

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 **\$730,000** for fiscal year 2008.

PROGRAM GOALS

MSGC Strategic Objectives: (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.

MSGC Goals and Objectives from our 2008 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 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.
 - Pursue a NASA launch of MSGC's Explorer 1 Prime satellite.
 - Work with JPL, AL, AZ, CO and TX on the first ever student-designed/ developed spacecraft for deep space; have a MT student participate in the summer 2008 team at JPL.
 - Place graduating students in graduate school or in aerospace industry.
- Send specially trained MSU and UM 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.

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

Example Student successes anecdotes:

- Jesse Way, undergraduate student engineer on the aurora detector Education Enhancement grant (see below), is now in graduate school at the University of Wisconsin – Madison, where here received a highly competitive graduate fellowship largely due to his experience working on the MSGC project. [Outcome 1]
- Joey Key, fellowship recipient, gave the "Astronauts & Aliens" SPOT show to a group of teachers from the Crow and Cheyenne Reservations in Lame Deer, MT. As a SPOT manager, she co-wrote a SPOT show about gravitational wave astronomy called "Listening to the Universe" that has been popular in Montana classrooms. As the Montana Student Ambassador for the International Year of Astronomy, she is currently planning trips to all of Montana's Indian Reservations to give talks about current NASA missions. [Outcomes 1, 2 and 3]

Example Higher Education projects anecdotes:

- In 2008, the MSU BOREALIS team flew an cosmic dust capture experiment on NASA's High Altitude Student Platform (HASP) for the second year and was selected to fly an improved cosmic dust capture and optical particle detector for a third flight in 2009. In mid-2008, the three HASP students (all undergraduates: Jayson Nissen, physics junior; Nathan Martin, physics senior; and Jennifer Susan Hane, electrical engineering junior) modified their first year's HASP experiment to accommodate the lessons they learned. Unfortunately, the 2008 HASP payload had a rough landing, crushing the BOREALIS experiment and choking the box with dirt. This spring, eight undergraduate BOREALIS students are actively working on the new HASP capture box and particle detector, which is one of the most advanced experiments to fly on the Student Platform. [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 potentially 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 FY2008, the satellite design has matured, and prototyping of hardware has led to flight hardware assembly and testing. [Outcome 1]
- The University of Montana, Montana State University, and Montana Tech Undergraduate Research Programs competitively awarded research grants to 22 students (14 female) with MSGC funds. One of the UM students, Amanda Ormesher, was featured in the local news for her project, "Osprey Population Monitoring as an Environmental Indicator". [Outcome 1]
- The MSGC Awards for Research in Engineering and Science (ARES) Program awarded undergraduate research grants to 2 students (1 female), one at Rocky Mountain College and one at the University of Montana-Western. [Outcome 1]
- MSGC's Space Public Outreach Team continues to be widely successful. MSGC supported SPOT manager/physics graduate student Adam Kobelski to manage the program, which sends specially trained

undergraduate students to give presentations about current NASA missions to K-12 schools in Montana. Since March 1st, 2008, SPOT has given presentations to 6,376 students (20% of which are underrepresented, mostly Native American) and 457 teachers. [Outcomes 1, 2 and 3]

Example Research Initiation and Education Enhancement anecdotes:

- Educational Enhancement award PI Dr. Craig Zaspel completed a year's worth of work on his project, "An Experiential Astronomy Course at the University of Montana-Western". His team has developed about 15 student projects for in-class use along with lectures. These included planetary geology using NASA photographs. Student feedback at the end of the course indicated that the projects were very important for the understanding of the material presented in lectures. [Outcome 1]
- Educational Enhancement award PI Dr. Adrian Leighton completed a year's worth of work on his project, "Expansion of Geospatial Science at the Salish Kootenai College (SKC)". MSGC support for curriculum design has led to the development of two GIS courses and the inclusion of remote sensing data in forest measurements classes. So far, the new courses and module development has exposed over 40 Native American students from at least 6 tribes to geospatial science technology and applications. [Outcome 1]
- In February, 2009, the results of the 2008 MSGC/Montana NASA EPSCoR call for Research Initiation and Educational Enhancement proposals were announced. Five Educational Enhancement projects were funded by MSGC (three Research Initiation projects were funded by Montana NASA EPSCoR, not reported on here).

Example Administrative successes anecdote:

- Between October and December 2008, MSGC Deputy Director Dr. Angela Des Jardins and occasionally Program Coordinator Ms. Glenda Winslow visited 9 of MSGC's 19 Affiliate institutions. The travel, 2,300 miles in total, enabled the MSGC staff to better understand Affiliate needs and circumstances. Also, Dr. Des Jardins gave a talk at each institution and visited with STEM students about MSGC and NASA opportunities. [Outcomes 1 and 3]

PROGRAM ACCOMPLISHMENTS

- *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.* In FY2008, all of our Research Initiation awards were funded by Montana NASA EPSCoR and are thus not reported on here. We do report on our 2006 and 2007 Research Initiation awards (work completed in during this reporting period):
 - *Collect final report from grant PI.* Accomplished for our 2006 awards. Many of our 2007 grants are still underway; a report was collected for the purposes of this Progress Report and another report will be due for our OEPM reports this spring.
 - *Encourage participation by women and minority PIs; give special consideration to proposals from women, minorities and tribal college faculty.* (No Space Grant awards.)
- *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.* Accomplished; see description of our Educational Enhancement awards in the anecdotes section above.
 - *Collect final report from grant PI.* Accomplished for our 2006 awards. Many of our 2007 grants are still underway; a report was collected for the purposes of this Progress Report and another report will be due for our OEPM reports this spring.
 - *Encourage participation by women and minority PIs; give special consideration to proposals from women, minorities and tribal college faculty.* An encouraging 47% of the proposals we received in our 2008 call for Research Initiation and Educational Enhancement awards had female PIs. Of the eight proposals funded, four of them (50%) had female PIs. Two of the five Educational Enhancement awards funded by MSGC had female PIs. We received no proposals from tribal colleges.
- *Create and enable undergraduate research opportunities in NASA-related fields at all Affiliate institutions [Objective 1.2].* Accomplished, see 'Higher Education projects anecdotes' section above. We do wish to solicit more applications for our ARES program.
 - *Collect a final report from all participants.* Accomplished for our FY2007 ARES participants. We are currently in the process of revising how we get student reporting from the larger institutions (MSU, UM

- and Tech), who's MSGC undergraduate research programs are administered by those institution's university-wide program managers.
- *Targets: 50% women, 12% minorities (reflects enrollment statewide).* 63% of our participants were women, 4% underrepresented. We continue to encourage tribal college students to apply for ARES awards, but have had only limited success. We hope that, if we are awarded a Space Grant Minority Serving Institution Partnership Development grant, we will be able to greatly improve the percentage of minority undergraduate research participants.
 - *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].* For the 2008-2009 AY, we awarded a scholarship to each Academic Affiliate institution except Ft. Peck Community College and Miles Community College.
 - *Collect final report from all awardees. Collect list of peer-reviewed articles and conference proceedings from Fellowship recipients.* Accomplished for the 2007-2008 AY awardees.
 - *Targets: 50% women, 12% minorities (reflects enrollment statewide).* 28% of our scholarship/fellowship awardees were women and 15% were underrepresented. 32% of the scholarship/fellowship applicants were women. Therefore, it is clear that we need to make an effort to recruit more women to our programs.
 - *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.* Accomplished, see 'Higher Education projects anecdotes' section above.
 - *Offer BOREALIS and student satellite summer internships at MSU.* Accomplished. In summer 2008, MSGC supported 6 BOREALIS (2 female) and 3 student satellite internships (all non-MSU students).
 - *Have students advance to more sophisticated projects or opportunities such as NASA center internships.* Accomplished. For example, MSGC student satellite program participants George Anderson, Sebastian Goodman, Sean O'Hern and David Racek completed internships at JPL, and student satellite participant Scott Kratchovil interned with the LARS program at Langley.
 - *Collect an end of the year survey from project participants.* Accomplished for the 2007-2008 AY.
 - *Pursue a NASA launch of MSGC's Explorer 1 Prime satellite.* Accomplished, see 'Higher Education projects anecdotes' section above.
 - *Work with JPL, AL, AZ, CO and TX on the first ever student-designed and developed spacecraft for deep space; have a Montana student participate in the summer 2008 team at JPL.* Accomplished. MSU student David Racek participated on the Hyperspectral Infrared Imager (HyspIRI) student project at JPL and received national press for his accomplishments.
 - *Place graduating students in graduate school or in aerospace industry.* Accomplished. BOREALIS student Michael Lenander is now a graduate student in physics at the University of California-Santa Barbara, student satellite participant Cory Wiltshire is now employed by Space Micro, Inc., student satellite participant Floyd Azure (Native American) is now employed by Planetary Systems, Inc., student satellite participant Drew Eldeen is now employed by Space Exploration Corp., and three student satellite participants have graduated and gone on to master's in engineering programs.
 - *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].*
 - *Collect reports for each presentation, including student and teacher numbers, and evaluation of the presentation by the teachers.* Accomplished. Based on this information, we know that the SPOT program continues to be very well received and presentations are in high demand.
 - *Provide Montana teachers with the resources necessary to teach their students about current NASA missions.* Accomplished. Each of the teachers (457 so far this FY) who's class receives a SPOT presentation is given a packet of NASA educational materials.

PROGRAM CONTRIBUTIONS TO PART MEASURES

- Longitudinal Tracking: Total awards in FY 2008 = 112; Fellowship/Scholarship = 46; Higher Education = 65; Research Infrastructure = 1; 8 awards represent underrepresented minority funding; 34 awards were made to women. Of our FY 2007 and FY 2008 major student awards (54 total), we know that 43 students are still enrolled in their current degree program, 3 have graduated and are pursuing an advanced STEM degree, and 3 have graduated and are employed in by an Aerospace Contractor.

- Course Development: As described in the Educational Enhancement awards anecdotes section above, three new courses (two GIS and one astronomy) were developed as a result of our 2007 grants. Of our five newly funded EE awards, four are specifically for developing new courses targeted at the STEM skills need by NASA.
- Matching Funds: MSGC matches all non-scholarship/fellowship NASA funds at 1:1.
- Minority-Serving Institutions: In FY 2008, MSGC's BOREALIS team interacted closely with Chief Dull Knife College on developing a remote sensing instrument to fly on a tethered blimp. This interaction led to MSGC's proposal for a Space Grant MSI Partnership Development grant.

IMPROVEMENTS MADE IN THE PAST YEAR

- In FY2008, MSGC has made an effort to improve our Longitudinal Tracking of students. Our new strategy is to use Facebook, a communications technology that a huge percentage of today's students use, to track our Space Grant supported students. We have created a MSGC "group" within Facebook and have invited all of our past and currently supported students as well as our Affiliate Representatives and other key people to join the group. Within Facebook, we have the ability to post opportunities, see the educational and employment status the students choose to share, e-mail everyone in the group with the click of a button, and more. Since we created the group in October, 2008, we have seen additional survey responses that would not have been received by our traditional e-mail methods.
- In order to make our supported students more visible at their home institutions, we have created graduation vestments for our students to wear at their ceremonies. We tested the use of the vestments at the 2008 MSU graduation. We found that the vestments caught the attention of many families and University people, including MSU President Geoff Gamble. Based on this success, we will expand the use of the graduation vestments to all MSGC-supported students for the 2009 graduation ceremonies.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

Academic Affiliates:

Blackfeet Community College, Browning, MT
 Carroll College, Helena, MT
 Chief Dull Knife College, Lame Deer, 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.