

Rhode Island Space Grant Consortium
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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 **Rhode Island Space Grant Consortium** is a Program Grant Consortium funded at a level of **\$535,000** for fiscal year 2009.

PROGRAM GOALS: Our program goals and objectives are summarized below. These summaries are abridged for brevity, but full descriptions of our goals can be found in our 2009 Budget Package.

A. OUTCOME 1: *Fellowship/Scholarship, Higher Education, and Research Infrastructure programs*

1. Faculty and Research Support: Our goal was to provide NASA competency-building education and research opportunities for faculty, researchers, and post-doctoral fellows. For the Lead Institution, we proposed to allocate (from NASA) a total of \$23K for research support. For our Affiliates, we allocated \$35K for Affiliate research support in FY'09, which represented about 17% of our Affiliate allocation, consistent with our consortium emphasis on higher education. We anticipated making 5 awards at \$7K each. The Research Review Committee will review proposals on the following criteria (in order): relevance to NASA, merit, potential for broadening Affiliate involvement (new institutions or faculty), and potential for new NASA collaborations. Included in these proposals are travel grants to conferences, NASA Centers, and Visiting Researchers. *Our success was also to be measured by: research papers, conference presentations, and new proposed research grants.*

2. Student Support: Provide NASA competency-building education and research opportunities to develop qualified undergraduate and graduate students who are prepared for employment in STEM disciplines at NASA, industry, and higher education. We proposed the following awards. *Success was to be measured by the quality of the applicant pool, research papers/abstracts, presentations at the annual Symposium, and a short report (or published abstract/paper) at the end of the support period.*

- a. Full-year *RISG Fellowships* at Brown (4) and our Affiliates (2)
- b. *RISG Undergraduate Research Opportunities* (at least 4)
- c. *RISG Summer Research Fellows* (at least 1)
- d. *RISG Summer Research Scholars* (at least 3) and *Academic Year Outreach Scholars* (3)
- e. *RISG Graduate/Undergraduate Travel Grants*
- f. *RISG Special Undergraduate Awards*
- g. *RISG Undergraduate Research Opportunities*
- h. Joint Industry Partnership (up to 4)
- i. *RISD Internships at NASA Centers* (4)

3. Course Development: Develop NASA-related course resources for integration into STEM disciplines.

a. *RISD Design for Extreme Environments program:* This program was proposed to consist of a six-credit course centered around the annual NASA Great Moonbuggy Race, run in the Department of Industrial Design during the 2009-2010 academic year with internships awarded at the *JSC Habitability Design Center (HDC)* and or other NASA centers.

b. *Brown Capstone Engineering Course:* We proposed to continue supporting classes offered by the Engineering Department at Brown University that emphasize hands-on activities.

4. Student Field Experiences: We proposed to continue a popular undergraduate Spring Field Trip where undergraduates are immersed in field studies while using NASA materials (remote sensing and planetary analogs).

5. Targeted Institution Research and Academic Infrastructure: We proposed to improve the ability for targeted institutions to compete for NASA research and development work through a *Visiting Research Faculty Program* in collaboration with the *Office of Diversity* at Brown.

B. OUTCOME 2: *Higher Ed programs and Pre-College Programs*

1. Educator Professional Development:

a. Museum of Natural History (MNH): Educator workshops were planned at our Affiliate, the *Museum of Natural History*, all tied to the ongoing RISG-co-sponsored exhibits entitled: *Pole-to-Pole: Earth's Dynamic Extreme* and *Life of Stars: From Nebula to Supernova*.

b. Teacher Partnership Program: Our 75:25 (75% Research to 25% Outreach) Program engages our RISG Fellows and Scholars through partnerships with RI K-12 teachers. They bring their current NASA-focused research into the RI classrooms, thereby providing a context to learning classroom materials.

c. Brown Summer Academy: We proposed to support 2 classes for middle and high school students given by RISG Summer Teaching Fellows.

2. Curricular Support Resources: Our Affiliates (RIC, MNH, and the Ladd Observatory) and Fellows, and Low-Gravity Program provide resources for students and mentoring through our outreach programs. We proposed to continue sharing research results and experiences with students through class visits, public speaking (e.g., local astronomy clubs), and special seminars.

3. Student Involvement K-12: Most of our involvement is through programs provided by our Affiliate, the Natural History Museum. In addition, our Fellows and Scholars interact with K-12 students. This experience, however, is primarily to provide teachers with STEM materials and to develop tools for informal-education skills that can be used as they become professional researchers.

a. Gaudet Middle School Planetarium and Cormack Planetarium: The Director of the Cormack Planetarium proposed to develop new STEM-based programs using resources provided by RISG-sponsored NASA programs.

b. NASA Mission-related Outreach: Fellows and Scholars involved in NASA missions engage K-12 by describing their experiences and the need for academics in order to achieve their dreams of participating in the exploration of other worlds.

C. OUTCOME 3: General Public and External Relations programs

1. Resources

a. Pole-to-Pole: Earth's Dynamic Extremes: This exhibit guided visitors on a multi-media tour of Earth's cryosphere.

b. Life of Stars: From Nebula to Supernova: This exhibit focuses on stars, interstellar matter, galaxies and the Universe. It also includes an emphasis on the importance of studying the cosmos using different filters and colors.

c. Educator List-serve: Relays current NASA-related news, educational opportunities, and relevant websites to educators.

d. Ladd Observatory Outreach Program: Provides weekly presentations about hot topics in astronomy.

2. Professional Development for Informal Education Providers:

a. Fellows and Scholars Teacher Partnerships: This program specifically addresses this outcome by instilling a desire (and responsibility) to provide informal education in the community even after their fellowship ends.

b. Museum Docent Program: An important part of the museum exhibits at Providence's Natural History Museum is the involvement of Planetary Geology graduate students, who interact with the public each Saturday.

PROGRAM/PROJECT BENEFIT TO OUTCOME (1,2, OR 3): *Provide meaningful highlights (anecdotes) that are directly related to work completed in 2009. Show specificity relative to an Outcome – highlighting student and/or project.*

A. RISD Extreme Environments Studio: For the entire 2009-2010 academic year the class was centered around developing an entry into the annual NASA Great Moonbuggy Race. This gave the students the unique challenge of having to build a working Moonbuggy within specific parameters and for a mockup of the Moon's surface. The students and faculty member embraced the challenge and by the end of the fall semester had a working Moonbuggy. They spent the early part of the spring semester testing and refining their Moonbuggy. There was substantial local press coverage in local news programs and *Rhode Island Monthly* magazine about the project especially when a competition engineer and NASA press relations officials came to inspect their progress. At the competition the team came in third in the college/university division and won Rookie of the Year in their division as well. Many of the students became so enthused with the project that they are planning to work on their model further on their own time and enter into the competition again next year. Since 2005 four student internships are offered annually at NASA-JSC (through contractors). This year one internship led to an offer to attend further testing of the items developed at the NASA Desert RATs test site.

B. ChipSat Workshop: Building on the success of the previous year's NanoSatellite Conference, RISG co-hosted (Brown, NASA Ames, and RISG) a one-day workshop on February 18, 2010. The workshop was held on the Brown University campus and focused on the development of small chips, which will enable functions of nanosatellites.

C. Museum of Natural History Programs: RISG-supported programs at the Museum of Natural History have had a significant impact on the community, museum, its staff, and infrastructure improvements. Institutions of higher learning have been drawn back to the museum as a place for family learning, with the "Space Science Room" being a focal point. Museum attendance was up 11% and summer planetarium attendance up 16%. The Museum Director (Renée Gamba) increased involvement with NASA Educators and was invited to attend a shuttle launch based on the amount of work the museum does with NASA. Both the Museum Director and Museum Educator (Dawn Valentim) were selected to be NASA Solar System Ambassadors given the work that they do in the "Space Science Room" and in the community.

D. Research Outcome: RI Space Grant provided seed funding for innovative research looking into bat sonar infrastructure and function. The research led to the identification of a network or mutually interconnected large multipolar cells with minimal connections to the ascending auditory system. This forms the basis for bat echolocation, which is the first plausible biological explanation for bat temporal hyperacuity. These findings were presented at the 5th Annual International Biosonar Conference in Kyoto, Japan and at the International Society for Neuroethology in Madrid, Spain (neither trips funded by RISG). This work also led the development of a new computational model that will directly tie into the development of a biomimetic radar system for an autonomous flying device, which was presented at the Unmanned Biomimetic Autonomous Vehicles Conference at the Office of Naval Research and has applications for future autonomous docking strategies in space. New proposals were submitted from this effort.

PROGRAM ACCOMPLISHMENTS: *CONNECTION BACK TO CONSORTIUM ANNUAL PERFORMANCE GOALS AND OBJECTIVES*

OUTCOME 1

A. Fellowship/Scholarships

Achievements and Progress: Our target for involvement by under-represented minority students is 18% (the percentage of minority enrollment in our state, 17.2%) and 40% for women. Our projected support for all fellowships and scholarships is \$228.4K, which exceeds the minimum for a Program Grant (\$150K) according to the Budget Call. All awards were directly related to NASA's mission and goals. Our primary metrics for our Fellows included the quality of the applicant pool, presentations at the annual symposium, and papers/abstracts. These goals were achieved. We encouraged women and under-represented groups to apply. While we did not meet our goal for under-represented minority students, we did exceed our goal of 40% for awards to women (51.5%).

a. 2009 Summer Fellowships: We supported one Summer Fellow.

b. 2009-2010 Academic Year Fellowships (Brown): We awarded 5 fellowships at Brown and 2 to our Affiliates.

c. 2009-2010 RISG Academic Year Undergraduate Outreach Scholars: 4 awarded – 1 female chemistry major, 1 female engineering major, 1 female geology major, and 1 male neuroscience major.

d. Summer Undergraduate Research Scholars: 6 awarded – 1 female history major, 1 female geology major, 1 female physics major, 1 female dual math and philosophy major, 1 female engineering major, and 1 female planetary geology major.

e. RISD Internships at NASA Centers: 4 awarded – 3 males and 1 female all are industrial design majors.

B. Higher Education

Achievements and Progress:

a. Course Development

i. RISD Design for Extreme Environments program: This program changes its design focus each year with focused goals in collaboration with NASA-JSC personnel. This program includes a winter-semester internship at NASA, summer internships, and mentorship by graduate students who have completed the class sequence.

ii. Brown Capstone Engineering Course: This year the course was team-taught by the faculty member who historically has taught this course and an upcoming visiting investigator at Brown University. This has been beneficial in that it exposed the visiting investigator to RISG who is now developing innovative concepts for upcoming classes.

iii. Freshman Seminar: We supported a freshman seminar course at Brown focusing on the threat of cosmic collisions.

iv. Bryant University Initiative: Bryant University was awarded a grant to enhance and complement their new graduate and undergraduate programs in Environmental Science. This includes new NASA-related courses and research projects dealing with robotics and remote sensing being incorporated within the programs.

b. RISG Graduate/Undergraduate Travel Grants: Travel grants were awarded to 3 students over the report period.

c. Student Field Experiences: RISG provides support for an annual geology field trip over spring break. Students highlight planetary analogs and illustrate how remote-sensing materials can be used in the field.

C. Research Infrastructure

Achievements and Progress:

a. Faculty and Research Support: One of our goals last year was to enhance broader Affiliate participation in our Research Infrastructure. This led to new proposals from 5 new faculty members at 3 Affiliates: Bryant University, Roger Williams University, and the University of Rhode Island.

b. High-frequency Monitoring of Impact Processes: Detectors were placed throughout the NASA Ames Vertical Gun Range. Experiments were monitored from launch to impact at ultra-high frequencies. The goal is to develop a new approach for time-resolving impacting debris and to integrate the results into a possible exhibit dealing with sounds of nature.

OUTCOME 2

Achievements and Progress:

1. Educator Professional Development: 7 NASA-related educator workshops were held over the report period (approximately 122 participants). These included: *From Space Shuttle to Constellation*, *Life of Stars Educator Workshop*, *Life of Stars: Bringing it to Your Classroom*, *Martian Geology: Exploring the Landscape*, *NASA's Great Observatories: A Look Beyond Our Milky Way*, and *More Than Just Rocks: The Terrestrial Planets*.

2. Museum of Natural History (MNH): The Museum hosts a variety of STEM-based professional development opportunities each year. These include NASA Lunar and Meteorite Certification workshops, as well as workshops based on, and aligning with, current NASA missions. The Museum also facilitates STEM workshops for local Girl Scout troop leaders and educators from Afterschool Programs, Providence After School Alliance, and homeschool families.

3. Brown Summer Academy: We supported one class for middle school students given by *RISG Summer Teaching Fellows*: "Astrobiology: the Search for Life in the Universe" by Seth Horowitz and Mary Bates and contributed to two other programs.

4. Student Involvement K-12:

a. Gaudet Middle School Planetarium and Cormack Planetarium: Transformed the Gaudet Planetarium into a hands-on teaching and enhancement tool for middle school teachers. This includes innovative programming for immersive learning using the Gaudet Middle School Planetarium. That led to a new proposal to upgrade the Cormack Planetarium.

b. NASA Mission-related Outreach: Two of our fellows are dealing with various NASA related missions and they brought their insight to numerous school groups around the state throughout the year. An Educator Short Course on Lunar Geology was hosted at the Museum of Natural History in July 2009.

c. Science Olympiad: RISG Affiliate Rhode Island College hosted the Rhode Island portion of the national Science Olympiad. RISG was called upon to help provide an astronomy expert who developed exam content and graded the exams.

OUTCOME 3

Achievements and Progress:

- 1. Resources:** The costs for this effort represent a relatively small fraction of our budgeted dollars; our success represents extensive leveraging in order to stimulate a broader public awareness of NASA-related research in RI.
 - a. Exhibits:** During this reporting period for the two below exhibits there were over 23,000 visitors, 10,014 school children, 399 camp/after-school programs, and 94 Girl Scout programs. General museum attendance is up 11% and the planetarium attendance is up 16%. Both exhibits were very successful and continued to help the Museum's and RISG's presence in the community.
 - i. "Pole- to-Pole: Earth's Dynamic Extremes"** (July 2009 through January 2010): The exhibit, student workshops, docents (including volunteers and Museum staff) and family programming were very successful at the Museum. This exhibit enabled visitors to experience the ebb and flow, freezing, thawing, and refreezing of Earth's dynamic polar regions as captured by state-of-the-art NASA remote sensing technology.
 - ii. "Life of Stars: From Nebula to Supernova"** (January 2010 through December 2010). A faculty member who had previous minor involvement in RISG came forward with a plan for an exhibit this year. The exhibit was given guidance from the Museum Director and our Partner, the *Northeast Planetary Data Center*, providing images and design advice.
 - b. Programs at the MNH:** Our seed money for the *Museum of Natural History* and *Cormack Planetarium* has had multiplicative effects on support from the city. For example the museum can now count on the VIP openings of RISG supported exhibits to ensure that the city does necessary renovations (previously placed at low priority). The relationship continues to provide the Museum with resources that have allowed an increase in visitor and school group attendance through its NASA programming. The increased visibility in the community also has provided the museum with new opportunities, including strong positioning to petition for additional funding.
 - c. Educator Listserve:** Listserve was revived with the addition of a new Program Manager. Teachers are again receiving timely updates of opportunities of interest to them from both NASA and RISG.
 - d. Ladd Observatory Outreach Program:** RISG supported a major Open House during Halloween. This support enabled broader participation, advertising, and displays related to observing the planets and the universe. This also reinforced the community awareness of the observatory.
 - e. NASA Mission-related Outreach:** "Chicken Little or Armageddon: Past and Future Threats," University of Connecticut, Storrs, CT (April, 2008); *Breakfast on the Moon: LCROSS Impact* (October, 2009) National Space Grant Meeting, *LCROSS: Shooting the Moon*, Portland, OR (October, 2009) and RI Symposium (November, 2009), students and faculty from U. Maine, and *LCROSS Mission* (November, 2009).
- 2. Professional Development for Informal Education Providers**
 - a. Summer Teaching Fellows:** We proposed to fund *RISG Teaching Fellowships* as a response to student requests for hands-on teaching experience. This award was made to one graduate student with a faculty mentor, developing a one-week NASA-themed class over the summer, for middle school students. The class during the summer of 2009 was *Astrobiology: The Search for Life in the Universe*. Each class had attendance 15 and received very positive reviews, with some students returning to Brown for next level courses (from middle school to high school).
 - b. Development Travel Grants:** *RISG* supported several trips for the Museum Director, otherwise impossible due to the limited city budget. All trips were heavily leveraged and could be directly tied to ongoing *RISG*-supported programs and exhibits. The Museum's Director and Curator of Education traveled to a Climate Literacy Conference to prepare for the *Pole-to-Pole* exhibit. The Museum Director also traveled to other trips at the invitation of the NASA connections that she made through *RISG*. Materials and lessons from these travel grants have fed directly into museum programming and future plans. These trips have also led to new proposals (to NASA and local foundations) designed to expand capabilities for NASA related STEM education and outreach.

PROGRAM CONTRIBUTIONS TO PART MEASURES

- **Longitudinal Tracking:** *Total FY'09 awards = 82 awards (35 female, 45 male); Fellowship/Scholarship = 25 (13 women, 12 men); Higher Education/Research Infrastructure = 57 (22 women, 33 men), 3 of whom were under-represented minorities. Of these students, all but 10 are continuing in STEM-related careers; 13 are continuing in advanced education in NASA-related disciplines.*
- **Course Development:** *Number of new or revised courses targeted at the STEM skills needed by NASA that are developed with NASA support: 4 revised courses were offered over the report period.*
- **Matching Funds:** *Ratio of funds leveraged by NASA funding support: Our ratio of Match-to-NASA is estimated to be 1.06 to 1*
- **Minority-Serving Institutions:** *Summarize interactions: During FY2009 we made connections with the Nebraska Space Grant Consortium, which has several Tribal Colleges. The RISG Director began exploratory work with them to establish a connection that is leading to a workshop in Rhode Island for a pilot program geared towards Tribal College teachers. Due to the fact that Rhode Island does not have any Historically Black Colleges or Tribal Colleges we have been finding ways to engage these colleges using our unique strengths. Nevertheless, there are active programs at Brown University and we have reinitiated programs following the departure of a key administrator (leading to the inclusion in a recent RI EPSCoR grant).*

IMPROVEMENTS MADE IN THE PAST YEAR: Succinctly describe improvements and/or adjustments made last year that demonstrate significant change(s) within the Consortium. ** The improvements and/or adjustments that brought about change may have been in management, resource allocation, project design, project evaluation, etc. **

A. Management Changes: FY2009 was the first full year that our new Program Manager has been in office. The Director and Program Manager have been working well together to get the Program Manager up to speed as soon as possible. So far the Program Manager has done well at establishing connections both in and out of the state as well as removing some of the burden from the Director. This has allowed the Director to more focus on other areas of the Consortium.

B. Resource allocation adjustments:

- 1. Low-gravity Opportunity:** The Brown Space Club proposal for the Low-gravity Flight Opportunities was not successful this year after very active leadership had graduated. The funds were redirected to some of the unexpected blow requests.
- 2. Targeted Institution Academic and Research Infrastructure:** A key Brown Administrator who was key in our proposed HBCU program left the university. We reallocated these funds and support to a Native American student in order to identify a new approach for transitioning Native American students from high school into university.
- 3. UTC Industry Summer Internships:** In FY2009 an invitation was received from the *Connecticut Space Grant Consortium* to allow some of our students to apply for an internship program with *United Technologies Corporation*. We had budgeted to accommodate one student but three of our students were selected to participate. Given the previously mentioned funds that had been freed up we were able to pay the cost for all three students. *United Technologies Corporation* heavily leverages the program.

C. Research Enhancement: We used RISG contacts to contribute to a successful EPSCoR proposal. These contacts enabled the identification of key NASA support and areas in need of additional work.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION: List the institutions that comprise the consortium; include the name, type of institution, and key characteristics.

Bryant University: Private university. Their relatively new programs in Environmental Sciences and Biology have begun to flourish and receive strong institutional support especially as they are learning how RISG can benefit them. They hosted the RI Space Grant Symposium last year.

Community College of Rhode Island: Community college. This two-year community college provides opportunities for re-training and a stepping-stone to a four-year institution (including Brown).

Graduate School of Oceanography: GSO is part of the state-supported *University of Rhode Island* system (Narragansett Bay campus) exclusively for graduate studies and research on oceanography. They are the *Sea Grant* Lead for the state. Their NASA research includes remote sensing, astrobiology (past *National Astrobiology Institute* Lead), and climate.

Providence College: Four-year liberal arts institution. This past year their Affiliate Representative has received some seed funding from RISG and has started to gain an enhanced understanding of the program.

Rhode Island College: Primary training institution for teachers in the state. It houses the NASA's *Educator Resource Center*.

Rhode Island School of Design: RISD is a nationally ranked private college in the arts and design. RISD has been a very active of the consortium through innovative curricula linking industrial design classes with NASA centers (JSC, KSC). They have also offered to host the RI Space Grant Symposium this coming year.

Museum of Natural History: MNH is funded by the *City of Providence* and is located in historic Roger Williams Park. It contains the *Cormack Planetarium* where NASA-related programming is often featured. This museum has become increasingly important to our program through NASA-themed exhibits and programs (educator workshops). In return, they have created a "Space Science Room" which is reserved for rotating exhibits related to current events, missions, or themes related to NASA.

Roger Williams University: RWU is a private institution (MAT, Masters of Public Administration, Architecture, Law, Criminal Justice) with growing programs in environmental and international studies.

Salve Regina University: University offering PhD in the humanities. They offer a number of programs in the STEM fields.

University of Rhode Island: Lead state-supported undergraduate/graduate institution (identified here as "URF") and a *Land Grant* institution. RISG supports students and faculty in engineering and geology.

Wheaton College: Private liberal arts college with several faculty members who are involved in NASA-related research (studies into the satellites of the outer planets (using Galileo and Cassini data), astronomy, and environmental science.

Other Partners: In addition to our formal Affiliates, RISG has active partners including the **Northeast Planetary Data Center** (NEPDC at Brown) is funded through NASA's Planetary Geology and Geophysics Program and is an active partner through cooperative programs (exhibits) and access to planetary image data. **Ladd Observatory** provides weekly notices on topics related to astronomy as well as lectures and special events.