

Montana Space Grant Consortium  
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Consortium URL: <http://spacegrant.montana.edu>  
Grant Number: NNX10AJ83H

## 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 \$575,000 for fiscal year 2011.

## PROGRAM GOALS

2011 SMART Objectives by Strategic Goal:

*(These SMART Objectives apply to the 2011 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 1<sup>st</sup>, 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% for the 2010-2014 grant period.

1b. By August 1<sup>st</sup>, award \$7,500 one-semester 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 for the 2010-2014 grant period.

1c. Continue to strive to award at least one scholarship to each Academic Affiliate, maintaining the number of represented institutions at a minimum of 16 per year for the 2010-2014 grant period.

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 for the 2010-2014 grant period.

1e. Increase the number of Affiliate Institutions actively participating in the BOREALIS high altitude ballooning program from 3 to 5 in the 2010-2014 award.

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 for the 2010-2014 grant period.

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 for the 2010-2014 grant period.

2c. Continue to create interdisciplinary, hands-on, and meaningful opportunities for Montana students to design and build BOREALIS high altitude balloon experiments at the BOREALIS launch centers; 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 for the 2010-2014 grant period.

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 for the 2010-2014 grant period.

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 for the 2010-2014 grant period.

**(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. Continue to hold MSGC Student Research Symposiums (MSRS) for all students involved in MSGC programs; maintain at least 150 student and faculty participants from at least 17 Affiliate Institutions, and maintain at least a 95% participant agreement that the Symposium was beneficial.

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 for the 2010-2014 grant period.

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 for the 2010-2014 grant period.

**(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 for the 2010-2014 grant period.

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 for the 2010-2014 grant period.

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% for the 2010-2014 grant period.

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% for the 2010-2014 grant period.

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% for the 2010-2014 grant period.

## 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 Education Priorities are referred to by number. NASA Education Priorities: 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.

**Student Space Hardware highlights:** On October 28, 2011 Montana’s first satellite was launched with NASA’s NPP mission as part of the ELaNa program. Formerly known as Explorer-1 [Prime] (E1P) the satellite has been named the Hiscock Radiation Belt Explorer (HRBE) in honor of the late Dr. William A. Hiscock, founder of the Montana Space Grant Consortium. HRBE’s mission is to study the Van Allen radiation belts in honor of the 50<sup>th</sup> anniversary of NASA’s first satellite Explorer-1. On February 15, 2012 HRBE matched Explorer-1 in collecting 111 days of data from orbit. Since then, the satellite has well surpassed the entire 111-day mission of its history-making predecessor. [Outcome 1] [EP 1]

Scientific ballooning highlights: The MSU BOREALIS launch center successfully completed six high altitude balloon launches and two tethered blimp system flights. Two of the high altitude flights were in association with the NASA ESMD Space Grant Project ‘Summer Opportunity for Women Students in Engineering’ program. During the academic year, the MSU group started a very successful rocket design and data analysis competition as a way to introduce new students to hands-on research. The UM launch center continues to collaborate in a global climate change project by conducting several small launches in the Amazon jungle in Columbia, South America. The UM group also worked with Salish Kootenia College on a tethered blimp project examining remnant ripples on the Salish Kootenai Reservation left from the flooding of Glacial Lake Missoula 12,000 years ago. Both the MSU and UM launch centers maintain their 100% payload recovery record, an outstanding accomplishment, especially considering they have done about 150 flights! [Outcome 1 and 2] [EP 1, 3, 6]

Montana State University engineering student and former Flathead Valley Community College student, Andrew Crawford was a MSGC intern at JPL in the summer of 2011. Andrew shared the story of his summer internship experiences on an official JPL blog. As a former professional snowboarder, Andrew’s blog was featured on the ESPN website. [Outcome 1] [EP 1, 4]

Tribal College students Adrian Shawl and Jonna Sullivan from Aaniiih Nakoda College presented their poster *Riparian Vegetation Along the Milk River Employing Infrared Photography* on their summer internship project. Their project was made possible by the MSGC Tribal College Research program that provided the training and materials for their remote sensing tethered blimp. Teams from Blackfeet Community College and Stone Child College were winners of the associated Tribal College Research Student Team Competition. [Outcome 1] [EP 1, 4, 6, 7]

Salish Kootenai College (SKC) Hydrology student Noel White Running Water Stewart is the recipient of the 2011-2012 William A. Hiscock Memorial Award. Noel is working with the SKC Cubesat project and was a summer intern at NASA’s Marshall Space Flight Center (MSFC). As the Hiscock Memorial Award recipient Noel is studying ways to use the SKC Cubesat project to enhance the hydrology, science, and education curricula at SKC. She also serves as a NASA Student Ambassador sharing NASA science and opportunities with fellow students and her community. [Outcome 1] [EP 1, 6, 7]

Longitudinal Tracking highlights for FY11 student awardees: Of the 13 students not still enrolled we currently know the status of 11. Of these 11, 100% are pursuing an advanced STEM degree, employed in a STEM field, or seeking STEM employment. Three students are employed in a STEM field: Stephanie Schielke at Fast Link, Clint Hadwin at Space Micro (an aerospace company), and Luke Humphrey at NASA Langley Research Center. Six students are pursuing an advanced STEM degree: Stephen Barton at University of Montana, Adam Gunderson and Alyssa Peck at MSU, Martin Lorenzo at Montana Tech, Courtney Peck at University of Colorado, Boulder, and Brianna Peck at University of Texas, Austin. Two students are seeking STEM employment.

Student Research Symposium (MSRS) highlights: Quote from Jaime Waydo, MSU Mechanical Engineering alum and Mobility Engineer at JPL: “The best moment of this Symposium was

when a young lady stopped me in the hall and told me that after my talk last year, she had been so encouraged that she decided to change her major to engineering. She said she was afraid to do it, but my talk and the great MSGC symposium was the inspiration she needed. It is an honor to be part of your program. You are changing kids' lives and I am thankful you let me be a tiny sliver of that." In addition, a MSU news article about the 2012 MSRS award winners attracted the attention of a researcher at a large international research company. The researcher then sought out the contact information of the student doing the research he was interested in. This speaks well for the success and reach of MSRS and MSGC. [Outcome 1] [EP 1, 7, 8]

Graduate Fellowship Highlight: "I would like to take the time to point out the successes that have accrued as a result of the informal relationship between the MSGC and the graduate program in Science and Natural History Filmmaking at MSU. Over the years MSGC has been generous to this program and has supported several students and projects. As you know some of that work went on to achieve national exposure through major television broadcasters. But what might not be as apparent is the strong presence the MSU graduate program has at the Goddard Space Flight Center film production unit, which is the main visual production unit in NASA. As a result of a grant MSGC awarded to this writer, I was able to set up a fellowship at Goddard about nine years ago, and over the years Goddard has come to rely almost exclusively on MSU for employees and interns in its production units. Several of our students who had internships there are now employees of NASA, and I believe right now we have seven people at the production unit at Goddard, which means virtually the whole department is comprised of MSU graduates and students."

-- Ronald Tobias, Discovery Professor of Science and Natural History Film Making at MSU [Outcome 1] [EP 1, 8]

Once again in summer 2012 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 summer's student is previous a MSGC participant from Stone Child College. [Outcome 1] [EP 1, 4, 7]

## PROGRAM ACCOMPLISHMENTS

NOTE: THIS LIST REFERENCES OUR SMART OBJECTIVES BY OUTCOME AND REFERENCES RELATED NASA EDUCATION PRIORITIES [IN BRACKETS]. In order to be succinct, NASA 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 29 undergraduate scholarships; mean GPA = 3.68; underrepresented = 28%; female = 41%. All objectives met.
- 1b. Fellowships [EP7]
- Awarded 7 graduate fellowships; mean GPA = 3.89; all FY 2011 still enrolled (LT for FY 2010: 1 on to STEM employment, 10 still enrolled); underrepresented = 0%; female = 43%. Only objective not met is underrepresented, but we will have two Native American students in the FY12 year (29% underrepresented)!
- 1c. State-wide Scholarships [EP4] [EP7]
- Maintained 14 Affiliate Institutions receiving awards. We are planning specific visits and a new focus on increasing participation at the institutions where we have not had as much activity, specifically Dawson Community College, Miles Community College, and Little Big Horn College.
- 1d. Education Enhancement grants [EP4] [EP6] [EP7]
- Awarded 4 grants (details below) to two institutions.
  - Female PIs = 0%; underrepresented PIs = 25%. While the female PI number is low this year, our SMART objective is for the entire 2010-2014 period, and we are on our way to meeting it.
  - Titles, PIs, and institutions:
    - o “Creating a GIS Certificate Program and Expanding the Geospatial Curriculum at the Salish Kootenai College,” Robert Kenning, Salish Kootenai College (Tribal College)
    - o “Development of a balloon-borne orientation system for astronomical observations for the High Altitude Student Platform – An undergraduate research education experience,” Berk Knighton, Montana State University
    - o “Design and Implementation of a Laboratory-Scale Solar Photovoltaic Power Generation System and Smart Microgrid for Electrical Engineering Education at Montana State University,” Hashem Nehrir, Montana State University
    - o “Celebrating Einstein,” Nico Yunes, Montana State University
- 1e. BOREALIS state-wide effort [EP1] [EP4] [EP6] [EP7]
- As a result of the Tribal College tethered ballooning program and our main launch centers, we had BOREALIS activity at Montana State University, University of Montana, Salish Kootenai College (a Tribal College (TC)), Stone Child College (TC), Fort Peck Community College (TC), Blackfeet Community College (TC), and Aaniiih Nakoda College (TC) in FY 2011. This is *nearly half of all of our Affiliate campuses*, meaning we have well exceeded our SMART Objective metric! Students from Salish Kootenai College, Stone Child College, Aaniiih Nakoda College, Montana State University, and University of Montana presented research posters at conferences on their ballooning projects.
- 1f. Space Public Outreach Team [EP1] [EP2] [EP7]
- This program is a collaboration between NASA SDO:AIA E/PO and MSGC. The AIA E/PO program funds presenter travel and pay and thus reports the presenter data, K-12 students, and teachers. MSGC provides graduate student fellowship support of the SPOT managers. The managers are longitudinally tracked and evaluated for their performance. The AIA program met their goals for SPOT participation.
- 2a. Student Satellites [EP1] [EP6] [EP7]

- 6 major student awards; underrepresented = 0%; female = 17%. 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 2011 awards, 3 are still enrolled, one employed in aerospace, one pursuing an advanced degree, and one seeking STEM employment.
- 2b. SSEL internships [EP1] [EP4] [EP6] [EP7]
- Two students, one from Rocky Mountain College and one from Flathead Valley Community College have accepted internship positions for summer 2012. From the FY 2010 (summer 2011) award, the student is pursuing an advanced degree.
- 2c. BOREALIS launch centers [EP1] [EP6] [EP7]
- Note: 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. Also, several yet to be identified students will be supported on FY11 base funds at UM in summer 2012.
  - In the MSU program, a total of 22 students participated; 5% underrepresented; 9% female. In the UM program so far, 3 students participated; 0% underrepresented; 100% female. Total, this is 25 students, 4% underrepresented, 25% female. Therefore, we are exceeding our objective for female students. For underrepresented students, we continue to encourage participation.
  - All FY 2011 UM awardees are still enrolled. From FY 2010 UM awards, 2 students are pursuing advanced STEM degrees and the remainders are still enrolled.
- 2d. BOREALIS internships [EP1] [EP6] [EP7]
- Awards will be made in summer 2012 to 7 interns (one co-sponsored by the American Indian Research Opportunities program and two co-sponsored on Berk Knighton’s Education Enhancement Grant); 14% underrepresented; 14% female. We are therefore meeting the goals set out in our SMART objective.
  - All FY 2011 interns (summer 2012) are still enrolled. From FY 2010 awards (summer 2011), 1 student has moved on to an advanced STEM degree, 2 are now employed in STEM, and the remainders are still enrolled.
- 2e. Minority Serving Institutions [EP1] [EP4] [EP7]
- We continue to support students and faculty on two main Tribal College (TC) projects: the Aurora Detector Project and the Remote Sensing Project. Now that funding for the MSI Partnership Development Program is finished, we support these projects via our primary MSGC Apprenticeship, ARES, and BOREALIS state-wide programs. Highlights on these two main programs and other TC activities are given below and throughout this report. We are exceeding our SMART Objective metric for engaging our TCs.
  - Aurora Detector Project: Randy Plummer (Native), a summer 2011 BOREALIS intern, took aurora detector units to Fort Peck Community College and Aaniih Nakoda College and helped with training and selecting installation sites for the units. MSGC staff and Aurora Detector developer Joe Shaw travelled to Blackfeet Community College and Salish Kootenai College to participate in hands on installation of the aurora detectors at both schools. Tashina Russette (Native) at Stone Child College helped with the selection of their site and is continuing with installation of the unit. The Montana Aurora Detector Network was announced and can be viewed at: <http://aurora.montana.edu/>. Currently, the MSU and SKC detectors are on-line and working very well. The remainders should be on-line in the near future!

- Tethered Blimp Remote Sensing Project: A poster was presented on the “Riparian Vegetation Along the Milk River Employing Infrared Photography” by Adrian Shawl and Jonna Sullivan (both Native) of Aaniih Nakoda College that utilized the remote sensing setup. Randy Plummer (Native) from Fort Peck Community College used and tested the tethered blimp remote sensing system in his summer BOREALIS internship. Randy studied vegetation around thermal areas along the Madison River, teepee rings along the Madison River, and Pine Bark Beetle kill in the Hyalite drainage south of Bozeman. Tashina Russette (Native) from Stone Child College used the tethered blimp remote sensing system to study Normalized Difference Vegetation Index (NDVI) of plants native to her area and presented a poster at the MSRS event in Bozeman. Students from Salish Kootenia College worked with the UM BOREALIS students on a tethered blimp project examining remnant ripples on the Salish Kootenai Reservation left from the flooding of Glacial Lake Missoula 12,000 years ago.
  - An Education Enhancement Grant was awarded to Robert Kenning at Salish Kootenai College for “Creating a GIS Certificate Program and Expanding the Geospatial Curriculum at the Salish Kootenai College.”
- 3a. Affiliates' Meetings [EP4]
- We held our annual Affiliates’ Meeting September 9<sup>th</sup>, 2011. Of the Affiliate Representatives, 63% were in attendance. In a post-meeting evaluation, 100% of the Representatives were very satisfied with the meeting. For the second year, our Reps also had a chance to interact at our Student Research Symposium April 20<sup>th</sup>, 2012. In this setting, the Reps have a chance share what is happening at their institutions, rather than the MSGC staff providing most of the dialog.
- 3b. MSGC Student Research Symposium (MSRS). [EP4] [EP7]
- In 2011 MSRS included 159 participants from 13 Montana campuses and the 2012 MSRS that just took place included 127 participants from 12 campuses. Evaluations of the both Symposiums were overwhelmingly positive.
- 3c. NASA internships [EP1] [EP7]
- Awarded 5 internships to take place in summer 2012 at three different NASA centers; underrepresented = 0%; female = 60%. While our minority participation looks low, it is important to remember that at least five *Native Amercian interns recruited by MSGC are being paid directly by NASA* or other sources – an even bigger honor than being supported by MSGC! One FY2011 intern is pursuing an advanced degree, one is seeking STEM education employment, and 3 are still enrolled. From FY 2010 (summer 2011), one student has continued on to an advanced STEM degree, one is employed by NASA, and four are still enrolled.
- 3d. Industry internships [EP1]
- In FY 2011 we have no industry partner internships. From FY 2010 (summer 2011), the Science Mission Directorate MSSG intern and the MSGC Industry Affiliate Anasphere intern are still enrolled.
- 3e. National and Regional Meeting Attendance
- We met our goal for staff attendance at regional and national meetings.
  - We met our goal for bringing students or affiliate representatives to the SG meetings. We brought MSU mechanical engineering student and MSGC JPL intern Andrew Crawford to the 2012 Spring Meeting in Washington, DC. Andrew gave a terrific talk that inspired many and garnered the positive attention of NASA AA for Education Leland Melvin.

- 4a. Research Initiation grants [EP4] [EP5] [EP6] [EP7] [EP8]
  - No FY11 awards (all awards were made under MT NASA EPSCoR)
- 4b. MSU undergraduate research [EP1] [EP5] [EP6] [EP7]
  - FY 2011 awards have not yet been made. We anticipate awards to ~18 students.
  - **\*\*Unreported FY 2010 data (specifics)\*\***: Awarded support to 21 students; 100% of the students are presenting their work, many of them at MSGC's MSRS; 50% female; 0% underrepresented; 5% disabled. This exceeds our female participant SMART Objective but does not meet our underrepresented one. We continue to encourage minority 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 2011 awards have not yet been made. We anticipate awards to ~10 students.
  - **\*\*Unreported FY 2010 data (specifics)\*\***: Awarded support to 10 students; 100% of the students are presenting their work, several of them at MSGC's MSRS; 60% female; 0% underrepresented. We continue to encourage minority 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 2011 awards have not yet been made. We anticipate awards to ~5 students.
  - **\*\*Unreported FY 2010 data (specifics)\*\***: Awarded support to 3 students; 100% of the students are presenting their work, two of them at MSRS; 33% female; 0% underrepresented, 33% reporting a disability.
- 4e. ARES [EP1] [EP6] [EP7]
  - Awards were made to 13 students at 5 institutions including one Tribal College and one Community College; 30% female; 8% underrepresented. All awarded students complete Responsible Conduct of Research tutorials and are expected to present their research at the MSGC Student Research Symposium or other conference.

## **Outcome 2:**

### 1g. Precollege

MSGC spent a small amount of base funding (0.3% of our total NASA budget) on several Precollege projects. See details below. MSGC staff also volunteered at several events. Being sponsors and volunteers creates awareness about our Higher Education opportunities among the Precollege teachers and students that is quite valuable.

- BOREALIS K-12 student opportunity (\$0). At UM, one male HS student participated in the weekly academic year program. At MSU, one female and one male HS students participated in the program. [EP1] [EP3] [EP7]
- 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 2011. In summer 2012, MSGC will host a MAP research student who will work with our Education Specialist for 90 hours. [EP1] [EP3] [EP7]

- Volunteer activities include: Science Olympiad (\$0); several MSGC staff and students volunteered. FIRST Lego League and FIRST Tech Challenge Tournament (\$0); seven MSGC staff and students volunteered for the Montana regional tournament in February, 2012. Montana Regional Middle School and Montana Regional High School Science Bowls (\$0); the MSGC director volunteered for and gave the welcome addresses (talking about MSGC) to hundreds of students at the competitions in February, 2012; two Women In Science and Engineering (WISE) events (\$0); two Engineering and Physics Women's Lunches (\$200). [EP1]
- Sent MSU Electrical Engineering student Stephanie Schielke to the Grace Hopper Celebration of Women in Computing in Portland, Oregon in November, 2011 (\$800). Stephanie gave a presentation at the conference and at MSU when she returned. [EP1]
- Sent two female UM Physics students to the Undergraduate Women in Physics Conference at Stanford in January, 2012 (\$1,200 total). [EP1]

### **Outcome 3:**

#### 1g. Informal Education/Synergistic projects

- Astronomy Day, April 21<sup>st</sup>, 2012. MSGC helped arrange the associated visits by Dr. David Levy and Jaime Waydo. MSGC also had interactive booths for our general program, and for our BOREALIS, SPOT, and National Student Solar Spectrograph Competition programs. A total of 850 people attended the event, calling it 'AWESOME!'. [EP1],[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. [EP1],[EP7]

## **PROGRAM CONTRIBUTIONS TO PART MEASURES**

### **• Student Data and Longitudinal Tracking:**

Clarification note: as instructed, the numbers below are for FY 2011 base data ONLY. Some awards allocated on FY11 base funding, such as undergraduate research stipends and student support associated with the UM BOREALIS program and Education Enhancement awards have not yet been made. See 'Program Accomplishments' section above for LT highlights from FY 2010 students.

Total awards so far = 111; Fellowship/Scholarship = 43, Higher Education/Research Infrastructure = 68; 46% of the total awards were made to females and 10% to underrepresented minority students. F/S funding; 51% of the total awards were to females and 21% to underrepresented minorities. HE/RI funding; 43% of the total awards were to females and 3% to underrepresented minorities. Of the 13 students not still enrolled we currently know the status of

11. Of these 11, 100% are pursuing an advanced STEM degree (6), employed in a STEM field (3), or seeking STEM employment (2).

- **Diversity:**

- Diversity of Institutions

In FY11, 18 of our 19 Academic Affiliate institutions were ‘active’, meaning they were involved in at least one MSGC program during the year. Below is a list of the institutions and the primary programs they participated in. It is always our goal to garner as broad of Affiliate participation as possible in all programs. For the three institutions with little or no involvement this year (DCC, LBHC, MCC), we have plans to visit those campuses this fall to foster a better understanding of MSGC amongst faculty and students.

- Aaniiih Nakoda College: remote sensing/BOREALIS, aurora detector
- Blackfeet Community College: scholarship, aurora detector, remote sensing/BOREALIS
- Carroll College: scholarship, MSGC Student Research Symposium (MSRS)
- Dawson Community College: none
- Flathead Valley Community College: scholarship, undergraduate research, National Student Solar Spectrograph Competition (NSSSC), student satellite internship, MSRS
- Fort Peck Community College: remote sensing/BOREALIS
- Little Big Horn College: MSRS
- Miles Community College: MSRS
- Montana State University: scholarship, fellowship, BOREALIS, undergraduate research, education enhancement grants, SPOT, student satellites, NSSSC, NASA internship, MSRS
- Montana State University-Billings: scholarship, undergraduate research, MSRS
- Montana State University-Northern: scholarship
- Montana Tech: scholarship, undergraduate research, NSSSC, MSRS
- Rocky Mountain College: scholarship, student satellite internship, undergraduate research, MSRS
- Salish Kootenai College: scholarship, undergraduate research, remote sensing/BOREALIS, aurora detector, education enhancement grant, MSRS, student satellites (mostly NASA TCUP funding)
- Stone Child College: scholarship, BOREALIS internship (MSU American Indian Research Opportunities co-sponsored), remote sensing/BOREALIS, aurora detector, MSRS
- University of Great Falls: scholarship, undergraduate research, MSRS
- University of Montana: scholarship, fellowship, BOREALIS, undergraduate research, SPOT, NSSSC, MSRS
- University of Montana-Western: scholarship, NASA internship, MSRS

- Diversity of faculty participants

In FY11, one of our four Education Enhancement Grant PIs is Hispanic and one teaches at a Tribal College. Of our 19 Affiliate Reps, eight are female and one is Native American.

- Diversity of student participants

Of 111 total awards, 46% of the total awards were made to females and 10% to underrepresented minority students. F/S funding; 51% of the total awards were to females and 21% to underrepresented minorities. HE/RI funding; 43% of the total awards were to females and 3% to underrepresented minorities.

- **Minority-Serving Institutions:**

Activities with our MSIs are highlighted in the Program Accomplishments: Outcome1: 1e and 2e sections.

- **NASA Education Priorities:**

Accomplishments related to NASA Education Priorities are given in the ‘Program Accomplishments’, ‘Program Contributions to PART Measures’, or ‘Improvements’ sections. See references above and below to numbered Education Priorities: 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.

## IMPROVEMENTS MADE IN THE PAST YEAR

- Apprenticeships. Starting in FY11, we have put in place a new Apprenticeship program that offers a top rung in the ladder of academic year research opportunities for undergraduate students. Aerospace science and engineering students who already have some research experience and who are looking for support for a ‘major’ research project are eligible. Currently, we are supporting major student satellite research students. In the fall, with FY11 Augmentation funding, we will fund additional projects in several MSU departments and at Salish Kootenai College. This new program fills the void MSGC had for funding our top-level undergraduate students during the academic year.

- Strategic Plan. It was pointed out to us in the review of our 2010 proposal that our strategic plan wasn’t strong and we should improve it. We have been working toward adopting a better official strategic plan since then, and have made good progress in the last year. A draft has been commented on by our new Advisory Board (see below) and the revised version will go up for approval by our Affiliate Reps at our annual Affiliates’ Meeting in September, 2012.

- Advisory Board. MSGC has never had an official Advisory Board and we thought it was about time that we did. In FY11 we decided who we wanted to invite to the Board, formed the board,

and had our first meeting April 21, 2012. The Board has 20 non-MSGC-staff members including faculty and student representatives from all types of MSGC campuses (large research institution, small 4-year college, Tribal College, Community College). In addition, the Board has representation from many external organizations that MSGC works with such as MSU administration, undergraduate research programs, STEM non-profits, NASA, and other Space Grants. The Advisory Board mission statement is to “Ensure the continuing primacy of the Montana Space Grant Consortium. The Board will do this by ensuring alignment with sponsor’s goals, ensuring the consortium activities benefit its constituent communities, engaging the diverse communities represented by the Board in consortium activities, and supporting MSGC staff in reaching MSGC’s goals.”

- Montana STEM Education and Research Collaborative (MSERC). As a result of statements made at national meetings by Diane DeTroye and others, we have become aware that there is a focus in the federal government to eliminate overlapping federal programs. In addition, we are aware that in some areas of student opportunities, there is confusion among students and faculty about what federal program they should apply to. Therefore, MSGC has initiated in-depth collaborations with the two other federal programs in the state that offer support for STEM students and faculty, NSF EPSCoR and NIH INBRE. The areas where our three programs have similar opportunities are: undergraduate research, graduate fellowships, student and faculty travel support, women in STEM, outreach, and engagement of Montana Tribal Colleges. So far, we are in the process of starting two new state-wide initiatives: one for student research and one for travel support. The student research initiative is to create a clearinghouse web page where undergraduate and graduate students at every campus in Montana can find a list of opportunities and which organization to seek out to pursue the opportunity. In the travel support initiative, we are creating a list of all of the organizations (the three federal plus other campus and state programs) that provide STEM student and faculty travel support and who is eligible. This list will then be distributed to appropriate department heads and administrators at each campus. For the remaining overlapping areas, MSERC will meet quarterly to make progress toward new initiatives.

- Database and tracking project. This past year has seen great progress in our effort to build a novel multi-layer database that tracks each step for every MSGC awardee since 1991. We have successfully contacted all 87 of our past graduate fellowship grantees and have a fantastic list of what each person has gone on to accomplish. The next step is to contact our other awardees and flesh out the details for those hundreds of other participants. In the next month, our MySQL database with webpage PHP query will be set up. This freeware database software will allow former students to enter updated data via web interface as well as allow MSGC staff to enter data and query the database for all kinds of statistics.

- NASA Education Activity Training (NEAT) Pilot. With MSU physics research professor David McKenzie, the MSGC director co-wrote a proposal and won a \$25,000 NASA education grant. The resulting program is called NASA Education Activity Training (NEAT) and sends specially trained graduate students to teach Montana teachers how to use NASA education activities in their classrooms. The pilot program ran from October 2011 – May 2012 and was widely successful. NEAT reached 137 teachers in 14 locations and had glowing teacher reviews. MSGC

and NASA HQ education personnel are pursuing writing additional, much larger proposals to bring the program model to a national level.

- 1<sup>st</sup> generation and low income reporting. This past year, the MSGC Education Specialist spearheaded a national Space Grant effort to collect information about the first generation and low income status of participating students. These populations are in the ‘underserved’ category, but we have not been collecting any information about them until now. On all of our applications we now ask two additional questions: “Will you or your siblings be the first in your family to graduate from college?” and “Did you qualify for subsidized school lunch?” These questions were pulled from other federal applications that collect first generation and low income underserved data on participants.

## PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

### **Academic Affiliates:**

Aaniiih Nakoda College, Harlem, MT; Blackfeet Community College, Browning, MT; Carroll College, Helena, MT; Dawson Community College, Glendive, MT; Flathead Valley Community College, Kalispell, 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 Aaniiih Nakoda and Stone Child Colleges.

For information on the involvement of the Affiliate campuses with our various activities, please see the Contributions to PART Measures: Diversity of institutions section.