

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.

New York Space Grant Consortium
Lead Institution: Cornell University
Director: Yervant Terzian
Telephone Number: (607) 255-2710
Consortium URL: <http://astro.cornell.edu/spacegrant/>
Grant Number: NNX10AI94H

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 New York Space Grant Consortium is a Designated Consortium funded at a level of \$575,000 for fiscal year 2014.

PROGRAM GOALS

The New York Space Grant (NYSG) Consortium aims to inspire, engage, and educate students in science, technology, engineering, and math (STEM) disciplines, and to prepare students across NY State to be the future workforce for NASA and high-technology industries.

NYSG Goal #1: Our NASA Education Outcome 1 (Fellowship/Scholarship, Higher Education, and Research Infrastructure Programs) programs will positively impact the **diversity** of students entering the STEM workforce and pursuing advanced STEM degrees.

SMART Objective 1 – The percentage of NYSG underrepresented minority student awardees (monetary and non-monetary) per budget year shall meet or exceed the minority enrollment percentage in NY higher education institutions (30.7%). Statistics published in the National Center of Education Statistics (NCES) Digest (NCES Table 265: Fall enrollment in degree-granting institutions, by race/ethnicity of student and state or jurisdiction: 2011 (http://nces.ed.gov/programs/digest/d12/tables/dt12_265.asp) are used as the benchmark for this objective.

SMART Objective 2 – The percentage of NYSG female student awardees (monetary and non-monetary) per budget year shall meet or exceed 39%. For this benchmark, data from the National Science Foundation, Division of Science Resources Statistics, *Women, Minorities, and Persons with Disabilities in Science and Engineering* Table 5-2 “Bachelor's degrees awarded, by field and sex: 2002–12” (<http://www.nsf.gov/statistics/2015/nsf15311/tables.cfm>) shows that females earned 39% of the bachelor's degrees awarded in engineering and sciences (excluding psychology and social sciences) in 2012.

NYSG Goal #2: Our NASA Education Outcome 1 (Fellowship/Scholarship, Higher Education, and Research Infrastructure Programs) programs will positively impact the **number** of students entering the STEM workforce and pursuing advanced STEM degrees.

SMART Objective 3 – NYSG shall strive for 90% or more of graduating significant awardees to take the next step to STEM employment or STEM advanced. Our progress toward this objective will be measured by data obtained from annual polling of significant student awardees' current status/progress, based on the NASA HQ guidelines on longitudinal student tracking.

NYSG Goal #3: Our consortium will help build NY State higher education-industry collaborations, while assisting with high technology workforce development to decrease the “brain drain” afflicting NY State.

SMART Objective 4 – NYSG shall add 2-3 more industrial affiliates in New York State by the end of the 2010-2015 grant period. One new industrial affiliate (Moog) joined during the current grant period; NYSG is seeking at least one more industry partner within NY State.

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

Examples of NYSG benefits to Outcome 1 (Fellowship/Scholarship, Research Infrastructure, and Higher Education):

New York Space Grant funded an undergraduate Rensselaer Polytechnic Institute student, Tiffany Hawley, for a summer 2014 internship arranged through a partnership between a National Council of Space Grant Directors working group and the NASA Science Mission Directorate. Ms. Hawley worked with the OSIRIS-REx Communication and Public Engagement team at the University of Arizona to produce multimedia resources for engaging the public in science, engineering, and math concepts behind the asteroid sample return mission. She created several graphics for the mission's social media outlets, participated in outreach activities related to the OSIRIS-REx mission, and completed a *321Science* video, from start to finish, on the scale of the universe (<http://youtu.be/LMuAAPw9Zpw>). Ms. Hawley's mentors were thrilled with her work over the summer.

Three NYSG-funded undergraduate students designed, built, and tested a wireless underwater rover during their summer 2014 internship at Lockheed Martin in Owego, NY. The multi-disciplinary student team (computer, mechanical, and electrical engineering majors from CUNY

City College of New York, SUNY Binghamton, and the Univ. of Rochester) devised and completed the project themselves, mentored by several full-time engineers. The interns learned many valuable skills from this hands-on project, including working with people from different fields, engineering product development, and 3D modeling/printing techniques.

Example of NYSG benefits to Outcome 2 (Precollege):

NYSG sponsored two middle school teachers to participate in the August 2014 Northeast Regional Space Grant Teacher Workshop hosted by Connecticut Space Grant Consortium. This workshop was designed to increase educator capacity to teach standards-based science concepts using engineering design activities based on Next Generation Science Standards. Inspired by a straw and paperclip tower activity from the workshop, one of the teachers (seventh grade science teacher at a NYC public school) ran a marshmallow challenge at her school that incorporated the engineering design process. Her students loved this hands-on competition!

Example of NYSG benefits to Outcome 3 (Informal Education):

The NYSG affiliate director and students in New York University's Mechatronics Laboratory continued outreach with interactive exhibits of their cutting-edge robotics and mobile technology research. The Liberty Science Center extended a special invitation to present at the Genius Gala 3.0 in May 2014, stating "...we are impressed with your work in robotics at NYU Polytechnic School of Engineering and would like to invite you to attend with your interactive robots to bring the excitement of robotics to our guests throughout the evening. It is an exciting opportunity, especially as we honor Dean Kamen, a pioneer of robotics education and founder of First Robotics."

PROGRAM ACCOMPLISHMENTS

Outcome 1 [Fellowship/Scholarship, Higher Education, and Research Infrastructure programs] – In FY2014 New York Space Grant provided opportunities for students to engage in hands-on STEM research and projects at NYSG colleges/universities, industry affiliates, and NASA centers. These opportunities serve to develop our nation's STEM workforce in disciplines needed to achieve NASA's strategic goals. Undergraduate and graduate students conducted research in a wide array of STEM fields (e.g., astronomy; astrogeophysics, astrophysics; biochemistry; biomedical engineering; computer engineering; electrical engineering; environmental and earth systems science; fluid dynamics; human factors engineering; materials science; mathematics; mechanical engineering; mechatronics; physics; robotics; space medicine; spacecraft control and dynamics) during the academic year and summer at **all** NYSG colleges/universities. Students were also involved in analyzing data from NASA science missions such as the Fermi Gamma-ray space telescope. NYSG also supported student travel to conduct research (e.g., Kitt Peak National Observatory) and student travel to present at conferences such as SpaceOps 2014 13th International Conference on Space Operations (May 2014) in Pasadena, CA; East Coast Gravity Meeting at West Virginia University (May 2014); SPIE (international society for optics and photonics) meeting in Baltimore, MD (May 2014); ASME Conference on Engineering Systems Design and Analysis (June 2014); American Astronomical Society meeting in Seattle, WA

(January 2015); and the Wearable Technology Symposium at NASA Johnson Space Center (April 2015).

The launch of the first CubeSat (CUNYSAT-1) in December 2013 resulted in significant interest in Medgar Evers College's (MEC) Space Grant program. MEC's BalloonSat program, recently celebrating its 10th year, continued to engage students in hands-on science activities and launches. Several MEC students were also involved in robotics research and microcontroller development for space-related applications, and plans are already underway for CUNYSAT-2. Faculty and students at the University of Rochester worked on developing and testing detector arrays for space applications. This research includes collaboration with NASA Jet Propulsion Laboratory on detectors for the Near-Earth Object Camera (NEOCam), a proposed space telescope to discover and characterize near-Earth asteroids. NYSG also provided partial support to Hobart and William Smith Colleges for space to launch their physics experiments (spectrometer and muon detector) on a sounding rocket as part of Colorado Space Grant Consortium's RockSat-C program. Their experiments will be included in the sounding rocket canister and launched from NASA Wallops Flight Facility in June 2015.

NYSG sponsored seven students' summer 2014 internships at NASA Centers & NASA Academies at Ames Research Center, Goddard Space Flight Center, Johnson Space Center, Langley Research Center, and Marshall Space Flight Center. Seven engineering students engaged in NYSG co-funded summer internships at Lockheed Martin in Owego, NY, and Moog Space and Defense in East Aurora, NY. The Lockheed Martin interns' project is described in the previous section; Moog interns worked on projects such as thermal, structural, and dynamics analyses of satellite components; research and development of a power supply for satellite thrusters; and test equipment for electronics control units. In support of the joint NASA Science Mission Directorate (SMD)-Space Grant internship program for summer 2014, NYSG advertised opportunities to work with the three SMD mission teams throughout our affiliate institutions. We received many outstanding applications, and forwarded the top NY candidates for consideration. A Rensselaer Polytechnic Institute undergraduate was selected for the OSIRIS-REx internship at the Univ. of Arizona, whom NYSG directly funded (see more details in previous section).

Outcome 2 [Precollege] – Two middle school science teachers, from an upstate NY public school and a New York City public school, were funded by NYSG to attend the Northeast Regional Space Grant Teacher Workshop, hosted by Connecticut Space Grant Consortium in August 2014. This professional development opportunity focused on hands-on engineering activities for teachers to conduct with their students. At New York University, the NYSG affiliate director and students in his mechatronics laboratory ran several precollege activities. During summer 2014 they hosted twelve K-12 teachers who learned about mechatronics/robotics and participated in four-week research projects. The NYU students also mentored three NYC high school students in hands-on robotic projects over the summer. Six teams of high school teachers and students from the NY Capital District and Long Island attended Union College's Physics Constants Workshop in December 2014, working on physics experiments utilizing particle accelerators, scanning electron microscopes, and atomic force microscopes.

SUNY Buffalo's NYSG affiliate director and supported students were involved in several engineering programs for precollege teachers and students. During summer 2014, middle school

teachers were trained in engineering concepts and worked on a curriculum to be used in their public schools as part of the Buffalo Engineering Awareness for Minorities and Women (BEAM) program. The BEAM summer program also engaged underrepresented and female high school students in engineering enrichment activities at SUNY Buffalo. Tech Savvy engaged female middle school students in hands-on workshops on alternative energy solutions and robotics/data communications. NYSG faculty and students also provided in-classroom science lessons for elementary students at a Buffalo charter school.

Supported by NYSG, Syracuse University and the Museum of Science and Technology (MOST) continued three programs: Central New York (CNY) Rocket Team Challenge, CNY Bridge Build'em and Bust'em, and CNY Regional VEX Robotics. The CNY Rocket Team Challenge began in April with information sessions and materials pick-up, and culminated with the June 7th launch day in which 105 middle and high school student teams participated from 35 different schools. Teams were scored on multiple factors, including predicted versus actual apogee, eggstronaut condition after landing, and rocket performance. During the Bridge event (November 2014), 226 student teams (grades 4-12) representing 38 schools built balsa wood bridges, with awards given to teams with the highest scores in efficiency (load handled divided by bridge mass). Forty-six student teams built robots for the January 2015 CNY Regional VEX Robotics Competition. NYSG also sponsored middle and high school student awards at the Central New York Science and Engineering Fair (March 2015).

Outcome 3 [Informal Education] – Space Grant-funded undergraduate researchers at Alfred University also were involved in outreach over the summer, including leading public nights at the Stull Observatory and instructing Summer Astronomy Institute high school students in lab activities. Undergraduates at Colgate University worked with faculty and staff to develop astronomy teaching modules for use in classes and public outreach activities within the Ho Tung Visualization Laboratory. Columbia University held more than 24 outreach events so far, with more planned before the fiscal year is over. Activities included astronomy public lectures and stargazing, science fiction versus science facts film screenings/discussions, sidewalk astronomy in Harlem, school group and family astronomy sessions, and collaborations to infuse astronomy into NYC cultural events. The NYSG affiliate director and students at NYU were invited to present their interactive robotics exhibits at various venues in April-May 2014 (Genius Gala 3.0 at Liberty Science Center in Jersey City, NJ; NYU-School of Engineering Annual Research Expo; and the US National Science and Engineering Expo in Washington, DC). NYSG-supported students at Union College were involved in physics outreach to local middle and high school students. For example, students ran a workshop on Martin Luther King Day with demonstrations of physics in everyday applications and discussed life as college physics majors. Students received honors as Union College's "Volunteers of the Week" for this outreach event.

The Sciencenter continued its outreach events in Ithaca and surrounding rural areas to raise awareness about NASA's missions and increase STEM literacy. Hands-on activities for young students and their families focused on earth science, space science, nanoscale science, and engineering activities such as building rockets and making space elevators. NYSG also supported subject matter experts' interactive presentations at several locations in upstate New York (October 2014 "Mission to Mars" celebration at the Wings of Eagles Discovery Center in Horseheads, NY;

January 2015 “Search for Life & Intelligence” presentation at Kopernik Observatory in Vestal, NY).

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

- **Diversity:** The NY Space Grant Consortium incorporates a wide variety of institutions (public and private, small and large higher education institutions; informal education organizations; and industry), spread throughout upstate NY and the New York City area, with faculty from many different STEM fields serving as affiliate directors. Eight of the twenty-one (38%) NYSG affiliate institutions are helmed by female affiliate directors (not including the associate director at the lead institution). Diversity of student participants is the primary aim of NYSG’s SMART Objective #1 and #2.
- **Minority-Serving Institution Collaborations:** Three NYSG affiliates are minority-serving institutions: CUNY City College of New York, CUNY Medgar Evers College, and CUNY York College. The NYSG affiliate director at York College is the principal investigator of a five-year NSF Partnerships in Astronomy & Astrophysics Research and Education (PAARE) grant to increase minority representation in those fields; the seeds of this project were sown in part with NY Space Grant support. While SUNY Stony Brook is not a minority institution, NYSG is partnered with its Louis Stokes Alliance for Minority Participation (LSAMP) program to provide underrepresented minorities with NASA-related research opportunities with Stony Brook faculty.
- **NASA Education Priorities:** *Accomplishments related to the “Current Areas of Emphasis” stated in the 2010 Space Grant solicitation. Report on areas that apply to work proposed in your proposal and budget.*
 - *Authentic, hands-on student experiences in science and engineering disciplines.*

NY students engaged in authentic STEM research and internship opportunities at **all** NYSG colleges/universities, NASA centers, and NYSG industry affiliates (Lockheed Martin and Moog).
 - *Engage middle school teachers in hands-on curriculum enhancement capabilities through exposure to NASA scientific and technical expertise.*

NYSG supported two teachers’ participation in the Northeast Regional Space Grant Teacher Workshop.
 - *Summer opportunities for secondary students on college campuses with the objective of increased enrollment in STEM disciplines or interest in STEM careers.*

During summer 2014 the Buffalo Engineering Awareness for Minorities and Women (BEAM) program engaged underrepresented and female high school students in engineering enrichment activities at SUNY Buffalo; NYC high school students were mentored by NYSG-supported students in robotics projects on the NYU campus.

- *Community Colleges – develop new relationships as well as sustain and strengthen existing institutional relationships with community colleges.*

The Space Grant affiliate director at CUNY Medgar Evers College has a long-standing collaboration with faculty at CUNY LaGuardia and Queensborough Community Colleges, which extends to their participation in CUNYSAT. The many opportunities provided by this project (student workforce development, faculty collaboration, scientific research, systems engineering, and experience with the aerospace industry) are invaluable to the community colleges. Through his role as Program Director for NYSG's Community College Partnership Program, our affiliate director at CUNY York College has close relationships with faculty at CUNY LaGuardia, Queensborough, and Borough of Manhattan Community Colleges which are sustained through Space Grant activities. LaGuardia and Borough of Manhattan Community Colleges are minority institutions with high Hispanic enrollment. Our NYSG affiliate director at Rensselaer Polytechnic Institute is collaborating with faculty at CUNY Borough of Manhattan Community College to help place a student in an aeronautical engineering internship at Rensselaer.

- *Aeronautics research – research in traditional aeronautics disciplines.*

At SUNY Buffalo, a NYSG-funded student developed software to automatically identify and track distant objects, which could be used in unmanned aerial vehicles to assist in operations such as natural disaster relief and ground recognition.

- *Environmental Science and Global Climate Change – research and activities to better understand Earth's environments.*

Syracuse University undergraduate students conducted environmental science research on topics such as “Improvement on Correction Factor to Approximate Methyl Mercury using Specific Ultraviolet Absorbance,” “Chemical Contamination of Sediments Mobilized from Hurricane Sandy in the NYC Area,” and “Dynamics of Phosphorous and its Linkages with Organic Carbon in Soil Solutions.”

IMPROVEMENTS MADE IN THE PAST YEAR

Clarkson's Space Grant program began supporting activities of undergraduate professional societies (e.g., National Society of Black Engineers, Society of Hispanic Professional Engineers, and Society of Women Engineers) to increase awareness of the Space Grant program within more diverse student populations. Medgar Evers College's NYSG students and faculty are working to attract more women participants by volunteering in activities such as “Black Girls Code.” The NYSG Community College Partnership Program, initiated by a new NASA award in fall 2014, will help our consortium develop more ties to two-year colleges within our state; such relationships will be sustained beyond the period of the grant.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

1. **Alfred University**, Alfred, NY [*highly residential, Master's I, private*] undergraduate research and informal education
2. **Barnard College**, New York, NY [*highly residential, Baccalaureate - Liberal Arts, private*] **liberal arts college for women**, undergraduate research
3. **CUNY City College of NY**, New York, NY [*primarily nonresidential, Master's I, public*] **Minority Serving Institution**, undergraduate and graduate research and F/S
4. **CUNY Medgar Evers College**, Brooklyn, NY [*primarily nonresidential, Baccalaureate - General, public*] **Minority Serving Institution**, undergraduate research and F/S, student flight projects (high-altitude balloons and CubeSats)
5. **CUNY York College**, Jamaica, NY [*primarily nonresidential, Baccalaureate - General, public*] **Minority Serving Institution**, graduate research and F/S
6. **Clarkson University**, Potsdam, NY [*highly residential, Doctoral/Research - Intensive, private*] undergraduate and graduate research
7. **Colgate University**, Hamilton, NY [*highly residential, Baccalaureate - Liberal Arts, private*] undergraduate research and informal education
8. **Columbia University**, New York, NY [*highly residential, Doctoral/Research - Extensive, private*] graduate research and F/S, informal education
9. **Cornell University**, Ithaca, NY [*primarily residential, Doctoral/Research - Extensive, private and public (land grant)*] **NYSG lead institution**, undergraduate and graduate research and F/S, other consortium-wide projects such as summer internship programs, precollege, and informal education
10. **Lockheed Martin**, Owego, NY – Aerospace industry affiliate providing student internships.
11. **Moog, Inc.**, East Aurora, NY – Aerospace industry affiliate providing student internships.
12. **New York University (formerly Polytechnic Institute of New York University)**, Brooklyn, NY [*primarily nonresidential, Doctoral/Research - Intensive, private*] undergraduate and graduate research, precollege, informal education
13. **Rensselaer Polytechnic Institute**, Troy, NY [*highly residential, Doctoral/Research - Extensive, private*] graduate research and F/S
14. **Rochester Institute of Technology**, Rochester, NY [*highly residential, Master's I, private*] graduate research and F/S
15. **Sciencenter**, Ithaca, NY – Non-profit informal education affiliate
16. **SUNY Binghamton**, Binghamton, NY [*highly residential, Doctoral/Research – Extensive, public*] undergraduate research and F/S
17. **SUNY Buffalo**, Buffalo, NY [*primarily residential, Doctoral/Research - Extensive, public*] undergraduate and graduate research and F/S, precollege
18. **SUNY Geneseo**, Geneseo, NY [*highly residential, Master's I, public*] undergraduate research
19. **SUNY Stony Brook**, Stony Brook, NY [*highly residential, Doctoral/Research - Extensive, public*] **NYSG is partnered with the LSAMP program which runs minority-focused projects**, undergraduate research and F/S
20. **Syracuse University**, Syracuse, NY [*highly residential, Doctoral/Research - Extensive, private*] undergraduate research and F/S, precollege projects with informal education partner Museum of Science and Technology (MOST) in Syracuse

21. **Union College**, Schenectady, NY [*highly residential, Baccalaureate - Liberal Arts, private*] undergraduate research, precollege, informal education
22. **University of Rochester**, Rochester, NY [*highly residential, Doctoral/Research - Extensive, private*] undergraduate and graduate research