on rocket dynamics and propulsion, payload design, and the space environment. In terms of education and outreach, collaboration with Brazil's Institute of Aeronautics and Space is being planned, and preparation plans for payload development and U.S. and international student instruction are presented. An initiative for a local education and outreach activity involving Morgantown high schools is discussed.
- Jeremy Lockett, WVU Engineering Student, attended the NASA Connecticut Space Grant Consortium Helicopter Training Experience in New Britain, Connecticut on the campus of Central Connecticut State University. Participants received education on aerodynamics, rotorcraft principles, wind tunnel testing, control theory, Vertical Take-Off and Landing (VTOL) RC

aircraft, etc. Participants also toured KAMAN Aerospace and Sikorsky Aircraft as well as take a helicopter flight and receive a CX 2 Coaxial RC helicopter or equivalent.

- Diversity of institutions, faculty, and student participants (gender, underrepresented, underserved): WVSGC exceeded its initial targeted diversity rate of women participation in all our programs. We initially targeted 30% across the board, and due to the fact that the number of female faculty and research in STEM fields is much smaller than the number of men in these fields, we were aggressive in engaging female participants.

Research programs: 38% female

Direct student support: 40% female

Due to the diligence in increasing our program awareness, in 2011 and again in 2012, we surpassed our goal of maintaining a minimum number of Space Grant fellowships/scholarships at 120 per year. We awarded 157 fellowships/scholarships in FY 2012.

- Engage middle school teachers in hands-on curriculum enhancement capabilities through exposure to NASA scientific and technical expertise: WVSGC sponsored several programs to benefit teachers in West Virginia. The number of in-service and pre-service teachers that benefitted from our programs in FY 2012 was 84 and 5, respectively.

A new initiative, in collaboration with WVSGC, WVU Extended Learning, NASA IV&V Facility and WVU Benjamin M. Statler College of Engineering, is the WV Aerospace Scholars program. The program will provide a highly interactive experience for high school juniors as well as provide extensive professional development for involved K-12 teachers. The WVAS program additionally will address the critical need for a “pipeline” that encourages high school students to pursue STEM programs during their post-secondary studies. During the first year it is anticipated that the WV Aerospace program will recruit (12) teachers to participate in the online learning portion of the program. The 12 teachers that are selected as facilitators for the online student course will attend WVU for a three day professional development session in August 2013. During this time, the teachers will receive training on methods for quality online learning, tracking student educational progress, STEM instructional strategies, simulation software, aerospace engineering, and physical science concepts. The teachers will also tour the engineering facilities and explore how the facilities will be used throughout the student summer experience. These professional development activities will be conducted by the K-12 Partnership Coordinator at WVU Extended Learning, the program manager for the NASA Educator Resource Center, and the WVU Engineering faculty. A smaller subset of these teachers will take part in the summer portion of the WV Aerospace Scholars program. Through the recruitment of these teachers; at least 60 students will participate in the online academic portion of the program and from those 60; at least 30 students will participate in the summer component of WV Aerospace Scholars.

- WVSGC sponsored summer opportunities for secondary students on college campuses with the objective of increased enrollment in STEM disciplines or interest in STEM careers. An example of this program is as follows:

During the summer of 2012, WVSGC co sponsored the Academy of Engineering Success (AcES). AcES is an invitation-only program for incoming first-semester freshman accepted into the Pre-Engineering program within Statler College of Engineering and Mineral Resources at West Virginia University. It comprised of a week-long live-in program prior to the Fall semester beginning that included educational workshops, Math and Chemistry brush-up courses, Engineering field trips, team projects including rocket-building and wind-turbine design and academic success programming designed to help students adapt to the University setting for improved success. The program also comprised of a semester-long three-credit academic success and professional development course with engineering emphasis on team project design as well as a mentor program in which they were mentored by alumni of the college. By enrolling in the Academy, students were given the opportunity to begin building their professional network, explore engineering career options, and develop strategies for academic success in the Statler College's demanding engineering curriculum.

- Community Colleges – develop new relationships as well as sustain and strengthen existing institutional relationships with community colleges: For the first time since the inception of the WV Lego State Tournament, Fairmont State University in collaboration with Pierpont Community and Technical College (PCTC) hosted the 2012 event. News articles reported more than 1,000 in attendance. From the participant feedback, we plan to continue to develop this new relationship, enhance awareness, strengthen our ties with PCTC and host the event on their campus next year.
- Environmental Science and Global Climate Change – research and activities to better understand Earth's environments: Under the research guidance of Dr. Kenneth O'Connor, Marshall University, Undergraduate student Patricia Mihm is involved in Green chemistry on her research topic “A Green Grignard Reaction: The Use of 2-Methyl Tetramethylfuran as a Green Solvent.” Green chemistry technologies provide a number of benefits, including:

- reduced waste, eliminating costly end-of-the-pipe treatments
- safer products
- reduced use of energy and resources
- improved competitiveness of chemical manufacturers

West Virginia University Undergraduate student, Mohammad Afshari, with guidance from Dr. Robert Creese is researching the impact of the earth's

drinking water supply in his project entitled “Wind and Solar Tower for Atmospheric Water Generation.”

- Enhance the capacity of institutions to support innovative research infrastructure activities to enable early career faculty to focus their research toward NASA priorities: Dr. Majid Jaridi presented NASA research opportunities to new faculty members at West Virginia University, Benjamin M. Statler College of Engineering, during a lunch hosted by Dr. Pradeep Fulay, Associate Dean for Research. The theme for the lunch presentation was to introduce early career faculty members to focus their research toward NASA priorities.

The WVSGC management team, along with representatives from the Air Force ROTC, traveled to Bluefield State College (HBCU) and West Virginia University Institute of Technology to present and encourage participation in NASA research opportunities for students and faculty members.

WVSGC provided 40 research enhancements awards to faculty at twelve institutions to support innovative research infrastructure activities. In support of their research infrastructure activities, Marshall University reported that six faculty members (3 female, 3 male) traveled to various locations across the Continent of the United States to collaborate with colleagues and attend professional conferences.

IMPROVEMENTS MADE IN THE PAST YEAR

Addition of a new Industry Partner: Ms. Anne Barth, Executive Director, TechConnect West Virginia was unanimously approved to join the Board of Directors of WVSGC as of fall 2012. TechConnectWV is a statewide economic development organization dedicated to the advancement of science, technology, and the innovation economy in West Virginia, focused on four technology sectors: advanced energy, chemicals and advanced materials, biosciences, and biometrics. With members representing education and research, private industry, and the public sector, TechConnectWV works to grow and diversify West Virginia’s economy through innovation-based economic development.

TechConnect West Virginia seeks to diversify the state’s economy through innovation-based economic development, primarily in the areas of advanced energy, chemicals and advanced materials, biometrics, and biotechnology. TechConnectWV works to build R&D and commercialization capacity, a culture that supports innovation and entrepreneurship, access to capital, and a proactive business climate with incentives for innovation-based start-ups

Program Evaluation: At the Fall 2011 Board of Directors meeting discussed the application and submission process for the FY 2012-13 awards. From active discussion and deliberation from the members of our BOD, the NASA WVSGC drafted state wide

cost share guidelines to be used for submissions of all application. The guidelines which are posted on the NASA WVSGC website helped reduce disqualifying applicants thus creating a seamless review of our 2012-13 programs.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

The Consortium is governed by a Board of Directors consisting of one member from each affiliate organization and a few representatives from non-profit organizations and state government agencies. In accordance with its Mission Statement and its by-laws, the Board sets all policies and procedures governing the Consortium operations. Characteristics of our academic and other affiliates of the Consortium are as follow:

- West Virginia University, largest public university in the state, Land Grant, primarily research oriented, represented by Dr. Fred King.
- Marshall University, second largest public university in the state, research oriented, represented by Dr. Charles Somerville.
- Bluefield State College, an HBCU, primarily teaching oriented public university, represented by Dr. Felica Wooten Williams.
- WV State University, an HBCU, Land Grant, primarily teaching oriented public university, represented by Dr. Naveed Zaman.
- Shepherd University, primarily teaching oriented public university, represented by Dr. Reza Mirdamadi.
- WV Wesleyan College, teaching and research oriented private college, represented by Dr. Joseph Wiest.
- Wheeling Jesuit University, teaching and research oriented private university, represented by Ms. Margie Cook.
- Bethany College, teaching and research oriented private college, represented by Dr. Robert Paysen.
- Fairmont State University, teaching and research oriented public university, represented by Dr. Anthony Gilberti.
- West Liberty University, primarily teaching oriented public college, represented by Dr. Robert Kreisberg.
- WVU Institute of Technology, research and teaching oriented public university, represented by Dr. Paul Steranka.
- Glenville State College, teaching and research oriented public college, represented by Dr. John Peek.
- The Clay Center for Arts and Sciences, non-profit organization with the mission to inspire creativity, learning and wonder through experiences in the arts & sciences, represented by Mr. Lewis Ferguson.
- WV High Technology Consortium Foundation, non-profit organization to promote high technology and economic growth in the state, represented by Mr. James Estep.

- Polyhedron Learning Media, Inc., A technology development company specializing in creating educational software, audio/video, and print materials, represented by Dr. Jeanne Finstein.
- NASA IV & Facility, represented by Mr. Marcus Fisher, Associate Director.
- NRAO Green Bank Facility, home to the Robert C. Byrd Green Bank Telescope, the largest fully steerable dish in the world, represented by Dr. Karen O’Neil.
- Dr. Anne Cavalier, Educational Consultant
- Mr. Denny Avers, Engineering Consultant, a founding member of the Consortium, then representing IBM.

The National Space Grant Office requires two annual reports, this Annual Performance Data Report (APD) 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.