Greetings:

There are diverse reasons why I am active with the Space Grant (SG) program, in our state and nationally, all converging on the fact that SG enhances science, technology, engineering, and math (STEM) learning from K-12 to higher education to public outreach. In particular SG helps prepare NASA’s future workforce by supporting thousands of STEM students with competitive fellowship, scholarship, and internship opportunities. SG has a proven record of encouraging young students to continue in STEM careers, and pays special care to diversity issues to engage more minorities and females.

Outreach is indeed one of the important tasks that SG provides, including efforts to improve public understanding of key issues of existence, such as where we are in the universe and why we are. For example, in 1997 the Sciencenter in Ithaca dedicated a public outdoor exhibit to help children and adults understand our solar system. Pedestals represent the Sun and the planets on a 1-to-5 billion scale, where the sun is the size of a basketball and Earth is 33 yards away, with Pluto three-quarters of a mile out. When we were building this model I asked “Where on this scale is the closest star to the Sun, Alpha Centauri, located?” There were many guesses all far away. It turns out that Alpha Centauri on this scale is in Hawaii! So we pledged to construct a pedestal in Hawaii saying “on this scale the solar system is in Ithaca, NY.” After more than a decade the new pedestal was inaugurated at the ‘Imiloa Astronomy Center on the University of Hawai‘i’s Hilo campus on September 28, 2012. This Alpha Centauri station was made possible by collaborations between Hawaii SG, New York SG, ‘Imiloa, and the Sciencenter.

In this newsletter you will read about many of our other consortium activities, from student projects to robotics to supporting undergraduate and graduate students across New York. Late in October, I shall participate in the National Space Grant meetings in Seattle as Chair of the National Council of Space Grant Directors.

Yervant Terzian
Director
Barnard Students and Alumnae Thrive in Research

In 2011, Barnard College physics major Emily Lemonier spent a busy and productive summer on astronomy research at the American Museum of Natural History (AMNH) with Prof. Kelle Cruz of Hunter College. Lemonier worked with high-resolution optical spectra of suspected young brown dwarf stars, to prove or disprove their youth. If the brown dwarf stars are young, it is possible to use them as benchmark stars to determine other youth indicators among brown dwarfs. At the end of the summer she gave a research talk at the museum. In addition, Emily presented a poster paper on this work, entitled “Determining Youth Indicators Among Brown Dwarfs” (authors: E. Lemonier, K. Cruz, and V. Baldassare), at the American Astronomical Society meeting in January 2012.

Another Barnard physics major, Megan McGregor, was supported by NY Space Grant funds in summer 2012 to work with Prof. Chuck Hailey at the Columbia Astrophysics Laboratory. McGregor worked on the General Antiparticle Spectrometer Experiment (GAPS), a balloon-borne experiment to hunt for dark matter. GAPS uses a novel scheme to detect antimatter through identification of atomic de-excitation X-rays produced when antimatter is captured in matter, forming an exotic atom. A prototype experiment was successfully flown from Hokkaido, Japan in June 2012. McGregor spent the summer fabricating and testing semiconductor detectors that will eventually search for cosmic antideuterons. The GAPS team is currently working on the design of a major experiment to be flown from Antarctica in late 2016.

Through the summer 2012 NY Space Grant Undergraduate Research Internship Competition, Barnard astronomy major Jocelyn Ferrara received funds to work with Prof. Kelle Cruz at AMNH on refining the methods of classifying L-type brown dwarfs. As more L, T, and Y dwarfs are discovered, more gaps in their standard classification scheme are revealed. Using a much larger sample of objects than had been previously analyzed and published, Ferrara tested the accuracy of the current method that utilizes near infrared spectral index and spectral type relations by comparing its results to those determined by the optical spectral typing method.

Some of our Barnard Space Grant alumnae are doing very well in their new positions. Gwen Effgen is currently in the Biomedical Engineering PhD program at Columbia University, working on biophysics research. NY Space Grant funded her introduction to this type of research in the summer of 2009. Effgen is the founder and president of the Society of Women Engineers Graduate Student Group at Columbia Engineering. Erin Kara, another 2009 Space Grant awardee, is working on her PhD in Astronomy at the University of Cambridge and recently presented a paper at the Energetic Astronomy Conference in Annapolis, Maryland. Anne Norrick, another 2009 Space Grant recipient, is working on her PhD at the College of William & Mary. During a visit to Barnard in the spring of 2012, Norrick gave a guest lecture on neutrino oscillations in Prof. Mukherjee’s Quantum Mechanics class. We look forward to hearing more success stories from past Space Grant students.

University of Rochester Student Works on Infrared Detectors for NASA

After early completion of her BS degree in Imaging Science at Rochester Institute of Technology, Meghan Dorn joined the Infrared Astronomy group at the University of Rochester (UR) in April 2012 and began working on her MS thesis research. During summer 2012 she worked closely with Kelly Anderson, a Space Grant-funded undergraduate from Roberts Wesleyan College in Rochester, and Dr. Candice Fazar, a visiting faculty member from Roberts Wesleyan and former UR graduate.

UR was awarded a NASA grant early in 2012 to develop infrared arrays sensitive at a wavelength of 10 micrometers (10 microns). These arrays will be used in the NEOCam space telescope to study near-Earth objects and risk of Earth impacts. NEOCam is a project within the NASA Discovery Program, which aims to launch smaller planetary science missions that use fewer resources, have shorter development times, and include greater university and industry participation. NASA has given us two years to bring the detector array technology up to Technical Readiness Level 6. To meet this goal we are working closely with the
Surviving the Transit of Venus at Columbia in NYC

The weather during the first week of June 2012 did not seem to care very much about our blood pressure. Columbia’s astronomy department had big plans for June 5th, the last transit (when a planet becomes visible by passing directly between the Sun and Earth) of Venus in our lifetimes. We were organizing viewing parties at five public schools and setting up telescopes in two very public Manhattan locations. Over the course of several weeks, equipment worth several hundreds of dollars had been purchased, solar filters and funnels had been assembled and tested, deep discussions about the best ways to balance Galileoscopes had taken place, scouts had checked candidate viewing locations for sightlines, and a small army of volunteers had been rounded up and given its marching orders... we were ready for the big show.

Yet there we were, noon on the day, only a few hours to go before contact, still unsure whether to put the plan in motion. I think it may have been drizzling, or maybe it just looked like it might, but in any case the Sun was nowhere to be seen. The forecast was for more of the same until nightfall. Pessimism was rampant. Should we bother? Should our student volunteers really drag themselves and their equipment into the subways or onto trains (and in my case, onto the Staten Island Ferry)? Should they travel several hours round-trip only to stare at a gray bank of clouds? How would the students feel if we canceled? But how would they feel if they spent hours staring at those clouds?? Let me introduce the hero of our piece: John Pazmino, a member of NYSkies Astronomy Inc. In an interview with the NY Times, John was asked about the threat of clouds and rain. His response: “Our philosophy is to let Mother Nature kill the event, not human nature.” That became our rallying cry: if John wasn’t going to give up, neither were we. Off we went, to school rooftops in the Bronx, Queens, Manhattan, Staten Island, New Rochelle, and to Union Square in lower Manhattan and to the Adam Clayton Powell, Jr. Plaza in Harlem.

Six of our seven locations got great views of the transit; my apologies to the students of Curtis High School in Staten Island, to whom I brought my legendary good luck. Hundreds thronged our telescopes in Union Square and on 125th Street in Harlem, creating conditions that verged on the alarming. We were particularly amused and concerned by people’s need to rush the telescopes to photograph the projected images of the transit. Meanwhile, dozens of students at our partner schools were able to enjoy the transit, making this one of our most successful outreach events ever – fitting for a once (or sometimes twice!) in a lifetime event!

NEOCam Principal Investigator, Dr. Amy Mainzer at NASA JPL, as well as with the array manufacturer Teledyne Imaging Sensors.

Meghan has become an expert in the vacuum and cryogenic technologies required for infrared detector array operation, and has played a pivotal role in the data reduction of the new arrays. Three have been delivered to date; based on UR’s detailed measurements, Teledyne’s next lot will incorporate important changes and improvements. Meghan will continue to be intimately involved in the array development for her thesis research. Kelly worked on evaluating a prior set of 10 micron arrays, processed around 2003 and delivered in 2006, to determine if there has been any performance degradation in the intervening 6 years. Motivating Kelly’s work was last year’s discovery that the James Webb Space Telescope’s 5 micron arrays, also manufactured at Teledyne, had degraded. Dr. Fazar expects that Kelly will be able to continue work with her and UR over the academic year on aspects of the new arrays.
The University at Buffalo (UB) supported three fellowships, a research assistant, and the BEAM program for pre-college students with NY Space Grant funds. The fellowships were awarded to Daniel Snitzer (Mechanical and Aerospace Engineering) who studied nonlinear systems, Jun Wang (Electrical Engineering) who researched heterojunction solar cells, and Meredith Canty (Electrical Engineering) who studied high voltage resistors. Research assistant Eric Kozarsky was partially supported in his research on thin silicon films for lower cost solar cells. In addition, a graduate student team consisting of Eric Kozarsky, with co-authors Juhyung Yun, Chong Tong, Xueli Hao, and Jun Wang, along with their advisor Prof. Wayne A. Anderson, was awarded Best Poster at the 38th Institute of Electrical and Electronics Engineers (IEEE) Photovoltaic Specialists Conference, held June 2012 in Austin, Texas. Their “Thin-Film ZnO/Si Heterojunction Solar Cells: Design and Implementation” research focused on improvements in efficiency and light absorption of thin films.

The Buffalo Engineering Awareness for Minorities (BEAM) program aims to improve the mathematics and computer skills of post-eleventh grade minority students with a curriculum guided by the NY State Learning Standards for mathematics, science and technology. Hands-on projects, outside speakers and field trips further extend the students’ experience. Twenty students were selected for the 5-week course from July 5 to August 3, 2012. SUNY Buffalo engineering students taught the summer courses in mathematics, computers, and engineering; the peer mentoring relationship was beneficial to both the college and high school students. Outside speakers enhanced students’ knowledge of engineering careers. Trips to UB research labs included IDEA, ESI, NYCEDII, MCEER, SEESE. A field trip to Kistler Instruments, a BEAM company sponsor, taught students about the development, production and use of sensors for measuring pressure, force, torque and acceleration.

Seven of the twenty students participated in the BEAM Honors Research program, mentored by UB engineering professors including Professors Park, Swihart, Ramamurthy, Zhuang, Krovi, Wu and Das. The Honors Research students worked with their assigned faculty mentors for 12 hours per week, and enrolled in SUNY Buffalo’s Introduction to Computing & Engineering course. The program concluded with students giving oral presentations on their work.

Team Atlas from the Polytechnic Institute of New York University (NYU-Poly) competed for the second time in the 3rd annual NASA Lunabotics Mining Competition, held at the Kennedy Space Center in May 2012. This competition challenged students to design and build a remote control or autonomous excavator to mine and deposit simulated moon soil within a certain time limit. The team won the Judges Innovation Award for their lunar rover design, and came in third place for the Team Spirit Award. Despite unforeseen mechanical problems in the first round, Team Atlas still placed 6th out of 55 teams in the official competition.

NYU-Poly’s Atlas02, a lightweight rover designed to excavate lunar regolith, weighs a total of 36 kilograms (79 pounds).
During the past year, NY Space Grant funding supported diverse research, education, and outreach activities involving advanced control technology and mechatronics experiments at the NYU-Poly Mechatronics Lab.

The TINI (Tiny InterNet Interface) microcontroller platform, DSTINIM400, was recently deployed as a cost-effective solution for online control and monitoring of laboratory experiments. The DSTINIM400 was utilized to interface with a variety of experiments, execute user-selectable control algorithms, and communicate with remote users via intuitive graphical user interface (GUI) control panels. The GUI control panels were designed as Java applet web pages, with sensor data displayed on graphs and control system structure and parameter values presented as binary switches, sliders, and text boxes. Safety protocols were evaluated and implemented to safeguard the online laboratory experiments. For more details see: C. Dubey, H. Wong, V. Kapila, and P. Kumar, “Web-Enabled Remote Control Laboratory Using an Embedded Ethernet Microcontroller,” in Internet Accessible Remote Laboratories: Scalable E-learning Tools for Engineering and Science Disciplines, A.K.M. Azad, M.E. Auer, and V.J. Harward (Eds.), 338—361, IGI Global, USA, 2012, ISBN 978-1-61350-186-3.

Professor Kapila and his project team, including two NY Space Grant students (Jared A. Frank and David Lopez), were selected to present their “Mobile Apps for Robotics” exhibit at the U.S. National Science and Engineering Expo in Washington, DC in April 2012. During this event, over 3,000 Expo attendees explored and experienced innovative uses of iDevices (e.g., iPhone, iPod, and iPad) to intuitively interact with robots. Moreover, in June 2012 the same team presented the Mechatronics Mania exhibit at Innovation Square, an event held at NYU-Poly as part of the World Science Festival. The event was attended by over 1,000 K-12 teachers, students, STEM professionals, and general public.

David Lopez delivered mechatronics instruction to ten NYC high school students participating in a six-week “SYSTEM” environmental summer program. Lopez also guided the students’ project design, for which they developed a prototype device for environmental monitoring of air humidity, temperature, soil moisture level, etc. The device is capable of storing time-stamped data and activating an alarm if an undesirable environmental condition is sensed. The students installed and tested their devices in Lentol Garden.

Finally, both Jared and David entered the NYU-Poly Inno/vention Competition in spring 2012. Their entry “iDevice-Based Multi-Modal Intuitive Interfaces for Human-Robot Interaction” qualified as one of four finalists in the graduate student category.

With help from Jared A. Frank, young visitors investigate an iPhone-controlled mobile robot at the World Science Festival.

New Sagan Planet Walk Station in Hawaii

Alpha Centauri: the latest station of the Sagan Planet Walk exhibition. Dedicated on September 28, 2012, this expansion makes the Planet Walk the largest exhibition in the world, stretching 8,000 km from the Sun station in Ithaca, NY to Alpha Centauri at ‘Imiloa Astronomy Center on the University of Hawai’i campus in Hilo, HI. This represents the distance between the Sun and the nearest star, on a 1-to-5 billion scale.
What a great year for Space Grant at Rensselaer! Twenty-two New York State K-12 teachers attended the “Planetary Science and Astronomy for the Next Generation of Science Standards” workshop July 16-20, 2012. Participants attended lectures by leading researchers, learned hands-on activities that they can use in their classrooms, and were certified to borrow moon rocks and meteorites from NASA collections. More than half of the teachers would not have been able to attend without Space Grant support. Two assistant professors won NY Space Grant research & curriculum enhancement grants. Prof. Onkar Sahni and her graduate students are designing quieter and more efficient wind turbine blades using high-fidelity computer simulations. Prof. Joel Giedt, assisted by undergraduate student Will Cunningham, developed course materials for a Computational Physics class which will introduce students to the most modern techniques using Graphics Processing Units (GPUs). Graduate student Julie Dumas received a NYSG fellowship that allowed her to complete her qualifying exams and begin running simulations of the tidal disruptions of dwarf galaxies in the Milky Way. She is also learning about the distribution of dark matter in our own galaxy. She was accepted to (and attended) the 2012 SciCoder Workshop at NYU in July. Undergraduate student Jimmy DeLaunay used summer support from NYSG to comb through hundreds of thousands of spectra from a new survey conducted on the LAMOST telescope. In all, the NY Space Grant had a huge impact on K-12 teachers, undergraduate and graduate students, and space research through the Rensselaer affiliate.

The Sciencenter and New York Space Grant funded a two-part program to engage elementary-age children in the space sciences. This programming aligns with the Sciencenter’s mission “to inspire excitement for science through interactive exhibits and programs that engage, educate and empower.” The Sciencenter focused on schools in underserved communities, introducing students to space sciences who might not otherwise have the opportunity to engage in our programming.

During the 2011-2012 school year, the Sciencenter provided free-of-charge community science nights at four elementary schools in two counties. At these events, students and their families participated in hands-on, interactive science activities. Each family was provided with a free pass to return to the Sciencenter. Over 450 people participated in community science nights. This program was greatly appreciated by parents, as one wrote, “I just wanted to say that I thought Science Night was a huge success - lots of people, lots of activity, kids with big smiles on their faces and big wide eyes, happy parents. ... All in all, it was great fun!”

This year the Sciencenter also refurbished its Starlab Portable Planetarium. Sciencenter educators have developed and delivered two new Starlab programs: a citizen science project that focuses on light pollution, and a program on African constellations for Black History Month. Children from pre-K through 12th grade experienced a tour of the night sky that integrates astronomy content with earth science and history.
At York College CUNY, Space Grant supported CUNY graduate student Ryan Abrahams’ research as well as numerous outreach efforts. Abrahams’ dissertation centers on observations of extragalactic gamma-rays using the NASA Fermi Gamma-ray Space Telescope. In an attempt to determine the origin of the gamma-rays, he is assembling sensitive gamma-ray spectra of a variety of sources and comparing them to models of the emission. It is currently unknown whether massive star forming regions or active galactic nuclei are the dominant sources in galaxies that harbor both types of objects. His initial study with Dr. Tim Paglione at York and the CUNY Graduate Center resulted in an August 2012 publication in the Astrophysical Journal. Dr. Paglione participated in numerous outreach events sponsored by Space Grant including several presentations at local high schools and community colleges, as well as the July 2012 grand opening of the Space Shuttle Enterprise exhibit at the Intrepid Sea, Air & Space Museum.

York student Angelina Almonte was awarded funds through the summer 2012 NY Space Grant Undergraduate Research Internship Competition. Almonte worked with Dr. Kevin Lynch and Dr. James Popp on high-energy physics research involving the Mu2e experiment, planned for the Fermi National Accelerator Laboratory. Mu2e is a high-sensitivity search for the rare and as-yet unseen decay of a muon directly into an electron, with no associated neutrinos. Such a discovery would provide direct evidence of new physics beyond the Standard Model of Particle Physics. Pions are produced by directing an 8.3 kilowatt proton beam on a very dense target inside a large high-field superconducting solenoid magnet. The pions then decay into muons and are channeled by magnetic fields to the stopping target. Almonte helped design the collimator that protects the magnet surrounding the pion production target from the proton beam. Her task was accomplished using specialized particle physics software to simulate the collimator and magnet system, and determine the different ways the proton beam could damage the magnet and surrounding apparatus.

The Louis Stokes Alliance for Minority Participation (LSAMP) program at Stony Brook University had a productive and fulfilling year. NY Space Grant funds supported two undergraduates engaged in high-level research projects. A biomedical engineering student researched the loss of bone density during long-duration exposure to microgravity. His project, titled “Trabecular and Cortical Bone Morphology over Multiple Exposures to Unloading,” also has terrestrial relevance as it provides insight into the treatment of osteoporosis. A mechanical engineering student worked on a project titled “Understanding Chemical Emission from Rocket Combustion.” He studied modeling techniques used in the simulation of fluid flows and combustion, with a particular emphasis on computational fluid dynamics.

We are also proud report on three former students: one passed his qualification exams and has been accepted as a full-fledged computer engineering PhD student at City College of NY, another finished a two-year fellowship at the National Institutes of Health and has moved on to the Biomedical Engineering PhD program at Yale University, and the third is a female engineer at NASA Goddard Space Flight Center who has applied to become an astronaut.
Syracuse Area Students Excel in Science Competitions

In the past year NY Space Grant funds supported three outreach programs at Syracuse University (SU) and the MOST (Museum of Science and Technology): the eighth annual Central New York (CNY) Rocket Team Challenge, tenth annual CNY Bridge Build’em and Bust’em, and 1st Syracuse Regional VEX Robotics Competition. With the addition of the robotics event, we now have STEM programming for the fall, winter and spring.

These design-and-build programs recruit student teams from central NY schools and especially target team members from underrepresented groups within urban districts and the Onondaga Nation School. The number of K-12 students impacted by these three activities was approximately 1,500.

VEX Robotics Competition

Twenty-nine student teams competed in the 1st Syracuse Regional VEX Robotics Competition at the MOST on Saturday, February 11, 2012. Twenty-three of the teams represented the Syracuse City School District (SCSD). Approximately 56% of the team members (totaling 103) were from underrepresented groups (race and gender) in STEM fields. With guidance from teachers and mentors, the students built innovative robots designed to match the 2012 VEX ‘Gateway’ challenge. This event was both a US National Championship and World Championship Qualifying Event. Two teams attended the Northeast Regional event held on March 3, and two advanced to compete in the World Championship held April 18-22 in Anaheim, CA. At this event, SCSD’s Fowler High School team (T-Squared) finished 84th out of the 396 teams – a great showing for their first year.

Major sponsors for this event were Lockheed Martin and the NY Space Grant Consortium. A public video of the MOST event can be watched on line at: [http://innovationtrail.org/post/boys-and-girls-start-your-robots](http://innovationtrail.org/post/boys-and-girls-start-your-robots). A list of all participating teams and the list of winners can be found at: [http://robotevents.com/syracuse-regional-vex-robotics-competition-1.html](http://robotevents.com/syracuse-regional-vex-robotics-competition-1.html). The MOST/SU partners will host the 2nd Syracuse Regional VEX Robotics Competition on Saturday, February 9, 2013. This year’s challenge is titled VEX Sack Attack.

CNY Science & Engineering Fair

The NY Space Grant Consortium sponsored two new awards at the 2012 Central New York Science & Engineering Fair, held at the OnCenter in Syracuse on March 25, 2012. The senior division award, recognizing excellence in Physics and Astronomy, was won by Christopher Brenon (12th grade, East Syracuse-Minoa Central High School). His project was titled “Computational methods to simulate the behavior of excitons (electron-hole pairs) in semiconductor quantum dots.” The junior division award, recognizing excellence in Earth and Planetary Science, was won by Mia Matthews (6th grade, Edward Smith K-8 School) with a project on geodes.
Space Grant Internships at NASA & NY Industry: Summer 2012

This summer NYSG supported research at Cornell and affiliate institutions, plus awarded funds to six NY student interns at NASA centers and NASA Academies. Six additional Space Grant interns worked in NY industry, co-funded by NYSG and Honeybee Robotics Spacecraft Mechanisms Corp, Lockheed Martin, and Moog Inc. See more details on the NASA and industry interns in the table below.

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<tr>
<th>Location</th>
<th>Students</th>
<th>Students’ Home Institutions</th>
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<td>NASA Ames Research Center</td>
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<td>Columbia University</td>
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<td>NASA Goddard Space Flight Center</td>
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<td>Columbia University and NYC College of Technology, CUNY</td>
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<tr>
<td>NASA Glenn Research Center</td>
<td>1</td>
<td>Rochester Institute of Technology</td>
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<td>NASA Jet Propulsion Laboratory</td>
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<td>NASA Marshall Space Flight Center</td>
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<td>Columbia University</td>
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<td>Honeybee Robotics (New York, NY)</td>
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<td>Lockheed Martin (Owego, NY)</td>
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<td>Rochester Institute of Technology</td>
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<td>Moog Inc. (East Aurora, NY)</td>
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<td>Rochester Institute of Technology (2) and SUNY Buffalo (2)</td>
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New York Space Grant Affiliate Directors and Institution Locations

Prof. Yervant Terzian, Cornell University (Director)
Prof. Marcel Agüeros, Columbia University
Prof. Wayne Anderson, SUNY Buffalo
Prof. Shermane Austin, Medgar Evers College, CUNY
Prof. Thomas Balonek, Colgate University
Prof. Frank Cardullo, SUNY Binghamton
Mr. Ron Crawford, Lockheed Martin
Prof. David Ferguson, SUNY Stony Brook
Prof. Susannah Fritton, City College of NY, CUNY
Prof. Vikram Kapila, Polytechnic Institute of NYU
Prof. Rebecca Koopmann, Union College
Prof. Reshmi Mukherjee, Barnard College
Prof. Heidi Newberg, Rensselaer Polytechnic Institute
Prof. Chris O’Dea, Rochester Institute of Technology

Prof. Tim Paglione, York College, CUNY
Prof. Judith Pipher, University of Rochester
Prof. Peter Plumley, Syracuse University
Ms. Christine Seuffert, Moog Inc. *new affiliate
Prof. Aaron Steinhauer, SUNY Geneseo
Prof. David Toot, Alfred University
Prof. Charles Trautmann, Sciencenter
Prof. Daniel Valentine, Clarkson University
New York Space Grant News
Fall 2012

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Paul Siegel (SUNY Stony Brook)
Peter Plumley (Syracuse University and MOST)

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(Above) On the deck of the USS Intrepid, Prof. Terzian takes a break from training teachers during SpaceFest, celebrating the grand opening of the space shuttle Enterprise pavilion at the Intrepid Sea, Air & Space Museum in NYC (July 2012).

(Below) Students and parents learn about center of mass during a NYSG lecture at a Queens, NY middle school (March 2012).

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