

Montana Space Grant Consortium
Montana State University
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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 \$845,000 for fiscal year 2010.

PROGRAM GOALS

2010 SMART Objectives by Strategic Goal:

(These SMART Objectives apply to the 2010 MSGC grant year unless otherwise specified)

(1) Develop and connect interdisciplinary aerospace education programs that will build and enhance opportunities for involvement in space-based science, technology, engineering and math in Montana.

1a. By August 1st, award \$1,500 competitive scholarships to deserving undergraduate students; maintain at least a 3.5 mean grade point average (GPA); maintain at least 25% underrepresented awardees; increase the percentage of female awardees from 40% to 45%.

1b. By August 1st, award \$15,000 competitive fellowships to deserving graduate students with 3.25 GPAs or higher; maintain at least a 90% level of major awardees that continue on to STEM employment or STEM advanced education; increase the percentage of underrepresented and female awardees from 3% and 38% to 5% and 40%, respectively.

1c. Continue to strive to award at least one scholarship to each Academic Affiliate, increasing the number of represented institutions from an average of 14 to 16 in 2010.

1d. Award Education Enhancement grants that continue to be impact-full, interdisciplinary and have diverse participants; increase the average percentage of female PIs from 19% to 22% in the 2010-2014 award; increase the number of participating affiliate institutions to 8 (from 6 in the 2005-2009 award), including an increase in the number of Tribal College participants from 2 to 3.

1e. Increase the number of Affiliate Institutions actively participating in the BOREALIS high altitude ballooning program from 3 to 5.

1f. Through the efforts of the Space Public Outreach Team (SPOT) graduate managers, continue to educate 8% or more of the Montana K-12 teachers and students (~700 and 12,000 respectively) each year about NASA-related opportunities and careers available to Montana students as those students look forward to higher education; maintain at least a 80% level of teachers who use SPOT-provided NASA materials in their classroom instruction.

1g. Seek, wherever possible, to foster programs that reach across the artificial boundaries of “precollege,” “general public,” or “higher education;” continue to participate at least three times per year (on a volunteer basis) in outreach programs such as ‘Expanding Your Horizons,’ ‘Astronomy Day,’ ‘Science Olympiad,’ and ‘FIRST Lego League Tournaments;’ continue to participate (on a volunteer basis) on Montana museum boards.

(2) Strive to build a Montana aerospace workforce, integrating women, under-represented minorities and persons with disabilities.

2a. Continue to create interdisciplinary, hands-on, and meaningful opportunities for Montana students to participate in space hardware projects; maintain at least a 90% level of major awardees that continue on to STEM employment or STEM advanced education; increase the percentage of underrepresented and female participants from 8% and 16% to 10% and 20%, respectively.

2b. Continue to offer interdisciplinary, hands-on, and meaningful summer internships for Montana students from campuses other than MSU to participate in MSGC student space hardware projects; maintain at least a 90% level of interns that continue on to STEM employment or STEM advanced education; increase the percentage of underrepresented and female participants from 8% and 16% to 10% and 20%, respectively.

2c. Continue to create interdisciplinary, hands-on, and meaningful opportunities for Montana students to design and build BOREALIS high altitude balloon experiments; maintain at least a 90% level of major awardees that continue on to STEM employment or STEM advanced education; increase the percentage of underrepresented and female participants from 8% and 16% to 10% and 20%, respectively.

2d. Continue to offer interdisciplinary, hands-on, and meaningful summer internships for Montana students to participate in MSGC BOREALIS high altitude ballooning projects; maintain at least a 90% level of interns that continue on to STEM employment or STEM

advanced education; increase the percentage of underrepresented and female participants from 8% and 16% to 10% and 20%, respectively.

2e. Increase the involvement of students from Tribal College Affiliate Institutions in the MSGC Minority Serving Institution Partnership Development Program, BOREALIS, student space hardware, undergraduate research, and internship programs from 30% to 100% involvement of at least one student in at least one program.

(3) Network Montana colleges, universities, aerospace industries, and government with national aerospace programs in government and industry, especially NASA centers and other Space Grant Consortia.

3a. Continue to hold meaningful yearly Affiliates' Meetings, maintaining at least 75% Affiliate Representative attendance; create an evaluation of the Affiliates' Meeting and obtain at least 90% satisfaction with the meeting.

3b. Carry out a pilot Montana Collegiate Research Conference (MCRC) for all students involved in MSGC programs; through MCRC, strive to provide opportunities for MSGC-affiliated faculty and students to interact in a meaningful manner regarding STEM education opportunities and research efforts in Montana, at NASA centers, and at aerospace companies. [Note: this SMART Objective must be somewhat un-SMART as it is a pilot program.]

3c. Continue to offer support for NASA center internships; maintain at least a 90% level of NASA interns that continue on to STEM employment or STEM advanced education; increase the percentage of underrepresented and female participants from 5% and 10% to 7% and 15%, respectively.

3d. Increase support for aerospace industry internships – provide support for at least one industry internship.

3e. Continue nearly 100% MSGC staff attendance at Space Grant Regional and National Meetings; increase the participation of students, appropriate MSGC-associated faculty, and/or Affiliate Representative attendance at the Regional and National meetings to at least one student/faculty/Representative per year.

(4) Expand and enhance aeronautics and NASA-related research activity in Montana colleges and universities.

4a. Continue to maintain a 100% level of NASA-related interdisciplinary Research Initiation awards; create an evaluation of the number of PIs who propose for follow-on NASA funding and obtain at least 50%; increase the percentage of underrepresented and female PIs from 14% and 14% to 17% and 17%, respectively.

4b. Competitively award stipends to Montana State University students involved in STEM research; maintain at least a 90% level of students who present their work and/or submit a paper;

increase the percentage of underrepresented and female participants from 2% and 35% to 5% and 40%, respectively.

4c. Competitively award stipends to University of Montana students involved in STEM research; increase the percentage of students who present their work and/or submit a paper to at least 70%; maintain at least 50% female awardees; increase the percentage of underrepresented awardees to 3%.

4d. Competitively award stipends to Montana Tech students involved in STEM research; increase the percentage of students who present their work and/or submit a paper to at least 70%; increase the percentage of female awardees from 43% to 48%; increase the percentage of underrepresented awardees to 3%.

4e. Continue to make stipends available to students attending institutions other than MSU, UM and Montana Tech who are involved in STEM research; increase the average number of participating Academic Affiliate Institutions from 3 to 10; increase the percentage of students who present their work and/or submit a paper from 50% to 70%; maintain at least 50% female awardees; increase the percentage of underrepresented awardees from 8 to 11%.

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

Note: many anecdotes highlighting program accomplishments fit more naturally in the ‘Program Accomplishments’, ‘Program Contributions to PART Measures’, or ‘Improvements’ sections. Here, we have highlighted the activities not covered in the other sections below. In order to be succinct, Outcomes and NASA 2010 Education Priorities are referred to by number. The Education Priorities are numbered EP1. Hands-on student experiences, EP2. Middle school teachers, EP3. Summer opportunities for secondary students, EP4. Community colleges, EP5. Aeronautics research, EP6. Environmental Science and GCC, EP7. Diversity, EP8. Innovative research infrastructure.

- Scientific ballooning highlights: The MSU BOREALIS group successfully completed several high altitude balloon launches, including one record-setting flight that achieved an altitude of over 107,000 feet. The UM group was invited to participate in a global climate change project by conducting several small launches in the Amazon jungle in Columbia, South America. Also in the UM group, 10 middle school students participated in two launches in July, 2010. Four of these students were eligible to participate in the State Science Fair with their balloon research projects. [Outcome 1 and 2] [EP 1, 3, 6]
- Student Space Hardware highlights: Unfortunately, due to the mishap on the Taurus XL rocket in March, 2011, Montana still does not have a first satellite. The launch failure, however, does not mean the MSGC satellite project was a failure. Rather, the experience for the students in designing and building our Explorer 1 [Prime] satellite was very valuable. We are very lucky to have another chance to launch E1P’s twin, E1P2, in October, 2011. [Outcome 1] [EP 1]
- NASA Mission Partnership: During FY 2010, MSGC officially began a partnership with the NASA SmEx mission, IRIS. MSGC is carrying out a significant portion of the IRIS E/PO mission through our National Student Solar Spectrograph Competition (NSSSC). In

FY 2010, NASA and MSGC matching funds supported a successful pilot project that will culminate with demonstration of MSU and Salish Kootenai College's spectrographs in April, 2011. [Outcome 1] [EP 1, 4, 7]

- TC student trip to Poker Flats Research Range, Alaska: In March, 2011, MSGC took 3 TC students, plus 1 MSU student and two advisors, to Poker Flats to calibrate their Aurora Detectors (AD) and learn about the aurora. The trip was the culmination of a student competition within the AD project funded by MSGC's MSIPD program and other MSGC sources. The students interacted with aurora experts (including world-renowned Dr. Syun-Ichi Akasofu) and Alaska Space Grant students, observed and collected data from several amazing aurora, toured Poker Flats and University of Alaska labs, and more. Each of the students will present their research and experience at the Student Symposium. [Outcome 1] [EP 1, 4, 7]
- Community College student, MSGC scholarship recipient, and former professional snowboarder Andrew Crawford was part of the team that won the National Community College Aerospace Scholars Program rover design competition at JSC. Andrew says, "I can't tell you how much it means to me having the financial support and inspiration that your scholarship and program provides. The fact that somebody out there has put faith and investment in students like me provides an undying sense of motivation that you can't put a price on." [Outcome 1] [EP 1, 4]
- The MSGC Lunabotics team (Lunabotics is an ESMD SG Program, but most of the team support came from MSGC) took first place at the National competition at KSC in May, 2010. They were the only team in the country to achieve the technical goal of the competition. Team member Jennifer Susan Hane presented on the program at the Fall National Space Grant Directors Meeting in Maine. [Outcome 1] [EP 1]
- In summer 2011, MSU BOREALIS will host an intern from the American Indian Research Opportunities (AIRO) Bridges Program. The program's objective is to build a seamless educational experience between Montana Tribal Colleges and Montana State University. This will hopefully be the beginning of a new, strong partnership with AIRO and its programs. [Outcome 1] [EP 1, 4, 7]
- Undergraduate student Timothy Brox, who participates in undergraduate research with two of our Research Initiation projects, including the MSGC FY 2010 RI project, was selected as a Goldwater Scholar. [Outcome 1] [EP 1]

PROGRAM ACCOMPLISHMENTS

NOTE: THIS LIST REFERENCES OUR SMART OBJECTIVES BY OUTCOME, AND, IF APPROPRIATE, REFERENCES RELATED NASA 2010 EDUCATION PRIORITIES [IN BRACKETS]. In order to be succinct, NASA 2010 Education Priorities are referred to by number: EP1. Hands-on student experiences, EP2. Middle school teachers, EP3. Summer opportunities for secondary students, EP4. Community colleges, EP5. Aeronautics research, EP6. Environmental Science and GCC, EP7. Diversity, EP8. Innovative research infrastructure.

Outcome 1:

1a. Competitive Scholarships [EP7]

- Awarded 26 undergraduate scholarships; mean GPA = 3.72; underrepresented = 27%; female = 42%. All objectives met.
- 1b. Fellowships [EP7]
- Awarded 11 graduate fellowships; mean GPA = 3.74; all FY 2010 still enrolled (LT for FY 2009: 1 on to STEM employment, 1 on to STEM academic); underrepresented = 0%; female = 55%. Only objective not met is underrepresented - with higher statistics, number should improve.
- 1c. State-wide Scholarships [EP4] [EP7]
- Maintained 14 Affiliate Institutions receiving awards. Should see more participation as a result of a new Affiliate Representative and the highly visible MSGC Student Research Symposium. The expansion of the central office staff will also help to focus site visits at the institutions that tend to have less participation.
- 1d. Education Enhancement grants [EP4] [EP6] [EP7]
- Awarded 4 grants (details below) to three institutions; see anecdote in the ‘Program Contributions to PART Measures’ section for highlights on how these grants will have great impact.
 - Female PIs = 25%; underrepresented PIs = 25%. SMART objective goals are met or we are well on our way to meeting (in the case of number of affiliate institutions participating 2010-2014).
 - Titles, PIs, and institutions:
 - o “Expansion of Technology into Hydrology Curriculum at SKC,” Shandin Pete, Salish Kootenai College (Tribal College)
 - o “Learning Chemistry through Inquiry, Action, and Reflection,” Chrissie Carpenter, University of Great Falls
 - o “Following the Packet - An Educational Enhancement Proposal for Embedded Networking,” Ross Snider, Montana State University
 - o “Montana Aurora Detector Network for Education Enhancement,” Joseph Shaw, Montana State University
- 1e. BOREALIS state-wide effort [EP1] [EP4] [EP6] [EP7]
- MSU and UM were the main active BOREALIS participants in FY 2010. We expect, however, that with the continued active use of the helium blimps (associated this past year with MSGC’s MSIPD program) at each of the 7 Tribal Colleges, participation in BOREALIS will continue to prosper.
- 1f. Space Public Outreach Team [EP1] [EP2] [EP7]
- We are changing this objective to ensure that no double counting across NASA education programs occurs. The lead on the NASA SDO:AIA E/PO program will report the presenter data, K-12 students and teachers, as the funding for the presenter travel and pay comes from that source. The new objective refers only to the support MSGC lends the program, which is graduate fellowship support of the SPOT managers. The managers are longitudinally tracked and evaluated for their performance.
- 2a. Student Satellites [EP1] [EP6] [EP7]
- 10 student awards; underrepresented = 0%; female = 10%. We realize this is one of our toughest areas for recruiting female and minority student participation and are working on ways to boost these levels. From FY 2010 awards, all are still enrolled.
- 2b. SSEL internships [EP1] [EP4] [EP6] [EP7]

- Two internship positions will be filled in summer 2011; students are yet undecided. We do have qualified applications from three non-MSU schools. From the FY 2009 (summer 2010) award, the student is still enrolled.

2c. BOREALIS [EP1] [EP6] [EP7]

- Note 1: In the MSU program, the AY students are volunteers (therefore not counted as 'awards'). In the UM program, however, the AY students are paid, so we count them as awards.
- Note 2: In this report, we do not include the Tribal College participation that is associated with our MSIPD blimp program, as that is reported separately.
- In the MSU program, total of 16 students participated; 0% underrepresented; 19% female. In the UM program, a total of 7 undergraduate students participated; 0% underrepresented; 86% female. Total, this is 23 students, 0% underrepresented, 39% female. Therefore, we are exceeding our objective for female students. For underrepresented students, we continue to encourage participation. For example, we are optimistic that the MSI blimp program will continue to generate BOREALIS activity at the Tribal Colleges.
- All FY 2010 participants are still enrolled. From FY 2009 UM awards, 2 students have continued on to STEM employment, and the remainder is still enrolled.

2d. BOREALIS internships [EP1] [EP6] [EP7]

- Awards will be made in summer 2011 to 5 interns; 20% underrepresented; 40% female. We are therefore exceeding the goals set out in our SMART objective.
- All FY 2010 interns (summer 2011) are still enrolled. From FY 2009 awards (summer 2010), 1 student has moved on to an advanced STEM degree, 1 is taking a break from school due to financial hardship, and the remainders are still enrolled.

2e. Minority Serving Institutions [EP1] [EP4] [EP7]

- The MSGC MSIPD program has been very successful, fully involving 6 of the 7 tribal colleges (86%) thus far. The seventh TC, where we just appointed a new Affiliate Representative, will participate this summer. 'Involvement' includes MSGC visiting each TC, most of the TC Reps visiting MSU, extensive electronics station setups at each TC, hands-on train for TC students (by MSU students), development of an in-depth webpage on the science of the projects, and more. More than 112 students, nearly all Native American, have participated (paid and unpaid). Please see the 'Program/project benefit to outcome' section for an anecdote on this project. We expect that the partnerships developed in the MSIPD program will continue to produce Native American student participants in MSGC programs (that will be counted toward the revised FY 2011 SMART goal for MSI involvement).
- A great example of the success we are building with the TCs is in the MT applications in the OSSI:SOLAR system for summer 2011. More than half - **52%** - of these NASA Center applicants are from TCs! The applications come from students at three different TCs.

3a. Affiliates' Meetings [EP4]

- We held our annual Affiliates' Meeting September 10th, 2010. Of the Affiliate Representatives, 66% were in attendance. In a post-meeting evaluation, 100% of the Representatives were very satisfied with the meeting. Starting with our first full MSGC Student Research Symposium April 15th, 2011, our Representatives will have a second

- opportunity to meet in person. In this case, they will have a chance to really share what is happening at their institutions, rather than the MSGC staff providing most of the dialog.
- 3b. (Now called) MSGC Student Research Symposium, or MSRS. [EP4] [EP7]
- Carried out successful pilot symposium, which lasted 90 minutes and had 8 student presentations representing 4 institutions. Evaluations of the pilot were overwhelmingly positive and were taken into account for this year's full day event. Our FY 2011 SMART Objective will change to represent now full-fledged program.
- 3c. NASA internships [EP1] [EP7]
- Awarded 6 internships to take place in summer 2011 at 4 different NASA centers; underrepresented = 0%; female = 0%. We continue to encourage minority and female participation. One FY 2010 intern will be continuing to an advanced STEM degree, and the remainders are still enrolled. From FY 2009 (summer 2010), 1 student has continued on to an advanced STEM degree, and the remainders are still enrolled.
- 3d. Industry internships [EP1]
- In FY 2010, we are supporting part of one intern for a new SMD SG internship at the Lunar Science Institute in Boulder, CO. As a side note, we are also facilitating two industry internships through the ESMD SG program, one of which is with MSGC Industry Affiliate Anasphere.
- 3e. National and Regional Meeting Attendance
- With the exception that the MSGC director missing the National SG Director's meeting in Maine due to an illness, we met our goal for staff attendance at regional and national meetings.
 - We greatly exceed our goal for bringing students or affiliate representatives to the SG meetings. Bringing students to the SG meetings this past year has been an overwhelmingly positive experience for the students, the MSGC staff, and I believe, the other meeting attendees. The students are:
 - o 2010 Western Regional Meeting in Omaha, Nebraska: Salish Kootenai College Native American student Robert Sanchez, who gave a talk on SKC's wide field camera that will fly on the HASP payload in 2011.
 - o 2010 Fall NSGDM in Portland, Maine: Jennifer Susan Hane and Ehson Mosley. Jennifer gave a presentation about the ESMD SG Lunabotics competition and her team's first place finish. It was said that Jenny Sue "stole the show" with her excitement, intelligence, and enthusiasm. Ehson gave a presentation with other students who were involved on the first ELaNa launch on MSGC's Explorer 1 [Prime] satellite.
 - o 2011 Spring NSGCM in Washington, DC: First Hiscock Memorial Award winner Courtney Peck. Courtney gave a presentation on her BOREALIS research project (and was asked to explain the Heisenberg Uncertainty Principle to US Senator Max Baucus).
- 4a. Research Initiation grants [EP4] [EP5] [EP6] [EP7] [EP8]
- Awarded 1 grant (details below) to one institution; we don't yet know about follow on funding as this award was just made in January, 2011; the single award made with FY 2009 funding is also on-going; no Research Initiation awards were made on MSGC side of the program with FY 2008 funds, so no follow-on fund information is applicable in that case, either.

- Female PIs = 100%; underrepresented PIs = 0%. We are on track to meeting our SMART objective goals for the 2010-2014 period.
 - Title, PI, and institution:
 - o “Magnetic Resonance Microscopy Studies of Ice Structure,” Jennifer Brown, Montana State University
- 4b. MSU undergraduate research [EP1] [EP5] [EP6] [EP7]
- FY 2010 awards have not yet been made. We anticipate awards to ~18 students.
 - ****Unreported FY 2009 data (specifics)****: Awarded support to 17 students; 100% of the students are presenting their work, many of them at MSGC’s MSRS; 29% female; 0% underrepresented; 6% disabled. We continue to encourage minority and female participation, but it should be noted that the students are chosen by the MSU undergraduate research staff (not the MSGC staff).
- 4c. UM undergraduate research [EP1] [EP6] [EP7]
- FY 2010 awards have not yet been made. We anticipate awards to ~10 students.
 - ****Unreported FY 2009 data (specifics)****: Awarded support to 4 additional (unreported) students; 100% of the students are presenting their work; 25% female; 0% underrepresented. We continue to encourage minority and female participation, but it should be noted that the students are chosen by the UM undergraduate research staff (not the MSGC staff).
- 4d. Montana Tech undergraduate research [EP1] [EP6] [EP7]
- FY 2010 awards have not yet been made. We anticipate awards to ~5 students.
- 4e. ARES [EP1] [EP6] [EP7]
- Awards were made to 6 students at 2 institutions; 0% female; 0% underrepresented. We continue to encourage minority and female participation. For example, we are starting a pre-ARES pilot program to facilitate breaking down barriers to entry into more sophisticated research projects like ARES. (Most of the Tribal College students feel unprepared to propose for a \$750 ARES research stipend.) Also, we hope to increase the visibility of the program through our MSRS and site visit efforts.

Outcome 2:

1g. Precollege

- MSGC spent a small amount of funding (0.3% of our total NASA budget) on several Precollege projects. See details below. MSGC staff also volunteered at these events. Being sponsors and volunteers creates awareness about our Higher Education opportunities among the Precollege teachers and students that is quite valuable.
 - o UM BOREALIS K-12 student opportunity (\$0). One male HS student, 2 female and 3 male middle school students, and 1 female and 4 male elementary school students participated in the weekly academic year program. [EP1] [EP3] [EP7]
 - o MSU’s American Indian Research Opportunities (AIRO) Montana Assistantship Program (MAP) (\$0). MSU BOREALS interns created a 4 hour hands-on workshop for 20 Native American high school students in summer 2010. [EP1] [EP3] [EP7]
 - o Expanding Your Horizons (\$500). This national program is a day-long hands-on science and engineering workshop for middle school girls. More than 10 MSGC students and staff volunteered. [EP1] [EP3] [EP7]

- Volunteer activities including: Science Olympiad (\$0). National middle and high school science competition. Several MSGC staff and students volunteered. FIRST Lego League Tournament (\$0). Six MSGC staff and students volunteered for the Montana regional tournament in February, 2011. Montana Regional Middle School and Montana Regional High School Science Bowl (\$0). The MSGC director volunteered for and gave the welcome address (talking about MSGC) to the hundreds of students at the competitions in February, 2011. [EP1]
- Monforton Middle School Space Camp competition (\$500). MSGC will help send 6 bright 8th graders to Space Camp in summer 2011. [EP1]
- Sent teacher Shirley Green (Billings, MT) to the attempted launch of STS 133 (\$1,200). Shirley was selected as one of 50 educators to attend the launch with the NASA Education team from ARC. [EP2]
- Turning Eyes to the Big Sky (\$500). MSGC undergraduate student and NASA Space Science Student Ambassador Ryan Hannahoe **created and carried out a middle school teacher training workshop** and in-class activities on telescope building, with more than \$15,000 in grant funds he secured through several agencies. Ryan will intern with the JWST E/PO team at Goddard in summer, 2011. [EP1] [EP2]

Outcome 3:

1g. Informal Education/Synergistic projects

- MSGC participated in, on a volunteer basis, several informal education and synergistic projects, see details below. Being volunteers creates awareness about our Higher Education opportunities among the public that is quite valuable.
 - Astronomy Day, April 2nd, 2011. MSGC helped arrange the associated visit and educator workshops by Astronaut Ricky Arnold. More than 2,000 people are expected to attend the event, where MSGC will also have an informational booth. [EP2]
 - Laurel Aviation and Technology Days, May 2011. Thousands of high school students from Montana, the Dakotas, and Wyoming are expected to attend. MSGC will be giving talks and will have an information booth. [EP7]
 - The Director represents MSGC on the Tribal College and University Program (an NSF STEM higher education program) boards for Chief Dull Knife College and Stone Child College. The Director also represents MSGC on the MSU Women In Science and Engineering (WISE) committee and the Montana Big Sky Space Education Evaluation Committee. [EP7]

PROGRAM CONTRIBUTIONS TO PART MEASURES

- Longitudinal Tracking:
 - Clarification note: as instructed, the numbers below are for FY 2010 data ONLY. Some awards, such as undergraduate research stipends, a few internships, and student support associated with Education Enhancement and Research Initiation awards have not yet been made. See 'Program Accomplishments' section above for LT highlights from FY 2009 students.

- Total awards so far = 86; Fellowship/Scholarship = 46, Higher Education/Research Infrastructure = 40; 9 of the total awards represents underrepresented minority F/S funding; 27 of the total awards are to females. One student has graduated and is pursuing an advanced STEM degree and the remainders are still enrolled. When all of our funding is allocated, we anticipate approximately 120 total awards, ~46 F/S and ~75 HE/RI.

- **Course Development:**

The following three *sets* of courses (at three different institutions, including a Tribal College) are funded by FY 2010 Education Enhancement awards.

- Expansion of Technology into Hydrology Curriculum at **Salish Kootenai College**: Currently the USA awards only 20-30 degrees/year in geosciences disciplines to Native Americans. Only a small fraction of these students are in the field of hydrology or water resources. This highlights the geosciences as one of the least-diverse STEM fields. Surprisingly, American Indian Tribes exert sovereignty over ~20% of our nation's fresh water resources. Through this project, SKC will prepare Native American students to seek jobs in hydrological fields and assist Tribal, Federal and State governments in making sound management decisions using state-of-the-art technologies.
- Following the Packet - An Educational Enhancement Proposal for Embedded Networking: Embedded networked devices are ubiquitous in today's society and within industry. At MSU, computer engineering students currently take their networking curriculum in the Computer Science (CS) department. While there is nothing wrong with what the CS department teaches, it primarily focuses on networking at the application level and above. MSU doesn't currently have embedded networking curriculum material that focuses on the lower layers of the seven layer Open Systems Interconnection (OSI) networking model. In order for the computer engineering graduates to be competitive in the workforce, curriculum material focusing on the lower OSI layers into our computer engineering program is essential. This project provides the development of the essential lab and coursework.
- Learning Chemistry through Inquiry, Action, and Reflection: Some of the best undergraduate chemistry programs in the country share a common feature; they all present the student with hands-on laboratory experiences that mirror what the student will encounter after graduation. The key to a good chemistry laboratory experience is, in addition to a well equipped and up-to-date lab space to work in, an opportunity for the student to reflect on how the assigned experiments apply to the real world. This new chemistry program at the **University of Great Falls** will use an inquiry, action, reflection sequence in the laboratory portion of the courses that mimics an authentic research experience. This sequence has been proven to captivate students' interest by allowing them to design and carry out their own experiments and reflect upon their results.

- **Matching Funds:**

- In FY 2010, MSGC leveraged NASA funds 1:1 with the exception of scholarship and fellowship funds.

- **Minority-Serving Institutions:**

- See Accomplishments section above, objective **2e**.

- See the course development section above, on the Salish Kootenai College project.
- See the 'Poker Flats trip' anecdote in the 'Program benefit to outcome' section.

IMPROVEMENTS MADE IN THE PAST YEAR

- Webpage. We hired a student, Brian Shaw, to redesign and build a new set of web pages, as our old pages were in drastic need of a new look and enhancement. The new pages are interactive, use modern networking features such as Twitter and Facebook, have photo and student highlights, and are much more thorough than before. Check them out at: <http://spacegrant.montana.edu> .
- In September, 2010, we completed the hiring process for our new Education Specialist. Dr. Joey Key oversees SPOT, student recruitment, undergraduate research programs, the scholarship and fellowship programs, internship programs, the MSGC Student Research Symposium, student reporting and longitudinal tracking, the ESMD SG projects, and MSGC advertising and promotion. The new position is very valuable as many of these programs were suffering a bit from lack of sufficient attention due to low man power levels.
- After a pilot program in April, 2010, we will hold our first full-fledged, day-long MSGC Student Research Symposium on April 15th, 2010. The goals of MSRS are to create an opportunity for all MSGC student participants to present their work and to foster collaboration among Montana researchers on NASA-related projects. MSRS will also function as a second Affiliates' Meeting, but one with a very different focus from the main Affiliates' Meeting in the fall. As of the time of this report, we are expecting more than 100 participants from 16 of the 19 Affiliate institutions.

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.