

Montana 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 Montana Space Grant Consortium is a Designated Consortium funded at a level of **\$785,000** for fiscal year 2009.

PROGRAM GOALS

As they were stated in the MSGC 2009 proposal, our goals were:

1: Develop and connect space education programs that will build and enhance a set of K-Graduate opportunities for involvement in space-based science and engineering education, training, and research. **2:** Strive to build an aerospace workforce for the future by creating opportunities and fostering links between MSGC and NASA centers to advance Montana's undergraduate and graduate students. **3:** Create opportunities and support existing programs, such as teacher workshops and visits to NASA centers, for pre-college (both in-service and pre-service) teachers and informal educators around the state of Montana. **4:** Actively engage women and minority students to participate in all MSGC programs at all levels. **5:** Nurture the Montana college and university network and networks with NASA centers, aerospace industries, and local and state governments and creating cooperative programs involving different players within the networks. **6:** Have most MSGC programs be inter-disciplinary in nature, emphasizing science/engineering integration through designing and building space hardware. **7:** Expand and enhance, through competitive funding, aeronautics and space-related research activity in the state's colleges and universities.

Specific Objectives stated in the 2009 Proposal:

- Fund Research Initiation awards that help faculty at MSGC Affiliate institutions develop nationally competitive programs in NASA-related STEM fields; that address NASA Education Objectives 1.1, 1.2 and 1.3 and MSGC Strategic Objectives 1, 2, 4, 5, 6, and 7.
 - Collect final report from grant PI.

- Encourage participation by women and minority PIs; give special consideration to proposals from women, minorities and tribal college faculty.
- Fund Educational Enhancement awards that significantly improve educational programs and resources in NASA-related STEM fields; that address NASA Education Objectives 1.2, 1.4 and 2.3 and MSGC Strategic Objectives 1, 3, 4, 5, and 6.
 - Collect final report from grant PI.
 - Encourage participation by women and minority PIs; give special consideration to proposals from women, minorities and tribal college faculty.
- Create and enable undergraduate research opportunities in NASA-related fields at all Affiliate institutions [Objective 1.2].
 - Collect a final report and verification of presentation from all participants.
 - Targets: 50% women, 12% minorities (reflects enrollment statewide).
- Award at least one undergraduate scholarship to each Affiliate institution and competitively award remaining scholarship funds; award graduate fellowships to the best applicants in the state [Objective 1.2].
 - Collect final report from all awardees. Collect list of peer-reviewed articles and conference proceedings from Fellowship recipients.
 - Targets: 50% women, 12% minorities (reflects enrollment statewide).
- Provide the opportunity for students to participate in a mission-like team environment by conceiving, designing, building and flying space hardware with the BOREALIS high altitude ballooning program and the student satellite projects [Objective 1.3].
 - Improve the design of the BOREALIS High Altitude Student Platform (HASP) experiment.
 - Offer BOREALIS and student satellite summer internships at MSU.
 - Have students advance to more sophisticated projects or opportunities such as NASA center internships.
 - Collect an end of the year survey from project participants.
 - Bring MSGC's Explorer 1 Prime satellite to launch readiness level.
 - Place graduating students in graduate school or in aerospace industry.
- Send specially trained MSU students to Montana K-12 schools to give presentations about current NASA missions [Objectives 1.2, 2.1, 2.3, and 2.4].
 - Collect reports for each presentation, including student and teacher numbers, and evaluation of the presentation by the teachers.
 - Provide Montana teachers with the resources necessary to teach their students about current NASA missions.
 - Diversity targets for the SPOT program reflect the state population statistics (in terms of audience) and higher education enrollment at the two universities (for program presenters).

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

Example student successes anecdotes (OUTCOME 1):

- Student Satellite (MTSGC's Explorer 1 Prime satellite) students. Of the 19 funded students from FY2009, 11 students have graduated. The status of one student is unknown, but the

remaining 10 graduates tell of great success. Three graduates have moved onto advanced STEM degrees. Three students have moved on to employment in (non-aerospace) STEM fields. Four students have moved on to employment in aerospace fields. Explorer 1 Prime will launch as part of the ELaNa program with NASA's Glory spacecraft on Nov. 22, 2010.

- BOREALIS High Altitude Ballooning Program students. Of the funded students at MSU and UM in FY2009, seven have graduated. Of those seven students, six have gone on to advanced STEM degrees (four in physics, one in physics education, and one in electrical engineering). The sixth student is now employed by the Navy. On July 13, 2010, an article on the UM BOREALIS group was published on the front page of the Missoulian. Sample quotes from BOREALIS students on the program:
 - o "I feel this has opened an entirely new world for me to explore and I am eager to do so."
 - o "High-altitude ballooning provides compelling difficulties and really made me think about rigorously designing systems. Additionally, the needs of the entire Borealis group engendered strong team-building and encouraged multi-discipline approaches to problems."
 - o "During my BOREALIS internship, I was able to come up with and design a completely new experiment for the balloon. I really enjoy designing new things and actually being able to build them."
 - o "I feel like this internship was a good transition between school and a real job because we had many of the problems that a job would have, but we still had people around with experience that could help us see different ways to solve problems."
- Fellowship/Scholarship program. In early 2010, one of our 2009 scholarship recipients, Timothy Brox, became a Goldwater scholar. One example (of several) success story from our Fellowship program is Scott Wiessinger. Scott received a half-fellowship from us in FY2009, and has since graduated. He now works at Goddard Space Flight Center. He says, "I feel that MSGC's support was crucial in my getting this job, so I'm very grateful!"

Example Higher Education projects anecdotes (OUTCOME 1):

- MSGC's primary student space hardware project, led by Space Science and Engineering Laboratory (SSEL) director Dr. David Klumpar, is the Explorer-1 Prime (E1P) CubeSat. After an extensive review by a NASA independent review team, the E1P mission was selected for participation in the Educational Launch of Nanosatellite (ELaNa) Program. Achieving this milestone placed E1P in the historic position of being among the first of three non-NASA university CubeSats that will ride into space 1) on a NASA launch vehicle, 2) as a secondary non-NASA university payload accompanying a NASA satellite, 3) as the first university CubeSat to launch from the continental US. In FY2009, the satellite was completed, delivered to CalPoly, and passed its Mission Readiness Review.
- In 2009, the MSU BOREALIS team flew a cosmic dust capture experiment on NASA's High Altitude Student Platform (HASP) for the third year and an optical particle detector for the second year. In summer 2009, the three HASP students (all undergraduates: Jayson Nissen, physics senior; Nathan Martin, physics post-BS; and Jennifer Susan Hane, electrical engineering senior) modified their previous year's HASP experiment to accommodate the lessons they learned. The 2009 HASP flight was very successful. Several students have worked on analyzing the data post-flight. The HASP capture box and particle detector, was one of the most advanced experiments to fly on the Student Platform. Also, in 2009, Salish

Kootenai College began the development of a HASP experiment. Due to the unfortunate canceling of the 2010 HASP flight, the experiment will not be launched until spring 2011.

- The University of Montana, Montana State University, and Montana Tech Undergraduate Research Programs competitively awarded research grants to 31 students (14 female, 1 underrepresented) with MSGC funds. The MSGC Awards for Research in Engineering and Science (ARES) Program awarded undergraduate research grants to 15 students (3 female, 12 underrepresented), eight at Chief Dull Knife College, four at Stone Child College, two at Montana State University-Billings, and one at the University of Montana-Western.

Example Research Initiation and Education Enhancement anecdotes (Outcome 1):

- In FY2009, five Educational Enhancement projects and one Research Initiation projects were funded by MSGC (two additional Research Initiation projects were funded by Montana NASA EPSCoR, not reported on here). Montana State University, University of Montana, University of Great Falls, and University of Montana-Western received awards.
- The Education Enhancement award for MSU's ESMD Space Grant project Lunabotics team was very successful. Not only did the MSU team win the entire national competition, but the students gained "the most valuable experience of their undergraduate education" from it. Each of the eight student Lunabotics participants is considered a major awardee due to the extensive time they put in. Seven of the eight students have graduated. One of these students is pursuing an advanced STEM degree, and three are employed in STEM fields (the status of three of the students is unknown at this time). Several news stories were published on this success story, including the NASA webpage (<http://www.nasa.gov/topics/technology/features/lunabotics.html>), the MSU news service (<http://www.montana.edu/cpa/news/nwview.php?article=8551>), the local TV broadcast, two articles in the Bozeman Chronicle newspaper, and more.
- Educational Enhancement award PI Dr. Nate Bickford transformed the University of Great Falls General Biology (Bio 151 and 152) courses from "in dire need of help" to "incredible General Biology laboratory experiences."
- FY2009 Research Initiation award recipient Don Benn is starting the development of a research program in florescent-based molecular tools for studying extremophiles at the University of Montana's Native American Research Laboratories. The majority of the research program's participants are Native American.

PROGRAM ACCOMPLISHMENTS

Please refer to the Program Goals section for reference on these milestones.

- Research Initiation awards: In FY2009, one RI award was made to the University of Montana Native American Research Laboratories. All prior final reports have been collected; the FY2009 project is still underway. The PI on this RI award is Native American.
- Educational Enhancement awards: In FY2009, five EE awards were made, two to Montana State University, one to the University of Montana, one to the University of Great Falls, and one to the University of Montana-Western. All prior final reports have been collected; the FY2009 projects are still underway. Of the 16 RI and EE proposals we received, 31% had female PIs. Of the six proposals funded, one of them had a female PI (although two others had female Co-PIs). We received two proposals from tribal colleges.

- Undergraduate research opportunities: 37% of our 46 participants were women, 28% underrepresented. We continue to encourage tribal college students to apply for ARES awards, and have had some success due largely to collaboration with our Minority Serving Institution program.
- Undergraduate scholarships: For the 2009-2010 AY, we awarded a scholarship to each Academic Affiliate institution except Blackfeet Community College, Flathead Valley Community College, Fort Peck Community College, and Little Big Horn College. Of our 20 scholarship recipients, 30% were women and 40% were underrepresented, and one student was disabled. It remains clear that we need to continue make an effort to recruit more women to our programs.
- Graduate fellowships: For the 2009-2010 AY, we awarded nine graduate level fellowships. Four of these were to female students – effectively half. No awards were made to underrepresented students.
- BOREALIS high altitude ballooning program and the Student Satellite projects:
 - *Improve the design of the BOREALIS High Altitude Student Platform (HASP) experiment.* Accomplished, see ‘Higher Education projects anecdotes’ section above.
 - *Offer BOREALIS and student satellite summer internships at MSU.* In summer 2009 (FY2008 funds not yet reported on), MSGC supported 7 BOREALIS (1 female) and 3 student satellite internships (1 female). In summer 2010 (FY 2009 funds), MSGC supported 10 BOREALIS (1 female) and 1 student satellite internship.
 - *Have students advance to more sophisticated projects or opportunities such as NASA center internships.* For example, MSGC student satellite program participants Adam Gunderson, Lars Osborne, Christopher Lee, and Allen Ream went on to do JPL internships in summers 2009 and 2010. Also, Montana State University-Billings ARES student Steven Shoen completed a JPL internship in summer 2010, Carroll College 2009 SSEL intern Ian Lyon went on to do a NSF REU in summer 2010, SSEL students David Schipf and Lars Osborne completed NASA Academy internships, and 2009 SSEL intern Celena Byers went on to do an internship at Orbital Sciences Corp. in summer 2010.
 - *Collect an end of the year survey from project participants.* Reports from the participants are now being done through Survey Monkey and have been very helpful from the BOREALIS participants. We need to work on the reports from the Student Satellite students.
 - *MSGC’s Explorer 1 Prime satellite to launch readiness level.* Accomplished, see ‘Higher Education projects anecdotes’ section above.
 - *Place graduating students in graduate school or in aerospace industry.* A full 100% of the graduated students longitudinally tracked for FY2009 have gone on to an advanced degree or STEM employment, including several to NASA and aerospace industry. Some examples of those in aerospace industry (and their employers) are Alaina Garcia (Orbital Sciences Corp.), Scott Kratochvil (Air Force Research Laboratories), Collin Tileman (Space Exploration Technologies Corp.), Tom Boehler (AEi – Space Power firm), and Scott Wiessinger (Goddard Space Flight Center).
- *Send specially trained MSU and UM students to Montana K-12 schools to give presentations about current NASA missions (via the SPOT program) [Objectives 1.2, 2.1, 2.3, and 2.4]:* Based on this information, we know that the SPOT program continues to be very well received and presentations are in high demand. Each of the teachers (hundreds so far this FY) who’s class receives a SPOT presentation is given a packet of NASA educational materials.

As stated in the Survey Monkey tool, we will not report numbers of teachers and students so that those numbers are absolutely not reported twice in the NASA Education reporting system.

PROGRAM CONTRIBUTIONS TO PART MEASURES

- Longitudinal Tracking: Total **major** awards in FY 2009 = 51; Fellowship/Scholarship = 26; Higher Education and Research Infrastructure = 25; 0 awards represent underrepresented minority funding; 13 awards were made to women. Of our FY 2006 - FY 2009 major student awards next steps (85 total known), we know that 43 students are still enrolled in their current degree program, 15 have graduated and are pursuing an advanced STEM degree, 5 are seeking STEM employment, 7 are employed in by an Aerospace Contractor, 11 are employed in a non-aerospace STEM position, 2 are employed by NASA, and 2 are employed in STEM Higher Education.
- Course Development: As described in the Educational Enhancement awards anecdotes section above, two new courses (one climate change and one astronomy) and three revised courses (two biology and one physics) were developed as a result of our FY2009 grants.
- Matching Funds: MSGC matches all non-scholarship/fellowship NASA funds at 1:1.
- Minority-Serving Institutions: In FY 2009, MSGC's BOREALIS team interacted closely with Chief Dull Knife College on developing a remote sensing instrument to fly on a tethered blimp. In addition, students from Stone Child College participated in the end-product remote sensing project. Students from Salish Kootenai College are participating in the Space Grant High Altitude Student Platform program. We received Research Initiation proposals from Salish Kootenai College and Fort Peck Community College. Students from Chief Dull Knife College, Fort Belknap College, Salish Kootenai College, and Stone Child College received scholarships.

IMPROVEMENTS MADE IN THE PAST YEAR

With a small amount of FY2009 funding, we held the pilot MSGC Student Research Symposium (MSRS). There are two main purposes for the MSRS: (1) to give all MSGC participants the opportunity to share what they've learned and to experience giving an oral and/or written presentation on their work, and (2) to provide a unique opportunity for STEM faculty from across the state of Montana to interact. MSRS will give Affiliate Representatives and their students an additional, perhaps more meaningful, opportunity to interact with one another regarding STEM Education activities in the state. In FY 2009 (as will be the case in future years) travel support was provided for MSGC undergraduate and graduate student participants as well as their faculty mentors and/or Affiliate Representatives. Approximately 40 students and faculty from seven campuses attend the pilot program in April, 2010. In the future, students at MSGC Affiliate campuses who are currently involved in MSGC in any way, and any students not currently involved, but who are interested in our programs, will be encouraged to attend. We anticipate 150-200 attendees for the full-fledged program in April, 2011.

Sadly, in April, 2009, the MTSGC Director, Dr. William Hiscock passed away. Dr. Hiscock's contributions to the National Space Grant and Montana Space Grant programs were unparalleled

and invaluable. In September, 2009, Dr. Angela C. Des Jardins was selected by the MTSGC Affiliate Representatives to become the new Director. Prior to being selected as Director, Angela served as the Deputy Director and Interim Director for MTSGC.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

Academic Affiliates:

Blackfeet Community College, Browning, MT; Carroll College, Helena, MT; Dawson Community College, Glendive, MT; Flathead Valley Community College, Kalispell, MT; Fort Belknap College, Harlem, MT; Fort Peck Community College, Poplar, MT; Little Big Horn College, Crow Agency, MT; Miles Community College, Miles City, MT; Montana State University, Bozeman, MT; Montana State University-Billings, Billings, MT

Montana State University-Northern, Havre, MT; Montana Tech, Butte, MT; Rocky Mountain College, Billings, MT; Salish Kootenai College, Pablo, MT; Stone Child College, Box Elder, MT; University of Great Falls, Great Falls, MT; University of Montana, Missoula, MT; University of Montana-Western, Dillon, MT

Industrial Affiliates:

Anasphere, Inc., Bozeman, MT

All 19 institutions of higher education in Montana are MSGC Academic Affiliates. Only two members of the Consortium – Montana State University-Bozeman and the University of Montana-Missoula are Research Universities offering the Ph.D. degree in fields of science (MSU and UM) and engineering (MSU only). Montana Tech offers Master's degree studies in engineering. In STEM fields, MSU-Billings, Rocky Mountain College, UM-Western, Salish Kootenai College, MSU-Northern, Carroll College, and the University of Great Falls offer Bachelors degree studies. The remaining nine affiliates, including six of the tribal colleges, are two-year institutions. Enrollments at MSGC affiliates range from about 13,000 students at Montana State University and the University of Montana, to less than 200 at Fort Belknap and Stone Child Colleges.